Attachment F

Endangered Species Act
No Effect Letter

ESA

2801 Alaskan Way
Suite 200
Seattle, WA 98121
206.789.9658 phone
206.789.9684 fax

esassoc.com

memorandum

date	August 19, 2025
to	Tom Bonetti, FTA
cc	Jeff Peters, KPFF Maya Hunnewell, ESA
from	David Goltz, ESA
subject	STA I-90 Valley Transit Corridor – Argonne Station Park and Ride Project – Biological Evaluation Letter of "No Effect"

The Spokane Transit Authority (STA) is proposing to construct the Argonne Station Park and Ride Project (project) on approximately 1.6 acres adjacent to Interstate 90 (I-90) and within the existing transportation right-of-way in Spokane Valley, Washington. This new bus station will include three bus bays with shelters, a 40-stall parking lot, a bus flyer stop with a dedicated on-ramp lane to eastbound I-90, an operations building, stormwater bioinfiltration ponds and drywells, and modifications to the eastbound off-ramp and on-ramp intersections to accommodate pedestrian movements and the bus-only receiving lane. The project will improve transit connectivity on I-90 by creating new access to the I-90/Valley Corridor to better serve the communities of Millwood and Northwest Spokane, support identified demand and future growth, provide direct connection between the Spokane Airport and Liberty Lake, enable further network improvements in Spokane Valley, and provide better connectivity to/from the Valley Transit Center.

Environmental Science Associates has prepared this evaluation on behalf of STA in response to the current U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Endangered Species Act (ESA) listings. A federal nexus is present as the project requires a National Environmental Policy Act (NEPA) Categorical Exclusion from the Federal Transit Administration (FTA). The ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or their critical habitats. The purpose of this evaluation is to determine if the project may affect species or habitat protected under Section 7 of the ESA (19 United States Code 1536 (c)). Environmental Science Associates also evaluated the presence and potential impacts on Essential Fish Habitat (EFH), as required under the Magnuson Stevens Fishery Conservation and Management Act (Magnuson Stevens Act).

Environmental Science Associates concludes that the project will have no effect on the following ESA-listed species:

- Yellow-billed cuckoo (*Coccyzus americanus*).

- Monarch butterfly (*Danaus plexippus*).
- Suckley's cuckoo bumble bee (*Bombus suckleyi*).
- Bull trout (*Salvelinus confluentus*).
- Upper Columbia distinct population segment (DPS) summer-run steelhead (*Oncorhynchus mykiss*).
- Upper Columbia evolutionarily significant unit (ESU) Chinook salmon (*O. tshawytscha*).
- Snake River ESU sockeye salmon (*O. nerka*).
- Snake River ESU Chinook salmon.
- Columbia River ESU chum salmon (*O. keta*).
- Lower Columbia River ESU coho salmon (*O. kisutch*).
- Southern DPS eulachon (*Thaleichthys pacificus*).
- Southern DPS green sturgeon (*Acipenser medirostris*).

Project Location and Background

The project site is located on the south side of Exit 287 (Argonne/Mullan Road) interchange at Milepost 287 on I-90 in the City of Spokane Valley, Spokane County, Washington, in the SW ¼ of Section 8, Township 25 North, Range 44 East, Willamette Meridian. The project site was previously disturbed due to construction of I-90 in the 1950s. In addition to the I-90 corridor, the vicinity of the project is characterized by commercial and retail developments, parking lots, and residences. The project site is located approximately 1.1 mile south of the Spokane River. The project site is located immediately between Argonne Road and Mullan Road, which are major arterials running north/south through the City.

Project Description

The project is proposed on approximately 1.6 acres adjacent to I-90 and within the existing transportation right-of-way to create a new bus station with platforms and driver amenities, vehicle parking, and a bus flyer stop and dedicated on-ramp lane to eastbound I-90. The project is consistent with the STA Long-Range Transit Plan and is part of the larger program of improvements to transit on I-90 as part of the I-90/HPT.

Project elements include the following:

- New transit facility (bus station) with a center island platform within approximate 1.6-acre site in the existing I-90 right of way.

- Eastbound bus flyer stop on frontage road with transit-only receiving lane on eastbound I-90 on-ramp.
- 40 parking stalls, including required Americans with Disabilities Act (ADA) stalls.
- Operations and maintenance building with storage, bathrooms, and breakroom (about 900 square feet).
- Signal modifications at the intersection of N Mullan Road and the eastbound I-90 on-ramp.
- Non-motorized improvements include a connection from E Mission Avenue to the transit facility and connection to future City of Spokane Valley pedestrian/bike improvements on the Argonne Road overpass.
- Landscaping includes the use of native and drought-tolerant trees and shrubs along with appropriate groundcover hydroseeding/mulch.
- Lighting around the transit island platform and parking.
- Wayfinding signage.

Utilities

Existing utilities in the project site will be protected in place prior to project construction. New water line, power, and lighting will be required, and stormwater from the new and redeveloped impervious surfaces will be collected, treated, and infiltrated in seven proposed on-site bioswales (refer to Stormwater Management Report, **Attachment A**) (KPFF 2025). New utility connections will be made during construction as part of the project.

Construction

Project construction is expected to last about 9 months, likely beginning in March 2027 and may last until November 2027. Construction activities will typically occur during the work week (Monday through Friday) between 7:00 a.m. and 5:00 p.m. Nighttime construction is not anticipated. Typical construction equipment used will include bulldozers, backhoes, front-end loaders, dump trucks, pavers, rollers, generators, compressors, and work trucks. No impact pile driving or blasting will occur. Concrete joint sawing is anticipated for the bus loop pavement and center island. No dewatering is anticipated during construction activities.

The project proposes 101,150 square feet of land disturbing activity. Approximately 950 cubic yards of excavation will be necessary for utility installations, building foundation, stormwater features, and luminaire foundations. Excavations are expected to typically be 4 to 8 feet below finished grade elevations. The deepest excavations will be up to 8 feet for luminaire foundations and the stormwater treatment facility. The project requires the placement of approximately 4,500 cubic yards of fill material to raise the project site up approximately 4 feet to align with the current grade of the adjacent roadways. It is anticipated that excavated materials will be repurposed as fill on-site. The project proposes construction

of 47,460 square feet of combined new and replaced pollution-generating impervious surfaces (PGIS), 41,330 square feet of which will be new PGIS.

Equipment and materials will be staged for construction within the existing right-of-way and primarily in the areas associated with project improvements. Construction vehicles will access the project site via N Argonne Road and N Mullan Road.

During construction, temporary lane closures will be required on N Argonne and N Mullan Road and potentially one lane of the I-90 frontage road between N Argonne and N Mullan roads, but access to the I-90 ramps will be maintained throughout construction. Advance notification of construction and the required temporary lane closures will be provided a minimum of 2 weeks prior to starting construction through the use of notices posted on agency webpages (e.g., City of Spokane Valley, Washington State Department of Transportation, and STA) and signage provided on roadways up to 1 mile from the project site.

Construction Sequence and Schedule

Construction sequencing will be the responsibility of the selected construction contractor. It is expected that construction will begin with stripping and removal activities, then placement of fill, construction of underground utilities (water, sewer, stormwater, communications, electrical), followed by surfacing and paving of the site. Once the hard surfaces are completed, building foundations and vertical components will be constructed, including the operations and maintenance building. It is expected that landscaping, planting, finishes to the building, and signage will be the last construction activities.

Impact Avoidance and Minimization Measures

Impact minimization measures and appropriate best management practices (BMPs) that will be applied as part of the project include the following:

- No in-water work is required for the project, no riparian vegetation will be removed, and no grading or excavation will occur within an area that drains to the Spokane River.
- An Erosion and Sediment Control Plan will be implemented, and all soil-disturbing activities will incorporate appropriate sediment and erosion control BMPs.
- Construction staging and stockpile areas will be located within previously disturbed areas in the project footprint and outside sensitive areas, such as wetlands and streams.
- When not in use, equipment will be staged/stored in designated areas.

Action Area

The ESA requires that potential effects to listed and proposed endangered and threatened species be evaluated in relation to the complete extent of the area potentially influenced by the project (the Action Area) (50 Code of Federal Regulations Part 402.02). The Action Area is determined by the geographic extent of the physical, chemical, and biological effects resulting from the project. The primary activities

that define the Action Area for the project include project-generated noise, soil-disturbing activities, and stormwater runoff or discharge.

Based on the geographic extent of anticipated project impacts, the terrestrial zone of effect for the project includes the entire project footprint and terrestrial habitat extending within a 0.5-mile radius of any construction activities. This represents the area in which increased noise and human presence during construction may cause disturbance, within a noisy urban environment, and where excavation and other soil-disturbing activities will occur. No in-water work will occur, and the project site is over one mile from the Spokane River or its tributaries. With these factors considered, the application of appropriate BMPs eliminates the potential of sediment or fuel products entering the Spokane River. Therefore, the project does not contain an aquatic zone within the Action Area.

Listed Species Potentially Present in the Project Vicinity

Both NMFS and USFWS (the Services) provide listings of threatened and endangered species under their jurisdiction. Species lists from NMFS and USFWS are provided in **Attachment B**.

Species Under NMFS Management

The current listings from NMFS indicate no potential presence of listed species in the vicinity of the project, as the nearest documented presence of and critical habitat for anadromous fish is approximately 160 river miles downstream from Spokane Valley in the Columbia River, as described for each species below (NMFS 2016):

- Upper Columbia distinct population segment (DPS) summer-run steelhead (*Oncorhynchus mykiss*).
- Upper Columbia evolutionarily significant unit (ESU) Chinook salmon (*O. tshawytscha*).
- Snake River ESU sockeye salmon (*O. nerka*).
- Snake River ESU Chinook salmon.
- Columbia River ESU chum salmon (*O. keta*).
- Lower Columbia River ESU coho salmon (*O. kisutch*).
- Southern DPS eulachon (*Thaleichthys pacificus*).
- Southern DPS green sturgeon (*Acipenser medirostris*).

Upper Columbia DPS summer-run steelhead (*Oncorhynchus mykiss*) have documented historical presence in the Spokane River, but the closest current documented presence and designated critical habitat to the project site is downstream of the Grand Coulee Dam in the Columbia River, approximately 160 river miles downstream from Spokane Valley.

The closest currently documented presence and designated critical habitat for Upper Columbia ESU Chinook salmon (*O. tshawytscha*) is also downstream of the Grand Coulee Dam in the Columbia River, approximately 160 river miles downstream from Spokane Valley.

Snake River ESU sockeye salmon (*O. nerka*) and Snake River ESU Chinook salmon critical habitat begins approximately 280 river miles downstream from Spokane Valley at the confluence of the Snake and Columbia rivers.

Columbia River ESU chum salmon (*O. keta*) and Lower Columbia River ESU coho salmon (*O. kisutch*) critical habitat begins approximately 430 river miles downstream from Spokane Valley near the confluence of the Hood and Columbia rivers.

Southern DPS eulachon (*Thaleichthys pacificus*) critical habitat begins approximately 460 river miles downstream from Spokane Valley at the Bonneville Dam in the Columbia River.

Southern DPS green sturgeon (*Acipenser medirostris*) critical habitat begins approximately 620 river miles downstream from Spokane Valley near the mouth of the Columbia River.

The project does not include any in-water work, and the project site does not have a surface water connection to the Spokane River. Based on the Stormwater Management Plan that includes design for 100% stormwater infiltration, the project will have no effect on threatened or endangered fish species under the management of the NMFS that are distributed farther downstream within the Columbia River.

Species Under USFWS Management

The USFWS, through the Information for Planning and Conservation (IPaC) website, provides a site-specific species list for the project area (Attachment B) (USFWS 2025). For the majority of the species identified in the IPaC report, either the species was not historically distributed within the Action Area or the Action Area does not contain suitable habitat features to support the species. The IPaC report includes the following four species:

- Yellow-billed cuckoo (*Coccyzus americanus*).
- Monarch butterfly (*Danaus plexippus*).
- Suckley's cuckoo bumble bee (*Bombus suckleyi*).
- Bull trout (*Salvelinus confluentus*).

Yellow-billed cuckoos are extremely rare in Washington State; if breeding still occurs in the state, it is likely limited to an extremely small number of breeding pairs (single digits). Furthermore, yellow-billed cuckoos breed in large blocks of riparian habitats (particularly woodlands containing cottonwoods and willows) (Ehrlich et al. 1988), which is entirely lacking within the Action Area. Yellow-billed cuckoo critical habitat is not present within the Action Area.

Monarch butterflies can be found east of the Cascade Range in low numbers. They require abundant milkweed plants to lay eggs on and as a food source for caterpillars. Monarchs also need a variety of

blooming nectar resources as a food source. Nectar and milkweed resources are often associated with riparian corridors, which are not present within the Action Area. Proposed monarch butterfly critical habitat is not present within the Action Area.

Suckley's cuckoo bumble bees historically were found throughout Washington but are now extremely rare due to recent rapid population declines. They require floral nectar resources, which are not diverse or abundant within the Action Area due to human disturbance and land development activities. No critical habitat has been designated for Suckley's cuckoo bumble bee.

Bull trout have documented presence in the Columbia River downstream of the Grand Coulee Dam, approximately 140 river miles downstream from the project area. The nearest presumed presence of bull trout is approximately 50 river miles downstream from the project vicinity in the Spokane River (NWIFC 2025). The project design includes 100% on-site stormwater infiltration, so adverse effects from stormwater pollutant loading in the Spokane River will not occur. Bull trout critical habitat is not present within the Action Area.

Habitat Conditions

The project site is located in a broad valley on relatively flat terrain. Elevation ranges between approximately 1,990 and 1,985 feet above sea level at the project site.

The vicinity of the project site is highly developed with impervious surfaces on both sides of I-90. The interstate was constructed in the 1950s. The existing pervious surfaces within the project footprint are vegetated with mowed pasture grasses. There are no waterbodies in the project footprint, and the nearest waterbody to the project site is the Spokane River, which is located approximately 1.1 miles north of the project footprint.

Impact Assessment

The project proposes 47,460 square feet of combined new and replaced impervious surfaces. Although the constituents in stormwater (such as 6PPD-quinone, dissolved copper, and zinc) can result in negative effects to ESA-listed fish species, the runoff from these impervious surfaces will be treated for water quality through 100% infiltration, thus preventing the discharge of untreated stormwater to the Spokane River, its tributaries, or any other Waters of the United States.

The project proposes 101,150 square feet of land disturbing activity, which will remove vegetation from low-quality habitat adjacent to I-90. The affected areas do not contain suitable habitat for the ESA-listed terrestrial species described in this letter.

Effect Determinations

Terrestrial Species

The project will have ***no effect*** on the yellow-billed cuckoo, monarch butterfly, or Suckley's cuckoo bumble bee because:

- Yellow-billed cuckoo, monarch butterfly, and Suckley's cuckoo bumble bee do not occur on the project site due to a lack of suitable habitat for these species.

- No designated critical habitat for these species is present within, or adjacent to, the Action Area.

Aquatic Species

The project will have ***no effect*** on bull trout, Upper Columbia DPS steelhead, Upper Columbia ESU Chinook salmon, Snake River ESU sockeye salmon, Snake River ESU Chinook salmon, Columbia River ESU chum salmon, Lower Columbia River ESU coho salmon, Southern DPS eulachon, or Southern DPS green sturgeon because:

- The Grand Coulee Dam blocks upstream passage for ESA-listed salmonids, approximately 160 miles downstream from Spokane Valley.

- The project does not include in-water work, and sedimentation from project runoff will not enter the Spokane River or its tributaries, due to the distance between the project site and the Spokane River, and based on the implementation of a project Erosion and Sediment Control Plan and the use of appropriate BMPs.

- Stormwater runoff from new impervious surfaces will be collected and infiltrated; therefore, common stormwater pollutants will not enter the Spokane River or its tributaries.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act mandates that NMFS must identify Essential Fish Habitat (EFH) for federally managed marine fish. Federal agencies are required to consult with NMFS on all activities, or proposed activities, authorized, funded, or undertaken by the agency that may adversely affect EFH. The Pacific Fishery Management Council (PFMC) has designated EFH for the Pacific salmon fishery, federally managed ground fishes, and coastal pelagic fisheries (PFMC 2021).

The nearest EFH, as defined by the Magnuson-Stevens Fishery Conservation and Management Act, is approximately 160 river miles downstream from the project site in the Columbia River. This EFH is specific to Pacific salmon.

