STORMWATER
TECHNICAL INFORMATION REPORT
STRAWBERRY FIELDS CONVERSION
MARYSVILLE, WASHINGTON

Submitted by:
CEKO, L.L.C.
2255 Squak Mountain Loop, SW
Issaquah, Washington 98027

CEKO PN: 22007.01

For:
City of Marysville
80 Columbia Avenue
Marysville, Washington 98270

October 31, 2022

Prepared by:

Christopher P. Kovac, P.E., LEED® AP
Principal Engineer

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 PROJECT OVERVIEW

CEKO, L.L.C. (CEKO) has prepared this Stormwater Technical Information Report (TIR) for the Strawberry Fields Conversion project. The project work area consists of a portion of Snohomish County Parcel No. 31053400100500 at 6100 152nd Street Northeast in Marysville, Washington (herein referred to as the Property), an approximately 39.18-acre parcel of land developed as a City of Marysville-owned public park with athletic fields, walking trails, a picnic shelter, and a restroom building (Figures 1 and 2). The intent of the proposed redevelopment is to convert existing natural grass fields to synthetic turf. The Property is within the City of Marysville limits, and the project will be subject to the jurisdictional requirements of the City of Marysville and requirements of the Washington State Department of Ecology.

This TIR has been prepared to fulfill a requirement of the construction permit application to The City of Marysville Public Works Development Services and describes how the proposed project design complies with requirements established by the Marysville Municipal Code (MMC) and the adopted *2012 Stormwater Management Manual for Western Washington, as Amended in December 2014* dated December 2014 (SWMMWW 2014).

Per the flow chart in Figure I-2.4.2 of SWMMWW 2014 (Figure 3), Minimum Requirements 1 through 9 apply to new and replaced hard surfaces and converted vegetation.

1.1 EXISTING CONDITIONS SUMMARY

The Property is an approximately 39.18-acre parcel of land, west of the intersection of 152nd Street Northeast and 67th Avenue Northeast. The Property is bordered by 152nd Street Northeast to the north and by adjacent private properties to the east, south, and west.

Approximately 95,000 square feet of land on the Property, in the portion of the Property that is known as Field 2, an existing natural grass athletic field, is planned to be disturbed and restored with construction of the proposed field conversion and associated improvements (herein referred to as the Site). Site improvement areas are confined within the boundaries of the Property, with no work proposed to occur within the adjacent 152nd Street Northeast right-of-way.

Site areas are tabulated in Appendix A. Existing Site conditions are depicted on Figure 2.

Based on the U.S. Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web Soil Survey Soil Resource Report (2022), the Site is underlain with Norma loam (Figures 4A through 4E). According to the USDA, Norma series soils consist of deep, poorly drained soils, formed in old alluvium in depressions on glacial till plains and drainageways. Slopes are 0 to 3 percent. A project-specific geotechnical report is provided in Appendix B.

The Site is identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map No. 53061C0395E as being in a Zone X area (FEMA 2020). Zone X areas are those areas determined to be of minimal flood hazard (Figure 5).

Under existing conditions runoff from the Site and Property is collected and conveyed to an existing combined stormwater treatment wetlands and detention facility, previously sized via a continuous runoff timeseries method to manage runoff from the Property. The combined stormwater treatment wetlands and detention facility discharges via overflows to a natural wetlands area that is associated with and tributary to the Middle Fork of Quilceda Creek.

1.2 PROPOSED SITE CONDITIONS

Improvement areas are estimated to comprise approximately 95,000 square feet of the Site. The proposed improvements will follow the requirements of the City of Marysville. The proposed Site improvements are anticipated to include the following:

- A new concrete field curb, around the perimeter of Field #2;
- Synthetic turf surfacing over the extent of Field #2;
- New drainage facilities, beneath and extending from Field #2 to the existing stormwater pond;
- Athletic field site amenities; and
- Restoration of disturbed areas.

Under proposed conditions, runoff flows from the Site, Field #2, will be attenuated via detention in the void volume of the field's base-rock gravel bed. Limited infiltration from the bottom of the field's base-rock gravel bed will manage a portion of the Site runoff. Runoff from the Site and Property will continue to be collected and conveyed to the aforementioned existing combined stormwater treatment wetlands and detention facility. The stormwater treatment wetlands and detention facility will continue to discharge via overflow to a natural wetlands area that is tributary to the Middle Fork of Quilceda Creek.

Proposed conditions are depicted on Figure 6.

2.0 DETERMINATION OF APPLICABLE MINIMUM REQUIREMENTS

Per the flow chart in Figure I-2.4.2 of SWMMWW 2014 (Figure 4), Minimum Requirements 1 through 9 apply to new and replaced hard surfaces and all disturbed land. Descriptions of how the project design meets each of the Minimum Requirements are discussed below.

2.1 MINIMUM REQUIREMENT 1: PREPARATION OF STORMWATER SITE PLANS

Prepared in conjunction with this TIR, a stormwater site plan, consistent with the requirements described in 2014 SWMMWW Volume I, is provided as part of the project construction permit plans. After review by the jurisdiction, a revised final stormwater site plan will be submitted as part of the project construction permit application plans.

2.2 MINIMUM REQUIREMENT 2: STORMWATER POLLUTION PREVENTION PLAN

A Construction Stormwater Pollution Prevention Plan will be prepared and submitted under separate cover with the anticipated grading permit application.

2.3 MINIMUM REQUIREMENT 3: SOURCE CONTROL OF POLLUTION

Although the fields generally not generators of pollutants, source control will be provided through the application of source control best management practices (BMPs) during construction, and on the developed Site following construction. Selected BMPs will be appropriate for the proposed construction activities, buildings, facilities, and intended post-development Site uses in accordance with 2014 SWMMWW Volume IV.

2.4 MINIMUM REQUIREMENT 4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The existing natural location of discharge will remain unchanged. Runoff from the Site and Property will continue to be collected and conveyed to the aforementioned existing combined stormwater wetlands and detention facility. The stormwater wetlands and detention facility will continue to discharge via overflow to a natural wetlands area that is tributary to the Middle Fork of Quilceda Creek.

2.5 MINIMUM REQUIREMENT 5: ON-SITE STORMWATER MANAGEMENT

On-Site stormwater management will be provided in accordance with the requirements of 2014 SWMMWW Volume I, Chapters 2 and 4; and Volume III, Chapter 3; Volume V, Chapter 5. This requirement will be met via limited infiltration from the bottom of the field's base-rock gravel bed to manage a portion of the Site runoff.

2.6 MINIMUM REQUIREMENT 6: RUNOFF TREATMENT

The existing on-Site stormwater treatment wetlands facility can be expected to meet or exceed the following water quality treatment requirements:

- For existing natural grass areas, Phosphorous control requirements specified in 2014 SWMMWW Volume V-3.3, Phosphorous Treatment Menu. To meet this requirement, the stormwater treatment facilities were designed to achieve a goal of 50 percent total phosphorous removal for a range of influent concentrations of 0.1 to 0.5 mg/l total phosphorous.
- Fore proposed synthetic turf areas, Enhanced treatment requirements specified in 2014 SWMMWW Volume V-3.4, Enhanced Treatment Menu. To meet this requirement, the stormwater treatment facilities were designed to achieve performance goals of at least 80 percent removal of total suspended solids, at least 30 percent removal of dissolved copper, and at least 60 percent removal of dissolved zinc.

The existing combined stormwater wetlands and detention facility will continue to provide water quality treatment same as for the existing field. The converted field can be anticipated to release little to no phosphorous but more metals. The existing stormwater treatment wetlands can be expected to provide treatment meeting the enhanced treatment requirements of the 2014 SWMMWW Volume V-3.4, Enhanced Treatment Menu.

2.7 MINIMUM REQUIREMENT 7: FLOW CONTROL

Stormwater runoff for the proposed developed Site condition, as calculated using 15-minute time step increase in the 100-year recurrence interval flow using a continuous simulation runoff model, must match that of the predeveloped condition for all flows. The proposed Site stormwater system, which will provide detention in the void volume of the field base-rock gravel bed, can be expected to meet this requirement. Modeling of the system using the WWHM verified the anticipated compliance. WWHM modeling reports are provided in Appendix C. Flow attenuation provided by the field base-rock detention system will be in addition to flow attenuation provided by the existing combined stormwater treatment wetlands and detention facility that serves the Property.

2.8 MINIMUM REQUIREMENT 8: WETLANDS PROTECTION

As described above, the existing stormwater treatment wetlands and detention facility discharges via overflows to a natural wetlands area that is associated with and tributary to Quilcene Creek. This existing facility will continue to protect the existing wetlands via water quality treatment and by allowing continued supply of runoff water to the wetlands.

2.9 MINIMUM REQUIREMENT 9: OPERATION AND MAINTENANCE

Operation and maintenance of the stormwater management facilities will be the responsibility of the City of Marysville, and that responsibility will be passed to future owners.

3.0 SITE ANALYSIS

3.1 OFF-SITE SUMMARY

A review of downstream flow paths was performed as part of the project design work. Off-Site analyses consisted of inspection field walks of the project Site and downstream areas, review of topographic mapping of the Property and adjacent areas, and review of the City of Marysville and Snohomish County Geographic Information Systems databases.

3.2 DOWNSTREAM ANALYSES

Under existing and proposed conditions, stormwater runoff from the Site generally is conveyed southward via sheet flow and then via a system of catch basins and conveyance pipes. As described in Section 1.1, runoff from the Site and Property is collected and conveyed to an existing combined stormwater treatment wetlands and detention facility. The combined stormwater treatment wetlands and detention facility discharges via overflows to a natural wetlands area that is associated with and tributary to the Middle Fork of Quilceda Creek.

According to the Washington State Department of Natural Resources Forest Practices Application Mapping Tool, Quilceda Creek conveys flows southward, approximately 1.7-miles as a type F water course and then another approximately 5.3-miles as a Type S water course, to an eventual discharge to Puget Sound near Ebey Slough and the mouth of the Snohomish River, immediately north of downtown Everett.

3.3 UPSTREAM ANALYSIS

The surrounding area is developed such that limited, if any, off-Property stormwater runoff drains onto the Property. The upstream areas that might drain onto the Property are vegetated areas of the properties along the western boundary of the Property. Stormwater runoff from the west-adjacent properties likely infiltrates or is conveyed southward approximately along the existing property boundary without impact to the on-Site stormwater drainage conditions or management facilities. No changes are anticipated or proposed.

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4.0 DEVELOPMENT LAYOUT

A depiction of the proposed developed Site condition is provided as Figure 6, including proposed buildings, pavement, stormwater management system, retaining walls, and restoration of anticipated disturbed Site areas.

4.1 ON-SITE STORMWATER MANAGEMENT OVERVIEW

A simple but effective stormwater management system is proposed to control runoff from the proposed developed Site condition, and, per applicable requirements, to match the predeveloped condition of the Site. Summary of the proposed stormwater management system is provided in Section 4.3.2, Proposed Developed Site Hydrology and shown on Figure 6.

4.2 ON-SITE STORMWATER MANAGEMENT

For this project, the following BMPs were considered:

- Dispersion;
- Bioretention;
- Infiltration; and
- Detention.

The entire Site area will be resurfaced with synthetic turf, rendering bioretention infeasible. Because land is not available on the Property, dispersion also is not considered feasible. The underlying soils allow for only limited infiltration; therefore, full infiltration was considered unfeasible to manage stormwater fully. However, limited infiltration was included in the sizing of the detention system. The only feasible singular BMP for on-Site stormwater management is detention.

