

**24th Street Improvement Project
Preliminary Stormwater Site Plan**

Submitted to:

City of Lake Stevens

January 2018

Submitted by:

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Project No. 13510

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24th Street Improvement Project
Preliminary Phase
Stormwater Site Plan

Lochner 13510
January 2018
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24th Street Improvement Project

Preliminary Stormwater Site Plan

Lake Stevens, WA

1. PROJECT OVERVIEW

The City of Lake Stevens plans to construct a new extension of 91st Avenue SE and 24th Street SE. As a part of this development, a regional stormwater pond will be constructed to provide flow control from the new roads and from commercial lots planned on the property. Additionally, an existing stormwater pond serving a portion of State Road 9 will be combined with the regional stormwater pond. The project area is shown in Figure 1, below.

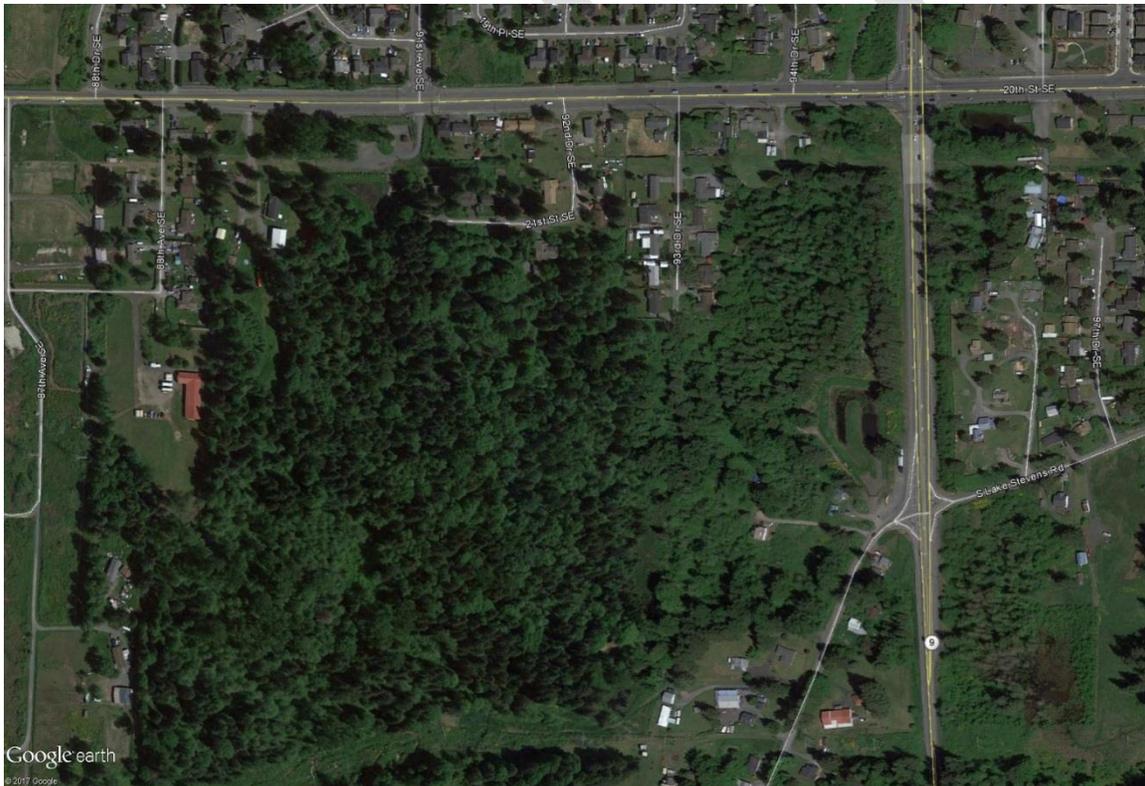


Figure 1 Aerial Photo of the Project Area (from Google Earth)

Project Description

Design Criteria

The stormwater design is based on the Stormwater Management Manual for Western Washington (SWMMWW) published by the Washington State Department of Ecology, dated 2014.

Core Requirements for Stormwater Design

Applicability of Core Elements

The project involves the addition of approximately 42 acres of new impervious area and is categorized as a new development under the SWMMWW. Stormwater will be detained in a stormwater pond and discharged into an existing downstream channel, therefore core elements 1 – 9 all apply, each of which is described briefly, below.

Core Element #1 – Preparation of a Stormwater Site Plan

This preliminary stormwater site plan has been prepared based on Section I-3 of the SWMMWW.