The project is expected to have ***no effect*** on EFH, based on the following:

- The project does not include in-water work, and sedimentation from project runoff will not enter the Spokane River or any of its tributaries, based on the implementation of a project Erosion and Sediment Control Plan and the use of appropriate BMPs.

- Stormwater will be infiltrated on-site; therefore, runoff will not be discharged into the Spokane River or any of its tributaries.

Environmental Science Associates believes that this evaluation satisfies the FTA's responsibilities under Section 7(c) of the ESA and the Magnuson-Stevens Act at this time. Environmental Science Associates will continue to remain aware of any change in status of these species and will be prepared to reevaluate potential project impacts if necessary.

If you require additional information or clarification regarding this project, please contact me at dgoltz@esassoc.com or 218.348.6061.

Sincerely,

David Goltz

Environmental Scientist, Environmental Science Associates

References

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. *The birder's handbook*. Simon and Schuster, New York.

KPFF Consulting Engineers. 2025. *Argonne Station Park and Ride: Draft Stormwater Report*. Prepared for Spokane Transit Authority, June 2025.

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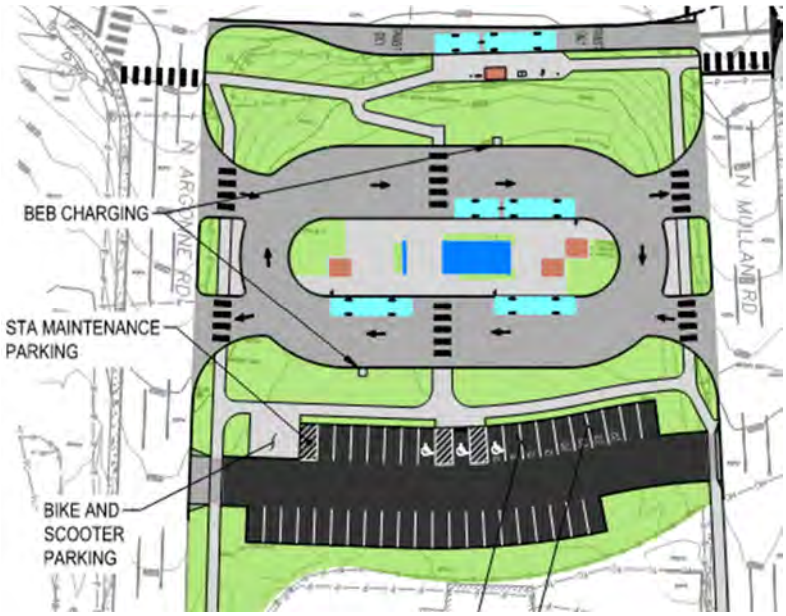
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Appendix A

Draft Stormwater Management Report



Argonne Station Park and Ride

Spokane Transit Authority

Draft Stormwater Report

June 2025 | Draft Report

kpff Consulting Engineers

Prepared for:

Spokane Transit Authority

Prepared by:

KPFF Consulting Engineers

Kayla Schunzel, EIT

Chariti D. Zlateff, PE

Subconsultants:

Budinger & Associates, Inc.

John Finnegan, PE

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1. PROJECT OVERVIEW

Spokane Transit Authority's proposed Argonne Station Park and Ride is a 1.6 acre park and ride facility located in Spokane Valley, just south of Interstate 90 (I-90), between Argonne Road and Mullan Road. Proposed improvements to the project site include a 40 stall parking lot, transit-only bus loop, three bus bays with shelters, and an operations building. The project also includes an eastbound High Performance Transit (HPT) flyer stop and signal modifications for a new dedicated bus-only receiving lane on the eastbound I-90 on-ramp.

SITE LOCATION

The project site is between N Argonne Road and N Mullen Road, north of E Mission Ave and south of I-90 located within the City of Spokane Valley, Washington. The proposed park and ride site is situated south of the I-90 off and on ramps, between Argonne Road and Mullan Road, north of Mission Avenue. The proposed receiving lane for buses is located northeast of the park and ride site, added along the eastbound I-90 on ramp. The proposed project is located within Washington State Department of Transportation (WSDOT) right of way, which extends north of the project site to I-90. Parcels 45083.9003 and 45083.9018 are directly south of the park and ride site and contain a restaurant building with a 42-stall parking lot. The project location is shown in the vicinity map below.

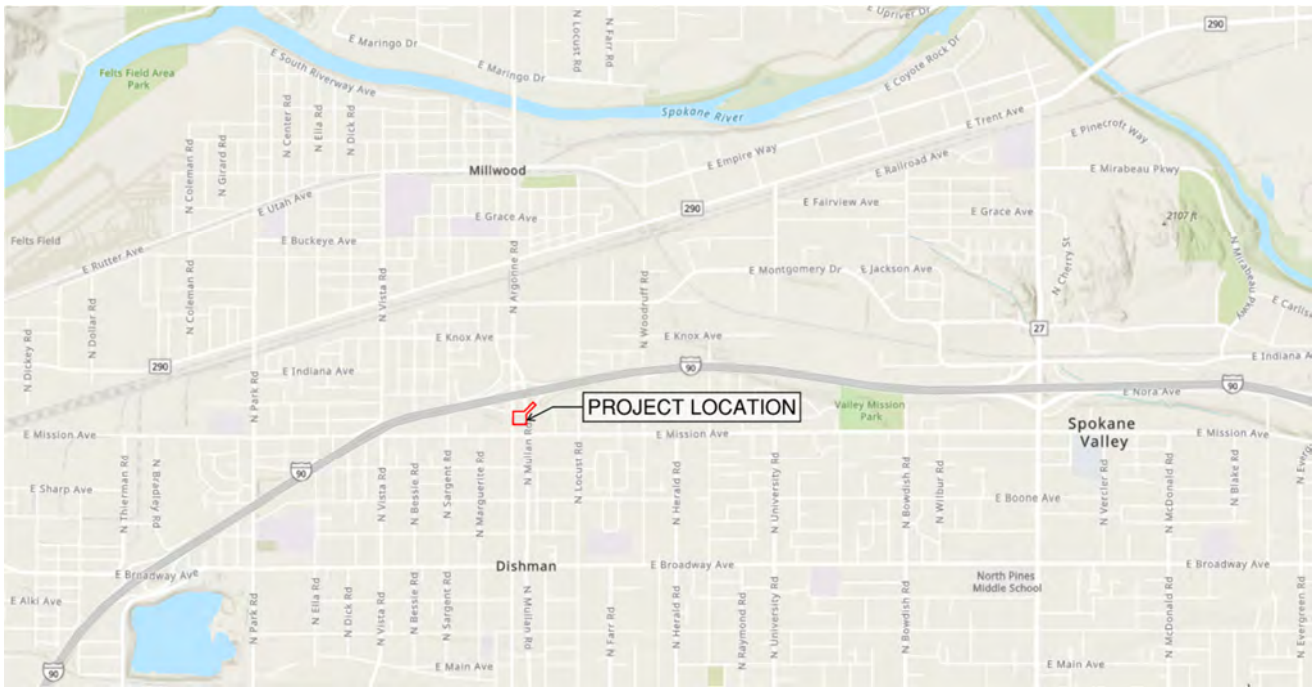


FIGURE 1-1 ARGONNE STATION PROJECT VICINITY MAP

SCOPE OF WORK

The Argonne Station Park and Ride project includes a 40-stall parking lot, transit only bus loop, containing three bus bays with shelters, and an operations building, an eastbound HPT flyer stop with an additional on ramp receiving lane, stormwater bioinfiltration ponds and drywells, and modifications to the eastbound off-ramp and on-ramp intersections to accommodate pedestrian

movements and the bus-only receiving lane. No off-site easements are needed for project development.

2. SITE CONDITIONS

THRESHOLD DISCHARGE AREAS (TDAS)

The project site consists of two distinct threshold discharge areas (TDAs). TDA 1 includes the main area that will develop into the park and ride site. TDA 2 is the area to the northeast consisting of a freeway on ramp that will include the receiving lane. Each TDA is broken out into basins to address the flows within the TDA for the Pre-Developed and Post-Developed Conditions Discharges and existing drainage patterns are illustrated in the TDA map located in Appendix A.2.

SOILS

The site contains three types of soils consisting of fill, topsoil, and coarse-grained soil. The silty gravel with sand fill is found within depths of 12 to 30 inches. Below the fill exists a 6 to 12 inch layer of topsoil. Coarse grained soil can be found under the topsoil layer. According to the Geotechnical Engineering Report, this native course ground soil is a suitable target layer for stormwater infiltration.

The Geotechnical Engineer Report was prepared for the Spokane Transit Authority Argonne Station by Budinger & Associates in 2025. See Appendix A-2 for the Geotechnical Engineering Report, which includes a map of soil testing locations and geologic cross sections at those locations.

PRE-DEVELOPMENT CONDITION

The pre-development condition for the existing main project site is primarily undeveloped with grass cover that slopes generally towards the center of site to an existing drywell. To the north of the existing site, the asphalt pavement of the roadway drains to the site and enters the site discharging stormwater flow into the existing drywell. Table 2-1 below shows a summary of the drainage basin areas in each TDA.

TABLE 2-1 PRE-DEVELOPMENT BASIN

	AREA (ACRES)	2-YR	10-YR	25-YR	50-YR	100-YR
TDA 1 - A	0.31	0.40	0.74	0.94	1.09	1.24
TDA 1 - B	1.75	0.74	1.37	1.74	2.01	2.29
TDA 2 -A	0.21	0.27	0.50	0.63	0.73	0.83
TDA 2 -B	0.04	0.03	0.06	0.08	0.09	0.10
TOTAL	**2.31**	**1.45**	**2.67**	**3.39**	**3.92**	**4.47**

The site includes one streetlight, eight signs and posts, and a signal mast arm structure at the northwest corner. Additionally, underground electrical utilities are present, supporting both the streetlight and signal mast arm structure.

The portion of the site that extends to the northeast that is currently a freeway on ramp contains three signs, one streetlight, sidewalk, and an ADA ramp with a pedestrian push button. No critical areas (wells, steep slopes, floodplains) exist on the park and ride site. The receiving lane site is located within a 1000' wellhead buffer per a Spokane Valley Rathdrum Prairie Aquifer map created by the City of Spokane Valley in 2006. See Appendix A-9 for the aquifer map and other information used to determine critical areas relevant to the project site.

EXISTING HYDRAULIC FEATURES

The main project site contains one double-depth drywell at the low point in the center of the main site which captures all stormwater flow from the TDA 1. An existing detention pond is located along the eastbound I-90 on ramp with the bus receiving lane, which is approx. 50 feet to 400 feet from the existing runoff on the south border as it disperses down the hill to the detention pond capturing stormwater flow from TDA 2.

EXISTING STORMWATER DISCHARGE POINT INVENTORY

Existing site stormwater discharge points include infiltration via drywell within the park and ride site and dispersion within the receiving lane site. The existing drywell WSDOT feature number is DRAI00057663 per the GIS inventory map titled "WSDOT – Stormwater Discharge Points" with data from the Stormwater Features Inventory Database.

EXISTING UTILITIES

Existing utilities onsite include underground power, junction boxes, one streetlight, two traffic signal structures, and one overhead power pole in the southeast corner of the site. The receiving lane site includes underground power and junctions for pedestrian crossing buttons and two traffic signal structures.

3. DESIGN STANDARDS

DESIGN FREQUENCY

Design storm frequencies and hydrologic methods to size conveyance systems were selected following Spokane Regional Stormwater Manual (2008), HRM Section 4-4 for Eastern Washington design criteria and WSDOT Hydraulics Manual (HM) chapters 3,4 and 6. Modeling outputs can be found in Appendix A-3.

STORMWATER MANAGEMENT GUIDELINES

The WSDOT HRM Stormwater Design Documentation spreadsheet was used in determination of the applicable Minimum Requirements (MR) for the project drainage. The completed spreadsheet can be found in Appendix A-1.

TDA 1 is required to comply with all WSDOT Minimum Requirements #1-9. The project proposes construction of new and replaced asphalt roadway surface (impervious pollutant generating surface) and areas of new landscaped area with sidewalks (new non-pollution generating new impervious surfaces.) The project proposes 47,460 square feet of combined new and replaced impervious surfaces and 101,150 square feet of land disturbing activity triggering the WSDOT HRM Minimum Requirements #1-4. The proposed 41,33 square feet of new impervious surfaces also triggers the WSDOT HRM Minimum Requirements #6-9. The BMP RT.04 – Biofiltration Swale will be used for TDA 1 onsite to capture the stormwater flow.

TDA 2 is required to comply with WSDOT Minimum Requirements #1-9 as it is currently considered part of one project. It is possible that MR# 6 does not apply to this area. BMP RT.02-Filter Strip is currently shown to be used to provide runoff treatment and flow control for TDA 2 to reduce the impact on the existing bioinfiltration pond to the east.

See Appendix A.1 for the WSDOT Stormwater Design Documentation Spreadsheet, and Appendix A.2 for Minimum Requirement flowcharts.

STORMWATER RETROFIT ANALYSIS

The existing drywell on the park and ride site will be removed as part of the development of the site and will not be retrofit to the new site. There are no other existing stormwater structures or facilities within the project site. An existing stormwater retention pond is located 50 feet from the end of the eastbound on-ramp receiving lane addition but will not be adversely impacted and will not be retrofitted.

OTHER REQUIREMENTS

Design for this project was completed using the 2008 Spokane Regional Stormwater Manual (SRSM), which meets or exceeds applicable criteria from the Washington State Department of Ecology's Stormwater Management Manual for Eastern Washington (SWMMEW) for underground injection and discharge to surface waters. Both TDA 1 and TDA 2 are required to comply with all of the SRSM's basic requirements (1-8).

HYDRAULICS MANUAL DEVIATIONS

No deviations from April 2024 WSDOT Hydraulics Manual were used during design.

HIGHWAY RUNOFF MANUAL DEVIATIONS

No deviations from April 2019 WSDOT Highway Runoff Manual were used during design.

PIPE ALTERNATIVES

Pipe used for construction of the stormwater conveyance system shall an 18-inches in diameter and polyvinyl chloride (PVC) material. Other accepted pipe materials include concrete (Class IV, and Class III).

DOWNSTREAM ANALYSIS

Current runoff patterns of flow will generally be maintained, and the stormwater will infiltrate into the existing soils then deposit into a drywell for higher flows as needed. The proposed stormwater system will generally maintain the pre-development flow patterns and use bioretention swales to capture stormwater flow and infiltrate runoff within the project limits. The BMP and conveyance systems designed will maintain existing drainage patterns during large storm events.

NEW STORMWATER DISCHARGE POINTS

Stormwater continues to infiltrate onsite in the post-development condition similarly to the pre-development condition. The proposed development includes seven bioinfiltration swales, each with a single-depth drywell, designed to treat and infiltrate stormwater runoff from both the park-and-ride site and the existing upstream flows from north. Stormwater runoff generated within the receiving lane site continues to sheet flow southeast off the on-ramp where it will naturally disperse, just as in the pre-development condition.

4. POST-DEVELOPMENT CONDITIONS

DRAINAGE BASINS

The post-development condition of the project does not impact TDA delineation. The developed project site consists of the same two distinct threshold discharge areas (TDAs). Table 4-1 below shows a summary of the drainage basin areas in each TDA.

TABLE 4-1 POST-DEVELOPMENT BASIN

	AREA (ACRES)	2-YR	10-YR	25-YR	50-YR	100-YR
TDA 1 - OFF1	0.19	0.25	0.45	0.58	0.67	0.76
TDA 1 - OFF2	0.18	0.23	0.43	0.55	0.64	0.72
TDA 1 - 1	0.05	0.01	0.03	0.03	0.04	0.04
TDA 1 - 2	0.25	0.25	0.45	0.58	0.67	0.76
TDA 1 - 3	0.34	0.29	0.54	0.69	0.80	0.91
TDA 1 - 4	0.23	0.22	0.41	0.52	0.60	0.68
TDA 1 - 5	0.13	0.13	0.23	0.30	0.34	0.39
TDA 1 - 6	0.10	0.09	0.16	0.20	0.23	0.26
TDA 1 - 7	0.60	0.57	1.06	1.34	1.55	1.77
TDA 2 - 1	0.25	0.30	0.56	0.71	0.82	0.93
TOTAL	**2.32**	**2.35**	**4.33**	**5.48**	**6.34**	**7.23**

TDA 1 includes the park and ride site that drains to onsite bioswales with single depth drywells. TDA 2 includes the I-90 on-ramp receiving lane site, to the northeast of the park and ride site. TDA 1 has seven (7) drainage basins that each drain to a pond within the basin. The adjacent roadway on either side of the site will continue to sheet flow to the south. See Appendix A.2 for TDA map and the Post-Development Basin map.