4.3 FLOW CONTROL

4.3.1 Existing Site Hydrology

The existing athletic field known as Field #2, is approximately 95,000 square feet of land on the Property and comprises nearly the entirety of the Site. Under existing conditions runoff from the Site and Property is collected and conveyed to an existing combined stormwater treatment wetlands and detention facility, previously sized for the Site and the Property. The existing combined stormwater treatment wetlands and detention facility discharges via overflows to a natural wetlands area that is associated with and tributary to the Middle Fork of Quilceda Creek.

4.3.2 On-Site Stormwater Best Management Practices

As required by ECDC 2017 and ESA 2017, the following BMPs were considered for on-Site stormwater management. Where a BMP was determined to be infeasible, discussion of infeasibility criteria is provided.

4.3.2.1 Lawn and Landscaped Areas

4.3.2.1.1. Post-Construction Soil Quality and Depth

This BMP will be applied to all areas of the Site that are disturbed and are proposed to be landscaped after construction. Areas within existing tree root zones will be excluded.

4.3.2.2 Other Hard Surface Areas

4.3.2.2.1. Full Dispersion

This BMP is considered infeasible due to the limited availability of downslope areas and close proximity to property lines.

4.3.2.2.2. Bioretention

This BMP is considered infeasible due to the limited availability of downslope areas without existing trees to be retained and close proximity to existing downslope rockeries, proposed buildings, and property lines.

4.3.2.2.3. Sheet Flow Dispersion

This BMP is considered infeasible due to the limited availability of suitable downslope areas and close proximity to existing downslope rockeries, proposed buildings, and property lines.

4.3.2.2.4. Detention Facilities

This BMP is considered feasible and is provided in the void volume of the field base-rock gravel bed.

4.3.3 Proposed Developed Site Hydrology

Site improvement areas are estimated to comprise approximately 95,000 square feet of land. The proposed improvements will follow jurisdiction requirements. Proposed Site improvements are anticipated to include the following:

- A new concrete field curb, around the perimeter of Field #2;
- Synthetic turf surfacing over the extent of Field #2;
- New drainage facilities, beneath and extending from Field #2 to the existing stormwater pond;

- Athletic field site amenities; and
- Restoration of disturbed areas.

Under proposed conditions, runoff flows from the Site, Field #2, will be attenuated via detention in the void volume of the field's base-rock gravel bed. Limited infiltration from the bottom of the field's base-rock gravel bed will manage a portion of the Site runoff. Runoff from the Site and Property will continue to be collected and conveyed to the aforementioned existing combined stormwater treatment wetlands and detention facility. The stormwater treatment wetlands and detention facility will continue to discharge via overflow to a natural wetlands area that is tributary to the Middle Fork of Quilceda Creek.

Because the Property is already served by a previously-sized stormwater management facility, the predeveloped Site condition is assumed to be the existing impacted condition of the Site. The developed Site condition is assumed to be as depicted on Figure 6. WWHM computer modeling of stormwater runoff for the predeveloped and proposed developed Site conditions was completed to demonstrate compliance with City of Marysville requirements.

Reporting documents generated from WWHM modeling (Appendix C) demonstrate that the proposed stormwater facilities will meet the Category 2 flow control requirements that estimated mitigated runoff flow rates after development are equal to or less than the estimated predeveloped runoff flow rates for the Site.

4.4 WATER QUALITY SYSTEM

Enhanced treatment is required for the Site, and phosphorus control is required for existing natural grass areas on the Property, as summarized in Section 2.0, Determination of Applicable Minimum Requirements. To meet these requirements, the previously-sized existing stormwater treatment wetlands is anticipated to provide adequate water quality treatment.

5.0 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

The stormwater system elements have been sized to convey the estimated peak stormwater flow adequately. Preliminary conveyance capacity calculations for the proposed stormwater management system are provided in Appendix D. Final conveyance capacity calculations for the proposed stormwater management system will be added to Appendix D of the final issuance of this report, after the proposed design has been reviewed and finalized.

6.0 SPECIAL REPORTS AND STUDIES

GeoEngineers, Inc. 2022. *Memorandum – Geotechnical Considerations. Strawberry Fields Athletic Complex – Field #2 Turf Conversion. Marysville, Washington*. Prepared for RWD Landscape Architecture, August 22.

7.0 OTHER PERMITS

The following permits are anticipated to be required for the proposed Site improvements:

- City of Marysville Grading Permit;
- Washington State Department of Labor & Industries Electrical Permit.

Because the Site is greater than 1 acre of land, a Washington State Department of Ecology Construction Stormwater General Permit is anticipated to be required.

Other required permits may be identified as the permit application and review process progresses. These permits will be added to this list with the final issuance of this TIR.

8.0 OPERATION AND MAINTENANCE MANUAL

An operation and maintenance manual is provided in Appendix E.

9.0 SECURITY DEVICE

Documentation establishing the appropriate security device(s) and amount(s) will be provided with the final issuance of this TIR.

10.0 REFERENCES

Washington State Department of Ecology. 2014. *2012 Stormwater Management Manual for Western Washington, as Amended in December 2014.* December.

Federal Emergency Management Agency (FEMA). 2020. Flood Map Service Center. <https://msc.fema.gov/portal/home>. (accessed October 17, 2022).

GeoEngineers, Inc. 2022. *Memorandum – Geotechnical Considerations. Strawberry Fields Athletic Complex – Field #2 Turf Conversion. Marysville, Washington.* Prepared for RWD Landscape Architecture, August 22.

U.S. Department of Agriculture Natural Resources Conservation Service. 2022. Web Soil Survey Soil Resource Report Search. <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>. (accessed October 17, 2022).

Snohomish County Assessor. 2020. *Snohomish County Online Property Information (SCOPI)*. < https://scopi.snoco.org/Html5Viewer/Index.html?configBase=https://scopi.snoco.org/Geocortex/Essentials/REST/sites/SCOPI/viewers/SCOPI/virtualdirectory/Resources/Config/Default>. (accessed October 17, 2022).

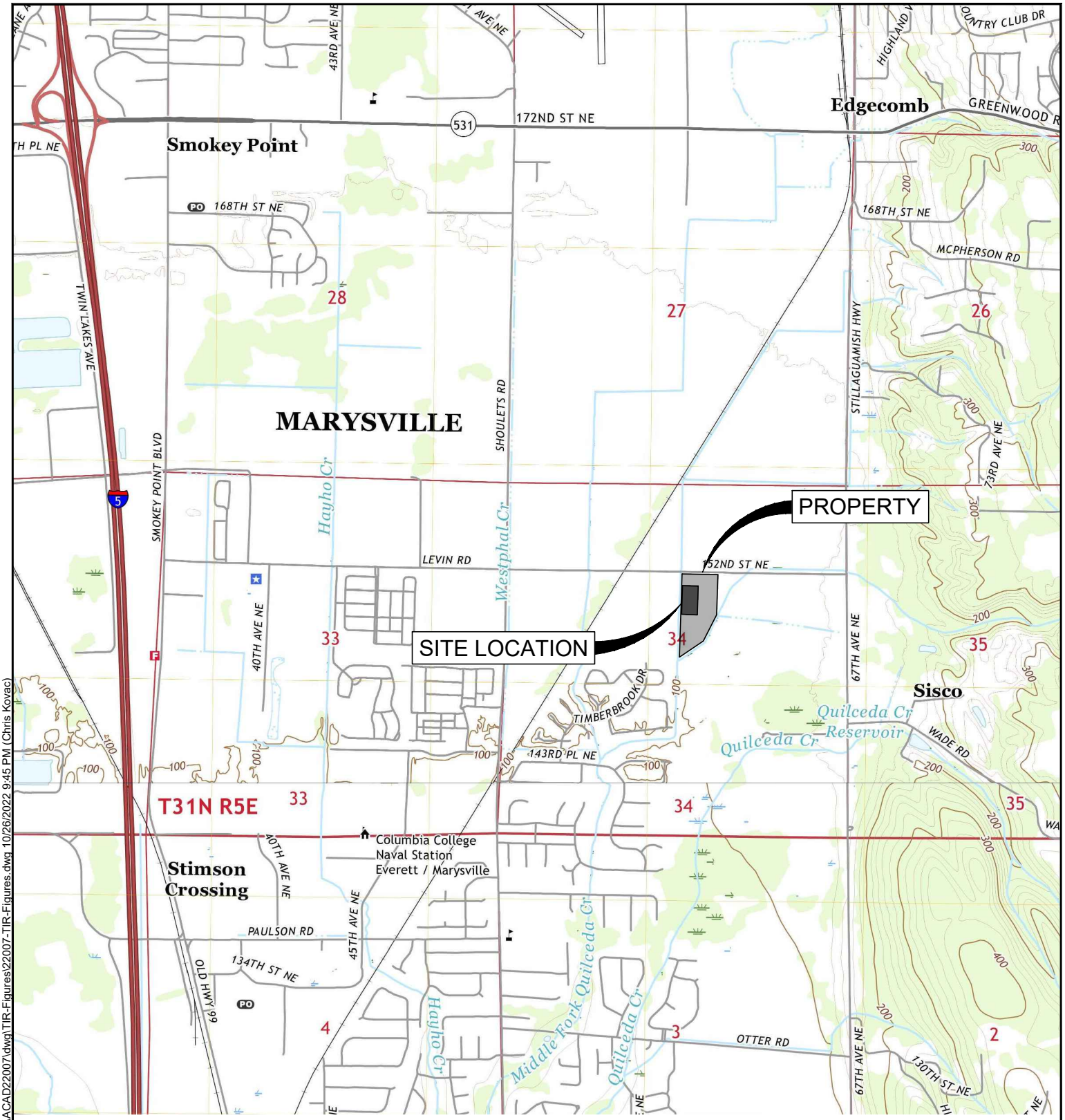
City of Marysville. 2022. *Marysville WA Maps – Marysville WA Critical Areas* (online GIS map application). <https://marysvillewa.maps.arcgis.com/apps/webappviewer/index.html?id=2ad43986d4204c278b68e2bf2126e1ff>. (accessed October 17. 2022).

Washington State Department of Natural Resources. 2022. *Forest Practices Application Mapping Tool (FPAMT)*. < https://fpamt.dnr.wa.gov/2d-view>. (accessed October 17, 2022).