Core Element #2 – Construction Stormwater Pollution Prevention Plan (CSWPPP)

A Construction Stormwater Pollution Prevention Plan (CSWPPP) will be provided during a future phase of design.

Core Element #3 – Source Control of Pollutants

The project includes new roadway and sidewalks, new commercial development of the lot area, and replacement of an existing stormwater pond treating portions of State Road 9.

The new roadways on 91st Avenue SE and on 24th Street SE have an average daily traffic volume of less than 25,000 trips, therefore oil control is not required for those roadways per Section V-2.1 of the SWMMWW.

The lot developments will be responsible for providing source control and water quality treatment to runoff before leaving the sites. The anticipated commercial developments do not include industrial uses or involve hazardous chemicals requiring special treatment.

The existing segment of State Road 9 has an average daily traffic volume in excess of 25,000, therefore oil control is required per Section V-2.1 of the SWMMWW. Water quality treatment is discussed in Section 3 of this report.

Core Element #4 – Preservation of Natural Drainage Systems

The existing project area drains to a downstream channel located near the southwest corner of the project which is tributary to the Ebey Slough. The regional stormwater detention pond discharges into this same downstream channel as the existing site.

The existing WSDOT stormwater pond discharges to Centennial Creek, located near State Road 9 and 24th Street SE. A flow control manhole will route low flows to

Centennial Creek to match the existing peak flow rates and route high flows to the regional stormwater detention pond, which discharges to the Pilchuck River.

More information regarding the flow control measures is provided in Section 3 of this report.

The downstream flow paths from the existing WSDOT stormwater pond and from the regional stormwater pond are shown in Figure 2, below. A larger exhibit, showing the downstream flow paths to the Snohomish River, is included in Appendix A.

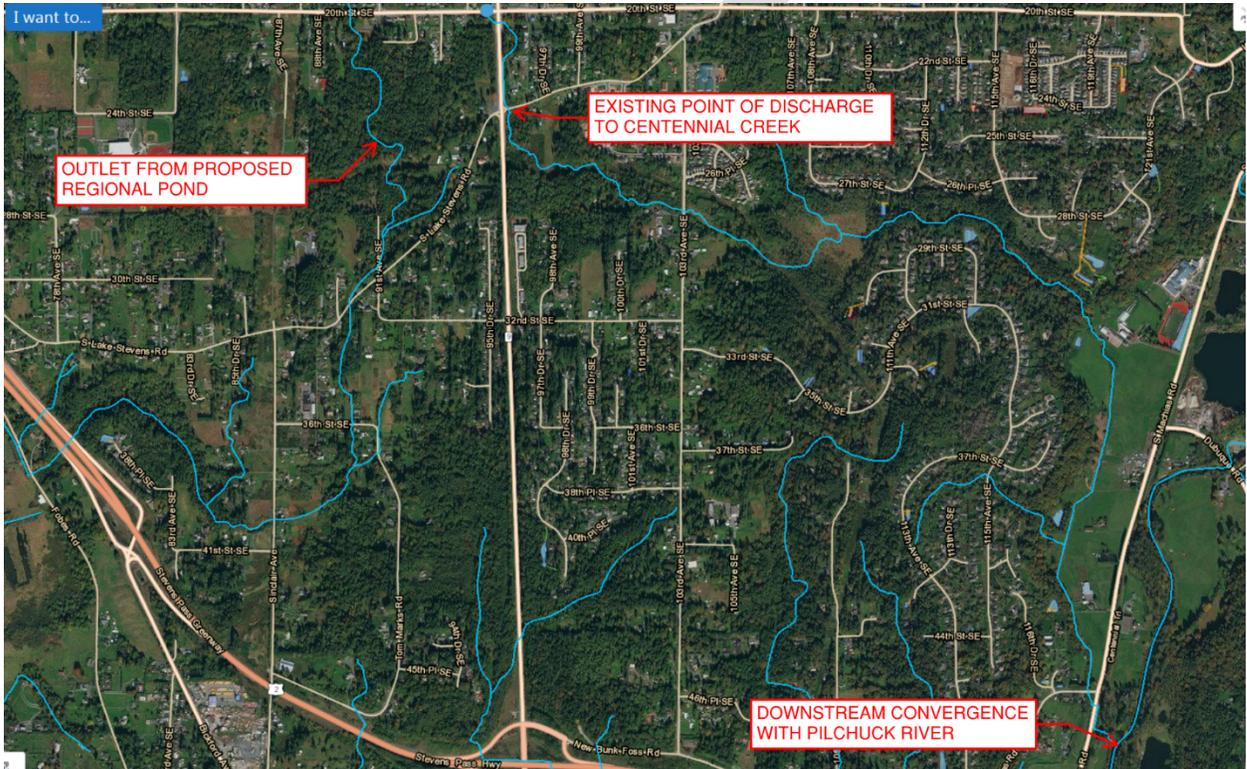


Figure 2 Downstream Flow Paths (from Snohomish County GIS)

Core Element #5 – On-site Stormwater Management

Onsite treatment for the commercial lot developments, including meeting any applicable LID requirements, will be performed on those commercial lots and is not a part of the regional stormwater pond design discussed here.

