LATITUDE 48
CIVIL ENGINEERING CONSULTANTS

Stormwater Drainage Report

City of Oak Harbor, WA

Mulberry Village Apartments
1550 Southwest Mulberry Place
Oak Harbor, WA 98277

August 2026

Civil Plan Review Number: TBD

PREPARED FOR:

Blue Ridge Cascade
2223 112th Avenue NE, Suite 102, Bellevue, WA 98004
Phone: 425.760.7606
Contact: Jenifer Lambert

PREPARED THROUGH:

Dahlin Group
10900 NE 8th Street, Suite 1650, Bellevue, WA 98004
Phone: 425.214.7092
Contact: Maarika Amado-Cattaneo

PREPARED BY:

Latitude 48 Engineers
2200 6th Avenue, Seattle, WA 9812
Phone: 206.556.1615
Contact: Brady Berriman, PE



Stormwater Drainage Report – City of Oak Harbor

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Project No. 2024-25

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1.0 Project Overview

General Description

The following Stormwater Drainage Report provides the drainage analysis and design for the Mulberry Village Apartments project stormwater plan. The stormwater design for the project is based on the requirements set forth in the 2019 Washington State Department of Ecology Manual (SWMMWW).

The project is located at 1550 Southwest Mulberry Place, Oak Harbor, WA 98277. The project is located in the City of Oak Harbor and includes the parcel (Parcel #R13203-110-1730). The parcel has a site area of 242,141 square feet (5.56 acres). The site is bound by SW Swantown Avenue to the north, with residential properties surrounding the east, south, and west, with SW Mulberry Place terminating along the southern border of the parcel. The development will consist of approximately 96 units of affordable housing, featuring a mix of walk-up apartments to create a diverse and inclusive community. Refer to Figure 1 in Appendix A for the project Vicinity Map.

Proposed development will include removal of the existing concrete pads, access drives, associated utilities, and several trees to make way for five (5) new buildings including four (4) apartment buildings and a single community building, totaling approximately 96 units. Additionally, the project will dedicate a new public right-of-way and construct the extension of SW Mulberry with a 90' circular cul-de-sac.

According to the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW), the project will trigger Minimum Requirements #1 through #9. See Section 3 of this report for a breakdown of these requirements and Figure 5A in Appendix A for the associated flowchart.

Existing Conditions

The project site was previously developed as a mobile home park and is currently vacant, leaving behind grass, shrubs, and trees throughout the site. The area has many concrete pads with utility hook ups accessed by a concrete and gravel access drive. Additional site encumbrances include various utility easements throughout the site. There is slope directly to the southwest of SW Swantown Avenue sloping from the back of the sidewalk to the project site approximately 6 feet below at roughly 3:1 slope. The rest of the site generally slopes toward the middle, near SW Mulberry place with a total grade change of approximately 9 feet over approximately 300 feet. According to the Geotechnical Report in Appendix C of this report, the site generally consists of a relatively thin layer of loose topsoil and fill soil above native sandy soils with varying grain sizes and varying amounts of gravel and silt.

The stormwater runoff from the site generally drains towards its center, where it either infiltrates or is collected in the public stormwater conveyance system which traverses the site to the northeast before connecting to the public storm system in SW Swantown Avenue.

The project site is mapped as a Moderate Critical Aquifer Recharge Area. There are no other known critical areas located on-site or within the project vicinity. See Figures 6A-6E for City of Oak Harbor Standard Maps.

Proposed Conditions

Under proposed conditions, stormwater from the project site and SW Mulberry Place roadway extension will be collected in catch basins, downspouts, and area drains, and conveyed to water quality facilities for treatment before entering two (2) on-site infiltration systems. Due to existing topography, the east and west sides of the site are split into two subbasins. Each subbasin has an associated water quality facility and infiltration system to fulfill runoff treatment and flow control requirements.

Refer to Figure 1 in Appendix A for the project Vicinity Map and the associated Civil Site Plan for the location of the proposed site improvements.

2.0 OFF-SITE DRAINAGE ANALYSIS

Upstream Analysis

The project site is bounded to the Northeast by SW Swantown Avenue, which drains to the public stormwater system within the roadway. As a result, runoff from SW Swantown Avenue does not enter the site. The existing development of condos along Mulberry Place drain to a detention pond to the South of the parcel, the water is then conveyed by a 12" storm pipe under the project site, where it eventually ties into the public stormwater system under SW Swantown Avenue. As this runoff does not ever reach the surface of the project site, it is not considered run-on. The site does, however, appear to receive ancillary run-on from portions of the adjacent residential properties located to the North, West and South. Roof runoff from neighboring buildings is generally collected by gutters and downspouts and directed to the respective stormwater systems. At-grade surfaces, however, slope toward the project site and contribute off-site run-on from adjacent pervious areas. Off-site run-on will be collected and managed as part of the proposed stormwater system. See Figure – 4A for a map of all areas which drain to the project site.

Downstream Analysis

The existing site does not contain a formal stormwater conveyance or detention system. Surface runoff generally drains toward a broad low area within the site, where runoff appears to pond and infiltrate into the underlying soils. Based on existing topography and observed drainage patterns, there is no apparent concentrated surface discharge from the site under existing conditions.

The project proposes to infiltrate 100% of stormwater runoff through the 100-year design storm using 15-minute modeling intervals. Therefore, no routine stormwater discharge from the proposed development is anticipated and downstream impacts are not expected. As an additional precaution, an emergency overflow pipe is connected to the infiltration system within the East Basin, which will convey stormwater to the public stormwater main in SW Swantown Avenue in the event of a storm exceeding the 100-year design storm. There are no known drainage concerns downstream of the project site.

3.0 DISCUSSION OF MINIMUM REQUIREMENTS

The 2019 SWMMWW Figure I-3.1 was used to determine the minimum requirements for this project. Because the existing site has less than 35% impervious surface coverage and the project is adding more than 5,000 square feet of new plus replaced impervious surface, the project is considered a new development project subject to all minimum requirements. Refer to Appendix A for the associated Figure 5A and 5B for the flow chart from the 2019 SWMMWW. A discussion of these Minimum Requirements is discussed in the following sections:

MR #1: Preparation of Stormwater Site Plans

In accordance with MR#1, the project will submit a Stormwater Site Plan, preserve native vegetation, and minimize impervious surfaces to the maximum extent feasible.

MR #2: Construction Stormwater Pollution Prevention (SWPPP)

A CSWPPP will be prepared for this project. Refer to Appendix D.

MR #3: Source Control of Pollution

Stormwater will be prevented from coming in contact with pollutants through a series of BMPs listed within the CSWPPP.

MR #4: Preservation of Natural Drainage Systems and Outfalls

No new drainage patterns offsite are expected. All existing drainage outfalls will be protected and maintained as part of the proposed development. The project proposes capture and infiltrate stormwater as well as to route to the existing drainage outfalls. No adverse impacts to downstream receiving waters are anticipated as a result of construction or leave-behind condition of this project.

MR #5: On-site Stormwater Management

The proposed project will achieve the LID Performance Standard and implement the Post-Construction Soil Quality and Depth BMP for all disturbed soils on-site to meet Minimum Requirement #5 as shown in Figure 5B. Refer to Section 5.0 for further discussion on MR#5.

MR #6: Runoff Treatment

The project is proposing more than 5,000 square feet of pollution generating surface on site and in the right-of-way. As such, water quality treatment is required for new and replaced pollution generating surfaces. The project will install two proprietary Modular Wetland Systems (MWS) to provide enhanced treatment to comply with Minimum Requirement #6. Refer to Section 6.0 for further discussion on MR#6.

MR #7: Flow Control

The proposed project includes two (2) separate infiltration systems to provide flow control in accordance with MR#7. Refer to Section 7.0 for further discussion on MR#7 on this project.

MR #8: Wetlands Protection

The proposed project is not located within a wetland protection area, therefore protection is not applicable to this project.

MR #9: Operations and Maintenance

An Operations and Maintenance Manual consistent with the provisions in Volume V of the SWMMWW is included in Appendix E of this report.

4.0 TEMPORARY EROSION AND SEDIMENT CONTROL

Erosion control systems will be implemented throughout the construction process until the site is stabilized. All temporary erosion and sedimentation control requirements will be in compliance with the Department of Ecology (DOE) Best Management Practices (BMPs). Best Management Practices are defined as physical, structural and/or managerial practices, that when used singly or in combination, prevent or reduce pollution of storm water runoff caused by construction activities. The Temporary Erosion and Sedimentation Control plan for the proposed site has been designed to protect off-site properties as well as to prevent sediment-laden water from entering the public storm system.

The project shall comply with all applicable SWPPP Elements #1 through #13 below:

Element 1: Preserve Vegetation / Mark Clearing Limits

a. To protect adjacent properties and to reduce sediment laden runoff, the limits of construction will be clearly marked and a silt fence will be installed before land-disturbing activities begin. The BMPs relevant to marking the clearing limits that will be applied for this project include:
    - Preserving Natural Vegetation (BMP 101)
    - High Visibility Plastic or Metal Fence (BMP C103)
    - Silt Fence (BMP C233)

    The high visibility fencing and silt fence shall be installed at the beginning of construction to ensure that the above listed areas are preserved to the maximum extent possible through the duration of construction activity.

Element 2: Establish Construction Access

b. Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, and wheel washing, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters. All wash wastewater shall be controlled on site. The specific BMPs related to establishing construction access that will be used on this project include:
    - Stabilized Construction Entrance (BMP 105)
    - Wheel Wash (BMP 106)
    - Construction Road/Parking Stabilization (BMP 107)

    The construction road/parking areas will be installed following the demolition of existing site. The proposed construction road and parking area is proposed in the same location as the proposed site driveway and parking lot. The areas that are to be repaved and regraded will ensure that all BMPs listed above are utilized to the maximum extent possible through the duration of construction activities.

Element 3: Control Flow Rates

c. Silt fences, swales, sediments traps, etc. will be installed on project to control flow rates during construction. In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements (e.g. discharge to combined sewer systems). The specific BMPs relevant to controlling flow rates include:
    - Interceptor Dikes and Swales (BMP 200)
    - Silt Fence (BMP 233)
    - Sediment Trap (BMP 240)
    - Sediment Pond (Temporary) (BMP 241)

The swales shall be installed at the beginning of construction activities prior to significant excavation and grading work so as to ensure the protection of properties and right-of-way downstream to the maximum extent possible. The swales shall be inspected to ensure they are functioning properly before constructing site improvements.

Element 4: Install Sediment Controls

d. All stormwater runoff from disturbed areas shall pass through appropriate sediment removal BMPs before leaving the construction site or prior to being discharged to an infiltration facility. The specific BMPs to be used for controlling sediment on this project include:
    - Storm Drain Inlet Protection (BMP 220)
    - Gravel filter Berm (BMP 232)
    - Silt Fence (BMP C233)
    - Wattles (BMP 235)
    - Sediment Pond (Temporary) (BMP 241)
    - Construction Stormwater Filtration (Baker Tanks) (BMP 251)

    In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize wash-off of sediments from adjacent streets in runoff. Whenever possible, sediment laden water shall be discharged into on-site, relatively level, vegetated areas.

    The above BMPs will ensure that the construction activities will not interfere with the movement of juvenile Salmonids attempting to enter off-channel areas or drainages.
    The above BMPs shall be installed at the beginning of construction, and must be functional before other land disturbing activities – especially grading and filling – take place.

Element 5: Stabilize Soils

e. Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:
    - Temporary and Permanent Seeding (BMP C120)
    - Mulching (BMP 121)
    - Nets and Blankets (BMP 122)
    - Plastic Covering (BMP C123)
    - Surface Roughening (BMP 130)
    - Dust Control (BMP 140)

    In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels. Construction activities shall be scheduled in a way that limits the amount of time soil is exposed throughout the duration of the project.