FIGURES

TECHNICAL INFORMATION REPORT
Strawberry Fields Conversion
Marysville, Washington

CEKO PN: 22007.01



REFERENCE: 7.5 MINUTE USGS QUADRANGLES ARLINGTON WEST AND MARYSVILLE, WASHINGTON. DATED 2020

2000 0 2000

SCALE IN FEET

MARYSVILLE

WASHINGTON

CEKO

FIGURE 1

SITE LOCATION MAP

STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

Drawn By: CPK Checked By: CPK

CEKO PN: 22007.01

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FIGURE 2

EXISTING CONDITIONS
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

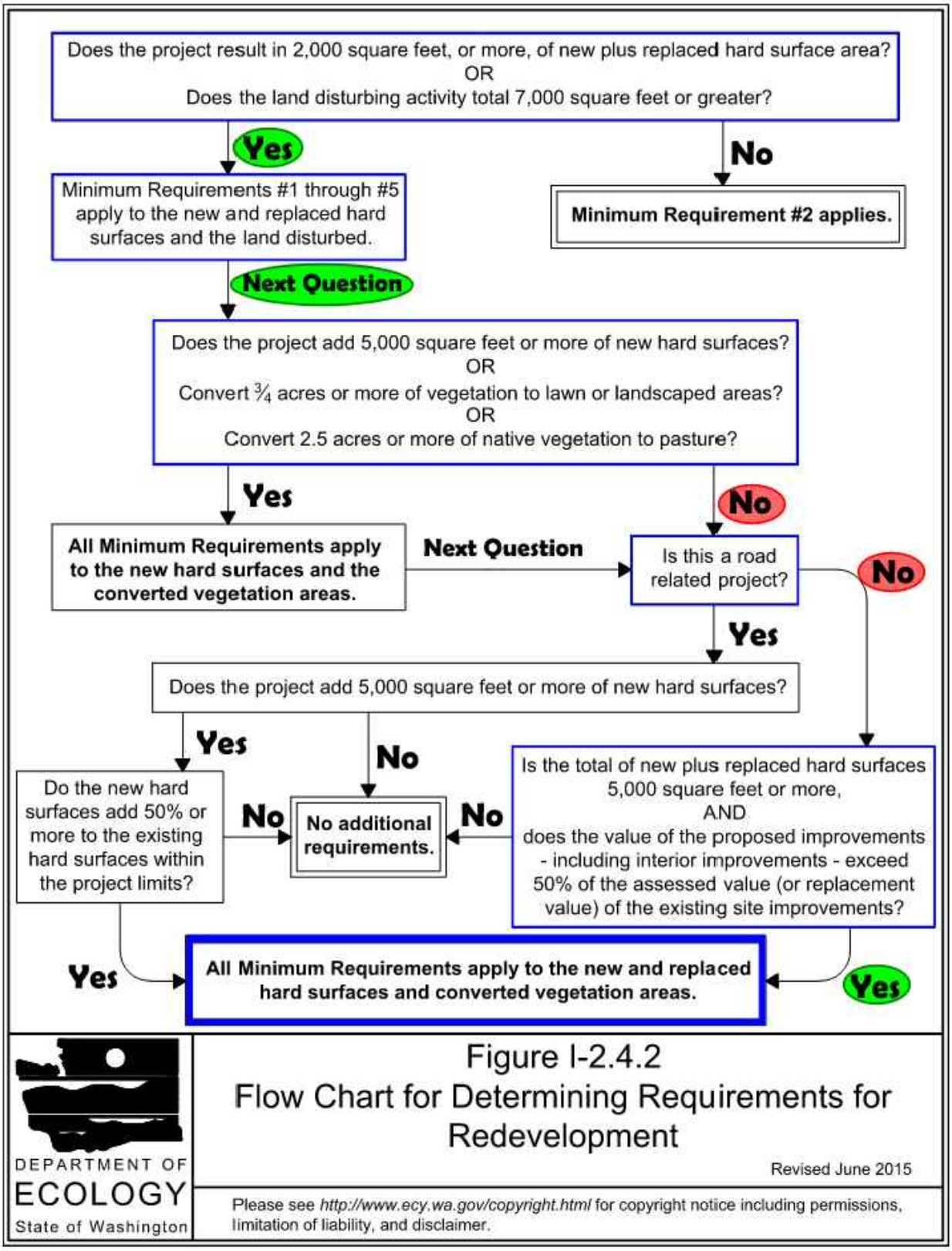
CEKO PN: 22007.01

SCALE: 1"=60'
0 30' 60' 90' 120'

FIELD 1

FIELD 2

FIELD 3



REFERENCE: WASHINGTON STATE DEPARTMENT OF ECOLOGY
2012 SURFACE WATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON
AMENDED DECEMBER 2014

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FIGURE 3

FLOW CHART FOR DETERMINING
REQUIREMENTS FOR REDEVELOPMENT
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

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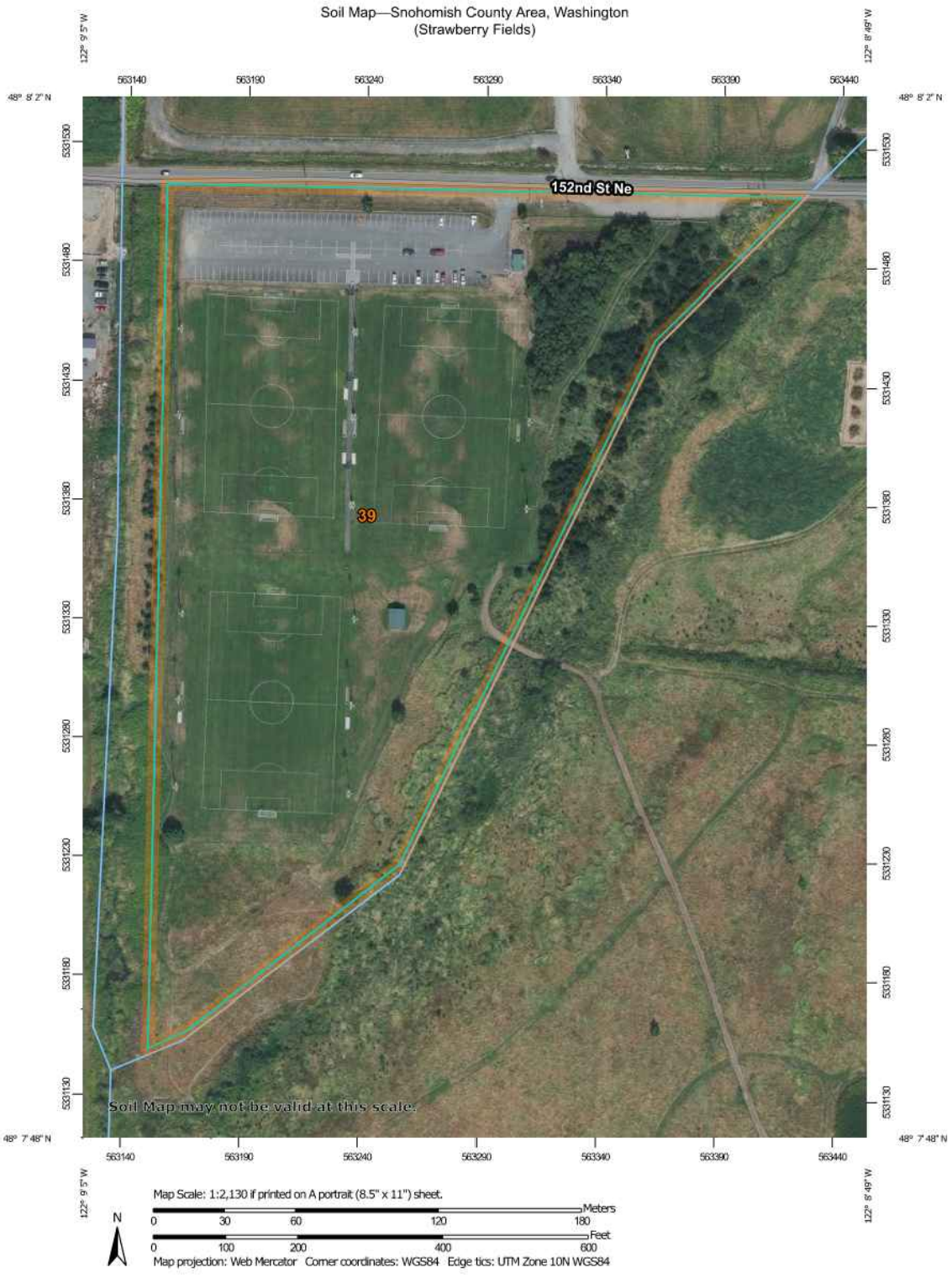

REFERENCE: USDA NRCS WEB SOILS SURVEY, 2022

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FIGURE 4A

USDA NRCS SOILS MAP

STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

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REFERENCE: USDA NRCS WEB SOILS SURVEY, 2022

Soil Map—Snohomish County Area, Washington
(Strawberry Fields)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 24, Sep 8, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 16, 2020—Aug 19, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Drawn By: CPK Checked By: CPK

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FIGURE 4B

USDA NRCS SOILS MAP
LEGEND
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

CEKO PN:22007.01

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
39	Norma loam	13.3	100.0%
Totals for Area of Interest		**13.3**	**100.0%**

REFERENCE: USDA NRCS WEB SOILS SURVEY, 2022

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FIGURE 4C

USDA NRCS SOILS MAP
UNIT LEGEND
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

Drawn By: CPK Checked By: CPK

CEKO PN: 22007.01

Snohomish County Area, Washington

39—Norma loam

Map Unit Setting

National map unit symbol: 2hyx
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Norma, undrained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norma, Undrained

Setting

Landform: Drainageways, depressions
Parent material: Alluvium

Typical profile

H1 - 0 to 10 inches: ashy loam
H2 - 10 to 28 inches: sandy loam
H3 - 28 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F002XA007WA - Puget Lowlands Wet Forest
Forage suitability group: Wet Soils (G002XN102WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

REFERENCE: USDA NRCS WEB SOILS SURVEY, 2022

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FIGURE 4D

USDA NRCS SOILS MAP
UNIT DESCRIPTION
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

Drawn By: CPK Checked By: CPK

CEKO PN: 22007.01

Minor Components

Norma, drained
Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: Yes

Terric medisaprists, undrained
Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Bellingham, undrained
Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 24, Sep 8, 2022

REFERENCE: USDA NRCS WEB SOILS SURVEY, 2022

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FIGURE 4E

USDA NRCS SOILS MAP
UNIT DESCRIPTION
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