POST DEVELOPED DRAINAGE PATTERNS

Stormwater runoff generated within the new park and ride site will sheet flow to curb openings and catch basins, then flow to bioinfiltration swales with drywells via PVC pipe. The developed site contains seven (7) new bioinfiltration swales with single depth drywells to treat and infiltrate stormwater runoff.

Stormwater runoff generated within TDA 2 can continue to sheet flow southeast off the on-ramp where it will naturally disperse following to the existing stormwater swale to the east, just as in the predeveloped condition. BMP RT.02 - Filter Strip is currently shown to provide runoff treatment and flow control for TDA 2 to reduce the impact on the existing bioinfiltration pond to the east. Further calculations and inspection during the project design will determine if the Filter Strip is necessary.

5. HYDROLOGIC AND HYDRAULIC DESIGN

Conveyance systems to route stormwater flow were designed with the general knowledge of the existing stormwater patterns.

CALCULATIONS

TDA 1 will utilize bioinfiltration swales on the park and ride site. The slope of the seven proposed swales will meet the WSDOT HRM standard for a 1.5% slope along the pond bottom. The biofiltration swale will generally follow the calculations and requirements outlined in the 2019 HRM Chapter 5-4.1.3.

Mannings Equation

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\ n}{1.49\ s^{0.5}}$$

Where: Q_{biofil} = width of natural dispersion in feet
A = area (ft^2)
R = hydraulic radius (ft)
s = slope (ft/ft)
n = Mannings coefficient

Natural dispersion is utilized for the existing stormwater flow pattern. The RT.02 – Vegetated Filter Strip will follow the calculations and requirements outlined in the 2019 HRM Chapter 5-4.1.3.

Natural Dispersion

$$LID = \frac{ACP}{\frac{K_s}{r_i} - 1}$$

Where: LID = width of natural dispersion in feet
ACP = width of roadway in feet
K_s = saturated hydraulic conductivity in inches per hour
r_i = rainfall intensity in inches per hour

The option to integrate the BMP RT.02 - Filter Strip is currently shown in the basin map to provide runoff treatment and flow control for TDA 2 to reduce the impact on the existing bioinfiltration pond to the east.

CONCLUSIONS AND RECOMMENDATIONS

Stormwater runoff generated within TDA 1 will be adequately treated and captured by the proposed seven (7) bioswales for the post-development project site. It is considered that onsite grading will generally grade towards the ponds as shown and all the ponds will be a minimum depth to accommodate the 1 foot of freeboard required. The drywells will be set at an elevation to allow time for water quality treatment and infiltration. All ponds are expected to drain and infiltrate within a 72-hour time period to meet requirements.

Stormwater runoff generated within TDA 2 will be adequately treated and captured by the I-90 on-ramp receiving lane. This will be accomplished by allowing the flows to disperse as in the pre-development condition or by adding a Filter Strip to the south of the shoulder.

6. PERMITS AND ASSOCIATED REPORTS

ENVIRONMENTAL ISSUES, FISH AND OTHER ENDANGERED HABITAT

No critical areas or fish passage issues were identified in the project area.

PERMITS/APPROVALS

No permits were required for storm drainage in this project.

EASEMENTS

No easements were required for storm drainage in this project.

ADDITIONAL REPORTS OR STUDIES

Geoengineers geotechnical report available. – See Appendix A-10

7. Inspection and Maintenance Summary

The project contains existing drainage conveyance systems and stormwater facilities. The proposed stormwater BMPs are low maintenance facilities and minimal maintenance is anticipated. Operational maintenance shall follow the guidelines of Table 5-11, 5-17, 5-18, and 5-19 of the WSDOT HRM.

Appendix A-1

Stormwater Design Documentation Spreadsheet

Project Title:	**I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride**
WSDOT Region:	Eastern
WIN:	
PIN(s):	
Design Manual Used:	Highway Runoff Manual
Manual Publication Year:	2019
Job Number:	STA WO# 10325-0007

2019 HRM Spreadsheet Version 6.3

Is this project in western Washington? **NO**

Existing Impervious Surface

Total Project Area (ft^2)	18,793
acres =	0.431

New Impervious Surface

Total Project Area (ft^2)	41,533
acres =	0.953

Conversion of Native Vegetation to Lawn or Landscaped

Total Project Area (ft^2)	N/A

Conversion of Native Vegetation to Pasture

Total Project Area (ft^2)	N/A

Replaced Impervious Surface

Total Project Area (ft^2)	5,927
acres =	0.136

Land Disturbing Activity

Total Project Area (ft^2)	101,150
acres =	2.322

Is this project a "non-road-related" project? (See HRM Glossary for definition) **YES**

>>>>>Enter replacement value of existing site here (Cell C31)-------> $300,000

>>>>>Enter cost of proposed improvements here (Cell C32)---------> $1,000,000

Set the box to the right to NO ----> NO

Description	Project Area	Threshold Area Triggers	HRM Figure 3-1 Step #	Decision Response	HRM Minimum Requirements
New and replace impervious surfaces added to Project	47,460	≥ 2,000 ft^2	2	YES	Apply MR 1-4 to the new and replaced impervious surfaces and land disturbed on the Project
Land disturbing activity for the Project	101,150	≥ 7,000 ft^2	2	YES	Apply MR 1-4 to new and replaced impervious surfaces and land disturbed on the Project
New impervious surface added to Project	41,533	≥ 5,000 ft^2	3	YES	Apply MR 6-9 for new impervious surfaces and converted pervious surfaces on the Project
Conversion of native vegetation to lawn or landscaped area	N/A	≥ 32,670 ft^2 (3/4 acres)	3	N/A	N/A
Conversion of native vegetation to pasture	N/A	≥ 108,900 ft^2 (2.5 acres)	3	N/A	N/A
New impervious surfaces add 50% or more to the existing impervious surfaces within the Project limit	N/A	New impervious ≥ 5,000 sq. ft AND (New Impervious surface) ≥ 1/2 (Exist Impervious surface)	4	N/A	Check non-road-related project theshold below
For non-road-related Projects, proposed value of improvements greater than replacement value	See HRM Figure 3-1 for complete threshold. Non-road-related project generally refers to rest area, ferry terminals, and maintenance facility Projects.	(New impervious + replaced impervious) ≥ 5,000 sq. ft AND (Proposed value of improvements) ≥ 1/2 (replacement value of existing site)	4	YES	Apply MR 6-9 to replaced impervious surfaces on the Project

Summary of All Minimum Requirements:

Apply MR 1-4 to New and Replaced impervious surfaces and land disturbed on the Project
Apply MR 6-9 to New impervious surfaces and Converted pervious surfaces on Project
Apply MR 6-9 to Replaced imperious surfaces on Project
Complete the Level of Retrofit Tab
Go To the 'Step 5 and 6' tab

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution Prevention	7	Wetlands Protection
3	Source Control of Pollutants	8	Incorporating Approved Basin Plans into Stormwater Management
4	Maintaining the Natural Drainage System	9	Operation and Maintenance
5	Runoff Treatment (quality)		

Project Title: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride
WSDOT Region: Eastern
WIN:
PIN(s):
Design Manual Used: Highway Runoff Manual
Manual Publication Year: 2019
Job Number: STA WO# 10325-0007

2019 HRM Spreadsheet Version 6.3

Is this project in western Washington? NO

Existing PGIS

Total Project Area (ft^2)	18,793
acres =	0.431

New PGIS

Total Project Area (ft^2)	41,533
acres =	0.953

Conversion of Native Vegetation to PGPS

Total Project Area (ft^2)	N/A

Replaced PGIS

Total Project Area (ft^2)	5,927
acres =	0.136

Is this project a "non-road-related" project? (See HRM Glossary for definition) YES

>>>>>Replacement value of exisitng site -------> $300,000

>>>>>Cost of propsed improvements --------> $1,000,000

Description	Project Area (ft^2)	Threshold Area (ft^2)	HRM Figure 3-2 Step #	Decision Response	HRM Minimum Requirements
New PGIS added to Project	41,533	≥ 5,000	5	YES	Apply MR 5 for new PGIS and converted PGPS on the Project
Conversion of Native Vegetation to PGPS	NA	≥ 32,670 (3/4 acres)	5	N/A	N/A
New PGIS add 50% or more to the existing PGIS within the Project limit	N/A	New PGIS ≥ 5,000 AND (New PGIS) ≥ 1/2 (Exist PGIS)	6	N/A	Check non-road-related threshold below
For non-road-related Projects, proposed value of improvements greater than replacement value	See HRM Figure 3-1 for complete threshold. Non-road-related Project generally refers to rest area, ferry terminals, and maintenance facility projects.	(New PGIS + replaced PGIS) ≥ 5,000 AND (Proposed value of improvements) ≥ 1/2 (replacement value of existing site)	6	YES	Apply MR 5 to Replaced PGIS on Project

Summary of All Minimum Requirements:

Apply MR 5 to New PGIS and converted PGPS the on Project
Apply MR 5 to Replaced PGIS on the Project
Complete the Level of Retrofit Tab
Go to Step 7 RT tab

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution Prevention	7	Wetlands Protection
3	Source Control of Pollutants	8	Incorporating Approved Basin Plans into Stormwater Management
4	Maintaining the Natural Drainage System	9	Operation and Maintenance
5	Runoff Treatment (quality)		

Project Title: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride
WSDOT Region: Eastern
WIN:

PIN(s):

Design Manual Used: Highway Runoff Manual
Manual Publication Year: 2019
Job Number: STA WO# 10325-0007

2019 HRM Spreadsheet Version 6.3

Refer to HRM Figure 3-3 Step 7

Are the replaced PGIS applicable to the project per HRM Figure 3-2 Step 6? YES
Are there any existing runoff treatment Stormwater BMPs within the project limits? NO

Is this project in western Washington? NO

Does the project have retrofit requirements for discharges to Puget Sound? NO

TDA Description	Description	New PGIS Area (ft^2)	Replaced PGIS Area (ft^2)	Non-Effective PGIS Area (ft^2)	Effective PGIS Area (ft^2)	Converted PGPS Area (ft^2)	RT needed for TDA based on Effective PGIS? *Flow Chart Step 7* (Yes/No)	RT needed for TDA based on PGPS? *Flow Chart Step 7* (Yes/No)	RT needed for TDA? PGIS Area (ft^2)	RT needed for TDA? Converted PGPS Area (ft^2)	If RT needed, what is ADT of roadway in TDA? (ADT)	Is Roadway inside Urban Growth Area? (Yes/No)	Does the Roadway Have Full or Partially Controlled Limited Access? (Yes/No)	Enhanced RT or Basic RT?	Oil Control (Yes/No)	Phosphorus Control? (Yes/No)	Comments
1	Park and Ride Site	41,533	0	0	41,533	0	YES	N/A	41,533	N/A	500	YES	NO	Basic RT	NO	NO	
2	On-Ramp	0	5,927	0	5,927	0	YES	N/A	5,927	N/A	8,600	YES	NO	Enhanced RT	YES	NO	
	Area Totals for Project	**41,533**	**5,927**	**0**	**47,460**	**0**			**47,460**	**0**							

Project Title: **I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride**
WSDOT Region: Eastern
WIN:
PIN(s):
Design Manual Used: Highway Runoff Manual
Manual Publication Year: 2019
Job Number: STA WO# 10325-0007

2019 HRM Spreadsheet Version 6.3

Refer to HRM Figure 3-3 Step 8

Are the replaced Impervious surfaces applicable to the project per HRM Figure 3-1 Step 4? YES
Are there any existing flow control stormwater BMPs within the project limits? NO

Is this project in western Washington? NO

Does the project have retrofit requirements for discharges to Puget Sound? NO

TDA Description	Description	New Impervious Surface Area (ft^2)	Reverted Impervious Surface** Area (ft^2)	Net-New Impervious Surface Area (ft^2)	Replaced Impervious Surface Area (ft^2)	Non-Effective Impervious Surface Area (ft^2)	Effective Impervious Surface Area (ft^2)	Conversion of Native Vegetation to Lawn or Landscape per TDA Area (ft^2)	Increase of 0.15 cfs in 100-year Recurrence Interval Flow for TDA?*** (Yes/No)	FC Needed for TDA based on Effective Impervious surface threshold? (Yes/No)	FC needed for TDA based on Native Vegetation Conversion? (Yes/No)	FC needed for TDA based on 0.15 cfs increase in flow? (Yes/No)	FC needed for TDA? Effective Impervious Area (ft^2)	FC needed for TDA? Converted Pervious Surfaces Area (ft^2)	Comments
1	Park and Ride Site	41,533	0	41,533	0	0	41,533	-	-	YES	N/A	N/A	41,533	N/A	
2	On-Ramp	0	0	0	5,927	0	5,927	-	-	NO	N/A	N/A	0	N/A	
	Area Totals for Project	**41,533**	**0**	**41,533**	**5,927**	**0**	**47,460**	**0**					**41,533**	**0**	

**** Input zero into this column if the reverted impervious surface does not meet the reversion requirements per HRM 4-3.5.3.**

*****See Highway Runoff Manual 3-3.6.3 for MGSFlood modeling guidance.**

Project Title: **I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride**
WSDOT Region: Eastern
WIN:

PIN(s):

Design Manual Used: Highway Runoff Manual

Manual Publication Year: 2019

Job Number: STA WO# 10325-0007

2019 HRM Spreadsheet Version 6.3

Is this a WSDOT project initiated by WSDOT (i.e., this isn't a project initiated by a developer, local agency, or other state agency)?**	NO	
Does any part of the project drain to Puget Sound AND does any TDA in the project exceed runoff treatment or flow control thresholds?		
Are the replaced Impervious surfaces applicable to the project per HRM Figure 3-2 Step 5?	YES	
Are the replaced PGIS applicable to the project per HRM Figure 3-2 Step 6?	YES	
Was there any retrofitting of existing impervious surfaces and/or existing PGIS done by the project (including offsite in-kind retrofitting)?	YES	
Choose the type of retrofit of existing impervious surfaces done by the project.	PROJECT TRIGGERED	
Choose N/A ---------->	N/A	
Choose N/A ---------->	N/A	

PROJECT TRIGGERED

How much area of replaced impervious was retrofitted onsite for flow control in the project? (PROJECT TRIGGERED)		acres
How much area of replaced PGIS was retrofitted onsite for runoff treatment in the project? (PROJECT TRIGGERED)		acres
How much area of existing impervious was retrofitted onsite for flow control in the project?	0.000	acres
How much area of existing PGIS was retrofitted onsite for runoff treatment in the project?	5.000	acres
Leave Blank ---------->		acres
Leave Blank ---------->		acres
How much area of existing impervious was fully reverted to a pervious surface?	0.00008	acres
Choose N/A ---------->	N/A	
Choose N/A ---------->	N/A	
Leave Blank ---------->		

Were any new permanent stormwater BMPs constructed by the project OR were any existing stormwater BMPs modified by the project? YES

Goto the 'BMPs_New_or_Modified' and 'BMPs_Removed_or_Modified' tabs and enter in the permenant stormwater BMP information.