    Soil stabilization BMPs shall be installed and maintained starting at the beginning of construction as soon as soils are exposed, and throughout construction activities for as long as they are exposed during the designated time frames listed above to ensure they are utilized to the maximum extent possible through the duration of construction activities.

Element 6: Protect Slopes

f. All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. The following specific BMPs will be used to protect slopes for this project:
    - Temporary and Permanent Seeding (BMP C120)
    - Mulching (BMP 121)
    - Nets and Blankets (BMP 122)
    - Plastic Covering (BMP C123)
    - Surface Roughening (BMP 130)

    The above BMPs shall be installed as soon as the necessary grading has been completed, so as to allow the maximum slope stabilization through the duration of the project.

Element 7: Protect Drain Inlets

g. All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site. The following inlet protection measures will be applied on this project:
    - Storm Drain Inlet Protection (BMP C220)

    Storm Drain Inlet Protectors shall be installed at the beginning of construction, as no grading or construction is required prior to their installation.

    Inlet protection will be cleaned (or removed and replaced), when sediment has filled the device by one third (1/3) or as specified by the manufacturer. Inlets will be inspected weekly at a minimum and daily during storm events.

Element 8: Stabilize Channels and Outlets

h. Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion. The specific BMPs for channel and outlet stabilization that shall be used on this project include:
    - Check Dams (BMP 207)
    - Triangular Silt Dike (BMP 208)
    - Outlet Protection (C209)

    The project is proposing swales as a way to manage or capture runoff, as such check dams will be utilized. Outlet protection is also proposed for all site discharge, before entering into the public storm system.

Element 9: Control Pollutants

i. The contractor shall make sure to keep the workplace clean of trash and keep their materials neat as to not leave any behind. In addition, all waste materials from the site will be removed in a manner that does not cause contamination of stormwater. All pollutants, including waste materials and demolition debris, that occur on-site shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well-organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

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

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in the SWMMWW.
- Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application procedures and rates shall be followed.

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).
- Process water and slurry resulting from saw cutting and surfacing operations will be prevented from entering the waters of the State by implementing Saw cutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

Other:

- Other BMPs will be administered as necessary to address any additional pollutant sources on site

The above listed BMPs shall be implemented as the need arises, depending on the pollutant they will mitigate, so as to reduce the possibility of pollutants off and on-site.

Where pH-modifying sources may be encountered, steps must be taken to prevent pollutants from contaminating stormwater and raising the pH level above 8.5. The acceptable pH range for stormwater is between 6.5 and 8.5, beyond that, pH neutralization must occur. The specific BMPs for pH modification that shall be used on this project include:

- High pH Neutralization Using CO2 (BMP C252). This BMP must be utilized as soon as a stormwater pH reaches higher than 8.5, which typically occurs when the afore mentioned pH-modifying sources come into contact with stormwater.

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

Element 10: Control Dewatering

j. Dewatering is not anticipated to be needed for this project, however, if dewatering is needed then the contractor will use the following BMPs:
   - Check Dams (BMP 207)
   - Sediment Pond (Temporary) (BMP C241)

   If needed the contractor shall discharge clean, non-turbid dewatering water, to the existing on-site storm system, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment BMPs.

   If needed the contractor shall handle highly turbid or otherwise contaminated dewatering water separately from stormwater

Element 11: Maintain BMPs

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

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

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

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

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

Element 12: Manage the Project

l. Management of the project, including inspection and monitoring and maintenance of the SWPPP will be implemented. The specific BMPs related to managing the project that will be used on this project include:

- Materials on Hand (BMP C150)
- Certified Erosion and Sediment Control Lead (BMP C160)
- Scheduling (BMP C162)

Inspection and monitoring:

- Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
- Site inspections and monitoring will be conducted regularly.

Maintain an updated SWPPP.

- The SWPPP will be updated, maintained, and implemented in accordance with local requirements.

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

Element 13: Protect Low Impact Development BMPs

m. The Mulberry Village project proposes to use two stormwater infiltration systems to manage all site drainage. In order to maintain the integrity of the native soils, the contractor must protect the site area from compaction, and must protect the footprint of the infiltration facilities from construction runoff infiltration.

5.0 ON-SITE STORMWATER MANAGEMENT – MR#5

According to the 2019 SWMMWW:
"Projects that are not Flow Control exempt that trigger Minimum Requirements #1 through #9 (per the Project Thresholds in I-3.3 Applicability of the Minimum Requirements) have the compliance options shown in Table I-3.1: Minimum Requirement #5 Compliance Options for Projects Triggering Minimum Requirements #1 - #9."

For Projects inside the UGA, on any size parcel:
"Use the LID BMPs from List #2 for all surfaces within each type of surface in List #2;"

or

"Use any Flow Control BMPs desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth (if feasible)."

The proposed project will demonstrate compliance with the LID Performance Standard and meet stormwater discharges that match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-year peak flow.

Through geotechnical investigation, a native soil infiltration rate was determined at **6.3 in/hr.** By the use of MGS-Flood stormwater modeling software, it was determined that using two infiltration systems, one on the East basin and one on the West basin, will match the LID performance standard requirements.

Supporting calculations for the infiltration systems are located in Appendix B. An operations and maintenance manual has been included in Appendix C.

6.0 Runoff Treatment – MR#6

6.1 Applicability

The project triggers Minimum Requirements #1 through #9 in accordance with the 2019 Stormwater Management Manual for Western Washington (SWMMWW), Volume I, Section I-3.3. Therefore, Minimum Requirement #6 is applicable to the project. In accordance with SWMMWW Section I-3.4.6, each threshold discharge area (TDA) is evaluated separately to determine whether runoff treatment BMPs are required. Runoff treatment BMPs are required for a TDA containing 5,000 square feet or more of pollution-generating hard surface (PGHS), or three-quarters of an acre or more of pollution-generating pervious surface (PGPS) separately below. The project site meets both of these, and thus is subject to MR #6.

The project site contains two separate threshold discharge areas (TDAs), the West basin, and East basin, each evaluated separately below.

6.2 West Basin

The West basin includes the largest portion of new development on the site, consisting of new multi-family buildings, a public roadway, parking areas, and associated drive aisles. The basin includes more than 5,000 square feet of new PGIS, thereby triggering the requirement for runoff treatment. Due to site layout and topographic constraints, runoff from pollution-generating and non-pollution-generating surfaces within the basin is combined within the stormwater conveyance system. As a result, runoff treatment is provided for the entire tributary area rather than only the PGIS areas.

Runoff treatment will be provided by an 8x8 Contech Modular Wetland System (MWS), located just upstream from the West infiltration system. The MWS unit will provide enhanced treatment through sedimentation, filtration, and biofiltration processes and are approved by the Washington State Designation (GULD) for basic and enhanced treatment. For Modular Wetland (MWS) sizing, refer to Appendix B.

6.3 East Basin

The East basin includes a smaller, but still significant portion of new development on the site, consisting of a new multi-family building, parking areas, and associated drive aisles. The basin includes more than 5,000 square feet of new PGIS, thereby triggering the requirements for runoff treatment. Similar to the West basin, runoff from pollution-generating and non-pollution-generating surfaces is combined within the stormwater conveyance system, and treatment is provided for the entire tributary area.

Runoff treatment will be provided by a 4x8 Contech Modular Wetland System (MWS), located just upstream from the East infiltration system. The MWS unit will provide enhanced treatment through sedimentation, filtration, and biofiltration processes and are approved by the Washington State Designation (GULD) for basic and enhanced treatment. For Modular Wetland (MWS) sizing, refer to Appendix B.

Both proposed treatment facilities have been designed to meet or exceed the pollutant-removal requirements of the SWMMWW, providing equivalent or better performance than an Ecology-approved linear sand filter. Oil control is not required, as the project does not qualify as an industrial high-traffic commercial site. Refer to Figure 3 in Appendix A for a breakdown of pollution generating and non-pollution generating surfaces in addition to the areas draining to each water quality facility. Details for each water quality facility are included in the Civil plans.

6.4 Summary

- Runoff treatment is required for the West and East Basin's due to exceeding 5,000 SF of new PGIS.
- Two (2) Modular Wetland System (MWS) units will provide treatment upstream of the infiltration systems, inclusive of both pollution-generating and non-pollution-generating surfaces.
- Water quality design and sizing calculations are provided in Appendix B.

7.0 Flow Control – MR#7

7.1 Applicability

The project proposes to install more than 10,000 square feet of effective impervious surfaces, and thus is required to construct flow control BMPs to meet the flow control compliance. Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition is modeled as forested land cover, as indicated by historical aerial photographs.

Additionally, the project has elected to achieve the LID Performance standard, in compliance with MR#5, which requires that stormwater discharges shall match developed discharge duration to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-year peak flow. When combined with the flow control requirements, the project must effectively match discharge durations from 8% of the 2-year peak flow through the full 50-year peak flow.

Two infiltration systems are proposed:

- West Infiltration System: 6,011 cubic feet of live storage capacity
- East Infiltration System: 3,143 cubic feet of live storage capacity

7.2 West Basin

The West Basin includes the majority of new impervious area on the site. A total of **99,294 square feet** of pollution-generating and non-pollution generating hard surfaces are proposed (See Figure 3 – Proposed Conditions). Stormwater will be collected from across the basin by a network of catch basins and storm drain piping and conveyed to the 6,011 cf West Infiltration System, located beneath the west parking lot. The West Infiltration System has been sized to fully infiltrate 100% of the runoff from all modeled storms within the period of record, including the 100-year design storm. The system will operate independently of the East Infiltration System, with each serving separate portions of the site consistent with existing drainage patterns.

7.3 East Basin

The East Basin includes a smaller portion of the new impervious area on the site. A total of **51,421 square feet** of pollution-generating and non-pollution generating hard surfaces are proposed (See Figure 3 – Proposed Conditions). Stormwater will be collected from across the basin by a network of catch basins and storm drain piping, then conveyed to the 3,143 cf East Infiltration System, located beneath the landscape area east of Building D. Similar to the West Basin, the East Infiltration System has been sized to fully infiltrate 100% of runoff from all modeled storms within the period of record and will operate independently of the West Infiltration System. Additionally, an emergency overflow pipe is provided at the East Infiltration System which will convey stormwater to the public stormwater main in SW Swantown Avenue in the event of a storm exceeding the 100-year design storm.

7.4 Contributing Areas and Infiltration System Calculations

A table summarizing the disturbed project areas is provided in Table 1 below:

Table 1: Site Areas Table

Site Areas Table			
Basin	**Surface Type**	**Total Area (SF)**	**Total Area(AC)**
East	NPGIS	22,084	0.507
	PGIS	29,337	0.673
	Pervious	40,380	0.927
	East Total	**91,801**	**2.107**
West	Site NPGIS	47,435	1.089
	Site PGIS	36,907	0.847
	Site Pervious	49,784	1.143
	ROW NPGIS	4,158	0.095
	ROW PGIS	10,794	0.248
	ROW Pervious	1,262	0.029
	ROW Total	**16,214**	**0.372**
	West Total	**150,340**	**3.451**
	Site Total	***242,141***	***5.559***

The above areas were modeled using MGS Flood to demonstrate compliance with the flow control requirements of the 2019 SWMMWW. Both the West and East Infiltration Systems utilize the StormTank 25 Series ST-36 modular chamber, which is designed to withstand HS-25 loading. These chambers have a void ratio ranging from 95.5% to 96.9%, depending on depth within the system. The chambers provide a live storage depth of 3.0 feet. Stage-storage relationships for the facilities are provided in Tables 2 and 3 below. Sections and details of this system can be found in the Civil plans of this project.