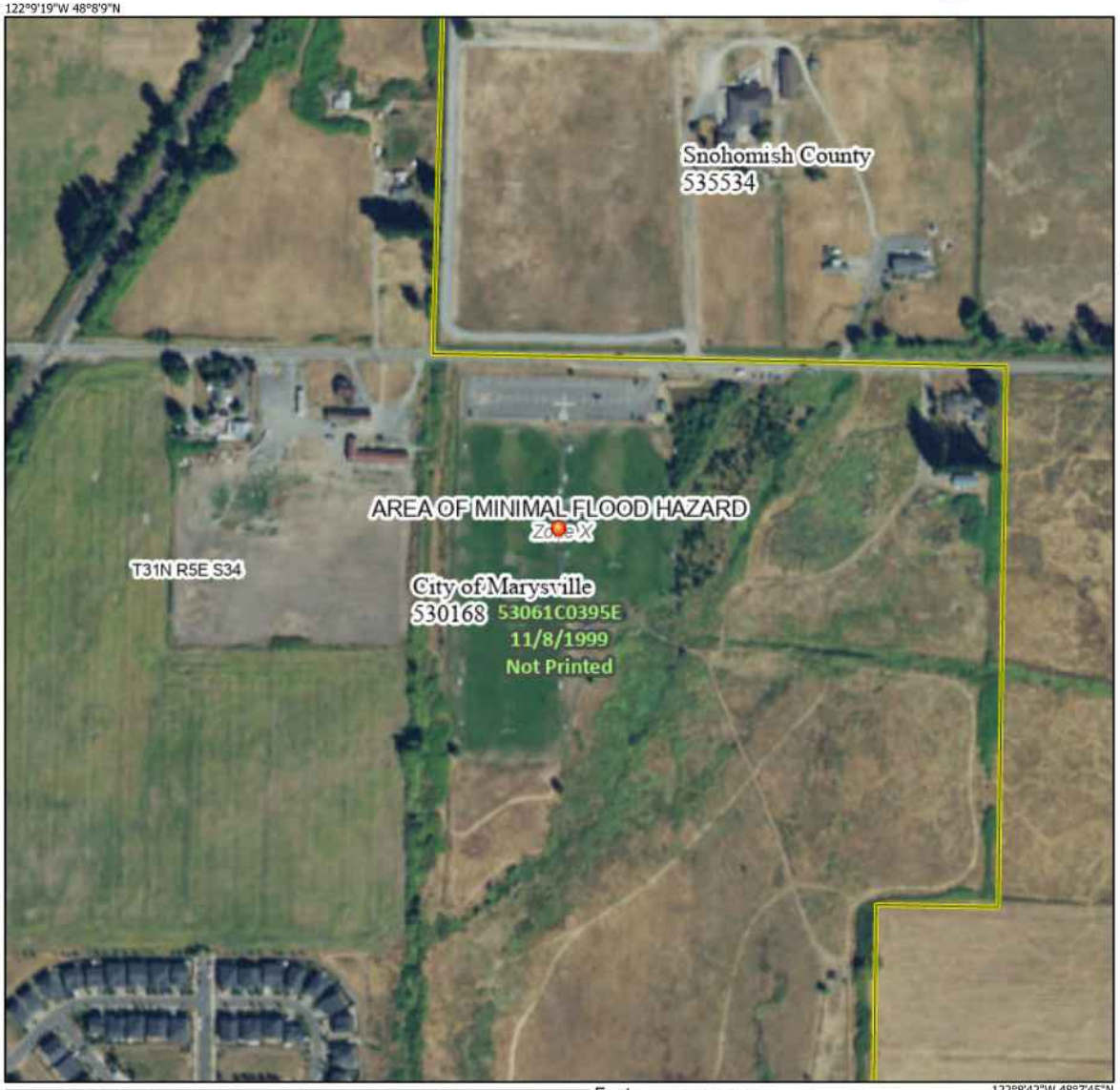
Drawn By: CPK Checked By: CPK

CEKO PN: 22007.01

REFERENCE: USDA NRCS WEB SOILS SURVEY, 2022

National Flood Hazard Layer FIRMette

FEMA



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- **SPECIAL FLOOD HAZARD AREAS**
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- **OTHER AREAS OF FLOOD HAZARD**
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- **OTHER AREAS**
  - NO SCREEN — Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- **GENERAL STRUCTURES**
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- **OTHER FEATURES**
  - 20.2 — Cross Sections with 1% Annual Chance
  - 17.5 — Water Surface Elevation
  - Coastal Transect
  - Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
- **MAP PANELS**
  - Digital Data Available
  - No Digital Data Available
  - Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/17/2022 at 5:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

CEKO

Drawn By: CPK
Checked By: CPK

FIGURE 5

FEMA FLOOD HAZARD MAP

STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

CEKO PN:22007.01

FIGURE 6

PROPOSED CONDITIONS
STRAWBERRY FIELDS - FIELD #2 CONVERSION
6100 152ND STREET, NE
MARYSVILLE, WASHINGTON

CEKO PN: 22007.01

SCALE: 1"=60'
0 30' 60' 90' 120'

FIELD 1

FIELD 2

FIELD 3

CB 15
TYPE 1 CATCH BASIN
RE 108.90
IE SOUTH 107.23

CB 14
TYPE 1 CATCH BASIN
RE 108.80
IE NORTH 107.12
IE SOUTH 107.12

CB 13
TYPE 1 CATCH BASIN
W/ SYNTHETIC TURF
LID
RE 109.48
IE NORTH 107.05
IE SOUTH 107.05

CB 12
TYPE 1 CATCH BASIN
W/ SYNTHETIC TURF
LID
RE 109.48
IE NORTH 106.63
IE SOUTH 106.63

CB 11
TYPE 1 CATCH BASIN
RE 108.85
IE NORTH 106.60
IE SOUTH 106.60

CB 9
TYPE 1 CATCH BASIN
RE 107.73
IE NORTH 106.32
IE SOUTH 106.32

CB 8
TYPE 1 CATCH BASIN
RE 107.71
IE NORTH 105.90
IE SOUTH 105.90

CB 7
TYPE 1 CATCH BASIN
RE 107.17
IE NORTH 105.50
IE SOUTH 105.50

CB 10
TYPE 1 CATCH BASIN
RE 108.90
IE NORTH 106.40
IE SOUTH 106.40
IE WEST 106.40

CB 6
TYPE 1 CATCH BASIN
RE 109.90
IE SOUTH 108.07

CB 5
TYPE 1 CATCH BASIN
RE 109.75
IE NORTH 107.12
IE SOUTH 107.12

CB 4
TYPE 1 CATCH BASIN
RE 109.75
IE NORTH 106.31
IE EAST 106.31
IE SOUTH 106.31

CB 3
TYPE 1 CATCH BASIN
RE 107.97
IE NORTH 106.14
IE SOUTH 106.14

CB 2
TYPE 1 CATCH BASIN
RE 107.15
IE NORTH 105.72
IE SOUTH 105.72

CB 1
TYPE 1 CATCH BASIN
RE 107.60
IE NORTH 105.29
IE SOUTH 105.29

8" HDPE SLOTTED COLLECTOR PIPE @ .25%

12" HDPE SLOTTED COLLECTOR PIPE @ .25%

12" STORM SEWER OUTFALL @ 105.41

12" STORM SEWER OUTFALL @ 105.20

PIPE CLEANOUT

GRADE BREAK

8" HDPE SLOTTED COLLECTOR PIPE @ .53%

8" HDPE SLOTTED COLLECTOR PIPE @ .5%

10" HDPE SLOTTED COLLECTOR PIPE @ .25%

12" FLAT DRAIN

GRAVEL DRAIN PIT

CONCRETE PICNIC AREA

TRASH CAN

TRAIL ACCESS

4X4 FENCE POST

5.5' CYCLONE FENCE

20' MESH NET FENCE

FENCE ANCHOR

BULLETIN BOARD

ELECTRICAL CONTROL BOX

ASPHALT PATH

OUTER PAINTED TRAIL LINES

SIGN "TRAIL SYSTEM"

WATER PUMP

TBM: MAG & SHINER ELEV = 110.10'

TBM: REBAR & 2" CAP MARKED "LSA" ELEV = 110.42'

TBM: REBAR & 2" CAP ELEV = 106.30'

C:\CEKO\Projects\Active\22007.01-Strawberry-Fields\ACAD22007\dwg\TIR-Figures\22007-TIR-Figures-2-&-6.dwg 10/26/2022 9:45 PM (Chris Kovac)

APPENDIX A
SITE AREAS SUMMARY

TECHNICAL INFORMATION REPORT
Strawberry Fields Conversion
Marysville, Washington

CEKO PN: 22007.01

CEKO PN: 22007.01 **Project Name:** Strawberry Fields - Field #2 Conversion

Subject: Stormwater Site Area Calculations

Prepared By: CPK **Date:** 10/18/2022

SITE AREAS SUMMARY

References:

1	*2012 Stormwater Management Manual for Western Washington (Amended in December 2014)*	2014-SWMMWW
2	Landscape Architecture and Civil Plans	CN.NN
4	Western Washington Hydrology Model 2012	WWHM2012

Total Site Sub-Basin Areas

Total Project Site Area =	**95,000**	-SF	or	*2.181*	-Acres

Total Existing Site Sub-Basin Areas (for modeling)

C Forest (flat) =	**0**	-SF	or	*0.000*	-Acres
C Forest (mod) =	**0**	-SF	or	*0.000*	-Acres
C Forest (steep) =	**0**	-SF	or	*0.000*	-Acres
C Pasture (flat) =	**0**	-SF	or	*0.000*	-Acres
C Pasture (mod) =	**0**	-SF	or	*0.000*	-Acres
C Pasture (steep) =	**0**	-SF	or	*0.000*	-Acres
C Lawn (flat) =	**95,000**	-SF	or	*2.181*	-Acres
C Lawn (mod) =	**0**	-SF	or	*0.000*	-Acres
C Lawn (steep) =	**0**	-SF	or	*0.000*	-Acres
Roads (flat) =	**0**	-SF	or	*0.000*	-Acres
Roads (mod) =	**0**	-SF	or	*0.000*	-Acres
Roads (steep) =	**0**	-SF	or	*0.000*	-Acres
Roof Tops (flat) =	**0**	-SF	or	*0.000*	-Acres
Driveways (flat) =	**0**	-SF	or	*0.000*	-Acres
Driveways (mod) =	**0**	-SF	or	*0.000*	-Acres
Driveways (steep) =	**0**	-SF	or	*0.000*	-Acres
Sidewalks (flat) =	**0**	-SF	or	*0.000*	-Acres
Sidewalks (mod) =	**0**	-SF	or	*0.000*	-Acres
Sidewalks (steep) =	**0**	-SF	or	*0.000*	-Acres
Parking (flat) =	**0**	-SF	or	*0.000*	-Acres
Parking (mod) =	**0**	-SF	or	*0.000*	-Acres
Parking (steep) =	**0**	-SF	or	*0.000*	-Acres
Pond =	**0**	-SF	or	*0.000*	-Acres
Porous Pavement =	**0**	-SF	or	*0.000*	-Acres
Site Total	***95,000***	**-SF**	**or**	***2.181***	**-Acres**
check				*OK*	
Total Site Impervious Area (for modeling) =	*0*	-SF	or	*0.000*	-Acres
Site Percent Impervious (for modeling) =	***0.0%***				

CEKO PN: 22007.01 **Project Name:** Strawberry Fields - Field #2 Conversion

Subject: Stormwater Site Area Calculations

Prepared By: CPK **Date:** 10/18/2022

SITE AREAS SUMMARY

References:

1	*2012 Stormwater Management Manual for Western Washington (Amended in December 2014)*	2014-SWMMWW
2	Landscape Architecture and Civil Plans	CN.NN
4	Western Washington Hydrology Model 2012	WWHM2012

Total Proposed Developed Site Sub-Basin Areas (for modeling)

C Forest (flat) =	**0**	-SF	or	*0.000*	-Acres
C Forest (mod) =	**0**	-SF	or	*0.000*	-Acres
C Forest (steep) =	**0**	-SF	or	*0.000*	-Acres
C Pasture (flat) =	**0**	-SF	or	*0.000*	-Acres
C Pasture (mod) =	**0**	-SF	or	*0.000*	-Acres
C Pasture (steep) =	**0**	-SF	or	*0.000*	-Acres
C Lawn (flat) =	**56,913**	-SF	or	*1.307*	-Acres
C Lawn (mod) =	**0**	-SF	or	*0.000*	-Acres
C Lawn (steep) =	**0**	-SF	or	*0.000*	-Acres
Roads (flat) =	**0**	-SF	or	*0.000*	-Acres
Roads (mod) =	**0**	-SF	or	*0.000*	-Acres
Roads (steep) =	**0**	-SF	or	*0.000*	-Acres
Roof Tops (flat) =	**0**	-SF	or	*0.000*	-Acres
Driveways (flat) =	**0**	-SF	or	*0.000*	-Acres
Driveways (mod) =	**0**	-SF	or	*0.000*	-Acres
Driveways (steep) =	**0**	-SF	or	*0.000*	-Acres
Sidewalks (flat) =	**38,088**	-SF	or	*0.874*	-Acres
Sidewalks (mod) =	**0**	-SF	or	*0.000*	-Acres
Sidewalks (steep) =	**0**	-SF	or	*0.000*	-Acres
Parking (flat) =	**0**	-SF	or	*0.000*	-Acres
Parking (mod) =	**0**	-SF	or	*0.000*	-Acres
Parking (steep) =	**0**	-SF	or	*0.000*	-Acres
Pond =	**0**	-SF	or	*0.000*	-Acres
Porous Pavement =	**0**	-SF	or	*0.000*	-Acres
Site Total	***95,000***	**-SF**	**or**	***2.181***	**-Acres**
check				*OK*	
Total Site Impervious Area (for modeling) =	*38,088*	-SF	or	*0.874*	-Acres
Site Percent Impervious (for modeling) =	***40.1%***				

APPENDIX B
MEMORANDUM - GEOTECHNICAL CONSIDERATIONS

TECHNICAL INFORMATION REPORT
Strawberry Fields Conversion
Marysville, Washington

CEKO PN: 22007.01

GeoEngineers

554 West Bakerview Road, Bellingham, Washington 98226, Telephone: 360.647.1510, Fax: 360.647.5044 www.geoengineers.com

Memorandum

To:	Robert W. Droll, PLA, ASLA (RWD Landscape Architecture)
From:	AF Amanda Fickeisen, LG, Sean W. Cool, PE SWC
Date:	August 22, 2022
File:	0925-019-00
Subject:	Memorandum - Geotechnical Considerations Strawberry Fields Athletic Complex - Field #2 Turf Conversion Marysville, Washington

INTRODUCTION

This memorandum presents a summary of GeoEngineers, Inc.'s (GeoEngineers) geotechnical considerations to support replacement of the existing sod field surfacing with a new synthetic turf surface for Field #2 of the City of Marysville Strawberry Fields Athletic Complex in Marysville, Washington. The project location is shown on the Figure 1, Vicinity Map. We understand that the field complex has an existing drain system with 2-inch-diameter pipes at 15 inches on-center and is not functioning properly; this system will be left in place. The new construction will include stripping existing sod, placing a flat geocomposite underdrain over the subgrade, placement of 6 inches of granular field fill within a containment curb surrounding the field, and new synthetic turf. The underdrain will slope to an 8-inch corrugated pipe and outlet to the existing detention basin to the south of the site.