Soils in the project area are generally impervious, therefore onsite infiltration using Bioretention BMPs or permeable pavement is not feasible for runoff from the new roads and sidewalks, or for the existing portion of State Road 9. Full or partial dispersion is not feasible because the runoff would not infiltrate into the ground, resulting in flooding damage to downstream properties.

Core Element #6 – Runoff Treatment

The project discharges to two existing surface channels. Stormwater releases from the regional pond are discharged to an existing channel near the southwest corner of the project. Runoff from State Road 9 is discharged to Centennial Creek.

Runoff from State Road 9 is required to provide enhanced treatment and oil control because of the high traffic volume on this road, per Section V-2.1 of the SWMMWW.

Runoff from 24th Street and 91st Avenue is required to provide basic treatment per Section V-2.1 of the SWMMWW.

Runoff from the future lot developments will be provided on those lots and will be determined during the site design process.

The water quality treatment BMPs are discussed in Section 3 of this report.

Core Element #7 – Flow Control

The project releases water at two existing discharge points, as described previously.

Runoff from State Road 9 is controlled by a flow control manhole, treated, and then discharged into the Centennial Creek at a rate not to exceed the predeveloped flow rate for storms between 50% of the 2 year storm and the 50 year storm, per Section I-2.5.7 of the SWMMWW. The excess runoff from State Road 9 is conveyed to the regional stormwater pond.

Runoff from the remainder of the project, including 24th Street, 91st Avenue, and the future commercial lot developments is detained in the regional stormwater pond and then released in to the existing channel to the south-west. The discharges are controlled so as not to exceed the predeveloped flow rate for storms between 50% of the 2 year storm and the 50 year storm, per Section I-2.5.7 of the SWMMWW.

More information is included in Section 3 of this report.

Core Element #8 – Wetlands Protection

There are multiple wetland areas in the vicinity of the project. The discharge point into Centennial Creek releases water into existing wetland areas. The project modifies the volume of water released into Centennial Creek and requires approval from the Department of Ecology. The discharge from the regional pond to the south releases into an existing channel in the vicinity of existing wetlands which flows to the Ebey Slough.

Some onsite wetland areas are eliminated by the project. These will be mitigated by replacement in an offsite wetland bank. More information about this exchange will be added to future versions of the design.

Core Element #9 – Operation and Maintenance

The stormwater management system will be owned and maintained by the City of Lake Stevens.

Geotechnical Site Characteristics

A preliminary geotechnical report was prepared by HWA Geosciences, dated October 16, 2017, which identified the site soils as containing three principal soil types:

- Gravelly sandy silt and sandy gravel over glacial till is located on the western, upland areas
- Peat and/or clay over water-bearing gravelly sand is located at the east end of 24th Street
- Silty sand over gravelly sand and sandy gravel is located in upland areas along the center of 24th Street
- Fill materials over glacial outwash and till soils are located in the northern parts of 91st Avenue
- Glacial till over hard silt is located in the area of the regional stormwater pond

The preliminary geotechnical report is included in Appendix C.

Groundwater Depth

The groundwater depth in the area of the regional stormwater pond was assessed by HWA GeoSciences in August of 2017. They performed borings at three locations in the vicinity of the regional stormwater pond. The borings were 31 to 36 feet deep and did not identify groundwater during that exploration.

During excavation of the stormwater pond, we anticipate that zones of seepage will be encountered. Perched ground water could collect within the pond and seep through saturated lenses from the adjacent wetlands east of the pond. The resulting perched water level is likely to be similar in elevation to the water levels in the wetlands east of the pond.

2. EXISTING DRAINAGE CONDITIONS

The existing drainage within the project area is divided into two basins based on their existing discharge points. Basin 1 includes the future commercial development lots and the new road and sidewalk improvements for 24th Street SE and 91st Avenue SE. Basin 2 includes the tributary area which discharges into the existing WSDOT stormwater pond. Existing drainage within each basin is discussed, below.

An existing basin map is included in Appendix A.