Project Title:	**I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride**
WSDOT Region:	**Eastern**
CN WIN:	
PIN:	
Design Manual Used:	**Highway Runoff Manual**
Manual Publication Year:	**2019**
Job Number:	**STA WO# 10325-0007**
CN Contract Number:	
SubstantiallyCompleteOperationallyComplete Date:	
CNPhaseEndPlanned Date:	
CNPhaseEndActual Date:	
Is the project within the WSDOT NPDES permit area?	**YES**
CN PE:	

2019 HRM Spreadsheet Version 6.3

State Route	Begin MP	Begin Latitude** (in Decimal Degrees)	Begin Longitude** (in Decimal Degrees)	End MP	End Latitude** (in Decimal Degrees)	End Longitude** (in Decimal Degrees)	TDA Name	Stormwater BMP Type	Is this an existing BMP to be modified by project or is this a new BMP?	Will this BMP be owned and operated by WSDOT?	Will this BMP be maintained by WSDOT?	List the old WSDOT Feature Number*** (existing BMPs that will be modified by the project will be given a new Feature Number)	List the new WSDOT Feature Number*** (existing BMPs that will be modified by the project will be given a new Feature Number)	Is this BMP designed to full or partial HRM standards?****	List the amount of Effective Impervious Surface (flow control) mitigated by the new or modified BMP (Acres)	List the amount of Effective PGIS (runoff treatment) mitigated by the new or modified BMP (Acres)	If retrofitting existing impervious surfaces, list the amount of existing impervious surface mitigated by the new or modified BMP for flow control (Acres)	If retrofitting existing PGIS, list the amount of existing PGIS mitigated by the new or modified BMP for runoff treatment (Acres)	Comments
090	287.86	47.67	-117.28	287.86	47.67	-117.28	Park and Ride Site	Bioinfiltration Pond (EW only)	New	YES	NO	N/A		Full			N/A	N/A	
090	287.86	47.67	-117.28	287.86	47.67	-117.28	Park and Ride Site	Drywell	New	YES	NO	N/A		Full			N/A	N/A	

Project Title: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride
WSDOT Region: Eastern
CN WIN:
PIN:
Design Manual Used: Highway Runoff Manual
Manual Publication Year: 2019
Job Number: STA WO# 10325-0007
CN Contract Number:
SubstantiallyCompleteOperationallyComplete Date:
CNPhaseEndPlanned Date:
CNPhaseEndActual Date:
Is the project within the WSDOT NPDES permit area? YES
CN PE:

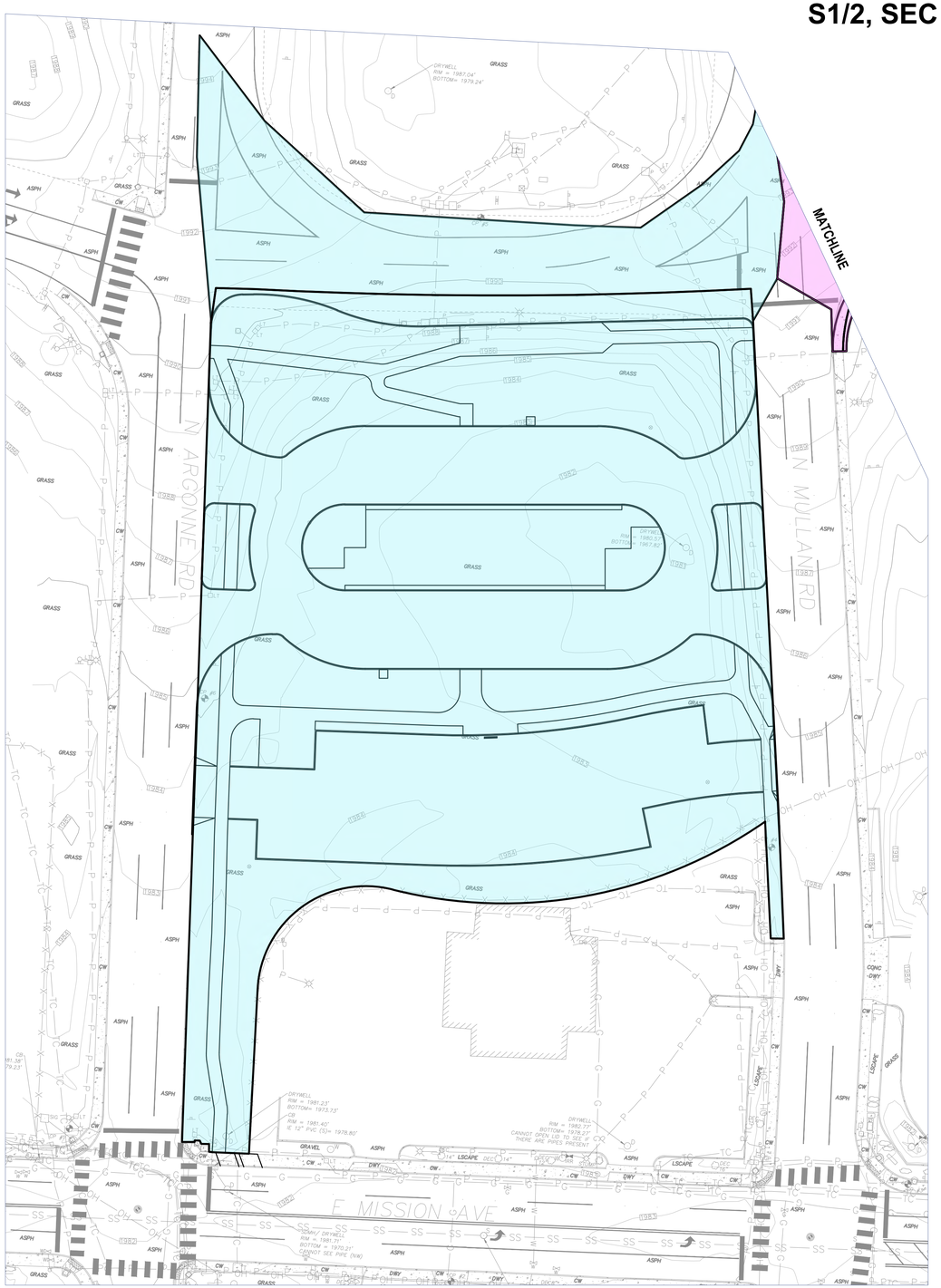
2019 HRM Spreadsheet Version 6.3

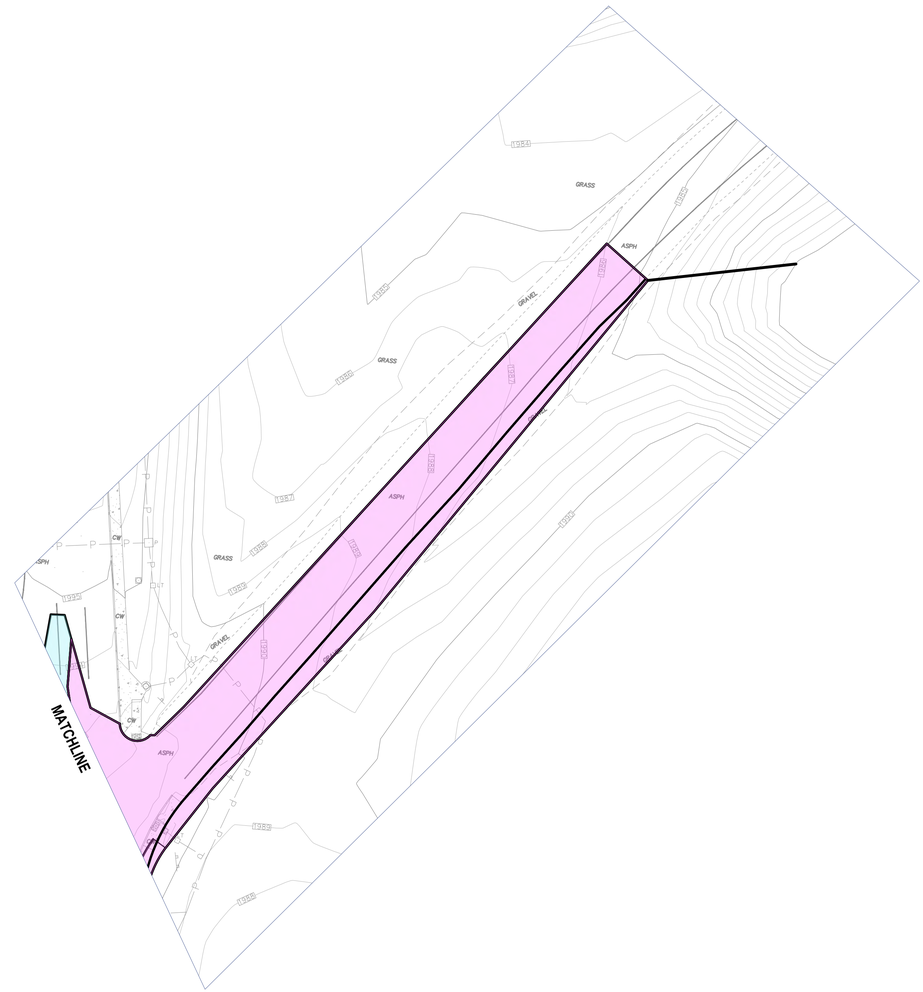
State Route	Begin MP	Begin Latitude** (in Decimal Degrees)	Begin Longitude** (in Decimal Degrees)	End MP	End Latitude** (in Decimal Degrees)	End Longitude** (in Decimal Degrees)	TDA Name	Existing Stormwater BMP Type	Is this an existing BMP going to be modified or completely removed by project?	Existing WSDOT Feature Number (See WSDOT HATS*** web application to determine Feature Number)	If this is an existing BMP being modified, please describe the proposed modification	List the amount of existing Impervious surface (flow control) mitigated by the existing BMP before the project (Acres)	List the amount of existing PGIS (runoff treatment) mitigated by the existing BMP before the project (Acres)	Is the amount of existing impervious surface and PGIS receiving treatment and flow control re-established by a new or modified BMP?	Comments
090	287.86	47.67	-117.28	287.86	47.67	-117.28	Park and Ride Site	Drywell	Completely Removed	DRAI00057663	N/A	0.000	0.000	YES	Drywell in low point of undeveloped project site

Appendix A-2

TDA Maps, Drainage Basin Maps, and Area Calculations

S1/2, SEC 07, T25N, R44E, WM





LEGEND

- TDA 1
- TDA 2

N

0 15' 30' 60'

1 inch = 30 feet

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY: KSS | DESIGNED BY: CDZ
CHECKED BY: JRP | APPROVED BY: MAB
DATE: 05/27/2025
JOB No.: 2400399
SCALE: AS NOTED

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

Spokane Transit

kpff
421 W. Riverside Ave, Suite 524
Spokane, WA 99201
509.289.2300
www.kpff.com

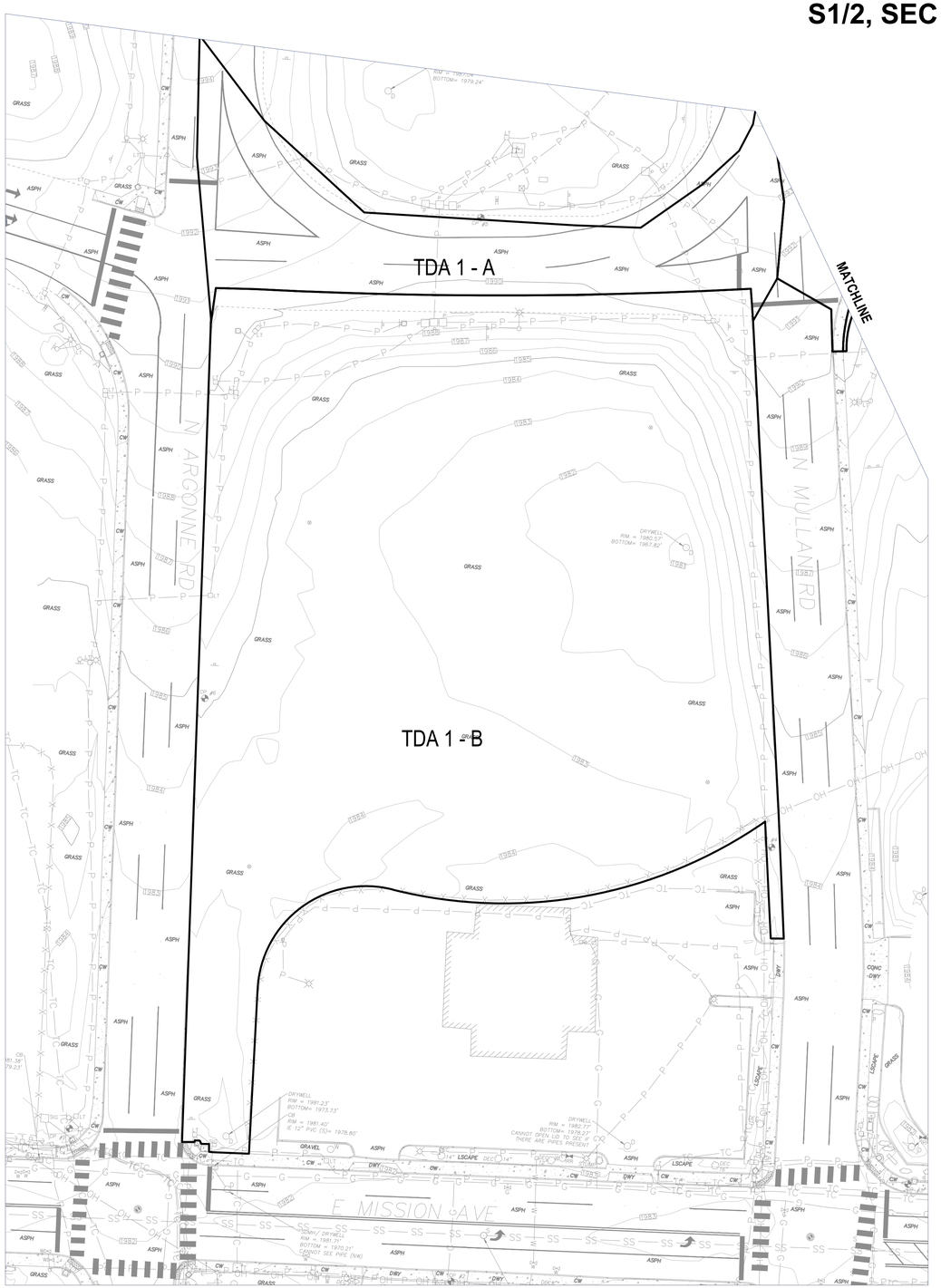
ARGONNE STATION PARK AND RIDE PROJECT
SPOKANE VALLEY, WA

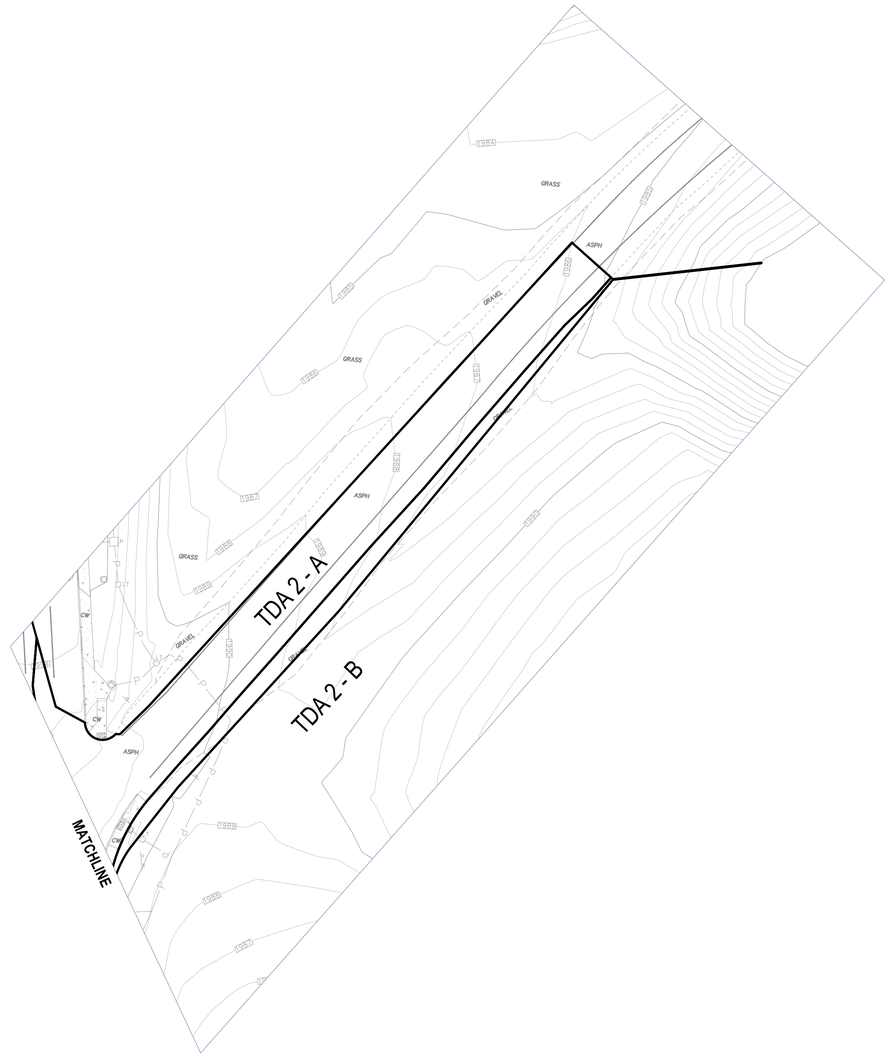
TDA MAP

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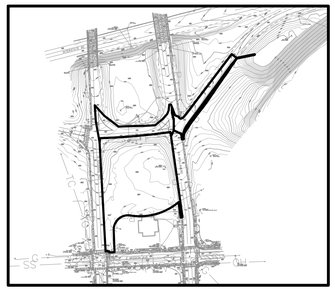
S1/2, SEC 07, T25N, R44E, WM