The purpose of our geotechnical engineering services was to explore subsurface conditions at the site as a basis for evaluating the existing shallow soil profile and groundwater conditions in Field #2. Our scope of work is described in our services agreement dated April 18, 2022 and authorized via notice to proceed on July 11, 2022. The scope of our services completed for the project included completing two test pits and two hand augers, completing limited lab testing, discussing site observations and recommendations on the suitability of the proposed turf section and preparing this geotechnical considerations memorandum.

SITE CONDITIONS

Surface Conditions

The project site is located at Strawberry Fields Athletic Complex in Marysville, Washington. The site is bounded by 152nd Street NE to the north, Pearson Drilling to the west and the Strawberry Fields Trail System to the south and east. The field complex is located nearby a residential neighborhood. The fields are relatively level and vegetated with manicured lawn/sod. An access way with bleachers and lights are located in between Field #2 and the field to the east.

Subsurface Conditions

Soil Conditions

Subsurface soil conditions were evaluated by completing two hand augers (HA-1 and HA-2) to depths of 5.5 and 5.3 feet below the existing ground surface (bgs), respectively. Two test pits (TP-1 and TP-2) were also completed to depths of 6 feet bgs on August 3, 2022 using a mini excavator. All explorations were completed at the approximate locations shown on the Figure 2, Site Plan attached to this memo. The explorations were

continuously monitored by a geotechnical engineer from our firm who examined and classified the soil encountered, obtained representative soil samples and maintained a detailed log of the explorations. Soil encountered during the explorations were classified in general accordance with ASTM International (ASTM) D 2488 and the classification chart listed on Figure 3, Key to Exploration Logs. The logs of the explorations are presented on Figures 4 through 7, Logs of Explorations. The results of laboratory sieve analyses from four representative soil samples collected within the depth of exploration are presented on Figure A-8, Sieve Analysis Results.

In general, subsurface soil conditions in both the test pits and hand augers consisted of 1 to 3 inches of sod overlying a loose brown medium to coarse sandy fill to a depth of approximately 1-foot bgs. A subsequent layer of fill consisting of medium dense gray-brown to gray-blue poorly graded fine to medium sand with silt to silty sand was found to depths ranging from approximately 1.5 to 3 feet bgs. Underlying the fill, an organic rich layer consisting of dark brown sandy silt to silt with sand was encountered, interpreted to be a relict topsoil layer. The relict topsoil ranged from 6 to 12 inches in thickness. Soil interpreted to be native Vashon Drift glacial recessional outwash was encountered underlying the relict topsoil to the full depth explored, ranging from 5.3 to 6 feet.

Groundwater Conditions

Groundwater seepage was encountered ranging from 5 to 6 feet in all explorations at the time of our site exploration in early August. Groundwater is often perched within sand and gravel fill layers overlying layers of fine-grained (silt and clay) fill and native undifferentiated glacial soils. We do not anticipate turf conversion will encounter significant perched groundwater if the work is done during the dry season, but perched groundwater could occur at and above the fill and native soil contact during the wet season. Groundwater conditions should be expected to fluctuate based on season, precipitation and other factors.

GEOTECHNICAL CONSIDERATIONS

Based on our site observations, it is our opinion that the site conditions are suitable for the proposed improvements with proper planning and construction practices. We provide the following general geotechnical considerations.

Site Preparation and Earthwork

In general, site preparation will include stripping the sod from the existing Field #2 area, placing a flat underdrain on the subgrade and placing 6 inches of new granular field fill material within a 6-inch containment curb surrounding the field. We recommend evaluation of the field subgrade after stripping to identify excessively soft/loose areas that may require overexcavation and replacement prior to placement of the turf section.

The existing granular fill will provide some protection to the subgrade during dry weather, but the underlying relict topsoil layer and other fine-grained soils may be subject to degradation from repeated heavy traffic even during dry weather. Accordingly, we recommend that site preparation and other earthwork be completed with low ground pressure track-mounted equipment to protect the subgrade from disturbance, or other considerations for vehicle/equipment routing if/where heavy wheeled vehicles will be used.

On-Site Soils

Near-surface on-site soil consist of fine to medium sand with variable silt content and density. Portions of the on-site soils, specifically the upper granular fill layers and native outwash sand with lower fines content (SP and SP-SM) may be suitable for use as general structural fill for site grading but may not meet specific gradation requirements for use within the turf section or drainage. If used, the soil should be free of excessive silt/clay, organic matter, oversized material and moisture conditioned as necessary for compaction. Because of the variable silt content, this material will likely be unsuitable as fill material if the soil is too wet to achieve satisfactory compaction, and moisture-conditioning by drying back the material may be required. If the material cannot be properly moisture conditioned, we recommend using imported material for fill.

A relict topsoil layer was observed between depths of approximately 1.5 to 3.5 feet bgs and extending up to 4 feet bgs. Any organic rich fill soils and relict topsoil layer will not be suitable for reuse and will require separation/segregation from other primarily granular soils if they are to be used for site grading.

Stormwater Drainage Considerations

Relatively shallow groundwater was encountered below the site as shallow as 5 feet bgs in early August, and groundwater elevations would be expected to be higher during the winter and spring. Additionally, the relict topsoil layer and other finer-grained soil deposits likely limit rates of vertical infiltration below the site. As noted, the existing drainage system consisting of buried piping is no longer functioning but will be left in place. Accordingly, new drainage provisions should be provided to maintain field function during the wet season. We understand that stormwater drainage will be managed using an underdrain system sloping towards an 8-inch slotted corrugated pipe. The corrugated pipe will drain to the detention basin located south of the site.

Wet Weather Earthwork

The upper soils at the site and the granular field fill material to be used are moderately susceptible to disturbance from construction traffic when excessively wet. The underlying relict topsoil layer is highly susceptible to disturbance even during moderately wet weather. If feasible, we recommend that the field improvements be constructed during the drier summer months to reduce extra costs and delays associated with wet weather earthwork.

If earthwork will occur during wet weather conditions and construction schedule cannot be adjusted, it may be necessary to use light-weight track-mounted equipment, load removed material into trucks supported on gravel haul roads, use gravel working pads and employ other methods to reduce ground disturbance. The contractor should be responsible to protect the subgrade during construction reflective of their proposed means and methods, and anticipated time of year for construction.

LIMITATIONS

We have prepared this limited design memorandum for the RWD Landscape Architecture, for the City of Marysville Strawberry Athletic Fields Turf Conversion project. RWD Landscape Architecture may distribute copies of this report to its authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The

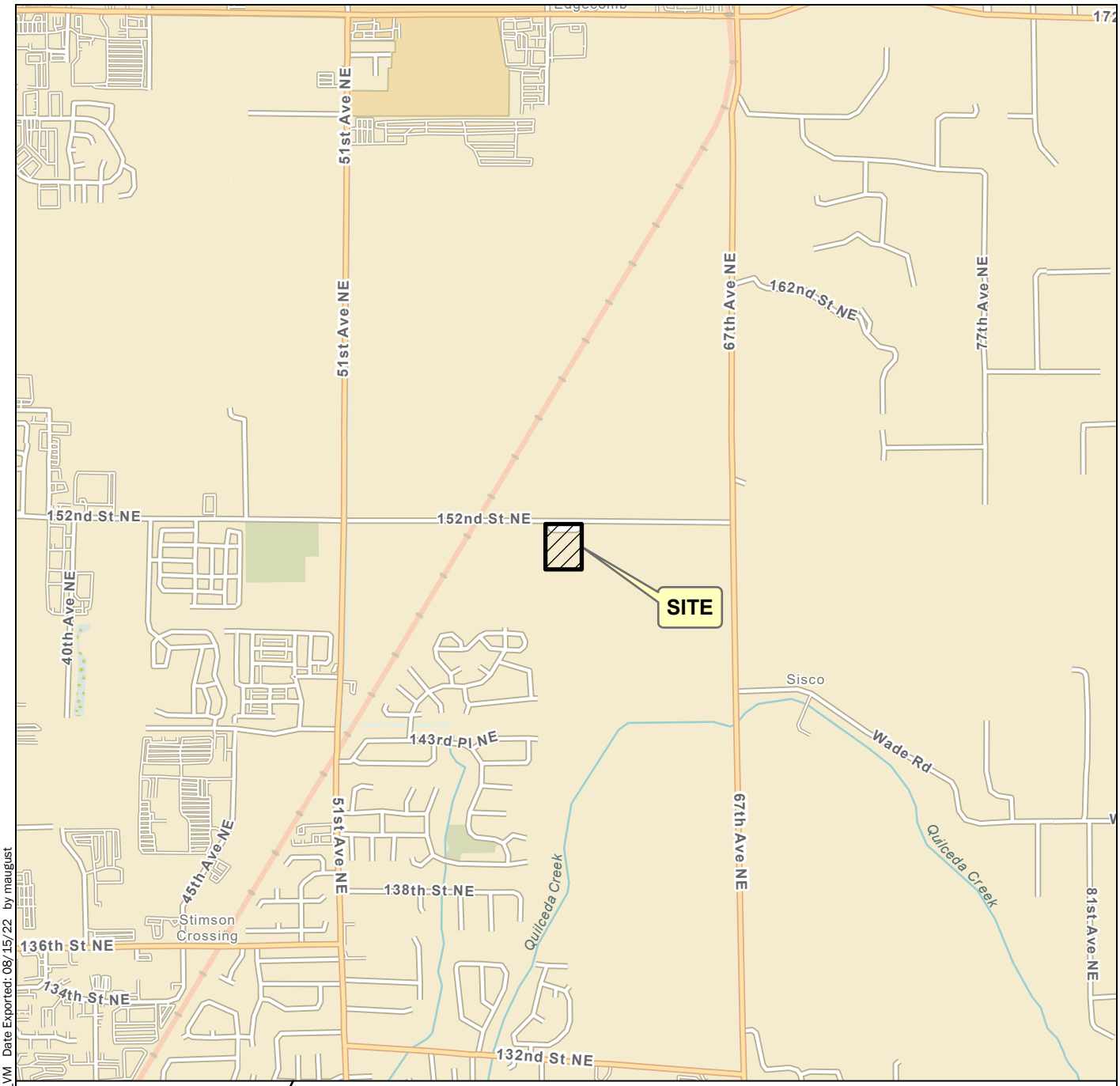
conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

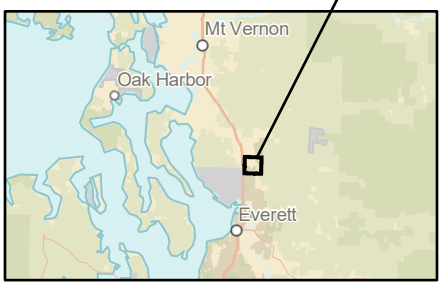
Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

PU:AF2:SWC:tlm

Attachments:
Figure 1. Vicinity Map
Figure 2. Site Plan
Figure 3. Key to Exploration Logs
Figures 4 through 7. Logs of Explorations
Figure 8. Sieve Analysis Results

One copy submitted electronically





N
W E
S

2,000 0 2,000

Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Strawberry Fields Turf Conversion
Marysville, Washington

GeoEngineers

Figure 1

P:\0\0925019\GIS\0925019_Project\0925019_Project.aprx\092501900_F01_VM Date Exported: 08/15/22 by maugust

Legend

- Approximate Test Pit Location and Identification
- Approximate Hand Auger Location and Identification

100 0 100

Feet

N W E S

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Bing Maps.