The facilities are installed over a 6-inch layer of gravel, surrounded by 12 inches of gravel around the perimeter, and overlaid by 12 inches of gravel. The additional storage provided by the 40% void ratio within the surrounding gravel was not included in the facility sizing calculations. This provides additional storage capacity for stormwater runoff during larger storm events or in the event of lower-than-anticipated infiltration rates.

Refer to Figures 2 and 3 in Appendix A for exhibits showing the existing and proposed site conditions.

Table 2: West Infiltration System – StormTank 25 Series ST-36 – Stage-Storage Table

West Infiltration System - Stage Storage Table						
Elevation (Inches)	Elevation (Ft)	Unit Tank Volume	Total Volume (CF)	Gravel (40% Voids)	Total Storage (CF)	Total Cumulative Storage (CF)
0	100.00	0.000	0.00	0.0	0.00	0.00
1	100.08	0.284	130.36	0.0	130.36	130.36
2	100.17	0.344	157.90	0.0	157.90	288.25
3	100.25	0.370	169.83	0.0	169.83	458.08
4	100.33	0.370	169.83	0.0	169.83	627.91
5	100.42	0.370	169.83	0.0	169.83	797.74
6	100.50	0.370	169.83	0.0	169.83	967.57
7	100.58	0.370	169.83	0.0	169.83	1137.40
8	100.67	0.370	169.83	0.0	169.83	1307.23
9	100.75	0.370	169.83	0.0	169.83	1477.06
10	100.83	0.370	169.83	0.0	169.83	1646.89
11	100.92	0.370	169.83	0.0	169.83	1816.72
12	101.00	0.370	169.83	0.0	169.83	1986.55
13	101.08	0.370	169.83	0.0	169.83	2156.38
14	101.17	0.370	169.83	0.0	169.83	2326.21
15	101.25	0.370	169.83	0.0	169.83	2496.04
16	101.33	0.370	169.83	0.0	169.83	2665.87
17	101.42	0.370	169.83	0.0	169.83	2835.70
18	101.50	0.370	169.83	0.0	169.83	3005.53
19	101.58	0.370	169.83	0.0	169.83	3175.36
20	101.67	0.370	169.83	0.0	169.83	3345.19
21	101.75	0.370	169.83	0.0	169.83	3515.02
22	101.83	0.370	169.83	0.0	169.83	3684.85
23	101.92	0.370	169.83	0.0	169.83	3854.68
24	102.00	0.370	169.83	0.0	169.83	4024.51
25	102.08	0.370	169.83	0.0	169.83	4194.34
26	102.17	0.370	169.83	0.0	169.83	4364.17
27	102.25	0.370	169.83	0.0	169.83	4534.00
28	102.33	0.370	169.83	0.0	169.83	4703.83
29	102.42	0.370	169.83	0.0	169.83	4873.66
30	102.50	0.370	169.83	0.0	169.83	5043.49
31	102.58	0.370	169.83	0.0	169.83	5213.32
32	102.67	0.370	169.83	0.0	169.83	5383.15
33	102.75	0.370	169.83	0.0	169.83	5552.98
34	102.83	0.370	169.83	0.0	169.83	5722.81
35	102.92	0.344	157.90	0.0	157.90	5880.71
36	103.00	0.284	130.36	0.0	130.36	6011.06

Table 3: East Infiltration System – StormTank 25 Series ST-36 – Stage-Storage Table

East Infiltration System - Stage Storage Table						
Elevation (Inches)	Elevation (Ft)	Unit Tank Volume	Total Volume (CF)	Gravel (40% Voids)	Total Storage (CF)	Total Cumulative Storage (CF)
0	100.00	0.000	0.00	0.0	0.00	0.00
1	100.08	0.284	68.16	0.0	68.16	68.16
2	100.17	0.344	82.56	0.0	82.56	150.72
3	100.25	0.370	88.80	0.0	88.80	239.52
4	100.33	0.370	88.80	0.0	88.80	328.32
5	100.42	0.370	88.80	0.0	88.80	417.12
6	100.50	0.370	88.80	0.0	88.80	505.92
7	100.58	0.370	88.80	0.0	88.80	594.72
8	100.67	0.370	88.80	0.0	88.80	683.52
9	100.75	0.370	88.80	0.0	88.80	772.32
10	100.83	0.370	88.80	0.0	88.80	861.12
11	100.92	0.370	88.80	0.0	88.80	949.92
12	101.00	0.370	88.80	0.0	88.80	1038.72
13	101.08	0.370	88.80	0.0	88.80	1127.52
14	101.17	0.370	88.80	0.0	88.80	1216.32
15	101.25	0.370	88.80	0.0	88.80	1305.12
16	101.33	0.370	88.80	0.0	88.80	1393.92
17	101.42	0.370	88.80	0.0	88.80	1482.72
18	101.50	0.370	88.80	0.0	88.80	1571.52
19	101.58	0.370	88.80	0.0	88.80	1660.32
20	101.67	0.370	88.80	0.0	88.80	1749.12
21	101.75	0.370	88.80	0.0	88.80	1837.92
22	101.83	0.370	88.80	0.0	88.80	1926.72
23	101.92	0.370	88.80	0.0	88.80	2015.52
24	102.00	0.370	88.80	0.0	88.80	2104.32
25	102.08	0.370	88.80	0.0	88.80	2193.12
26	102.17	0.370	88.80	0.0	88.80	2281.92
27	102.25	0.370	88.80	0.0	88.80	2370.72
28	102.33	0.370	88.80	0.0	88.80	2459.52
29	102.42	0.344	82.56	0.0	82.56	2542.08
30	102.50	0.284	68.16	0.0	68.16	2610.24
31	102.58	0.370	88.80	0.0	88.80	2699.04
32	102.67	0.370	88.80	0.0	88.80	2787.84
33	102.75	0.370	88.80	0.0	88.80	2876.64
34	102.83	0.370	88.80	0.0	88.80	2965.44
35	102.92	0.370	88.80	0.0	88.80	3054.24
36	103.00	0.370	88.80	0.0	88.80	3143.04

7.5 Summary

- The project site includes two independent infiltration systems, one serving the West Basin and one serving the East basin.
- Each infiltration system provides flow control for its respective tributary drainage area.
- Both infiltration systems have been sized to provide full infiltration through the 100-year storm. See Appendix B for engineering calculations.

8.0 APPENDICES

APPENDIX A: **Associated Site Figures**
APPENDIX B: **Engineering Calculations**
APPENDIX C: **Geotechnical Report**
APPENDIX D: **Construction Stormwater Pollution Prevention Plan (SWPPP)**
APPENDIX E: **Operations and Maintenance Manual**
APPENDIX F: **StormTank Design Documents**