LEGEND

- TDA 1
- TDA 2



KEY MAP

SCALE: 1" = 250'

N

0 15' 30' 60'

1 inch = 30 feet

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY KSS | DESIGNED BY CDZ
CHECKED BY JRP | APPROVED BY MAB
DATE 05/27/2025
JOB No.: 2400399

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

SCALE: AS NOTED

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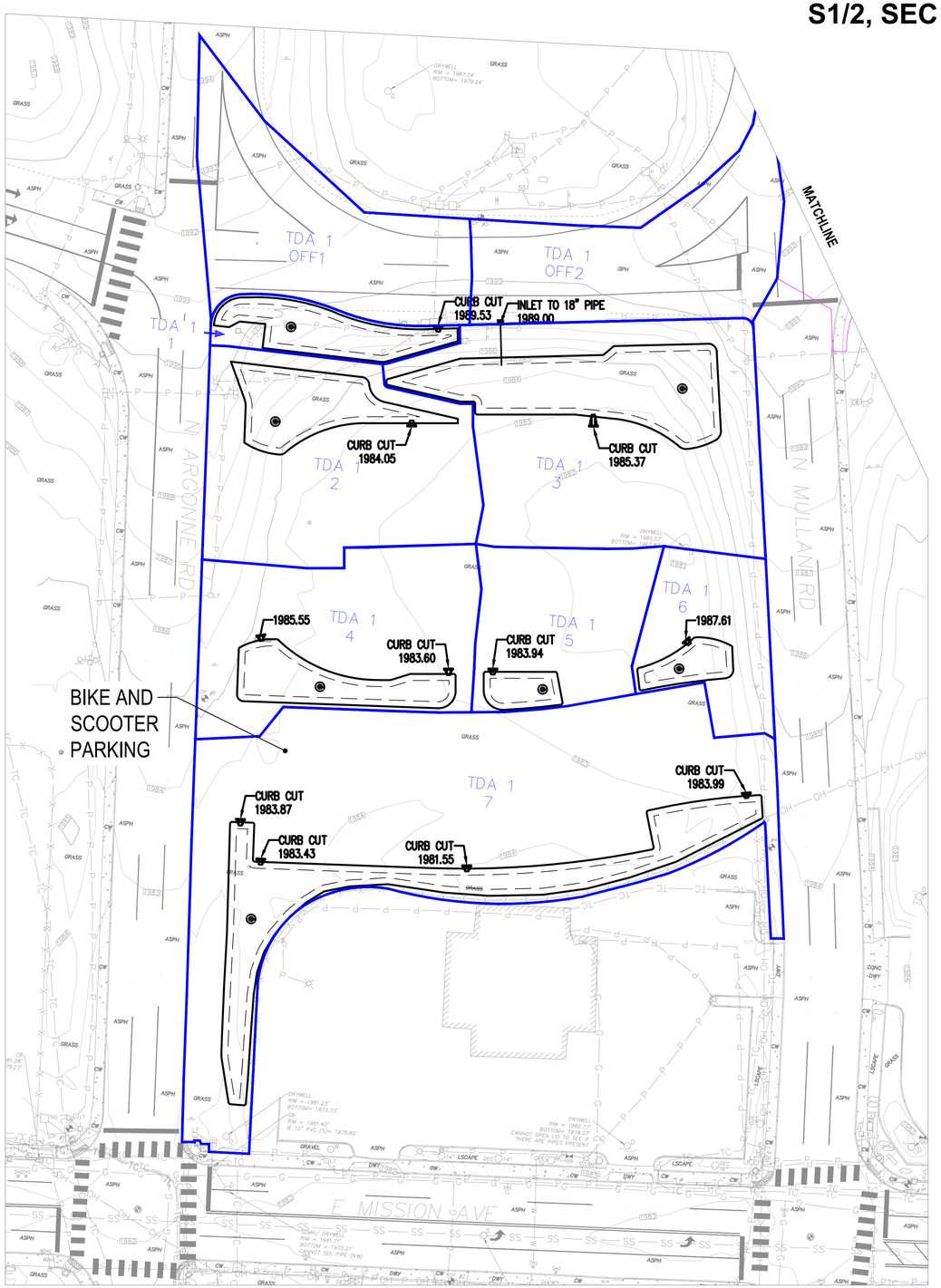
ARGONNE STATION PARK AND RIDE PROJECT
SPOKANE VALLEY, WA

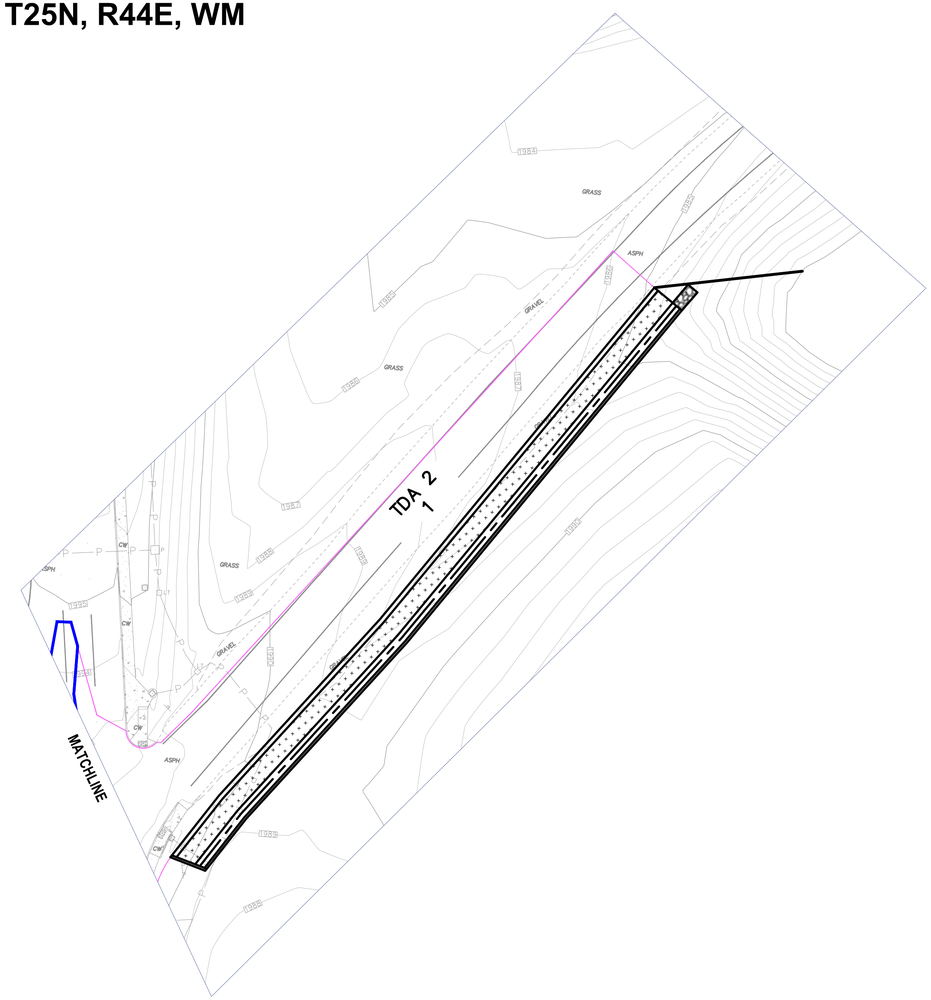
EXISTING BASINS

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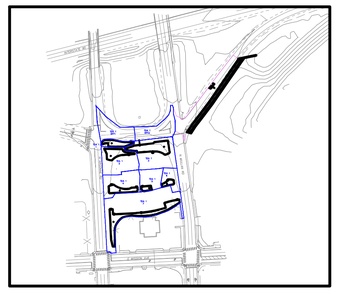
S1/2, SEC 07, T25N, R44E, WM





LEGEND

- TDA 1
- TDA 2
- BASINS



KEY MAP

SCALE: 1" = 250'

N

0 15' 30' 60'

1 inch = 30 feet

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY KSS | DESIGNED BY KSS
CHECKED BY JRP | APPROVED BY MAB
DATE 05/27/2025
J O B No. : 2400399

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

S C A L E: AS NOTED

Spokane Transit

kpff
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509.289.2300
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ARGONNE STATION PARK AND RIDE PROJECT
SPOKANE VALLEY, WA

PROPOSED BASINS

SHEET
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BASIN TABLES
RATIONAL METHOD

PROJECT: I-90 / ARGONNE RD & MULLAN RD INTERCHANGE - STA PARK & RIDE, SPOKANE VALLEY, WA
REVIEWER: JRP
DESIGNER: CDZ
DATE: 6/11/2025

BASIN INFORMATION TABLE		*"C" Value*									Q=CIA (cfs)				
		0.90	*0.90*	*0.90*	*0.90*	*0.15*	*0.30*	*0.55*	*Intensity (in/hr)*		*1.42*	*2.62*	*3.32*	*3.84*	*4.38*
Basin	**Total (sq ft)**	**Asphalt (sq ft)**	**Attached Concrete (sq ft)**	**Detached Concrete (sq ft)**	**Buildings / Roof (sq ft)**	**Grass / Landscape (sq ft)**	**Unimproved (sq ft)**	**Gravel (sq ft)**	**Combined "C"**	**Area (acres)**	**2 Year Storm**	**10 Year Storm**	**25 Year Storm**	**50 Year Storm**	**100 Year Storm**
PRE-DEVELOPMENT CONDITION															
TDA 1 - A	**13,691**	13,691	0	0	0	0	0	0	0.90	0.31	0.40	0.74	0.94	1.09	1.24
TDA 1 - B	**76,075**	0	0	0	0	0	76,075	0	0.30	1.75	0.74	1.37	1.74	2.01	2.29
TDA 2 -A	**9,185**	9,185	0	0	0	0	0	0	0.90	0.21	0.27	0.50	0.63	0.73	0.83
TDA 2 -B	**1,843**	0	0	0	0	0	0	1,843	0.55	0.04	0.03	0.06	0.08	0.09	0.10
PRE-DEVELOPMENT TOTALS	**100,794**	**22,876**	**0**	**0**	**0**	**0**	**76,075**	**1,843**	**0.44**	**2.31**	**1.45**	**2.67**	**3.39**	**3.92**	**4.47**
POST-DEVELOPMENT CONDITION															
TDA 1 - OFF1	**8,402**	8,402	0	0	0	0	0	0	0.90	0.19	0.25	0.45	0.58	0.67	0.76
TDA 1 - OFF2	**8,005**	8,005	0	0	0	0	0	0	0.90	0.18	0.23	0.43	0.55	0.64	0.72
TDA 1 - 1	**2,316**	0	0	120	0	2,196	0	0	0.19	0.05	0.01	0.03	0.03	0.04	0.04
TDA 1 - 2	**10,860**	4,860	0	3,036	0	2,964	0	0	0.70	0.25	0.25	0.45	0.58	0.67	0.76
TDA 1 - 3	**14,698**	4,820	0	4,300	0	5,578	0	0	0.62	0.34	0.29	0.54	0.69	0.80	0.91
TDA 1 - 4	**9,823**	4,420	0	2,637	0	2,766	0	0	0.69	0.23	0.22	0.41	0.52	0.60	0.68
TDA 1 - 5	**5,681**	2,754	0	1,318	0	1,609	0	0	0.69	0.13	0.13	0.23	0.30	0.34	0.39
TDA 1 - 6	**4,244**	2,050	0	609	0	1,585	0	0	0.62	0.10	0.09	0.16	0.20	0.23	0.26
TDA 1 - 7	**26,064**	13,390	0	4,800	0	7,874	0	0	0.67	0.60	0.57	1.06	1.34	1.55	1.76
TDA 2 - 1	**11,028**	9,185	0	0	0	0	0	1,843	0.84	0.25	0.30	0.56	0.71	0.82	0.93
POST-DEVELOPMENT TOTALS	**101,120**	**57,886**	**0**	**16,820**	**0**	**24,572**	**0**	**1,843**	**0.71**	**2.32**	**2.34**	**4.33**	**5.48**	**6.34**	**7.23**

PRE-DEVELOPMENT PGIS		**24,719 sq ft**
POST-DEVELOPMENT PGIS		**59,729 sq ft**
	NEW PGIS	**41,533 sq ft**
NEW AND REPLACED PGIS		**47,460 sq ft**

Appendix A-3

Calculations and Program Output

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.260 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.260 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.260	cfs - runoff treatment design flow rate
A	2.307	ft2 - wetted area
R	0.285	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	6.00	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow

Q_{biofil} 0.521 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.260	cfs - runoff treatment design flow rate
A	2.307	ft2 - wetted area
R	0.285	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	6.00	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow

Q_{biofil} 0.521 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	2.307	ft2 - Wetted Area
Enter Final Swale R	0.285	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	6.00	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$

HRM Chapter 5 Equation E-12

V_{biofil}	0.11	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	60.86	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

Freeboard Check (Online Swales Only)

FC-1	Q25yr	0.61	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	0.61	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.09	ft - design depth flow
	A	0.53	ft2 - wetted area
	R	0.082	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	6.00	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	0.61	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.09	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions			
Swale Length	60.86	ft	<----Note minimum swale length = 100 ft
Bottom Width	6.0	ft	
Swale Longitudinal Slope	0.015	ft/ft	
$z_{foreslope}$	3.0		
$z_{backslope}$	3.0		
WQ Depth	0.33	ft	
Swale Depth (includes 1 ft Freeboard)	1.09	ft	

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.250 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.250 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.250	cfs - runoff treatment design flow rate
A	2.967	ft2 - wetted area
R	0.294	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	8.00	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow

Q_{biofil} 0.684 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.250	cfs - runoff treatment design flow rate
A	2.967	ft2 - wetted area
R	0.294	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	8.00	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow

Q_{biofil} 0.684 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	2.967	ft2 - Wetted Area
Enter Final Swale R	0.294	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	8.00	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$

HRM Chapter 5 Equation E-12

V_{biofil}	0.08	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	45.51	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

Freeboard Check (Online Swales Only)

FC-1	Q25yr	0.58	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	0.58	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.07	ft - design depth flow
	A	0.57	ft2 - wetted area
	R	0.068	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	8.00	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	0.58	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.07	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions			
Swale Length	45.51	ft	<----Note minimum swale length = 100 ft
Bottom Width	8.0	ft	
Swale Longitudinal Slope	0.015	ft/ft	
$z_{foreslope}$	3.0		
$z_{backslope}$	3.0		
WQ Depth	0.33	ft	
Swale Depth (includes 1 ft Freeboard)	1.07	ft	

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.530 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.530 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.530	cfs - runoff treatment design flow rate
A	2.343	ft2 - wetted area
R	0.286	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	6.11	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow

Q_{biofil} 0.530 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.530	cfs - runoff treatment design flow rate
A	2.343	ft2 - wetted area
R	0.286	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	6.11	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow

Q_{biofil} 0.530 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	2.343	ft2 - Wetted Area
Enter Final Swale R	0.286	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	6.11	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$

HRM Chapter 5 Equation E-12

V_{biofil}	0.23	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	122.15	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

Freeboard Check (Online Swales Only)

FC-1	Q25yr	1.24	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	1.24	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.13	ft - design depth flow
	A	0.83	ft2 - wetted area
	R	0.121	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	6.11	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	1.24	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.13	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions		
Swale Length	122.15	ft
Bottom Width	6.1	ft
Swale Longitudinal Slope	0.015	ft/ft
$z_{foreslope}$	3.0	
$z_{backslope}$	3.0	
WQ Depth	0.33	ft
Swale Depth (includes 1 ft Freeboard)	1.13	ft

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.220 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.220 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.220	cfs - runoff treatment design flow rate
A	2.967	ft2 - wetted area
R	0.294	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	8.00	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow

Q_{biofil} 0.684 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.220	cfs - runoff treatment design flow rate
A	2.967	ft2 - wetted area
R	0.294	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	8.00	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow

Q_{biofil} 0.684 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	2.967	ft2 - Wetted Area
Enter Final Swale R	0.294	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	8.00	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$ HRM Chapter 5 Equation E-12

V_{biofil}	0.07	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	40.04	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

Freeboard Check (Online Swales Only)