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Site Plan

Strawberry Fields Turf Conversion
Marysville, Washington

GeoEngineers

Figure 2

P:\0\0925019\GIS\0925019_Project\0925019_Project.aprx\0925019_Project Date Exported: 08/15/22 by maugust

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel / Dames & Moore (D&M)

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure 3

Date Excavated	8/3/2022	Total Depth (ft)	6	Logged By PU Checked By AF2	Excavator Equipment CAT 402 mini excavator 305.5E2	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum	Undetermined			Easting (X) Northing (Y)	Coordinate System Horizontal Datum	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 1½ inches of sod			
					SP	Brown medium to coarse sand with gravel (loose, moist) (fill)			
	1		1		SP-SM	Dark gray fine to medium sand with silt (medium dense to dense, moist) (fill)			
	2		2		TS	Dark brown sandy silt with rootlets (dense, dry) (former native surface/relict topsoil)			
	3		3		CL	Gray-brown with iron staining silty sandy clay with occasional rootlets (dense, moist) (glaciomarine drift)			
	4		4 MC		SM	Bluish gray silty fine sand, iron staining (dense, moist) (glacial outwash)	20		
	5		5			Sand grades to fine to medium			Slow groundwater seepage observed at 5.8 feet
	6								

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TP-1

GeoEngineers

Project: Strawberry Fields Turf Conversion
Project Location: Marysville, Washington
Project Number: 0925-019-00

Figure 4
Sheet 1 of 1

Date Excavated	8/3/2022	Total Depth (ft)	6	Logged By PU Checked By AF2	Excavator Equipment CAT 402 mini excavator 305.5E2	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum	Undetermined			Easting (X) Northing (Y)	Coordinate System Horizontal Datum	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 3 inches of sod			
			1		SP-SM	Brown fine to coarse sand with silt (loose, moist) (fill/pitrun)			
			2 MC; SA		SP-SM	Dark gray fine to medium sand with silt (dense, moist) (fill)	11	6	
1					SM	Gray-blue silty fine to medium sand with interbedded silty clay (dense, moist)			
2			3						
3					TS	Dark brown silt with sand and organic matter (stiff, moist) (relict topsoil)			
			4		SM	Gray to blue silty fine to medium sand (dense, moist) (glacial outwash)			
4									
			5						
5						Increased moisture content at 5 feet			Slow groundwater seepage observed at 5 feet
			6						
6						Decreased silt content at 6 feet			

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TP-2

GeoEngineers

Project: Strawberry Fields Turf Conversion
Project Location: Marysville, Washington
Project Number: 0925-019-00

Figure 5
Sheet 1 of 1

Date Excavated	8/3/2022	Total Depth (ft)	5.5	Logged By PU Checked By AF2	Excavator Equipment Shovel/hand auger	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum	Undetermined	Easting (X) Northing (Y)		Coordinate System Horizontal Datum		

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 1½ inches of sod			
			1 MC		SP	Brown fine to medium sand with occasional gravel (loose, moist) (fill)	13		
	1								
			2		SP-SM	Grayish brown fine to medium sand with silt and occasional fine gravel (dense, moist0 (fill)			
	2								
			3		SM	Brown silty fine sand (medium dense, moist) (fill)			
					ML/TS	Dark brown sandy silt with organic matter (stiff, moist) (relict topsoil)			
	3		4						
			5		ML	Bluish gray clayey sandy silt (stiff, moist) (reworked glaciomarine drift)			
	4				SP-SM	Gray to brown fine to medium sand with silt (medium dense to dense, moist) (glacial outwash)			
			6						
	5		7		SM	Brown silty fine to medium sand with gravel (dense, wet)			Slow groundwater observed at 5.3 feet

Notes: See Figure 3 for explanation of symbols.
The depths on the hand-augered boring logs are based on an average of measurements across the hand-auger and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Hand Auger HA-1

GeoEngineers

Project: Strawberry Fields Turf Conversion
Project Location: Marysville, Washington
Project Number: 0925-019-00

Figure 6
Sheet 1 of 1

Date Excavated	8/3/2022	Total Depth (ft)	5.25	Logged By PU Checked By AF2	Excavator Equipment Shovel/hand auger	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum	Undetermined	Easting (X) Northing (Y)		Coordinate System Horizontal Datum		

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 2 inches of sod			
			1		SP-SM	Brown fine to medium sand with silt and gravel (loose, moist) (fill)			
	1				SP-SM	Dark gray fine to medium sand with silt and occasional fine gravel (loose to medium dense, moist)			
			2						
	2				ML	Dark gray to dark brown sandy silt with occasional organic matter (medium dense, moist)			
			3						
	3				TS	Dark brown silt with sand, clay and organic matter (rootlets) (stiff, moist) (relict topsoil)			
			4 MC; %F				39	57	
	4				SM	Light bluish gray silty fine to medium sand (dense, moist) (glacial outwash)			
			5 MC; SA				19	26	
	5		6						Slow groundwater seepage observed at 5 feet

Notes: See Figure 3 for explanation of symbols.
The depths on the hand-augered boring logs are based on an average of measurements across the hand-auger and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Hand Auger HA-2

GeoEngineers

Project: Strawberry Fields Turf Conversion
Project Location: Marysville, Washington
Project Number: 0925-019-00

Figure 7
Sheet 1 of 1

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	TP-2	1	11	Dark gray fine to medium sand with silt (SP-SM)
■	HA-2	4.5	19	Gray silty fine to medium sand (SM)

Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM D 6913. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

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Strawberry Fields Turf Conversion
Marysville, Washington

Sieve Analysis Results

Figure 8

APPENDIX C
STORMWATER MANAGEMENT SYSTEM MODELING REPORT

TECHNICAL INFORMATION REPORT
Strawberry Fields Conversion
Marysville, Washington

CEKO PN: 22007.01

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Strawberry-Fields-001
Site Name:	Strawberry Fields
Site Address:	6100 152nd Street NE
City:	Marysville
Report Date:	10/19/2022
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.200
Version Date:	2021/05/25
Version:	4.2.16

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Field #2 - Existing

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	2.181
Pervious Total	2.181
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.181

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Field #2 - Converted

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	1.307
Pervious Total	1.307

Impervious Land Use	acre
SIDEWALKS FLAT	0.874
Impervious Total	0.874
Basin Total	2.181

Element Flows To:

Surface	Interflow	Groundwater
Field Base-Rock Gravel Bed		

Routing Elements
Predeveloped Routing

Mitigated Routing

Field Base-Rock Gravel Bed

Bottom Length:	276.00 ft.
Bottom Width:	276.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	0.5
Pour Space of material for first layer:	0.33
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	0.05
Infiltration safety factor:	0.5
Total Volume Infiltrated (ac-ft.):	65.824
Total Volume Through Riser (ac-ft.):	106.969
Total Volume Through Facility (ac-ft.):	172.794
Percent Infiltrated:	38.09
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0.5 ft.
Riser Diameter:	18 in.
Orifice 1 Diameter:	5.5 in. Elevation:0 ft.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

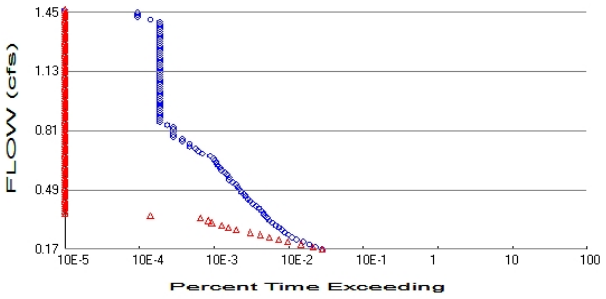
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	1.748	0.000	0.000	0.000
0.0065	1.748	0.003	0.066	0.044
0.0130	1.748	0.007	0.093	0.044
0.0194	1.748	0.011	0.114	0.044
0.0259	1.748	0.015	0.132	0.044
0.0324	1.748	0.018	0.147	0.044
0.0389	1.748	0.022	0.161	0.044
0.0453	1.748	0.026	0.174	0.044
0.0518	1.748	0.029	0.186	0.044
0.0583	1.748	0.033	0.198	0.044
0.0648	1.748	0.037	0.208	0.044
0.0713	1.748	0.041	0.219	0.044
0.0777	1.748	0.044	0.228	0.044
0.0842	1.748	0.048	0.238	0.044
0.0907	1.748	0.052	0.247	0.044
0.0972	1.748	0.056	0.255	0.044
0.1036	1.748	0.059	0.264	0.044
0.1101	1.748	0.063	0.272	0.044
0.1166	1.748	0.067	0.280	0.044
0.1231	1.748	0.071	0.288	0.044
0.1296	1.748	0.074	0.295	0.044
0.1360	1.748	0.078	0.302	0.044
0.1425	1.748	0.082	0.309	0.044