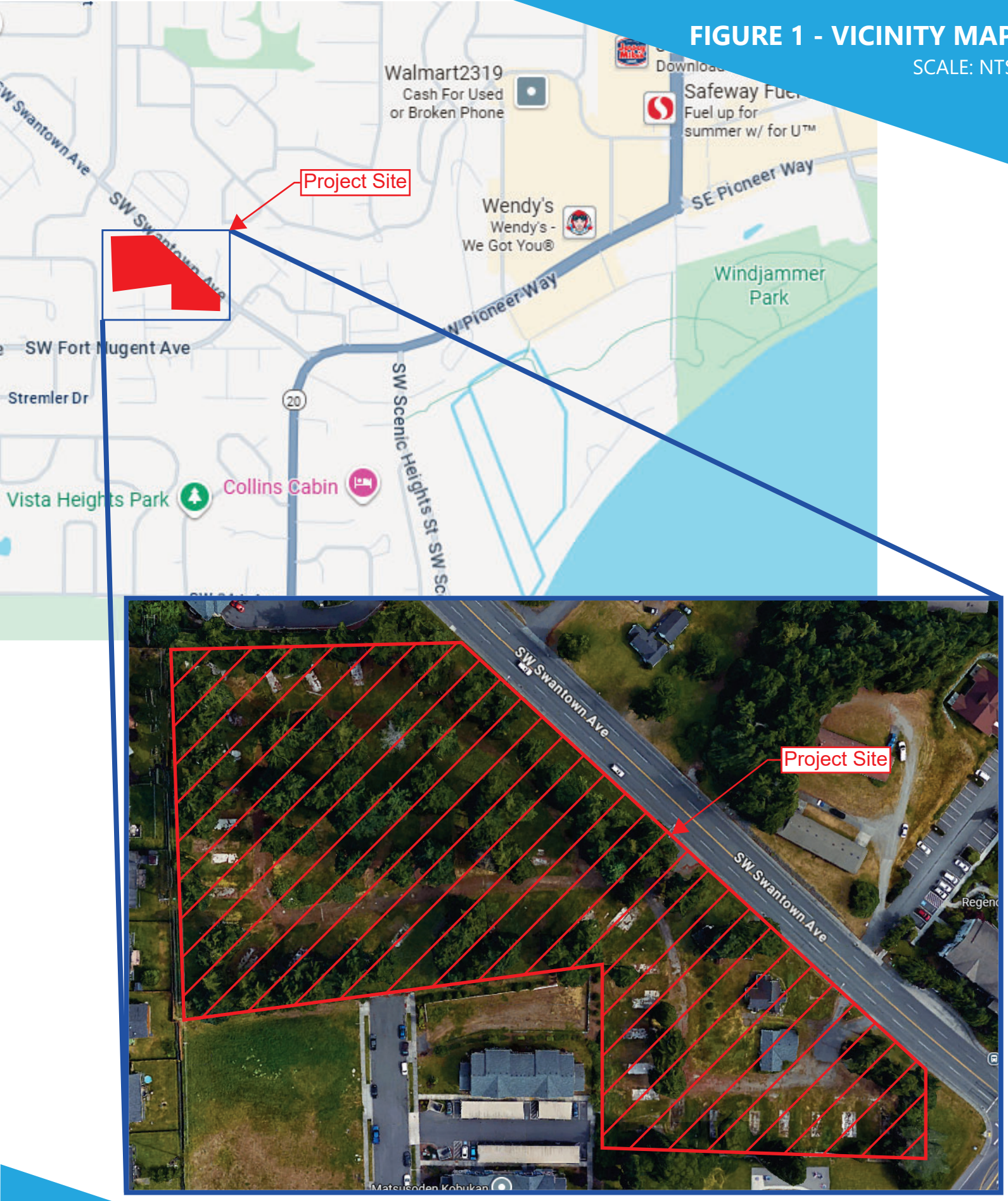
APPENDIX A

Associated Site Figures

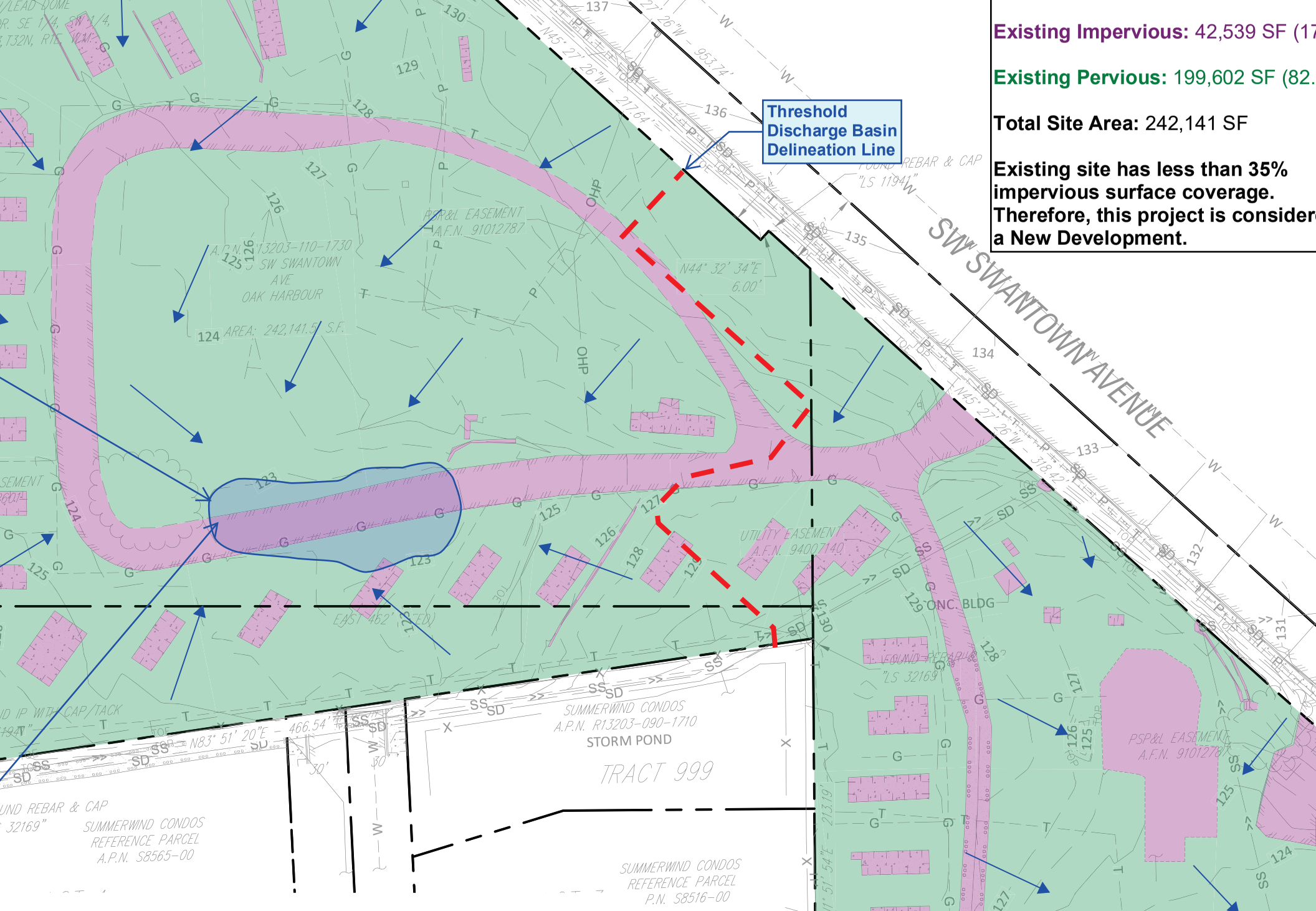
Figure 1 – Vicinity Map
Figure 2 – Existing Conditions
Figure 3 – Proposed Conditions
Figure 4A – Upstream Flow Path
Figure 4B – Downstream Flow Path
Figure 5A – Flowchart for Determining Minimum Requirements
Figure 5B – Flowchart for Determining MR #5 Requirements
Figure 5C – Runoff Treatment BMP Selection Flow Chart
Figure 6A – Critical Aquifer Recharge Areas
Figure 6B – Fish and Wildlife Habitat
Figure 6C – Frequently Flooded Area
Figure 6D – Geological Hazards
Figure 6E – Wetlands

FIGURE 1 - VICINITY MAP

SCALE: NTS



Source: Google Maps
Dated 09/2025



Existing Impervious: 42,539 SF (17

Existing Pervious: 199,602 SF (82.

Total Site Area: 242,141 SF

Existing site has less than 35% impervious surface coverage. Therefore, this project is consider a New Development.

FIGURE 2 - EXISTING CONDITIONS

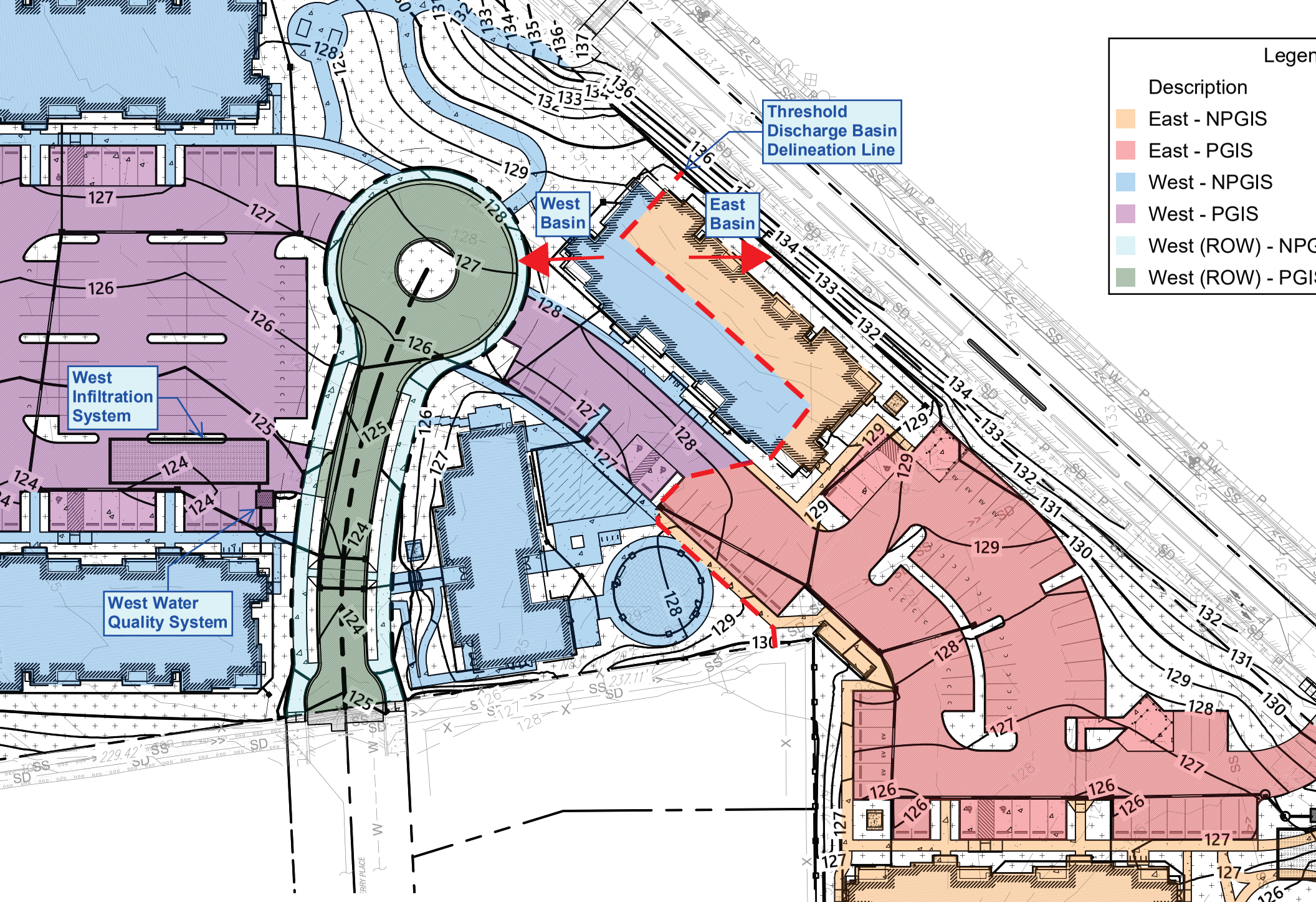
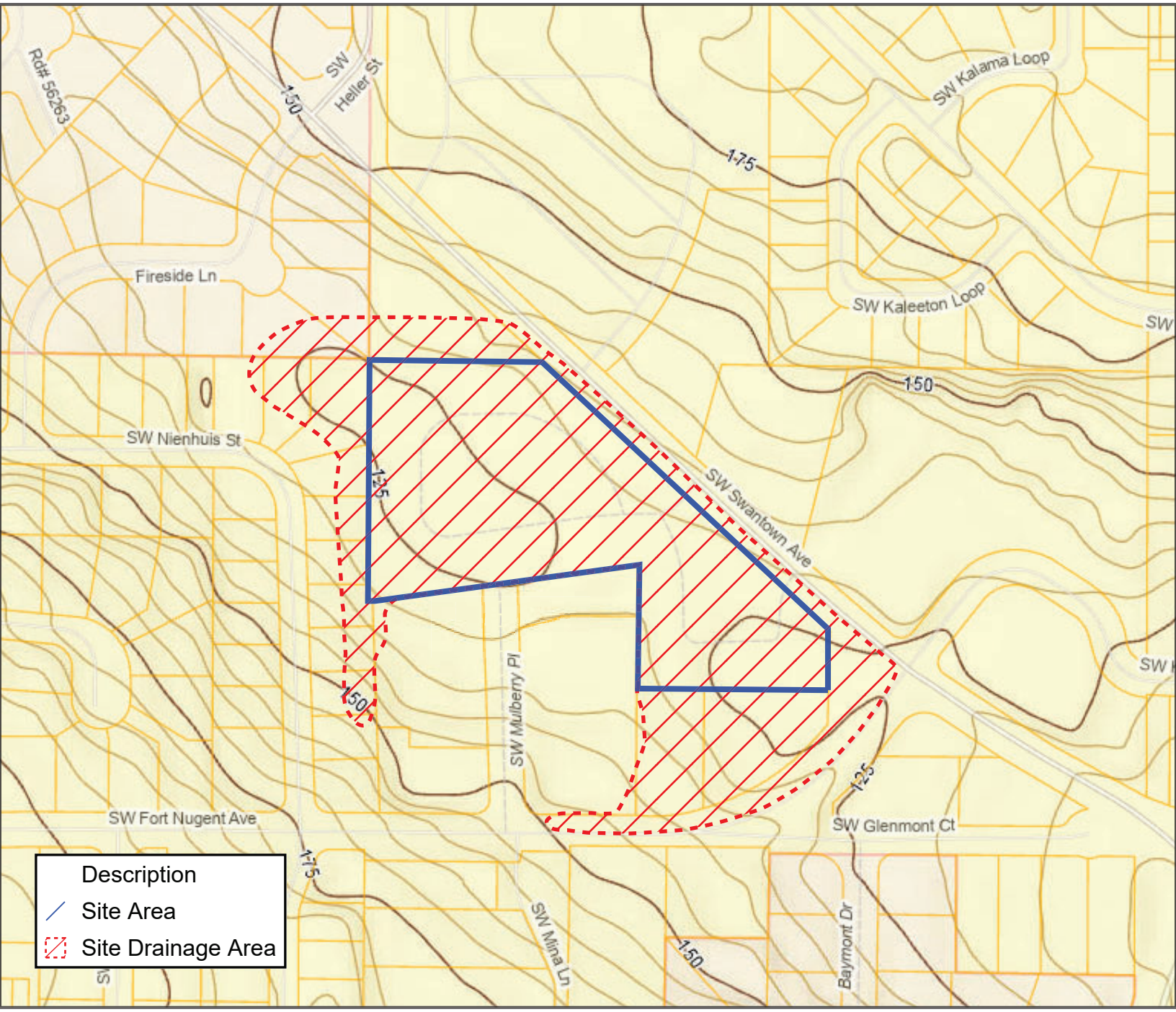