FC-1	Q25yr	0.52	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	0.52	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.07	ft - design depth flow
	A	0.54	ft2 - wetted area
	R	0.064	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	8.00	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	0.52	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.07	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions			
Swale Length	40.04	ft	<----Note minimum swale length = 100 ft
Bottom Width	8.0	ft	
Swale Longitudinal Slope	0.015	ft/ft	
$z_{foreslope}$	3.0		
$z_{backslope}$	3.0		
WQ Depth	0.33	ft	
Swale Depth (includes 1 ft Freeboard)	1.07	ft	

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.130 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.130 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.130	cfs - runoff treatment design flow rate
A	3.627	ft2 - wetted area
R	0.300	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	10.00	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow

Q_{biofil} 0.847 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.130	cfs - runoff treatment design flow rate
A	3.627	ft2 - wetted area
R	0.300	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	10.00	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow

Q_{biofil} 0.847 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	3.627	ft2 - Wetted Area
Enter Final Swale R	0.300	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	10.00	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$

HRM Chapter 5 Equation E-12

V_{biofil}	0.04	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	19.36	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

Freeboard Check (Online Swales Only)

FC-1	Q25yr	0.30	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	0.30	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.04	ft - design depth flow
	A	0.42	ft2 - wetted area
	R	0.041	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	10.00	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	0.30	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.04	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions			
Swale Length	19.36	ft	<----Note minimum swale length = 100 ft
Bottom Width	10.0	ft	
Swale Longitudinal Slope	0.015	ft/ft	
$z_{foreslope}$	3.0		
$z_{backslope}$	3.0		
WQ Depth	0.33	ft	
Swale Depth (includes 1 ft Freeboard)	1.04	ft	

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.090 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.090 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.090	cfs - runoff treatment design flow rate
A	2.307	ft2 - wetted area
R	0.285	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	6.00	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow

Q_{biofil} 0.521 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.090	cfs - runoff treatment design flow rate
A	2.307	ft2 - wetted area
R	0.285	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	6.00	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow

Q_{biofil} 0.521 cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	2.307	ft2 - Wetted Area
Enter Final Swale R	0.285	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	6.00	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$

HRM Chapter 5 Equation E-12

V_{biofil}	0.04	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	21.07	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

Freeboard Check (Online Swales Only)

FC-1	Q25yr	0.20	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	0.20	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.04	ft - design depth flow
	A	0.27	ft2 - wetted area
	R	0.043	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	6.00	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	0.20	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.04	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions			
Swale Length	21.07	ft	<----Note minimum swale length = 100 ft
Bottom Width	6.0	ft	
Swale Longitudinal Slope	0.015	ft/ft	
$z_{foreslope}$	3.0		
$z_{backslope}$	3.0		
WQ Depth	0.33	ft	
Swale Depth (includes 1 ft Freeboard)	1.04	ft	

RT.04 - Basic Biofiltration Swale and Compost Amended Biofiltration Swale
Project: I-90 / Argonne Rd & Mullan Rd Interchange - STA Park & Ride Designed By: CDZ
Description: Checked By:

BASIC BIOSWALE AND COMPOST AMENDED BIOSWALE SPREADSHEET VERSION 2.1

Design Steps

D-1 Determine runoff treatment design flow rate Q_{wq}

Q_{wq} 0.570 Runoff treatment design flow rate from MGS Flood OR SBUH; MGSFlood reports an online and offline flow rate, please enter the applicable design flow rate

D-2 Determine the biofiltration design flow rate (Q_{biofil})

Is the bioswale in eastern WA? Yes Qwq=Qbiofil

N/A

Is bioswale online or offline? online

Q_{biofil} 0.570 runoff treatment design flow rate

D-3 Determine the longitudinal slope of the proposed biofiltration swale (ft/ft)

s 0.015 ft/ft

D-4 Select a soil and vegetation cover suitable for the biofiltration swale

soil/veg Grass-legume mix on lightly compacted topsoil with 3-inch medium compost blanket (CABS) <--Use pull down box

Manning's n= 0.35 From HRM Table 5-3

D-5 Select the design depth of flow y (see HRM Table 5-4)

y 0.33 (ft) design depth of flow; for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-6 Select a trapezoidal swale cross-sectional shape.

D-7 Use Manning's Eq and first approximations relating hydraulic radius and dimensions to get width for trapezoidal cross section

$$Q_{biofil} = \frac{1.49 A R^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad AR^{.67} = \frac{Q_{biofil}\, n}{1.49\, s^{0.5}}$$

<--manning's changed

HRM Chapter 5 Equation E-11

Use Excel Solver

D-7a

Q_{biofil}	0.570	cfs - runoff treatment design flow rate
A	2.802	ft2 - wetted area
R	0.292	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	7.50	ft - bioswale bottom width
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow = maximum depth of flow
Q_{biofil}	0.643	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "b" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-7b If the swale calculations above give a swale width less than 2 feet wide, re-run calculations with 2 foot wide swale, solve for depth y Or if redesigning swale with different dimensions, use below calculator and use Excel Goal Seek to determine new depth of flow.

Q_{biofil}	0.570	cfs - runoff treatment design flow rate
A	2.802	ft2 - wetted area
R	0.292	ft - hydraulic radius
s	0.015	ft/ft longitudinal slope of swale
n	0.35	Manning's coefficient
b	7.50	ft - enter new bottom width if applicable (2 foot is minimum)
$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
y	0.330	ft - design depth flow
Q_{biofil}	0.643	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{biofil} above changing the "y" value

Note: Depth of flow for basic biofiltration swale and CABS = 4" max (0.33 ft max) for WQ event

D-8 **Enter Final Bioswale Dimensions from the calculations in Step D-7a or D-7b**

Enter Final Swale Area	2.802	ft2 - Wetted Area
Enter Final Swale R	0.292	ft - hydraulic radius
Enter Final Swale slope s	0.015	ft/ft longitudinal slope of swale
Enter Final Swale n	0.35	Manning's coefficient
Enter Final Swale bottom width b	7.50	ft - swale bottom width
Enter Final Swale $z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale $z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
Enter Final Swale flow depth y	0.330	ft - design depth flow

D-9 **Computer the flow velocity at Q_{biofil}**

$$V_{biofil} = \frac{Q_{biofil}}{A}$$

HRM Chapter 5 Equation E-12

V_{biofil}	0.20	ft/sec - flow velocity; 1 ft/sec maximum

Flow veloicty is OK since it is less than 1 ft/sec

D-10 **Compute Swale Length L (ft)**

$$L = V_{biofil} \times t$$

t	540	seconds - 9 minutes (540 seconds) for CABS, Basic, and Wet bioswale
L	109.86	ft - required length of bioswale; If swale is less than 100 feet, make swale have narrower bottom width (2 foot minimum) and repeat Steps D-7 - D-10 and recalculate to get length over 100 feet or keep swale bottom width make swale length 100 feet minimum

D-11 Does the bioswale need to be redesigned to fit within the provided right of way?

No	Continue to Step FC-1

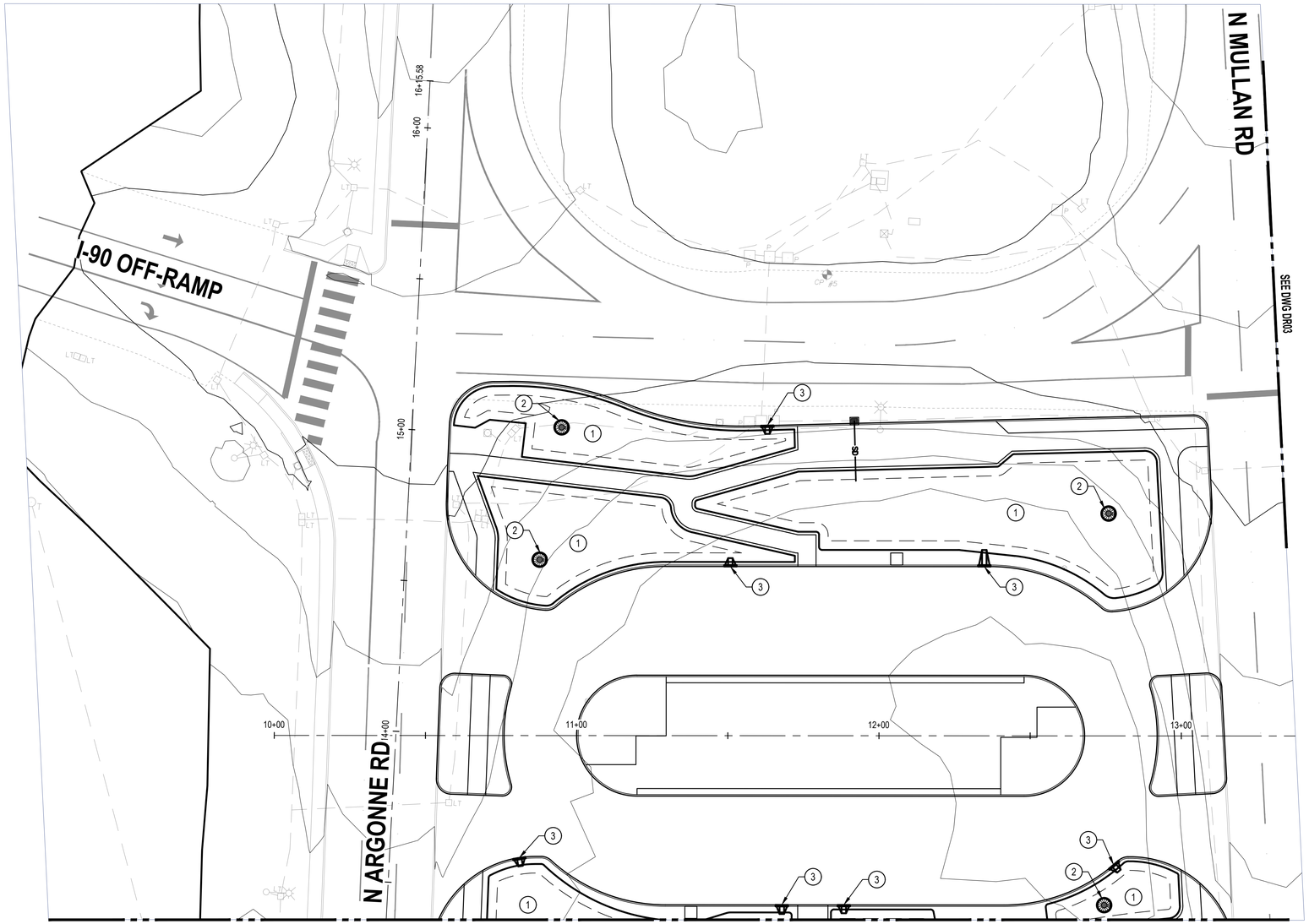
Freeboard Check (Online Swales Only)

FC-1	Q25yr	1.34	cfs - If in Eastern Washington, use the 25 year storm event
		1.00	Safety Factor - For SBUH or SCS, use 1.0
	Q_{convey}	1.34	cfs - Q25yr x saftey factor
FC-2	n	0.03	(lowest possible Manning's from HRM)
FC-3	depth y	0.12	ft - design depth flow
	A	0.94	ft2 - wetted area
	R	0.114	ft - hydraulic radius
	S	0.015	ft/ft longitudinal slope of swale
	b	7.50	ft - swale bottom width
	$z_{foreslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	$z_{backslope}$	3.00	horizontal number of bioswale slope i.e. 1V:3H, z=3 in this instance
	Q_{convey}	1.34	cfs - use goal seek under "What-If Analysis" in the "DATA" menu to set this cell equal to Q_{convey} above changing the "y" value
FC-4	$D_{(total)}$	1.12	ft, total required swale depth. Does not take into account design standards for minimum ditch depth from the Design Manual (roadway sections)

Final Swale Dimensions		
Swale Length	109.86	ft
Bottom Width	7.5	ft
Swale Longitudinal Slope	0.015	ft/ft
$z_{foreslope}$	3.0	
$z_{backslope}$	3.0	
WQ Depth	0.33	ft
Swale Depth (includes 1 ft Freeboard)	1.12	ft

Appendix A-4

Drainage Plan Sheets, Structure Notes, and Details



STORM DRAINAGE GENERAL NOTES

1. FOR ALL BIO-INFILTRATION SWALES THE TOP 12" OF SOIL SHALL CONSIST OF A THOROUGHLY BLENDED MIX OF 50% COMPOST WITH 50% NATIVE SOILS.

2. THE TOP 18" OF SOIL FOR ALL L.I.D. POND BOTTOMS SHALL CONSIST OF 40% COMPOST / 60% MINERAL AGGREGATE; COMPOST CATION EXHANGE CAPACITY (CEC) SHALL BE EQUAL TO OR GREATER THAN 5 MILLIEQUIVALENTS / 100 GRAMS OF DRY SOIL; MINERAL AGGREGATE SHALL BE WELL-GRADED SAND PER ASTM D2487-11 WITH COEFFICIENT OF UNIFORMITY CU = D60/D10 EQUAL TO OR GREATER THAN 4 AND COEFFICIENT OF CURVE CC = (D30)2/D60 X D10 GREATER THAN OR EQUAL TO 1 AND LESS THAN OR EQUAL TO 3. A BIORETENTION SOIL MEDIA DATA SHEET SHALL BE SUBMITTED TO THE ENGINEER OF RECORD AND THE CITY OF SPOKANE VALLEY FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.

   MINERAL AGGREGATE GRADATION

SEIVE SIZE	PERCENT PASSING
3/8"	100
#4	95-100
#10	75-90
#40	25-40
#100	4-10
#200	2-5

3. PROPOSED CONTOURS SHOWN ARE FINISHED GRADES.

4. CURB INLET HORIZONTAL CONTROL PROVIDED AT CENTERLINE AT FACE OF CURB.

CONSTRUCTION NOTES

1. CONSTRUCT BIO-RETENTION SWALE PER COSV STANDARDS
2. INSTALL DRYWELL TYPE A PER COSV STD PLAN S-101. FRAME AND GRATE PER COSV STD PLAN S-104. SPACING BETWEEN DRYWELL AND CURB INLET SHALL BE A MINIMUM OF 5'-9" PER STD PLAN S-130
3. INSTALL 6' WIDE CURB INLET TYPE 1 PER COSV STD PLAN S-110
4. CONSTRUCT VEGETATED FILTER STRIP

LEGEND

- XXXX — MAJOR CONTOUR
- XXXX — MINOR CONTOUR
- XXXX — EXISTING CONTOUR
- 2% — GRADE SLOPE DIRECTION
- SD — STORM DRAIN PIPE
- DRAINAGE POND BOTTOM
- DRYWELL
- CB TYPE 1

N

0 10' 20' 40'
1 inch = 20 feet

NOT FOR CONSTRUCTION - 30% SUBMITTAL

MARK A. BROWN, STATE OF WASHINGTON, 25658, REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY: TAJ | DESIGNED BY: MLT
CHECKED BY: JRP | APPROVED BY: MAB
DATE: 6/16/2025
J O B No. : 2400399
SCALE: AS NOTED