Existing Drainage in Basin 1

The existing ground within Basin 1 slopes in a south-westerly direction and discharges into an existing channel which is tributary to Ebey Slough. The ground slopes predominantly to the south and west within the basin and is captured in an existing channel to the south of the property. The existing land use is forested with several existing wetland areas.

Existing Drainage in Basin 2

Basin 2 includes a 7.2 acre area along State Road 9 which is north of South Lake Stevens Way. It drains in a predominantly southward direction and is made up of the roadway surface and surrounding areas near the right of way.

An existing stormdrain system along State Road 9 conveys water from the road and the surrounding area into an existing stormwater pond located near 24th Street SE and State Road 9, which is owned and maintained by WSDOT. The existing WSDOT stormwater pond is a combined detention and stormwater wetland BMP which was designed based on the WSDOT Highway Runoff Manual. It receives runoff from the stormdrain system to the north on State Road 9. The pond serves a basin area of 7.20 acres, all of which is impervious.

The bottom of the presettling cell of the existing WSDOT pond is at El. 304.0. The bottom of the wetland cell of the pond is at El. 306.5. Stormwater enters the pond through an 18" stormdrain pipe at El. 306.0. The groundwater elevation at the existing pond site was measured before construction and found to be between El. 302.1 and El. 307.5. The stormwater wetland storage volume is 21,669 cubic feet, measured between El. 304 and El. 309. The stormwater detention volume is 171,547 cubic feet, with a maximum water surface elevation of 315.0. A berm is located around the pond with a top at El. 316.0, providing 1.0 feet of freeboard.

The bottom of the pond includes a treatment liner consisting of 18" of engineered topsoil material. The sidewalls of the pond include an impermeable geomembrane liner covered by 12" to 36" of topsoil.

An oil control boom is provided across the pond to provide oil control.

Stormwater is released through a flow control structure with a maximum outflow rate of 0.18 cfs during the 100 year storm. An emergency overflow structure is also provided, designed to convey up to 2.98 cfs during the 100 year storm. Stormwater from both the flow control structure and the emergency overflow is conveyed through an open channel to a 12" culvert under State Road 9 then discharged into Centennial Creek, southeast of the intersection of State Road 9 and South Lake Stevens Road.

More information about the existing stormwater pond is included in the WSDOT Hydraulics Report, provided in Appendix D. Table 1 lists the peak runoff rate for the predeveloped Basin 2 area, prior to the construction of State Road 9, and the existing discharge rate from the existing WSDOT pond.

Event	Predeveloped Runoff Rate (CFS)	Existing Discharge Rate from WSDOT Pond (CFS)
2 year storm	0.149 CFS	0.072 CFS
5 year storm	0.249 CFS	0.128 CFS
10 year storm	0.302 CFS	0.159 CFS
50 year storm	0.495 CFS	0.174 CFS
100 year storm	0.541 CFS	0.181 CFS

Table 1 Discharge Rates from Basin 2 / Existing WSDOT Pond

3. PROPOSED DRAINAGE CONDITIONS

Proposed Basins

The proposed project area is divided into two basins. Basin 1 includes 91st Avenue SE, 24th Street SE, and the future commercial properties. Basin 2 includes the area along State Road 9 which is tributary to the existing WSDOT stormwater pond. Each is described, below.

A proposed basin map is provided in Appendix A.

Basin 1

Basin 1 is broken into four sub-basins. Basin 1.1 is a 38.1 acre area, including the majority of the developed area of the property. A stormdrain system collects runoff from Basin 1.1 and conveys it to the regional stormwater pond. Basins 1.2, 1.3, and 1.4 are small bypass areas which are not being developed by this project and are not captured by the stormdrain system.

Basin 1.1 is comprised of the right of way improvement, the future commercial lots, and a wetland area which will be retained during construction. The right of way improvements cover an area of 2.89 acres, all of which is impervious area. The future commercial lots cover an area of 34.94 acres, which is assumed to be 90% impervious and 10% greenspaces. The existing wetland and buffer area to be retained is 0.31 acres in size. Other wetland areas within the project are to be replaced by an offsite wetland bank.

Water quality treatment for the runoff from the roads and sidewalks is provided by using Contech's Filterra units or an equivalent proprietary system which is approved by the Washington State Department of Ecology.

Basin 2

Basin 2 is the tributary area which is conveyed to the existing WSDOT stormwater pond located at State Road 9 and South Lake Stevens Road. Information about this basin, the existing WSDOT stormwater pond and the existing stormdrain system on State Road 9 is taken from the hydraulics report which was prepared for it in 2007, included in Appendix D.