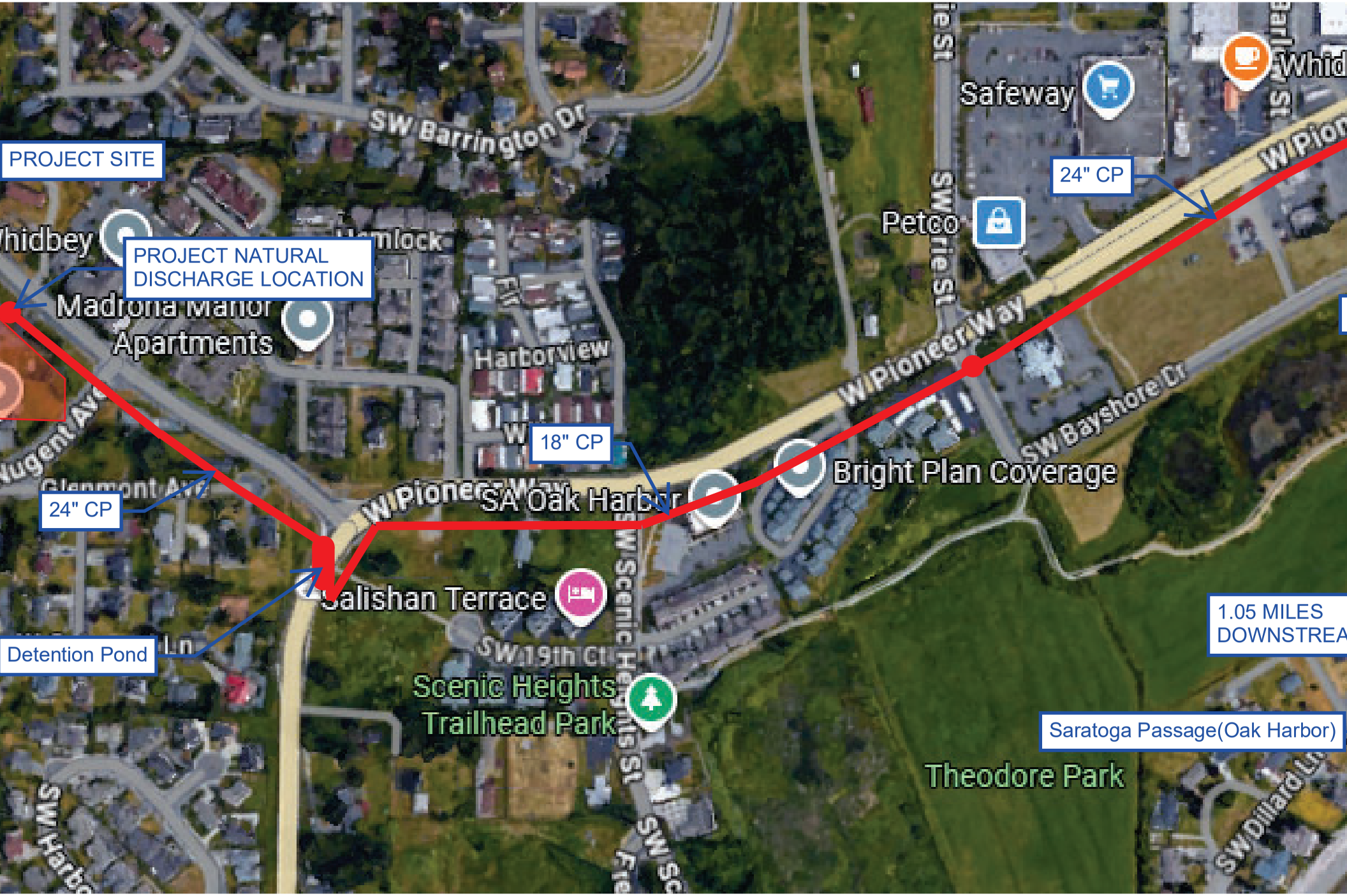
FIGURE 3 - PROPOSED CONDITIONS

NTS

FIGURE 4A
UPSTREAM FLOWPATH (EXISTING)



Project #: 2024-25
Mulberry Village



NOTE: FIGURE 4 only applies to the existing conditions, and the conditions d
Due to full on-site infiltration, **no off-site discharge is anticipated under the p**

FIGURE 5A
FLOW CHART FOR DETERMINING MINIMUM REQUIREMENTS

Figure I-3.1: Flow Chart for Determining Requirements for New Development

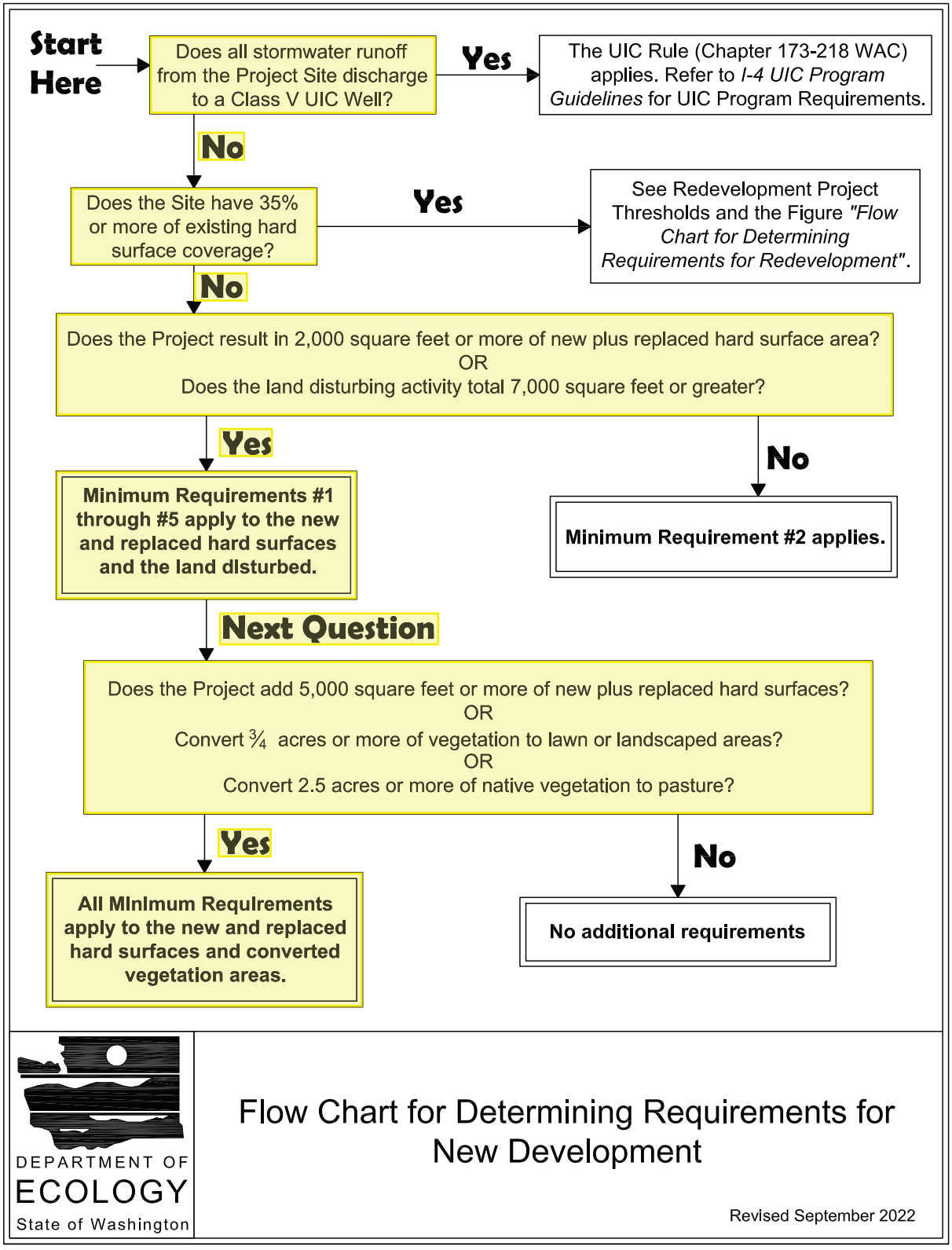
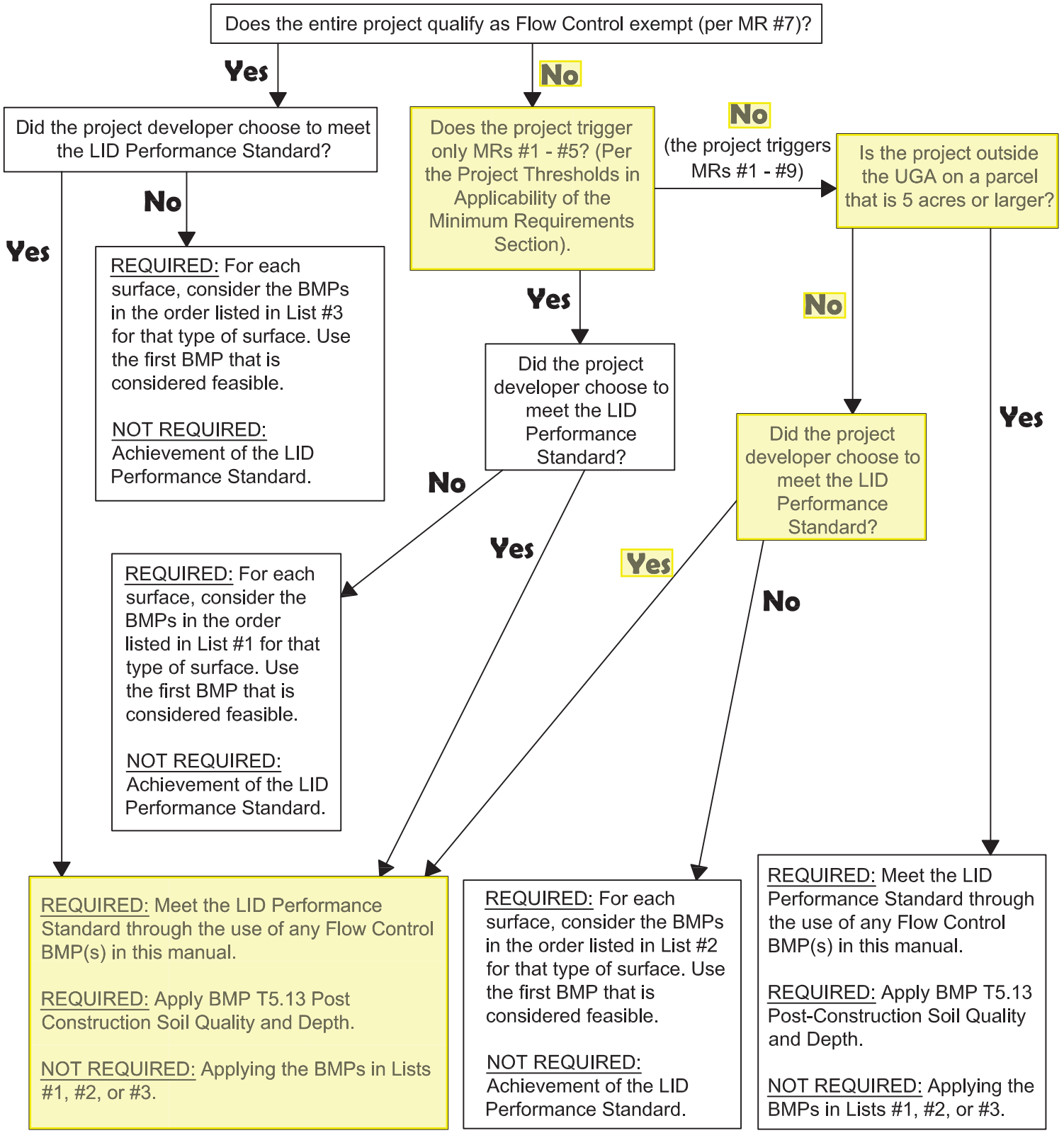


FIGURE 5B



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining MR #5 Requirements

Revised March 2019

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Step 1: Determine the receiving waters and pollutants of concern based on off-site analysis

Step 2: Determine if an Oil Control BMP is required

Yes

Select an Oil Control BMP
- API Separator
- CP Separator
- Linear Sand Filter
- Manufactured Treatment Device

No

Step 3: Determine if it is practicable to provide Runoff Treatment by infiltrating into the native soil

Yes

Select a Pretreatment BMP (if not already provided, e.g. permeable pavement or bioretention)
- Presettling Basin
- Any Basic Treatment BMP
- Manufactured Treatment Device
- A Detention BMP designed to meet Flow Control requirements

Apply Infiltration
- Infiltration Basin
- Infiltration Trench
- Bioretention
- Permeable Pavement

****Runoff Treatment BMP Selection Complete****

No

Step 4: Determine if a Phosphorus Treatment BMP is Required

Yes

Select a Phosphorus Treatment BMP
- Large Sand Filter
- Large Wetpond
- Manufactured Treatment Device
- Two Facility Treatment Train

Determine if an Enhanced Treatment BMP is required

No

****Runoff Treatment BMP Selection Complete****

Yes

Is the selected Phosphorus Treatment BMP also listed as an Enhanced Treatment BMP?