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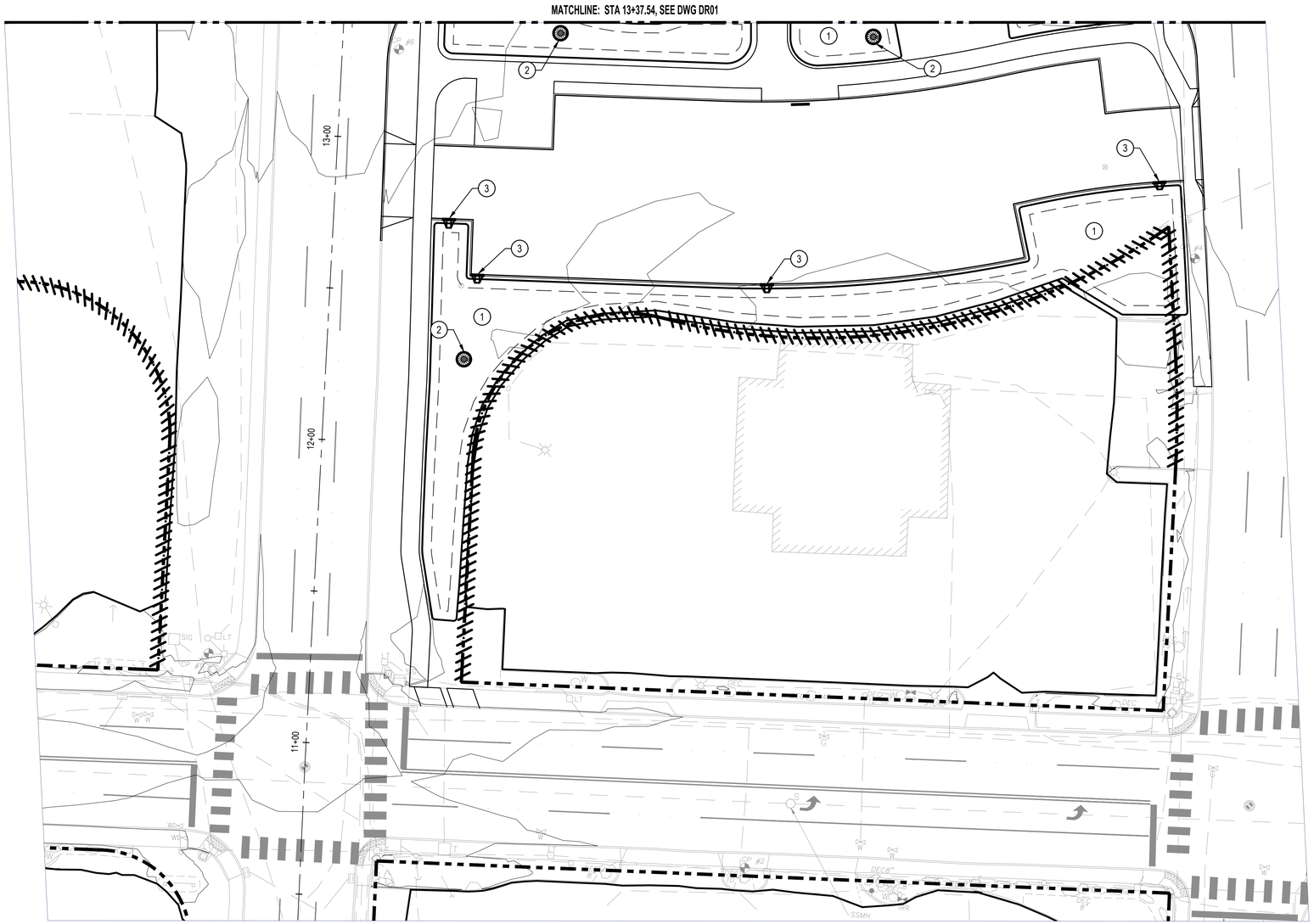
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ARGONNE STATION PARK AND RIDE PROJECT
SPOKANE VALLEY, WA

DRAINAGE PLAN

SHEET
DR01

Jun 16, 2025 - 3:16pm terence.j Z:\2400001 - 2409999\2400399 STA I-90 Valley HPTC WO7 Argonne SV\CAD\Design\ARG-DR.dwg



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- 2% — GRADE SLOPE DIRECTION
- SD — STORM DRAIN PIPE
- DRAINAGE POND BOTTOM
- DRYWELL
- CB TYPE 1

N

0 10' 20' 40'

1 inch = 20 feet

MARK A. BROWER STATE OF WASHINGTON 36938 REGISTERED PROFESSIONAL ENGINEER

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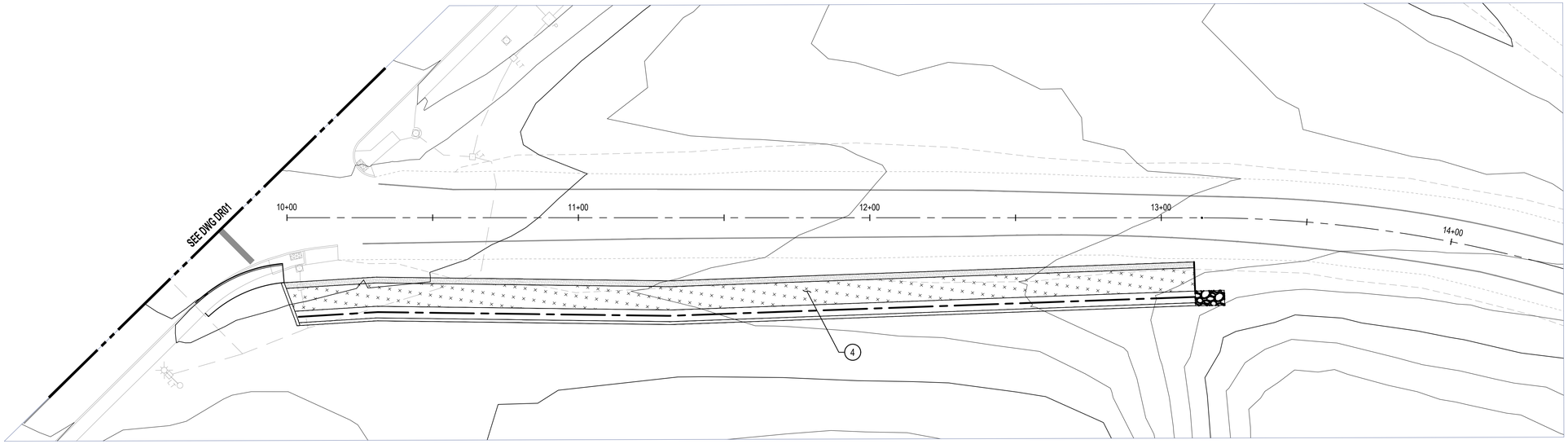
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SPOKANE VALLEY, WA

DRAINAGE PLAN

SHEET **DR02**

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- DRAINAGE POND BOTTOM
- DRYWELL
- CB TYPE 1

N

0 10' 20' 40'

1 inch = 20 feet

MARK A. BROWER — STATE OF WASHINGTON — 36938 — REGISTERED PROFESSIONAL ENGINEER

NOT FOR CONSTRUCTION - 30% SUBMITTAL

NO.	DATE	BY	CHD.	APPR.	REVISION

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J O B No. : 2400399

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S C A L E: AS NOTED

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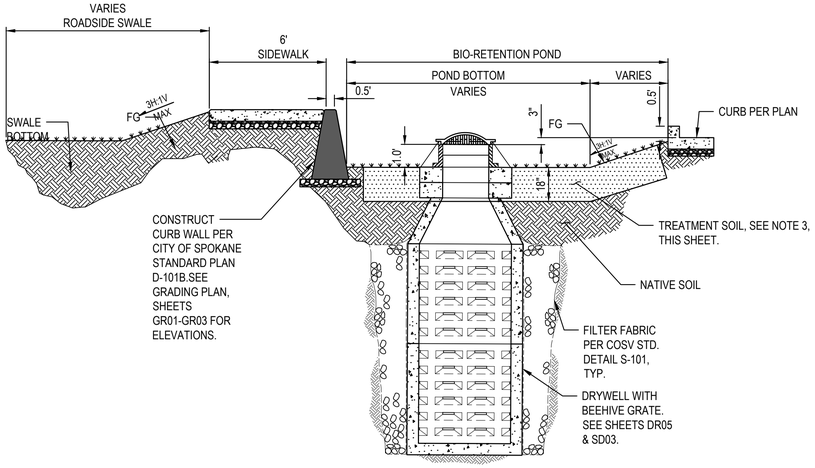
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SPOKANE VALLEY, WA

DRAINAGE PLAN

SHEET
DR03

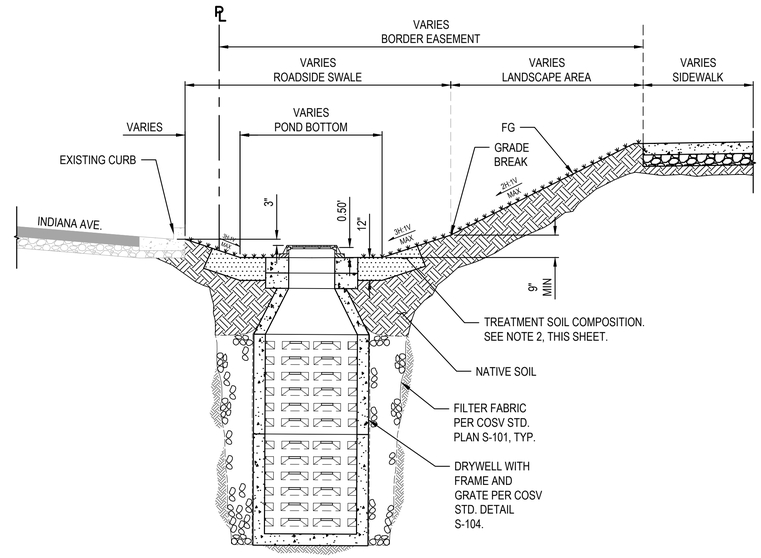
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BIO-RETENTION PONDS #1 & 2 TYPICAL SECTION

NTS

1 DR03



ROADSIDE SWALE TYPICAL SECTION

NTS

2 DR03

STORM DRAINAGE GENERAL NOTES

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- XXXX — EXISTING CONTOUR
- GRADE BREAK/ RIDGE LINE
- 2% — GRADE SLOPE DIRECTION
- SD — STORM DRAIN PIPE
- DRAINAGE POND BOTTOM
- DRYWELL
- CB TYPE 1
- PIPE (DAY LIGHT)
- V-DITCH

MARK A. BROWDER
STATE OF WASHINGTON
36928
REGISTERED
PROFESSIONAL ENGINEER

NOT FOR CONSTRUCTION - 30% SUBMITTAL

NO.	DATE	BY	CHD.	APPR.	REVISION

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SPOKANE VALLEY, WA

DRAINAGE DETAILS

SHEET
DD01

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Appendix A-5

Drainage Profile Sheets (if applicable)

Appendix A-6

Roadway Cross Sections and Profiles (if applicable)

Appendix A-7

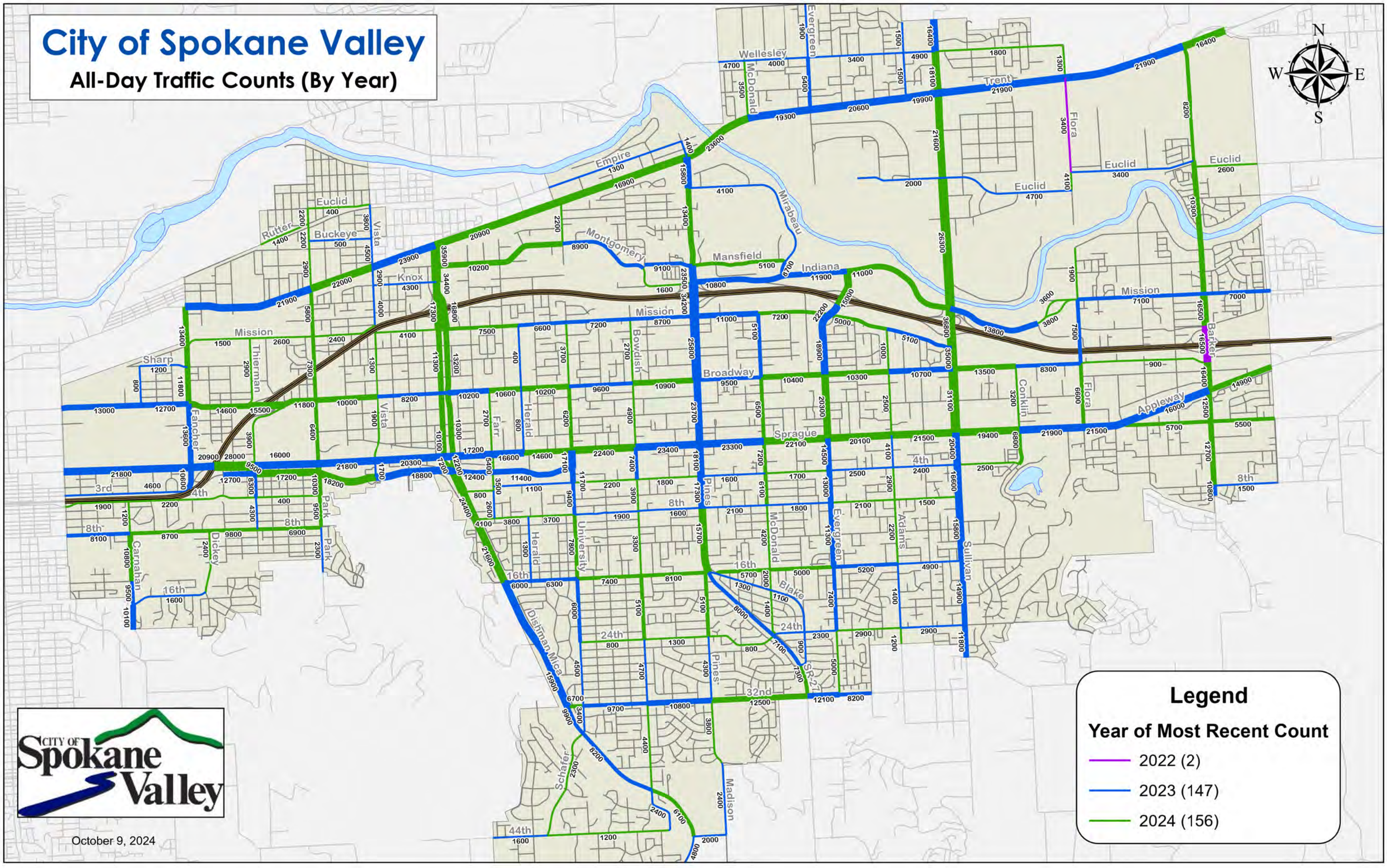
Miscellaneous, Contract Plans Sheets (if applicable)

Appendix A-8

Traffic Analysis Data (Design Year ADT)

City of Spokane Valley

All-Day Traffic Counts (By Year)



Legend

Year of Most Recent Count

- 2022 (2)
- 2023 (147)
- 2024 (156)

CITY OF Spokane Valley

October 9, 2024

Appendix A-9

Environmental Documentation

Spokane Valley Rathdrum Prairie Aquifer

0.5 0 0.5 1 Miles

Projection: Lambert Conformal Conic
Central Meridian: -177.42 degrees
Origin: 47.25 degrees

Legend

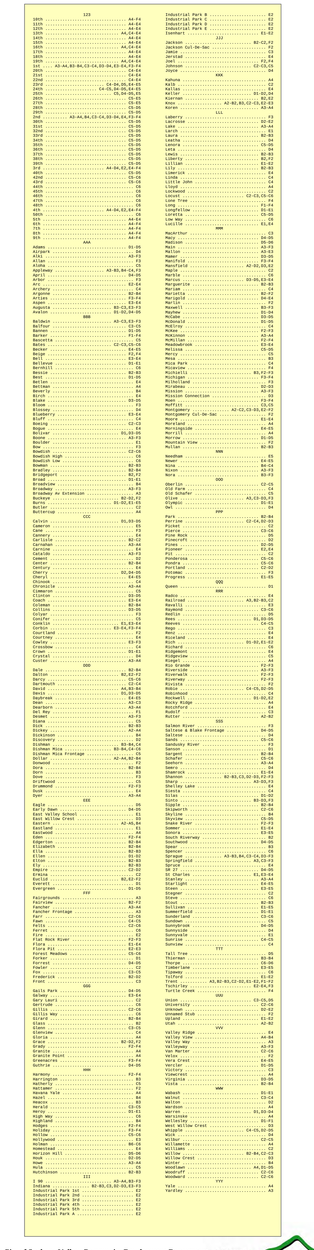
- Type A Well Head
- 1000' Well Head Buffer
- City of Spokane Valley
- Aquifer
- Urban Growth Area
- Seasonal Streams

Aquifer - River Exchange

- Gaining Reach
- Losing Reach
- Transitional Reach
- Minimum Interaction

Aquifer Susceptibility (CARA)

- Low
- Moderate
- High



Product of the City of Spokane Valley, Community Development Department

Notice: The information shown on this map is compiled from various sources and is subject to constant revision. The City makes no claims or guarantees about the accuracy or currency of this map and expressly disclaims liability for errors and omissions in its contents. To confirm accuracy contact the City of Spokane Valley, Community Development Department, Division of Planning, (509) 921-1000.