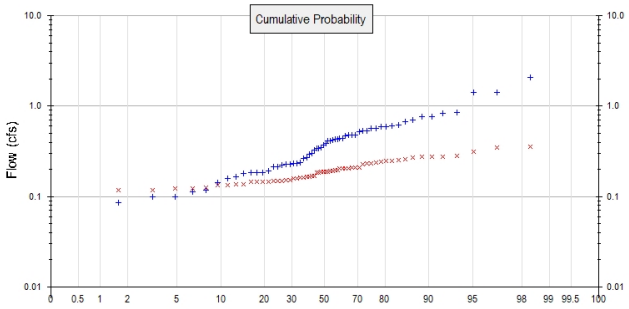
0.1490	1.748	0.086	0.316	0.044
0.1555	1.748	0.089	0.323	0.044
0.1619	1.748	0.093	0.330	0.044
0.1684	1.748	0.097	0.336	0.044
0.1749	1.748	0.100	0.343	0.044
0.1814	1.748	0.104	0.349	0.044
0.1879	1.748	0.108	0.355	0.044
0.1943	1.748	0.112	0.361	0.044
0.2008	1.748	0.115	0.367	0.044
0.2073	1.748	0.119	0.373	0.044
0.2138	1.748	0.123	0.379	0.044
0.2202	1.748	0.127	0.385	0.044
0.2267	1.748	0.130	0.390	0.044
0.2332	1.748	0.134	0.396	0.044
0.2397	1.748	0.138	0.401	0.044
0.2462	1.748	0.142	0.407	0.044
0.2526	1.748	0.145	0.412	0.044
0.2591	1.748	0.149	0.417	0.044
0.2656	1.748	0.153	0.423	0.044
0.2721	1.748	0.157	0.428	0.044
0.2785	1.748	0.160	0.433	0.044
0.2850	1.748	0.164	0.438	0.044
0.2915	1.748	0.168	0.443	0.044
0.2980	1.748	0.172	0.448	0.044
0.3045	1.748	0.175	0.452	0.044
0.3109	1.748	0.179	0.457	0.044
0.3174	1.748	0.183	0.462	0.044
0.3239	1.748	0.186	0.467	0.044
0.3304	1.748	0.190	0.471	0.044
0.3368	1.748	0.194	0.476	0.044
0.3433	1.748	0.198	0.481	0.044
0.3498	1.748	0.201	0.485	0.044
0.3563	1.748	0.205	0.490	0.044
0.3628	1.748	0.209	0.494	0.044
0.3692	1.748	0.213	0.498	0.044
0.3757	1.748	0.216	0.503	0.044
0.3822	1.748	0.220	0.507	0.044
0.3887	1.748	0.224	0.511	0.044
0.3951	1.748	0.228	0.516	0.044
0.4016	1.748	0.231	0.520	0.044
0.4081	1.748	0.235	0.524	0.044
0.4146	1.748	0.239	0.528	0.044
0.4211	1.748	0.243	0.532	0.044
0.4275	1.748	0.246	0.536	0.044
0.4340	1.748	0.250	0.540	0.044
0.4405	1.748	0.254	0.544	0.044
0.4470	1.748	0.257	0.548	0.044
0.4534	1.748	0.261	0.552	0.044
0.4599	1.748	0.265	0.556	0.044
0.4664	1.748	0.269	0.560	0.044
0.4729	1.748	0.272	0.564	0.044
0.4794	1.748	0.276	0.568	0.044
0.4858	1.748	0.280	0.572	0.044
0.4923	1.748	0.284	0.576	0.044
0.4988	1.748	0.287	0.579	0.044
0.5053	1.748	0.299	0.589	0.044
0.5117	1.748	0.310	0.607	0.044
0.5182	1.748	0.321	0.630	0.044

0.5247	1.748	0.333	0.656	0.044
0.5312	1.748	0.344	0.685	0.044
0.5377	1.748	0.355	0.718	0.044
0.5441	1.748	0.367	0.753	0.044
0.5506	1.748	0.378	0.790	0.044
0.5571	1.748	0.389	0.829	0.044
0.5636	1.748	0.401	0.871	0.044
0.5700	1.748	0.412	0.914	0.044
0.5765	1.748	0.423	0.959	0.044

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.181
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.307
Total Impervious Area: 0.874

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.341387
5 year	0.617697
10 year	0.842152
25 year	1.172043
50 year	1.451033
100 year	1.758291

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.184461
5 year	0.235331
10 year	0.268729
25 year	0.310864
50 year	0.342317
100 year	0.373896

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.532	0.167
1950	0.613	0.242
1951	0.225	0.188
1952	0.344	0.184
1953	0.436	0.198
1954	0.840	0.230
1955	0.572	0.275
1956	0.193	0.123
1957	0.522	0.193
1958	1.410	0.358

1959	0.262	0.165
1960	0.440	0.158
1961	2.083	0.351
1962	0.384	0.183
1963	0.770	0.260
1964	0.300	0.151
1965	0.086	0.124
1966	0.141	0.138
1967	0.297	0.250
1968	0.346	0.203
1969	1.417	0.278
1970	0.233	0.146
1971	0.478	0.236
1972	0.699	0.310
1973	0.413	0.190
1974	0.587	0.208
1975	0.482	0.204
1976	0.226	0.163
1977	0.114	0.134
1978	0.159	0.118
1979	0.770	0.270
1980	0.267	0.136
1981	0.233	0.145
1982	0.214	0.150
1983	0.482	0.207
1984	0.328	0.165
1985	0.443	0.206
1986	0.672	0.253
1987	0.413	0.187
1988	0.237	0.162
1989	0.427	0.189
1990	0.180	0.134
1991	0.164	0.144
1992	0.371	0.149
1993	0.184	0.158
1994	0.183	0.114
1995	0.186	0.152
1996	0.424	0.194
1997	0.855	0.282
1998	0.604	0.274
1999	0.117	0.123
2000	0.538	0.228
2001	0.067	0.145
2002	0.099	0.118
2003	0.099	0.149
2004	0.592	0.249
2005	0.211	0.206
2006	0.572	0.191
2007	0.470	0.207
2008	0.340	0.234
2009	0.225	0.169

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	2.0828	0.3575
2	1.4169	0.3506
3	1.4095	0.3104

4	0.8548	0.2821
5	0.8400	0.2782
6	0.7701	0.2750
7	0.7699	0.2737
8	0.6988	0.2700
9	0.6720	0.2605
10	0.6132	0.2525
11	0.6042	0.2498
12	0.5925	0.2490
13	0.5875	0.2416
14	0.5723	0.2359
15	0.5717	0.2342
16	0.5378	0.2302
17	0.5321	0.2284
18	0.5221	0.2085
19	0.4824	0.2073
20	0.4818	0.2067
21	0.4779	0.2063
22	0.4702	0.2058
23	0.4430	0.2044
24	0.4403	0.2032
25	0.4356	0.1977
26	0.4274	0.1940
27	0.4236	0.1935
28	0.4134	0.1915
29	0.4131	0.1897
30	0.3837	0.1893
31	0.3713	0.1881
32	0.3456	0.1874
33	0.3441	0.1842
34	0.3399	0.1827
35	0.3278	0.1695
36	0.2996	0.1674
37	0.2966	0.1652
38	0.2669	0.1651
39	0.2622	0.1630
40	0.2365	0.1617
41	0.2330	0.1583
42	0.2330	0.1577
43	0.2256	0.1522
44	0.2253	0.1508
45	0.2246	0.1498
46	0.2139	0.1495
47	0.2113	0.1488
48	0.1930	0.1457
49	0.1857	0.1453
50	0.1840	0.1449
51	0.1832	0.1442
52	0.1799	0.1378
53	0.1642	0.1361
54	0.1589	0.1345
55	0.1413	0.1339
56	0.1175	0.1243
57	0.1136	0.1231
58	0.0994	0.1227
59	0.0989	0.1184
60	0.0863	0.1175
61	0.0665	0.1139

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1707	597	602	100	Pass
0.1836	489	450	92	Pass
0.1966	402	313	77	Pass
0.2095	330	207	62	Pass
0.2224	270	157	58	Pass
0.2354	236	118	50	Pass
0.2483	212	89	41	Pass
0.2612	188	65	34	Pass
0.2742	174	42	24	Pass
0.2871	159	33	20	Pass
0.3000	143	27	18	Pass
0.3130	129	20	15	Pass
0.3259	119	18	15	Pass
0.3388	110	14	12	Pass
0.3518	102	3	2	Pass
0.3647	98	0	0	Pass
0.3776	92	0	0	Pass
0.3905	85	0	0	Pass
0.4035	79	0	0	Pass
0.4164	71	0	0	Pass
0.4293	65	0	0	Pass
0.4423	60	0	0	Pass
0.4552	56	0	0	Pass
0.4681	53	0	0	Pass
0.4811	49	0	0	Pass
0.4940	46	0	0	Pass
0.5069	44	0	0	Pass
0.5199	42	0	0	Pass
0.5328	38	0	0	Pass
0.5457	34	0	0	Pass
0.5587	34	0	0	Pass
0.5716	32	0	0	Pass
0.5845	30	0	0	Pass
0.5975	27	0	0	Pass
0.6104	26	0	0	Pass
0.6233	24	0	0	Pass
0.6363	23	0	0	Pass
0.6492	22	0	0	Pass
0.6621	21	0	0	Pass
0.6751	19	0	0	Pass
0.6880	15	0	0	Pass
0.7009	13	0	0	Pass
0.7139	12	0	0	Pass
0.7268	10	0	0	Pass
0.7397	10	0	0	Pass
0.7527	8	0	0	Pass
0.7656	8	0	0	Pass
0.7785	6	0	0	Pass
0.7915	6	0	0	Pass
0.8044	6	0	0	Pass
0.8173	6	0	0	Pass
0.8303	6	0	0	Pass
0.8432	5	0	0	Pass

0.8561	4	0	0	Pass
0.8691	4	0	0	Pass
0.8820	4	0	0	Pass
0.8949	4	0	0	Pass
0.9079	4	0	0	Pass
0.9208	4	0	0	Pass
0.9337	4	0	0	Pass
0.9467	4	0	0	Pass
0.9596	4	0	0	Pass
0.9725	4	0	0	Pass
0.9855	4	0	0	Pass
0.9984	4	0	0	Pass
1.0113	4	0	0	Pass
1.0243	4	0	0	Pass
1.0372	4	0	0	Pass
1.0501	4	0	0	Pass
1.0631	4	0	0	Pass
1.0760	4	0	0	Pass
1.0889	4	0	0	Pass
1.1018	4	0	0	Pass
1.1148	4	0	0	Pass
1.1277	4	0	0	Pass
1.1406	4	0	0	Pass
1.1536	4	0	0	Pass
1.1665	4	0	0	Pass
1.1794	4	0	0	Pass
1.1924	4	0	0	Pass
1.2053	4	0	0	Pass
1.2182	4	0	0	Pass
1.2312	4	0	0	Pass
1.2441	4	0	0	Pass
1.2570	4	0	0	Pass
1.2700	4	0	0	Pass
1.2829	4	0	0	Pass
1.2958	4	0	0	Pass
1.3088	4	0	0	Pass
1.3217	4	0	0	Pass
1.3346	4	0	0	Pass
1.3476	4	0	0	Pass
1.3605	4	0	0	Pass
1.3734	4	0	0	Pass
1.3864	4	0	0	Pass
1.3993	4	0	0	Pass
1.4122	3	0	0	Pass
1.4252	2	0	0	Pass
1.4381	2	0	0	Pass
1.4510	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Field Base-Rock Gravel Bed	☐	157.24			☐	38.09			
Total Volume Infiltrated		157.24	0.00	0.00		38.09	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