No

Select an Enhanced Treatment BMP
- Large Sand Filter
- Stormwater Treatment Wetland
- CAVFS
- Bioretention
- Media Filter Drain
- Manufactured Treatment Device
- Two Facility Treatment Train

****Runoff Treatment BMP Selection Complete****

Yes

****Runoff Treatment BMP Selection Complete****

No

Step 5: Determine if an Enhanced Treatment BMP is Required

Yes

No

Step 6: Select a Basic Treatment BMP

- Sand Filters
- Media Filter Drain
- Biofiltration Swales
- Filter Strips
- Wetponds/Wetvaults
- Stormwater Treatment Wetlands
- Combined Detention/Wetpool Facilities
- Bioretention
- Manufactured Treatment Devices

****Runoff Treatment BMP Selection Complete****

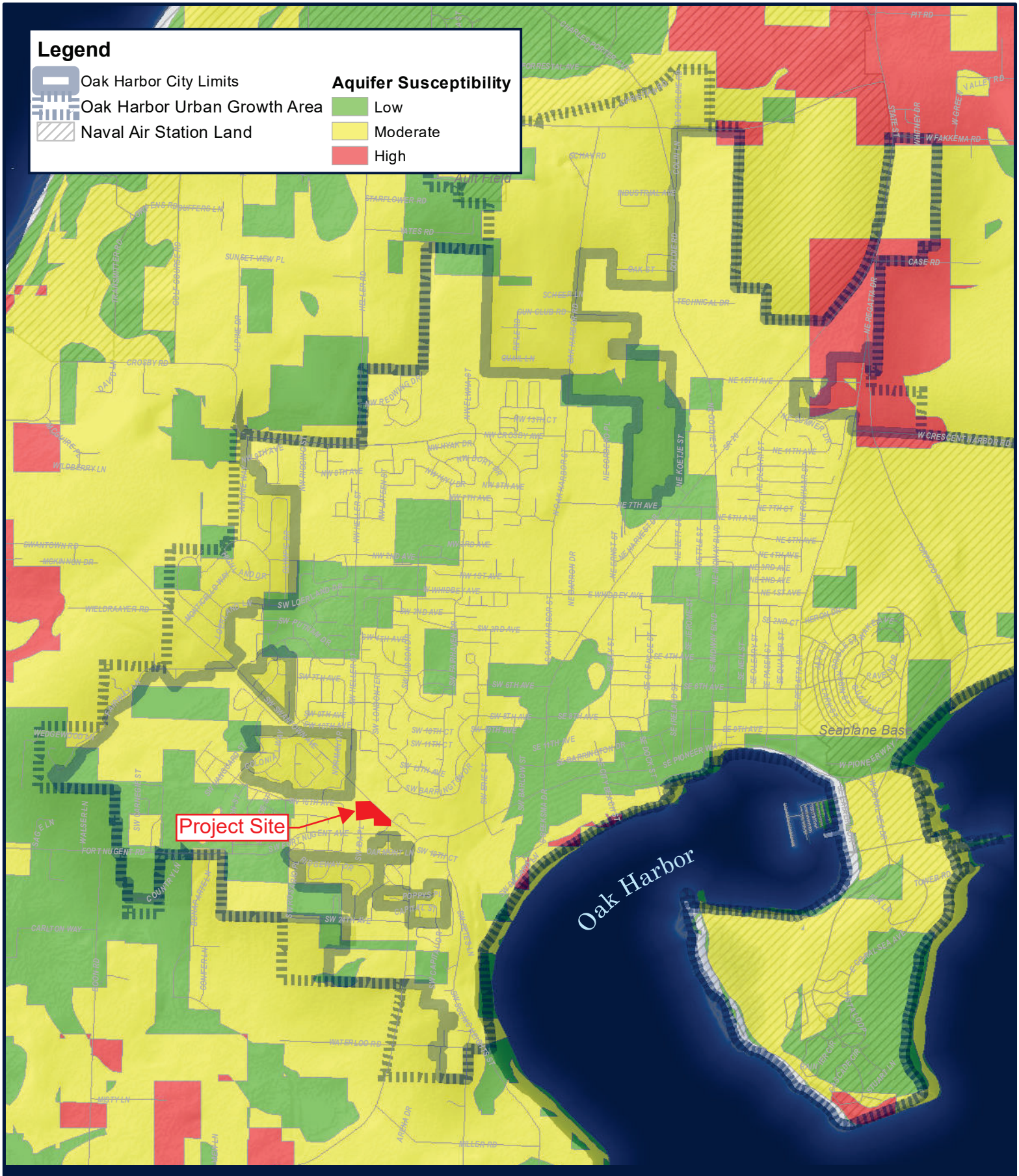
Note: This flow chart does not include all Runoff Treatment BMP options. Review the text in this section for all options for each Runoff Treatment Performance Goal.

DEPARTMENT OF ECOLOGY
State of Washington

Runoff Treatment BMP Selection Flow Chart

Revised January 2019

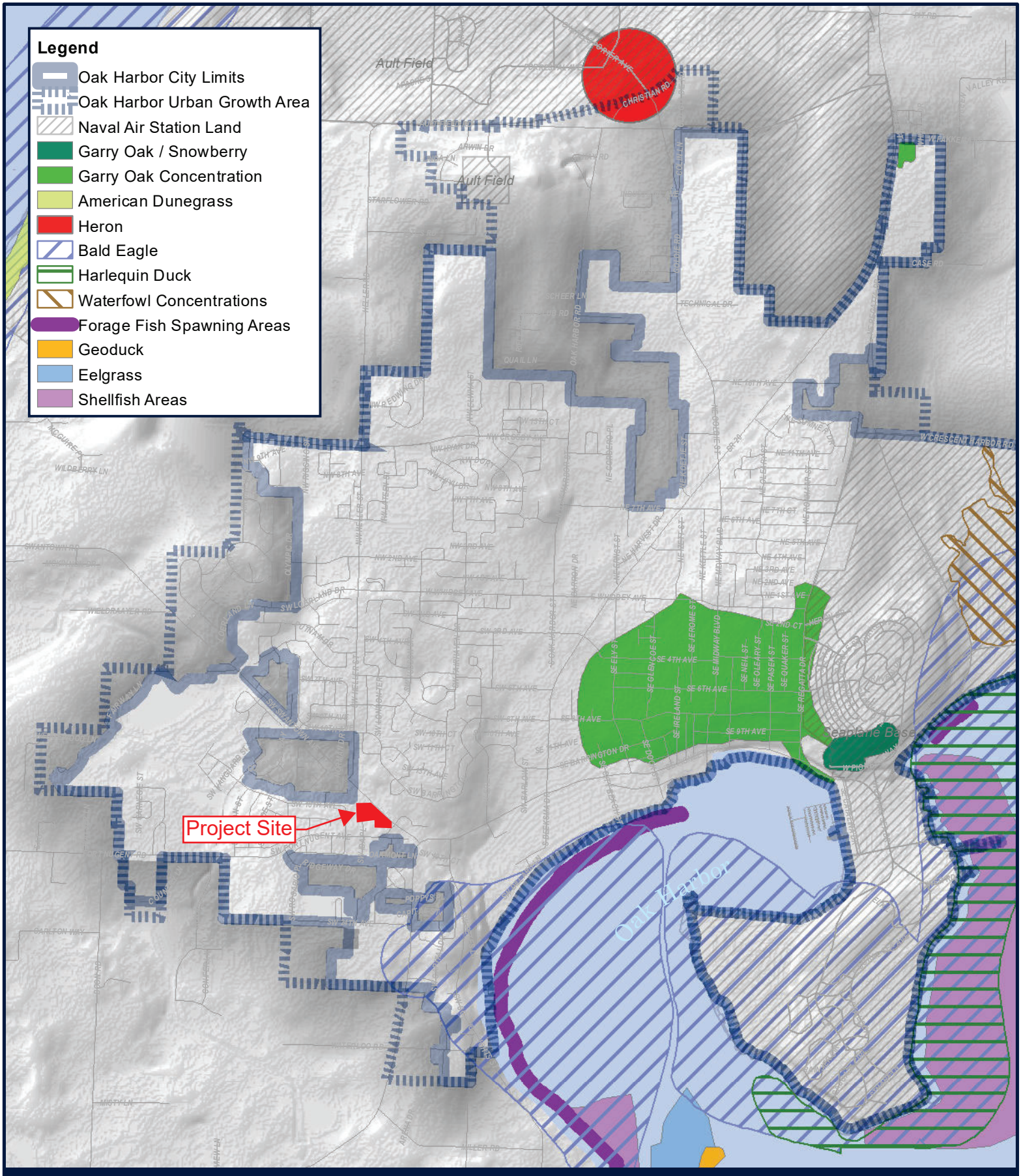
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Critical Aquifer Recharge Areas

Note: For clarity, some portions of the City east of Regatta Drive are not shown. Please consult the Oak Harbor Comprehensive Plan for more information.