Basin 2 is comprised of 7.2 acres of impervious area which is collected by an existing stormdrain system and conveyed to the existing WSDOT stormwater pond, described previously. No changes to the existing Basin 2 coverage or the conveyance system upstream of the existing pond are planned.

Water quality treatment is provided by the use of a proprietary treatment system which can provide enhanced water quality treatment and oil control. A Bioscape water quality system sold by Contech was used as the reference product. Based on discussions with the vendor, a Bioscape system with a bottom area of 690 square feet would be equivalent to the existing stormwater wetland BMP. The Bioscape system is located directly southwest of State Road 9 and 24th Street SE. The Bioscape system will provide oil removal and enhanced water quality treatment at an application rate of 35 inches per hour, or 0.64 cfs.

A flow control manhole is connected to the last catch basin prior to the existing pond which will meter flows into the Bioscape system. The flow control manhole is designed to route flows in excess of the capacity of the Bioscape system directly to the regional stormwater pond. A second flow control manhole is located downstream of the Bioscape system, which limits the flow into Centennial Creek to 50% of the 2 year flow rate and routes larger flows to the regional stormwater pond. The flow being provided to Centennial Creek is provided to help maintain the existing downstream hydrology, while preventing larger flows from causing erosion.

Flow Control

The regional stormwater pond is designed to provide sufficient flow control capacity for the new roads and sidewalks, for the future commercial lots developments, and to replace the existing WSDOT stormwater pond. No water quality treatment is provided by the regional stormwater pond.

Runoff from Basins 1 and 2 are conveyed to a regional stormwater detention pond, located south of the corner of 24th Street and 91st Avenue. The regional stormwater pond releases water into the existing channel, located south of the pond. A flow control manhole is provided at the detention pond to limit the discharge rate from the pond to the predeveloped flow rate from Basin 1 for flows between 50% of the 2 year storm up to the 50 year storm.

Hydraulic analysis of the regional stormwater pond was performed using WWHM. The proposed basin areas used are shown in Table 2, below. The WWHM analysis report is included in Appendix B.

The hydraulic analysis determined that a live storage of 20.8 acre-feet is required. The bottom of the regional pond is at El. 280. It is designed with a 1' sediment storage depth and a live storage depth of 10'. It is contained by a 6' wide berm along the south side with a top at El. 292, providing a 1' freeboard depth. The berm is designed with 3:1 (H:V) side slopes on the inside surfaces and 2:1 (H:V) side slopes on the outside surfaces. The regional stormwater pond has a live storage volume of 25.1 acre-feet between El. 281

and El. 291. An emergency overflow spillway is located on the south side of the pond which overflows into the existing channel, below.

The regional stormwater pond contains more than 10 acre-feet which is stored above the surrounding ground elevation, therefore the design of the berm requires review and approval by the state dam safety office.

Basin	Impervious Area (Acres)	Pervious Area (Acres)	Total Area (Acres)
Basin 1.1	34.34	3.80	38.14
Basin 1.2	-	0.01	0.01
Basin 1.3	-	0.40	0.40
Basin 1.4	-	5.70	5.70
Basin 1 Total	34.34	9.91	44.25
Basin 2	7.20	-	7.20
All	41.54	9.91	51.45

Table 2 Proposed Basin Areas

Event	Predeveloped Flow (CFS)	Inflow to Pond (CFS)	Outflow from Pond (CFS)
2 Year	1.10	29.63	0.62
5 Year	1.83	41.23	0.93
10 Year	2.41	50.22	1.18
25 Year	3.24	63.22	1.56
50 Year	3.94	74.19	1.90
100 Year	4.70	86.32	2.30

Table 3 Regional Stormwater Pond Flow Data

Conveyance

Catch basins are located along 24th Street SE and 91st Avenue SE. They are designed to collect runoff from the road and sidewalks and provide connection points for the future commercial lot developments.

Spreading calculations were performed using the WSDOT standard spreading calculation spreadsheet, included in Appendix B.

The conveyance system capacity was analyzed using WSDOT spreadsheets for the stormdrain pipes, included in Appendix B.

4. CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (CSWPPP)

A construction stormwater pollution prevention plan will be developed during a future phase of design. The plan will include silt fencing, stormdrain inlet protection, stabilized construction entrances, and a sediment trap. Protection will be provided for the existing wetland area, both onsite and downstream of the project.

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APPENDICES

Appendix A: Oversized Exhibits

Appendix B: Calculations

Appendix C: Geotechnical Report

Appendix D: Hydraulics Report for Existing WSDOT Stormwater Pond

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