City of Spokane Valley

Effective Date: 5/10/2006
Ordinance No, 06-010

Appendix A-10

Specialty Design Reports

Appendix A-11

Deviations to the Hydraulics Manual or Highway Runoff Manual

Appendix A-12

UIC Registration Forms

Appendix A-13

Supplements and Revisions

Appendix B
USFWS and NMFS Species Lists

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Location

Spokane County, Washington



Local office

Washington Fish And Wildlife Office

(360) 753-9440
(360) 753-9405

510 Desmond Drive Se, Suite 102

Lacey, WA 98503-1263

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

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The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Fishes

NAME	STATUS
Bull Trout Salvelinus confluentus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8212	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's Cuckoo Bumble Bee Bombus suckleyi No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

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Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts
For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete
If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information

NOT FOR CONSULTATION

on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the

maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

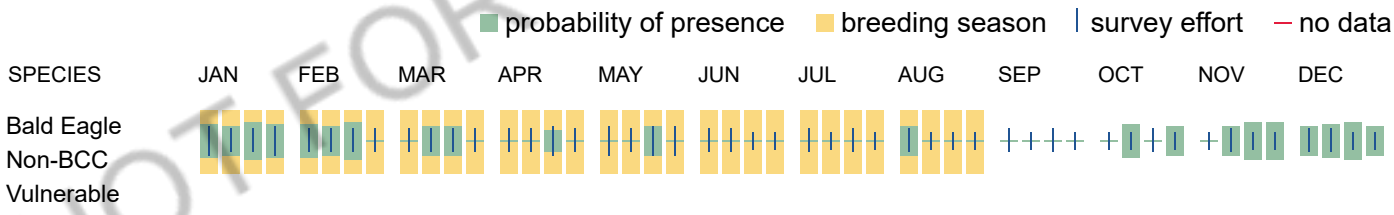
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



NOT FOR CONSULTATION

Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report
On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low

survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service). The incidental take of migratory birds is the injury or death of birds that results from, but is not the purpose, of an activity. The Service interprets the MBTA to prohibit incidental take.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

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NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Black Tern Chlidonias niger surinamenisis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
Calliope Hummingbird Selasphorus calliope This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9526	Breeds May 1 to Aug 15
Cassin's Finch Haemorhous cassinii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Evening Grosbeak Coccothraustes vespertinus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10
Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Olive-sided Flycatcher Contopus cooperi This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31

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Rufous Hummingbird Selasphorus rufus — Breeds Apr 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

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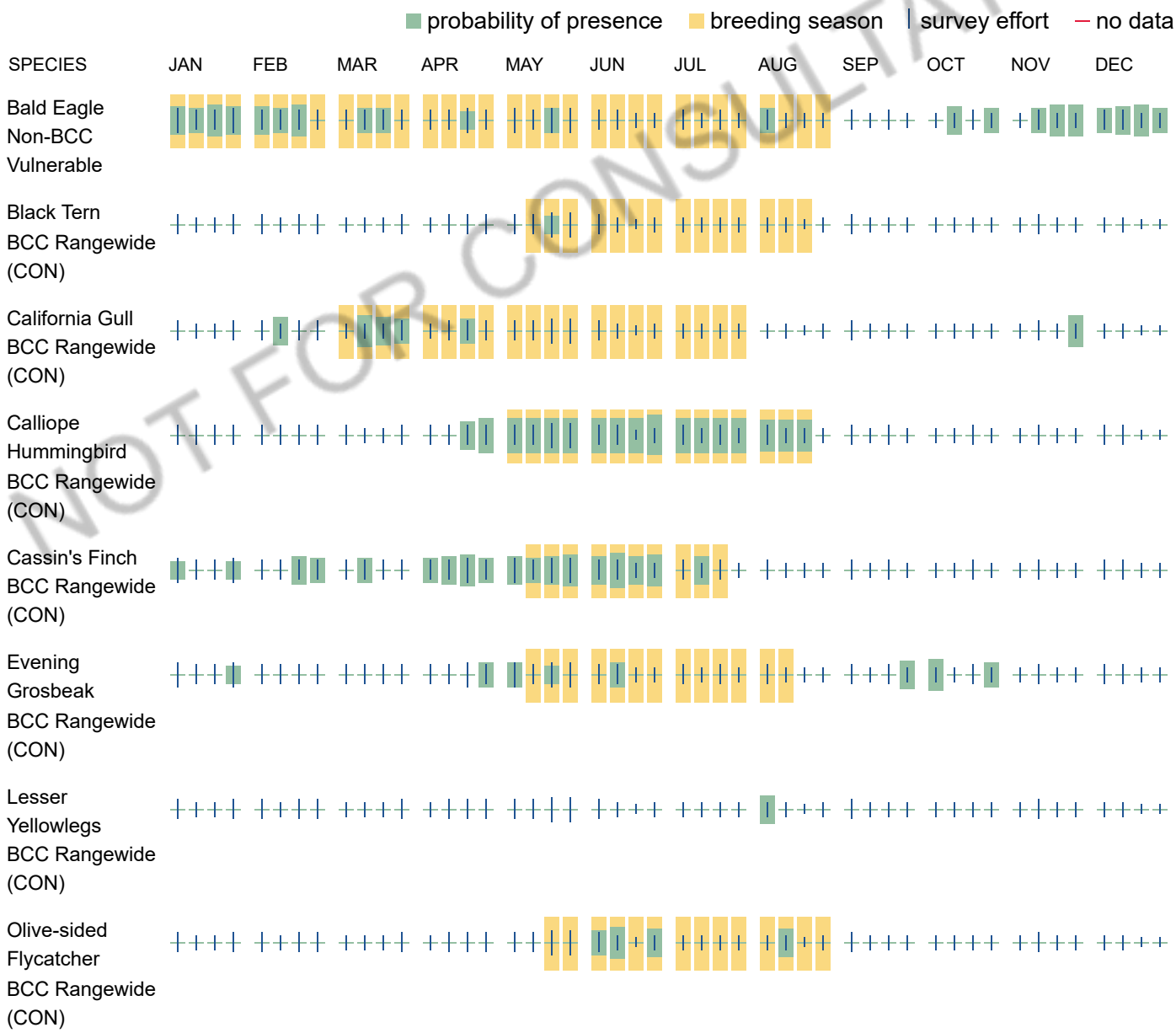
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

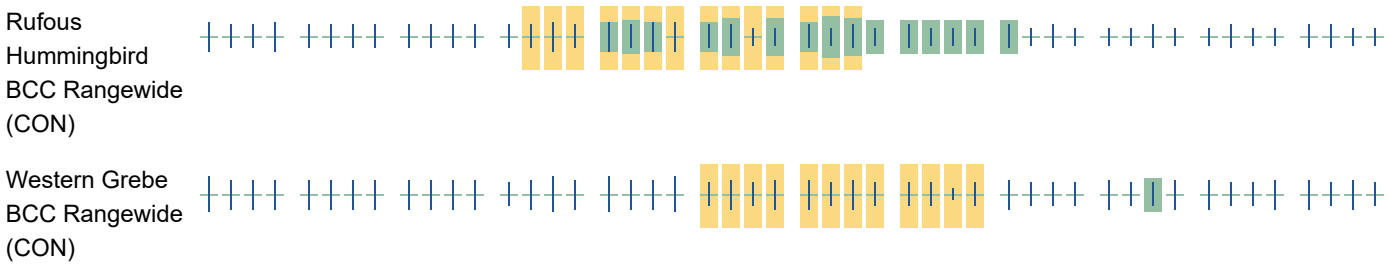
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



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Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as "Vulnerable". See the FAQ "What are the levels of concern for migratory birds?" for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

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The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ “Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds”.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially

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occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs
Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

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This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

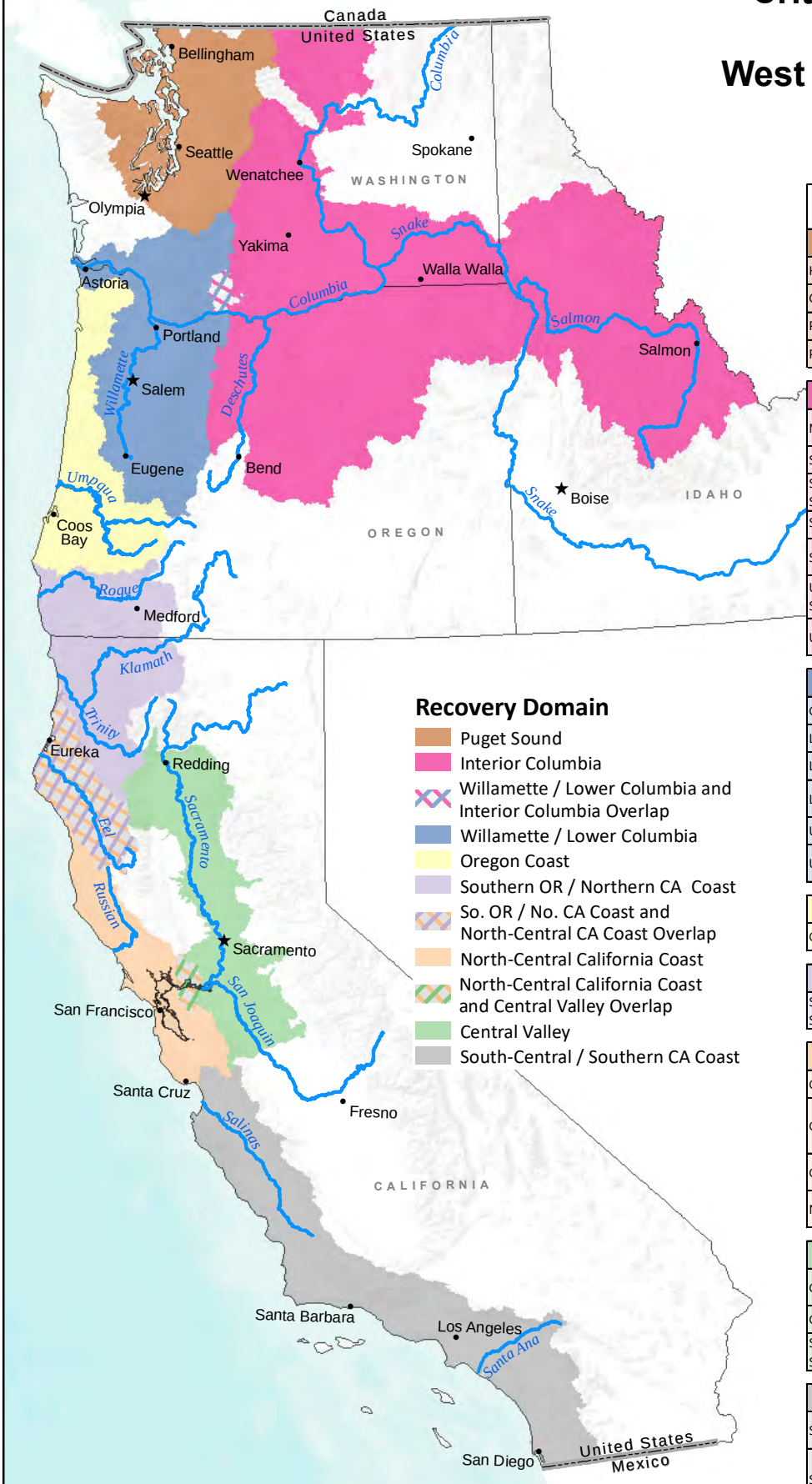
Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead



Evolutionarily Significant Unit / Distinct Population Segment	ESA Status	Date of ESA Listing	Date of CH Designation
Puget Sound Recovery Domain			
Hood Canal Summer-run Chum Salmon	T	3/25/1999	9/2/2005
Ozette Lake Sockeye Salmon	T	3/25/1999	9/2/2005
Puget Sound Chinook Salmon	T	3/24/1999	9/2/2005
Puget Sound Steelhead	T	5/11/2007	2/24/2016
Interior Columbia Recovery Domain			
Middle Columbia River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Snake River Fall-run Chinook Salmon	T	4/22/1992	12/28/1993
Snake River Spring / Summer-run Chinook Salmon	T	4/22/1992	10/25/1999
Sockeye Salmon	E	11/20/1991	12/28/1993
Snake River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Upper Columbia River Spring-run Chinook Salmon	E	3/24/1999	9/2/2005
Upper Columbia River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Willamette / Lower Columbia Recovery Domain			
Columbia River Chum Salmon	T	3/25/1999	9/2/2005
Lower Columbia River Chinook Salmon	T	3/24/1999	9/2/2005
Lower Columbia River Coho Salmon	T	6/28/2005	2/24/2016
Lower Columbia River Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Upper Willamette River Chinook Salmon	T	3/24/1999	9/2/2005
Upper Willamette River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Oregon Coast Recovery Domain			
Oregon Coast Coho Salmon	T	2/11/2008	2/11/2008
Southern Oregon / Northern California Coast Recovery Domain			
Southern OR / Northern CA Coasts Coho Salmon	T	5/6/1997	5/5/1999
North-Central California Coast Recovery Domain			
California Coastal Chinook Salmon	T	9/16/1999	9/2/2005
Central California Coast Coho Salmon	E	10/31/1996 (T) 6/28/2005 (E) 4/2/2012 (RE)	5/5/1999
Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Northern California Steelhead	T	6/7/2000 1/5/2006	9/2/2005
Central Valley Recovery Domain			
California Central Valley Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Central Valley Spring-run Chinook Salmon	T	9/16/1999	9/2/2005
Sacramento River Winter-run Chinook Salmon	E	11/5/1990 (T) 1/4/1994 (E)	6/16/1993
South-Central / Southern California Coast Recovery Domain			
South-Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Southern California Steelhead	E	8/18/1997 5/1/2002 (RE) 1/5/2006	9/2/2005

ESA = Endangered Species Act, CH = Critical Habitat, RE = Range Extension
E = Endangered, T = Threatened,

Updated July 2016

Critical Habitat Rules Cited

- 2/24/2016 (81 FR 9252) Final Critical Habitat Designation for Puget Sound Steelhead and Lower Columbia River Coho Salmon
- 2/11/2008 (73 FR 7816) Final Critical Habitat Designation for Oregon Coast Coho Salmon
- 9/2/2005 (70 FR 52630) Final Critical Habitat Designation for 12 ESU's of Salmon and Steelhead in WA, OR, and ID
- 9/2/2005 (70 FR 52488) Final Critical Habitat Designation for 7 ESU's of Salmon and Steelhead in CA
- 10/25/1999 (64 FR 57399) Revised Critical Habitat Designation for Snake River Spring/Summer-run Chinook Salmon
- 5/5/1999 (64 FR 24049) Final Critical Habitat Designation for Central CA Coast and Southern OR/Northern CA Coast Coho Salmon
- 12/28/1993 (58 FR 68543) Final Critical Habitat Designation for Snake River Chinook and Sockeye Salmon
- 6/16/1993 (58 FR 33212) Final Critical Habitat Designation for Sacramento River Winter-run Chinook Salmon

ESA Listing Rules Cited

- 4/2/2012 (77 FR 19552) Final Range Extension for Endangered Central California Coast Coho Salmon
- 2/11/2008 (73 FR 7816) Final ESA Listing for Oregon Coast Coho Salmon
- 5/11/2007 (72 FR 26722) Final ESA Listing for Puget Sound Steelhead
- 1/5/2006 (71 FR 5248) Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead
- 6/28/2005 (70 FR 37160) Final ESA Listing for 16 ESU's of West Coast Salmon
- 5/1/2002 (67 FR 21586) Range Extension for Endangered Steelhead in Southern California
- 6/7/2000 (65 FR 36074) Final ESA Listing for Northern California Steelhead
- 9/16/1999 (64 FR 50394) Final ESA Listing for Two Chinook Salmon ESUs in California
- 3/25/1999 (64 FR 14508) Final ESA Listing for Hood River Canal Summer-run and Columbia River Chum Salmon
- 3/25/1999 (64 FR 14517) Final ESA Listing for Middle Columbia River and Upper Willamette River Steelhead
- 3/25/1999 (64 FR 14528) Final ESA Listing for Ozette Lake Sockeye Salmon
- 3/24/1999 (64 FR 14308) Final ESA Listing for 4 ESU's of Chinook Salmon
- 3/19/1998 (63 FR 13347) Final ESA Listing for Lower Columbia River and Central Valley Steelhead
- 8/18/1997 (62 FR 43937) Final ESA Listing for 5 ESU's of Steelhead
- 5/6/1997 (62 FR 24588) Final ESA Listing for Southern Oregon / Northern California Coast Coho Salmon
- 10/31/1996 (61 FR 56138) Final ESA Listing for Central California Coast Coho Salmon
- 1/4/1994 (59 FR 222) Final ESA Listing for Sacramento River Winter-run Chinook Salmon
- 4/22/1992 (57 FR 14653) Final ESA Listing for Snake River Spring/summer-run and Snake River Fall Chinook Salmon
- 11/20/1991 (56 FR 58619) Final ESA Listing for Snake River Sockeye Salmon
- 11/5/1990 (55 FR 46515) Final ESA Listing for Sacramento River Winter-run Chinook Salmon