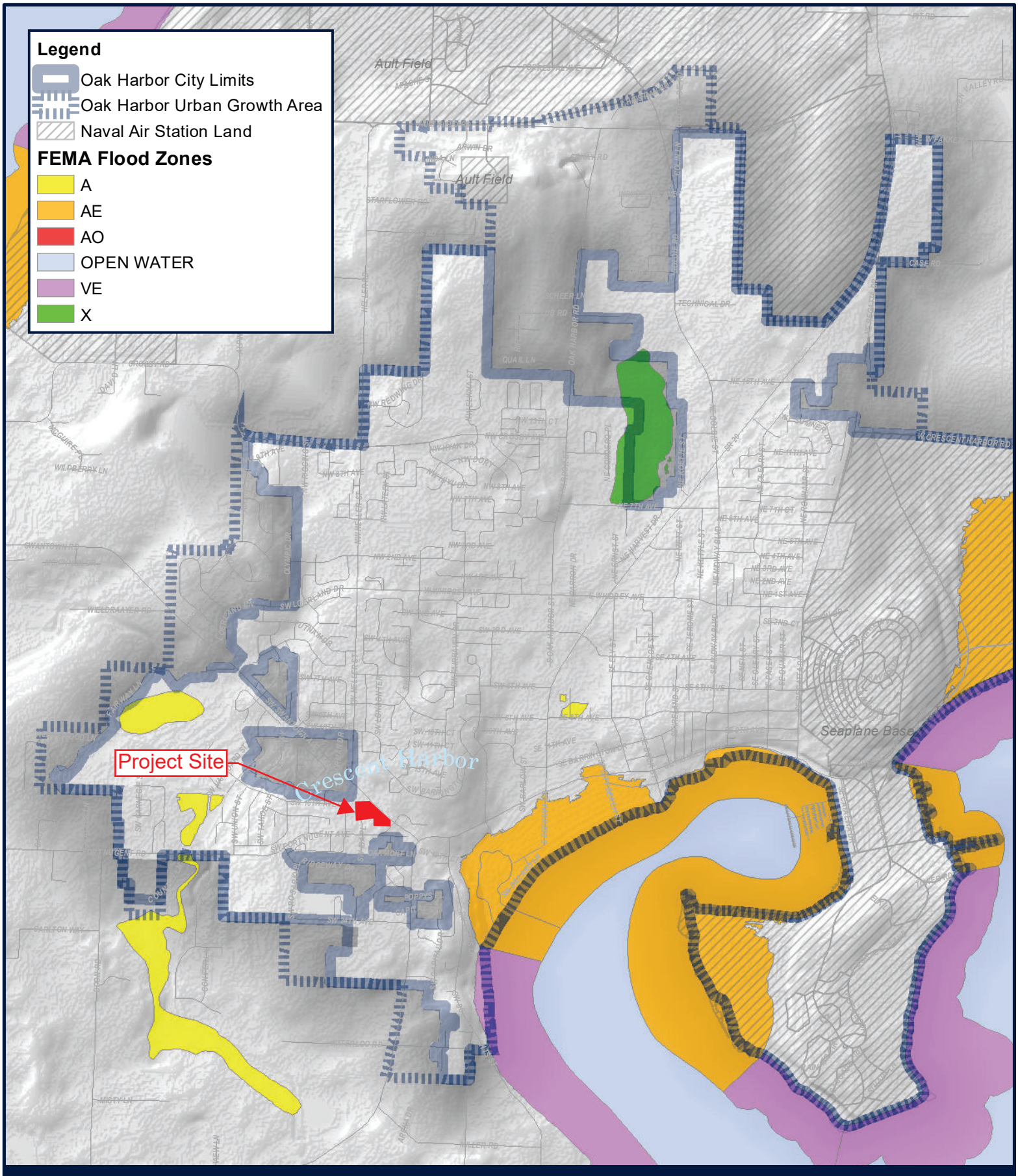
CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON



Fish and Wildlife Habitat

Note: For clarity, some portions of the City east of Regatta Drive are not shown. Please consult the Oak Harbor Comprehensive Plan for more information.

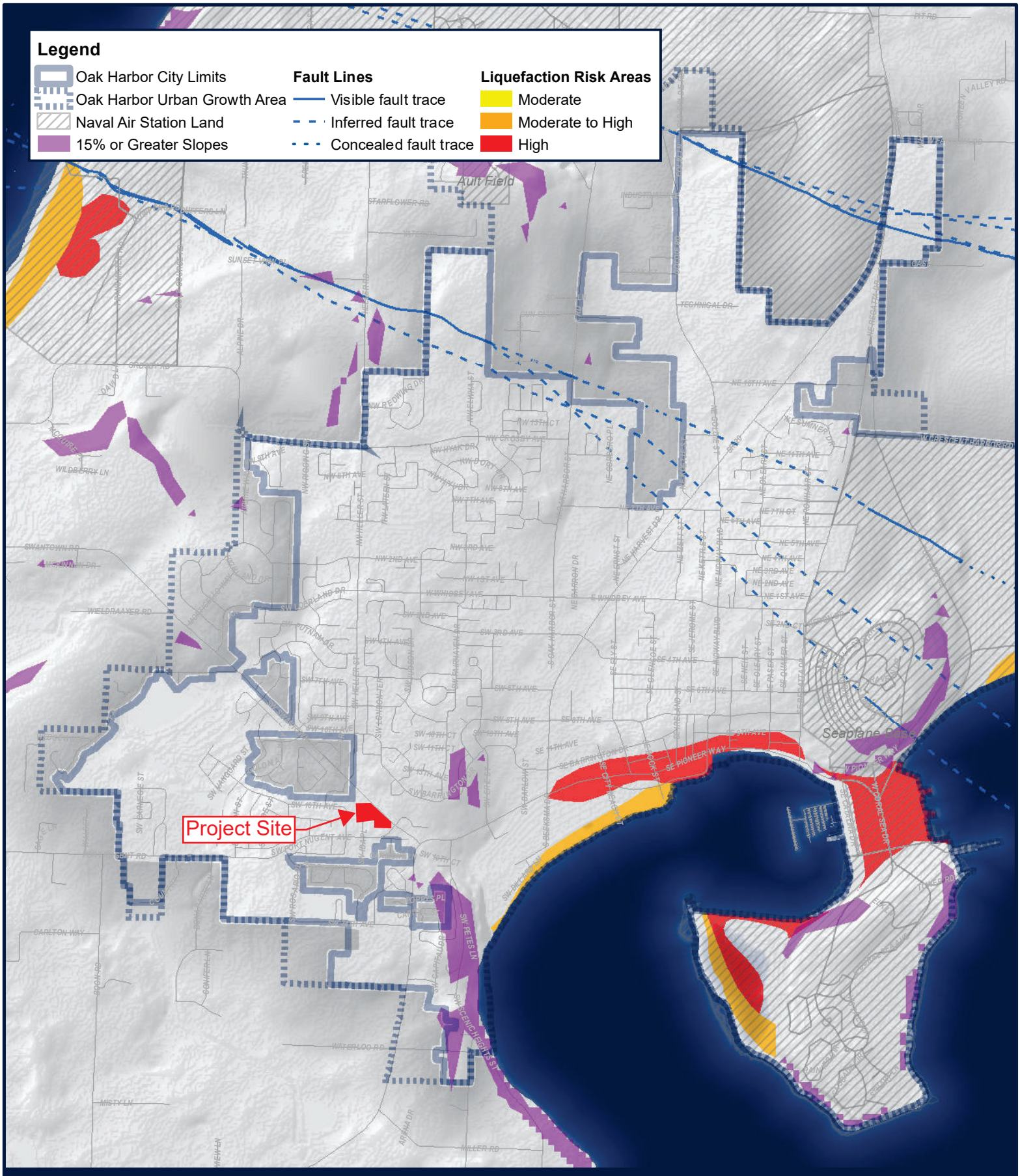
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Frequently Flooded Areas

Note: For clarity, some portions of the City east of Regatta Drive are not shown. Please consult the Oak Harbor Comprehensive Plan for more information.

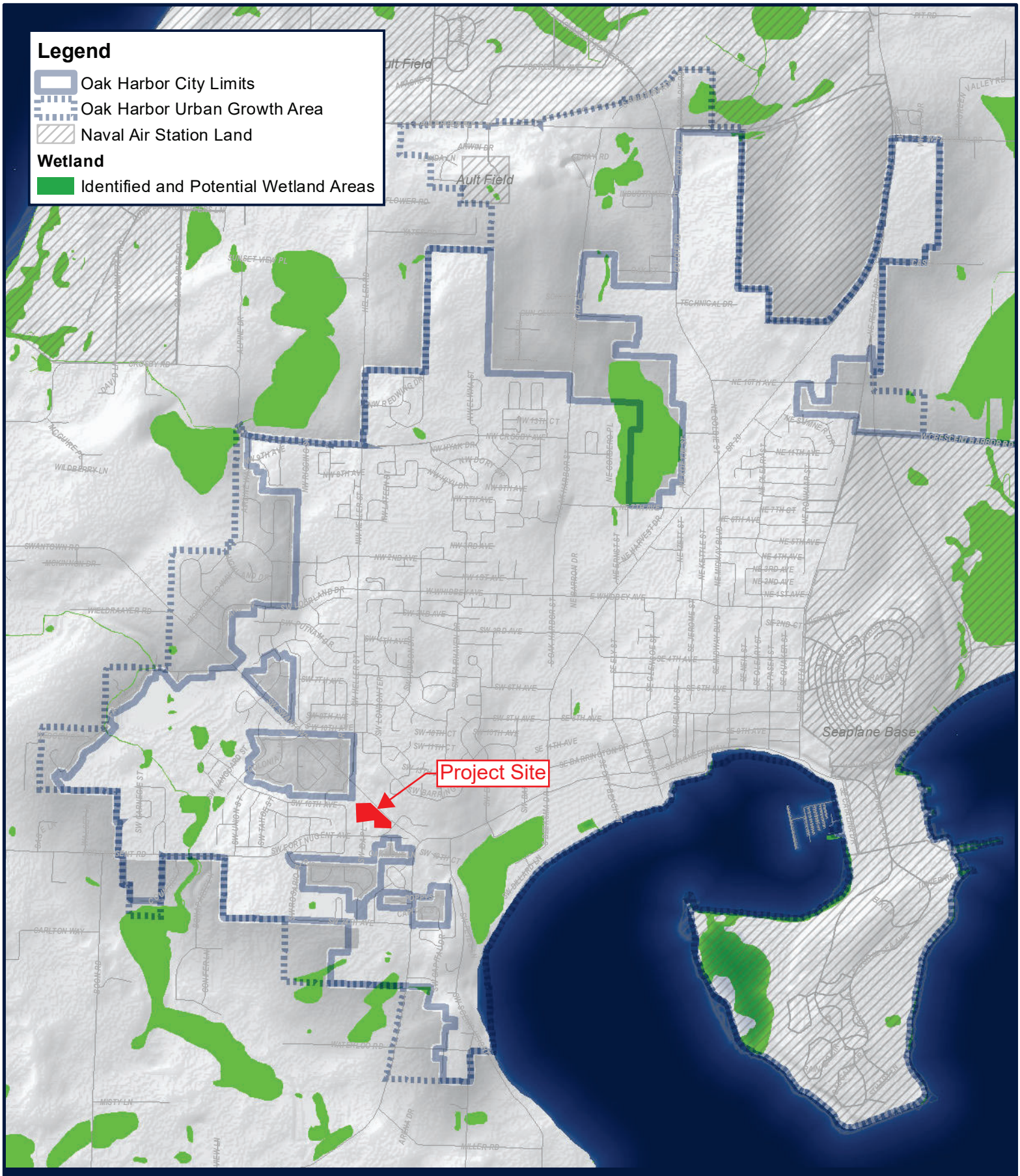
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Geologic Hazards

Note: For clarity, some portions of the City east of Regatta Drive are not shown. Please consult the Oak Harbor Comprehensive Plan for more information.

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Wetlands

Note: For clarity, some portions of the City east of Regatta Drive are not shown. Please consult the Oak Harbor Comprehensive Plan for more information.

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

APPENDIX B

Engineering Calculations

West Flow Control Calculations
East Flow Control Calculations
West Runoff Treatment Calculations
East Runoff Treatment Calculations
Conveyance Analysis – To be provided in future versions of this report

FLOW CONTROL AND LID PERFORMANCE STANDARD SUPPORTING CALCULATIONS (WEST BASIN)

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.70
Program License Number: 201910009
Project Simulation Performed on: 07/31/2026 9:14 AM
Report Generation Date: 07/31/2026 9:48 AM

Input File Name: Mulberry Storm Tank Sizing West.fld
Project Name: Mulberry
Analysis Title: West Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 14
Precipitation Station : 96002405 Puget East 24 in_5min 10/01/1940-10/01/2003
Evaporation Station : 961024 Puget East 24 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	3.451	3.451
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	3.451	3.451

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
C, Forest, Mod 3.451

Subbasin Total 3.451

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : West ----------

	-------Area (Acres) --------
C, Pasture, Mod	1.172
ROOF TOPS/FLAT	2.279
Subbasin Total	3.451

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: West Infiltration Vault
Link Type: Structure
Downstream Link: None

User Specified Elevation Volume Table Used

Elevation (ft)	Pond Volume (cu-ft)
100.00	0.
100.08	130.
100.17	288.
100.25	458.
100.33	628.
100.42	798.
100.50	968.
100.58	1137.
100.67	1307.
100.75	1477.
100.83	1647.
100.92	1817.
101.00	1987.
101.08	2156.
101.17	2326.
101.25	2496.
101.33	2666.
101.42	2836.
101.50	3006.
101.58	3175.
101.67	3345.
101.75	3515.

101.83	3685.
101.92	3855.
102.00	4025.
102.08	4194.
102.17	4364.
102.25	4534.
102.33	4704.
102.42	4874.
102.50	5044.
102.58	5213.
102.67	5383.
102.75	5553.
102.83	5723.
102.92	5881.
103.00	6011.
103.08	6181.
103.17	6351.
103.25	6521.
103.33	6690.
103.42	6860.
103.50	7030.
103.58	7200.
103.67	7370.
103.75	7540.
103.83	7709.
103.92	7879.
104.00	8049.

TOTAL STORAGE VOLUME AT RISER CREST ELEVATION

Constant Infiltration Option Used
Infiltration Rate (in/hr): 6.30

INFILTRATION RATE PER 5/14/2025 PANGEO GEOTECHNICAL REPORT (REFER TO APPENDIX C)

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 24.00
Common Length (ft) : 0.000
Riser Crest Elevation : 103.00 ft

Hydraulic Structure Geometry

Number of Devices: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

********** Link: West Infiltration Vault ********** Link WSEL Stats
WSEL Frequency Data(ft)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	100.124
1.11-Year	100.137
1.25-Year	100.169
2.00-Year	100.484
3.33-Year	100.971
5-Year	101.169
10-Year	101.431
25-Year	102.179
50-Year	102.598
100-Year	102.840

100-YEAR DESIGN STORM DOES NOT OVERTOP THE INFILTRATION SYSTEM

*************Groundwater Recharge Summary ***************

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	94.163
Total:	94.163

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: West	33.467
Link: West Infiltration Va	229.515
Total:	262.982

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 63)
Predeveloped: 1.495 ac-ft/year, Post Developed: 4.174 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: West Infiltration Vault **********

Basic Wet Pond Volume (91% Exceedance): 6474. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 9711. cu-ft

2-Year Discharge Rate : 0.000 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.25 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.14 cfs

Time to Infiltrate 91% Treatment Volume, (Hours): 6.23

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 229.51
Inflow Volume Including PPT-Evap (ac-ft): 229.51
Total Runoff Infiltrated (ac-ft): 229.51, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

**********Compliance Point Results **********

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: West Infiltration Vault

*** Point of Compliance Flow Frequency Data ***
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	1.179E-02	2-Year	0.000
5-Year	2.512E-02	5-Year	0.000
10-Year	4.124E-02	10-Year	0.000
25-Year	4.629E-02	25-Year	0.000
50-Year	5.847E-02	50-Year	0.000
100-Year	8.630E-02	100-Year	0.000
200-Year	**	200-Year	**
500-Year	**	500-Year	**

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

WEST INFILTRATION FACILITY FULLY INFILTRATES STORMWATER FOR ALL DESIGN STORMS ON RECORD

WEST INFILTRATION FACILITY MEETS FLOW CONTROL STANDARD

**** Flow Duration Performance ****

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	0.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	0.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

**** LID Duration Performance ****

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	0.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	0.0%	PASS

WEST INFILTRATION FACILITY MEETS LID PERFORMANCE STANDARD

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

WEST INFILTRATION FACILITY MEETS LID PERFORMANCE STANDARD

FLOW CONTROL AND LID PERFORMANCE STANDARD SUPPORTING CALCULATIONS (EAST BASIN)

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.70
Program License Number: 201910009
Project Simulation Performed on: 07/31/2026 9:44 AM
Report Generation Date: 07/31/2026 9:46 AM

Input File Name: Mulberry Storm Tank Sizing East.fld
Project Name: Mulberry
Analysis Title: East Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 14
Precipitation Station : 96002405 Puget East 24 in_5min 10/01/1940-10/01/2003
Evaporation Station : 961024 Puget East 24 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	2.108	2.108
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	2.108	2.108

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
C, Forest, Mod 2.108

Subbasin Total 2.108

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : East ----------

	-------Area (Acres) --------
C, Pasture, Mod	0.927
ROOF TOPS/FLAT	1.181
Subbasin Total	2.108

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: East Infiltration Vault
Link Type: Structure
Downstream Link: None

User Specified Elevation Volume Table Used

Elevation (ft)	Pond Volume (cu-ft)
100.00	0.
100.08	68.
100.17	151.
100.25	240.
100.33	328.
100.42	417.
100.50	506.
100.58	595.
100.67	684.
100.75	772.
100.83	861.
100.92	950.
101.00	1039.
101.08	1128.
101.17	1216.
101.25	1305.
101.33	1394.
101.42	1483.
101.50	1572.
101.58	1660.
101.67	1749.
101.75	1838.

101.83	1927.
101.92	2016.
102.00	2104.
102.08	2193.
102.17	2282.
102.25	2371.
102.33	2460.
102.42	2542.
102.50	2610.
102.58	2699.
102.67	2788.
102.75	2877.
102.83	2965.
102.92	3054.
103.00	3143.
103.08	3232.
103.17	3321.
103.25	3409.
103.33	3498.
103.42	3587.
103.50	3676.
103.58	3765.
103.67	3853.
103.75	3942.
103.83	4031.
103.92	4120.
104.00	4209.

TOTAL STORAGE VOLUME AT RISER CREST ELEVATION

Constant Infiltration Option Used
Infiltration Rate (in/hr): 6.30

INFILTRATION RATE PER 5/14/2025 PANGEO GEOTECHNICAL REPORT (REFER TO APPENDIX C)

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 24.00
Common Length (ft) : 0.000
Riser Crest Elevation : 103.00 ft

Hydraulic Structure Geometry

Number of Devices: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

********** Link: East Infiltration Vault ********** Link WSEL Stats
WSEL Frequency Data(ft)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	100.122
1.11-Year	100.135
1.25-Year	100.166
2.00-Year	100.498
3.33-Year	100.945
5-Year	101.183
10-Year	101.468
25-Year	102.152
50-Year	102.582
100-Year	102.807

100-YEAR DESIGN STORM DOES NOT OVERTOP THE INFILTRATION SYSTEM

*************Groundwater Recharge Summary ***************

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	57.504
Total:	57.504

Total Post Developed Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: East		26.480
Link:	East Infiltration Va	121.913
Total:		148.393

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 63)
Predeveloped: 0.913 ac-ft/year, Post Developed: 2.355 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: East Infiltration Vault **********

Basic Wet Pond Volume (91% Exceedance): 3439. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 5158. cu-ft

2-Year Discharge Rate : 0.000 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.13 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.07 cfs

Time to Infiltrate 91% Treatment Volume, (Hours): 6.31

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 121.91
Inflow Volume Including PPT-Evap (ac-ft): 121.91
Total Runoff Infiltrated (ac-ft): 121.91, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

**********Compliance Point Results **********

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: East Infiltration Vault

*** Point of Compliance Flow Frequency Data ***
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	7.202E-03	2-Year	0.000
5-Year	1.534E-02	5-Year	0.000
10-Year	2.518E-02	10-Year	0.000
25-Year	2.827E-02	25-Year	0.000
50-Year	3.571E-02	50-Year	0.000
100-Year	5.270E-02	100-Year	0.000
200-Year	**	200-Year	**
500-Year	**	500-Year	**

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

WEST INFILTRATION FACILITY FULLY INFILTRATES STORMWATER FOR ALL DESIGN STORMS ON RECORD

WEST INFILTRATION FACILITY MEETS FLOW CONTROL STANDARD

**** Flow Duration Performance ****

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	0.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	0.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

**** LID Duration Performance ****

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	0.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	0.0%	PASS

WEST INFILTRATION FACILITY MEETS LID PERFORMANCE STANDARD

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

WEST INFILTRATION FACILITY MEETS LID PERFORMANCE STANDARD

MODULAR WETLAND SUPPORTING CALCULATIONS (WEST BASIN)

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.70
Program License Number: 201910009
Project Simulation Performed on: 08/10/2026 1:14 PM
Report Generation Date: 08/10/2026 1:15 PM

Input File Name: Mulberry WQ Sizing West.fld
Project Name: Mulberry
Analysis Title: West WQ Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 14
Precipitation Station : 96002405 Puget East 24 in_5min 10/01/1940-10/01/2003
Evaporation Station : 961024 Puget East 24 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	3.451	3.451
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	3.451	3.451

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
C, Forest, Mod 3.451

Subbasin Total 3.451

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : West ----------
-------Area (Acres) --------
C, Pasture, Mod 1.172
ROOF TOPS/FLAT 2.279

Subbasin Total 3.451

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk2
Link Type: Copy
Downstream Link: None

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

**********Groundwater Recharge Summary **********
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation
Model Element Recharge Amount (ac-ft)

Subbasin: Subbasin 1 94.163
_____
Total: 94.163

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: West	33.467
Link: New Copy Lnk2	Not Applicable
Total:	33.467

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 63)
Predeveloped: 1.495 ac-ft/year, Post Developed: 0.531 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: New Copy Lnk2 **********

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.25 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.14 cfs

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: West

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	1.179E-02	2-Year	0.621
5-Year	2.512E-02	5-Year	0.826
10-Year	4.124E-02	10-Year	1.029
25-Year	4.629E-02	25-Year	1.378
50-Year	5.847E-02	50-Year	1.461
100-Year	8.630E-02	100-Year	1.633
200-Year	**	200-Year	**
500-Year	**	500-Year	**

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	630.6%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	1572.1%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	178.6%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	630.6%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

MODULAR WETLAND SUPPORTING CALCULATIONS (EAST BASIN)

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.70
Program License Number: 201910009
Project Simulation Performed on: 08/10/2026 1:17 PM
Report Generation Date: 08/10/2026 1:18 PM

Input File Name: Mulberry WQ Sizing East.fld
Project Name: Mulberry
Analysis Title: East Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 14
Precipitation Station : 96002405 Puget East 24 in_5min 10/01/1940-10/01/2003
Evaporation Station : 961024 Puget East 24 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	2.108	2.108
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	2.108	2.108

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
C, Forest, Mod 2.108

Subbasin Total 2.108

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : East ----------
-------Area (Acres) --------
C, Pasture, Mod 0.927
ROOF TOPS/FLAT 1.181

Subbasin Total 2.108

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk2
Link Type: Copy
Downstream Link: None

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

**********Groundwater Recharge Summary **********
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation
Model Element Recharge Amount (ac-ft)

Subbasin: Subbasin 1 57.504
_____
Total: 57.504

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: East	26.480
Link: New Copy Lnk2	0.000
Total:	26.480

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 63)
Predeveloped: 0.913 ac-ft/year, Post Developed: 0.420 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: New Copy Lnk2 **********

2-Year Discharge Rate : 0.322 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.13 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.07 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 121.91
Inflow Volume Including PPT-Evap (ac-ft): 121.91
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 121.91
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: New Copy Lnk2

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	7.202E-03	2-Year	0.322

5-Year	1.534E-02	5-Year	0.428
10-Year	2.518E-02	10-Year	0.533
25-Year	2.827E-02	25-Year	0.716
50-Year	3.571E-02	50-Year	0.757
100-Year	5.270E-02	100-Year	0.846
200-Year	**	200-Year	**
500-Year	**	500-Year	**

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	606.9%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	1462.3%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	179.2%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	606.9%	FAIL

LID DURATION DESIGN CRITERIA: FAIL