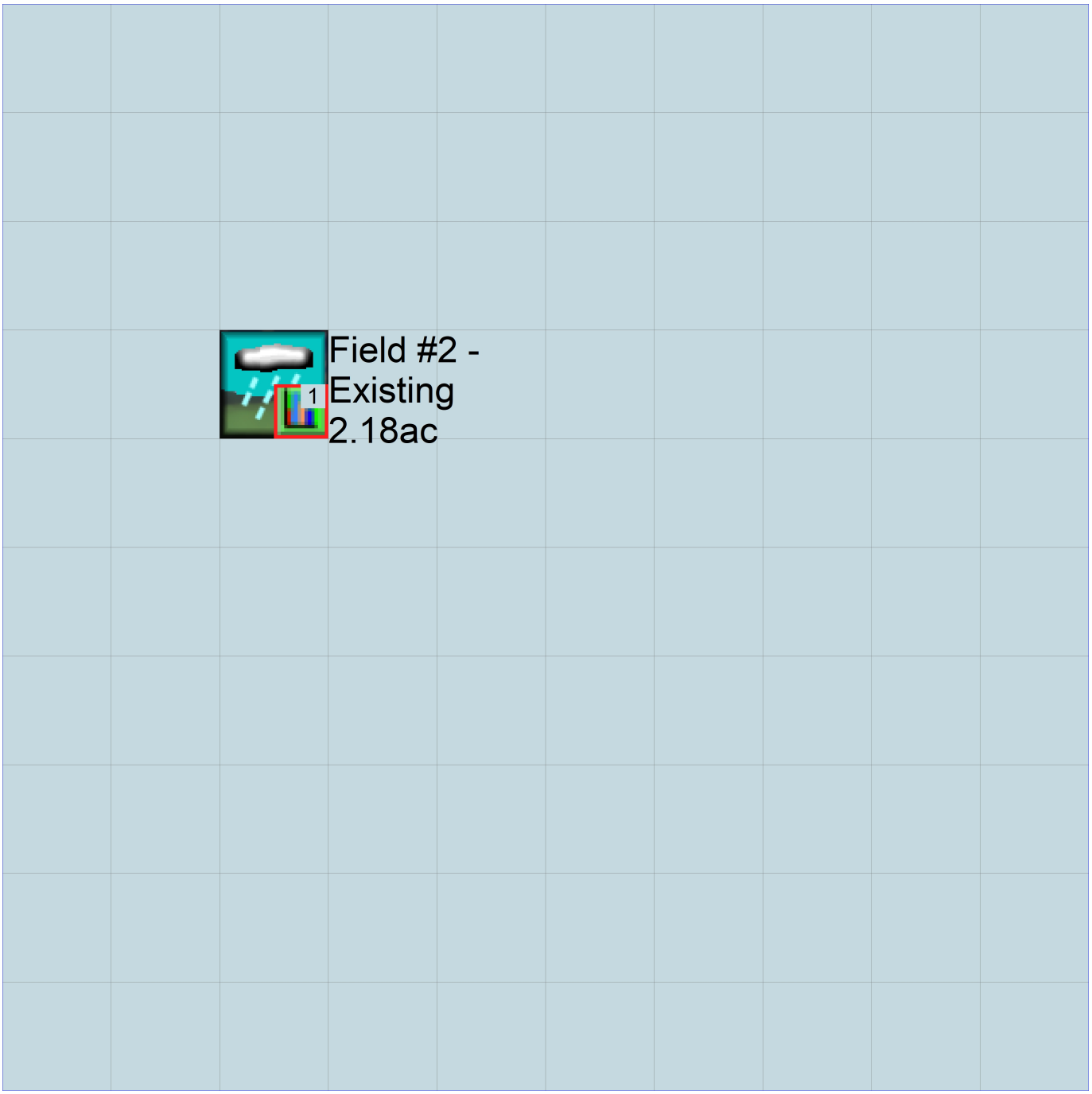
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   Strawberry-Fields-001.wdm
MESSU       25   PreStrawberry-Fields-001.MES
            27   PreStrawberry-Fields-001.L61
            28   PreStrawberry-Fields-001.L62
            30   POCStrawberry-Fields-0011.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Field #2 - Existing         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                      in  out           ***
   16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16              0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Field #2 - Existing***
PERLND  16                       2.181     COPY   501     12
PERLND  16                       2.181     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *      *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                     ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><---><---><---><---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   Strawberry-Fields-001.wdm
MESSU       25   MitStrawberry-Fields-001.MES
            27   MitStrawberry-Fields-001.L61
            28   MitStrawberry-Fields-001.L62
            30   POCStrawberry-Fields-0011.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      16
      IMPLND       8
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Field Base-Rock Gravel Be   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                      in  out           ***
   16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16             0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16           0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS       GWVS
   16             0         0         0         0       2.5         1          0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                  in  out           ***
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
```

```
    # -  # ***PETMAX    PETMIN
    8             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    8             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Field #2 - Converted***
PERLND  16                       1.307     RCHRES   1      2
IMPLND   8                       0.874     RCHRES   1      5

******Routing******
PERLND  16                       1.307     COPY     1     12
IMPLND   8                       0.874     COPY     1     15
RCHRES   1                           1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                      in  out                               ***
    1     Field Base-Rock -007    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------->      ***
    1              1      0.05       0.0       0.0       0.5       0.0
  END HYDR-PARM2
```

```
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit        for each possible exit
  <------><--------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  1.748760  0.000000  0.000000  0.000000
  0.006478  1.748760  0.003738  0.066069  0.044083
  0.012956  1.748760  0.007477  0.093436  0.044083
  0.019433  1.748760  0.011215  0.114435  0.044083
  0.025911  1.748760  0.014953  0.132138  0.044083
  0.032389  1.748760  0.018691  0.147735  0.044083
  0.038867  1.748760  0.022430  0.161835  0.044083
  0.045344  1.748760  0.026168  0.174802  0.044083
  0.051822  1.748760  0.029906  0.186871  0.044083
  0.058300  1.748760  0.033644  0.198207  0.044083
  0.064778  1.748760  0.037383  0.208928  0.044083
  0.071256  1.748760  0.041121  0.219126  0.044083
  0.077733  1.748760  0.044859  0.228869  0.044083
  0.084211  1.748760  0.048597  0.238215  0.044083
  0.090689  1.748760  0.052336  0.247207  0.044083
  0.097167  1.748760  0.056074  0.255884  0.044083
  0.103644  1.748760  0.059812  0.264276  0.044083
  0.110122  1.748760  0.063551  0.272409  0.044083
  0.116600  1.748760  0.067289  0.280307  0.044083
  0.123078  1.748760  0.071027  0.287988  0.044083
  0.129556  1.748760  0.074765  0.295469  0.044083
  0.136033  1.748760  0.078504  0.302766  0.044083
  0.142511  1.748760  0.082242  0.309891  0.044083
  0.148989  1.748760  0.085980  0.316855  0.044083
  0.155467  1.748760  0.089718  0.323670  0.044083
  0.161944  1.748760  0.093457  0.330345  0.044083
  0.168422  1.748760  0.097195  0.336887  0.044083
  0.174900  1.748760  0.100933  0.343304  0.044083
  0.181378  1.748760  0.104671  0.349604  0.044083
  0.187856  1.748760  0.108410  0.355792  0.044083
  0.194333  1.748760  0.112148  0.361874  0.044083
  0.200811  1.748760  0.115886  0.367856  0.044083
  0.207289  1.748760  0.119625  0.373742  0.044083
  0.213767  1.748760  0.123363  0.379537  0.044083
  0.220244  1.748760  0.127101  0.385245  0.044083
  0.226722  1.748760  0.130839  0.390869  0.044083
  0.233200  1.748760  0.134578  0.396413  0.044083
  0.239678  1.748760  0.138316  0.401881  0.044083
  0.246156  1.748760  0.142054  0.407276  0.044083
  0.252633  1.748760  0.145792  0.412600  0.044083
  0.259111  1.748760  0.149531  0.417856  0.044083
  0.265589  1.748760  0.153269  0.423047  0.044083
  0.272067  1.748760  0.157007  0.428175  0.044083
  0.278544  1.748760  0.160745  0.433243  0.044083
  0.285022  1.748760  0.164484  0.438252  0.044083
  0.291500  1.748760  0.168222  0.443204  0.044083
  0.297978  1.748760  0.171960  0.448101  0.044083
  0.304456  1.748760  0.175699  0.452946  0.044083
  0.310933  1.748760  0.179437  0.457739  0.044083
  0.317411  1.748760  0.183175  0.462482  0.044083
  0.323889  1.748760  0.186913  0.467178  0.044083
  0.330367  1.748760  0.190652  0.471826  0.044083
  0.336844  1.748760  0.194390  0.476430  0.044083
  0.343322  1.748760  0.198128  0.480989  0.044083
```

```
  0.349800  1.748760  0.201866  0.485505  0.044083
  0.356278  1.748760  0.205605  0.489980  0.044083
  0.362756  1.748760  0.209343  0.494414  0.044083
  0.369233  1.748760  0.213081  0.498809  0.044083
  0.375711  1.748760  0.216819  0.503166  0.044083
  0.382189  1.748760  0.220558  0.507485  0.044083
  0.388667  1.748760  0.224296  0.511768  0.044083
  0.395144  1.748760  0.228034  0.516015  0.044083
  0.401622  1.748760  0.231773  0.520227  0.044083
  0.408100  1.748760  0.235511  0.524406  0.044083
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  0.453444  1.748760  0.261679  0.552772  0.044083
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  0.492311  1.748760  0.284108  0.575975  0.044083
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  0.505267  1.748760  0.299175  0.589593  0.044083
  0.511744  1.748760  0.310503  0.607503  0.044083
  0.518222  1.748760  0.321831  0.630103  0.044083
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  0.531178  1.748760  0.344487  0.685896  0.044083
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  0.544133  1.748760  0.367143  0.753040  0.044083
  0.550611  1.748760  0.378471  0.790244  0.044083
  0.557089  1.748760  0.389799  0.829642  0.044083
  0.563567  1.748760  0.401127  0.871101  0.044083
  0.570044  1.748760  0.412455  0.914509  0.044083
  0.576522  1.748760  0.423784  0.959767  0.044083
  0.583000  1.748760  0.435112  1.006790  0.044083
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
```

```
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1               COPY           INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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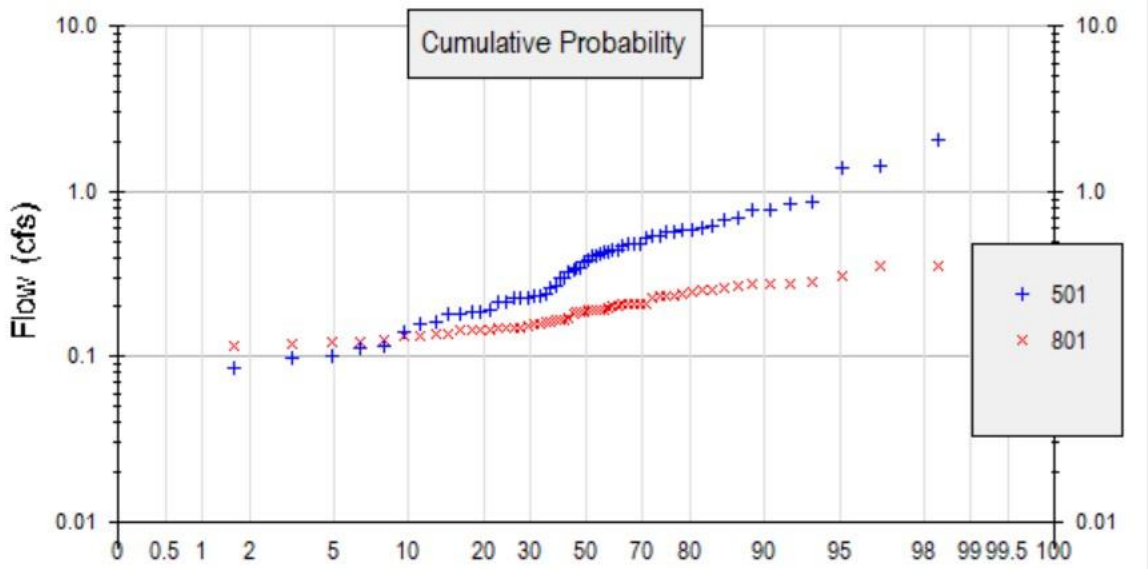
Western Washington Hydrology Model

File Edit View Help Summary Report

Analysis Help

Analysis



Stream Protection Duration | LID Duration | Flow Frequency | Water Quality | Hydrograph

Wetland Input Volumes | LID Report | Recharge Duration | Recharge Predeveloped | Recharge Mitigated

Analyze datasets Compact WDM Delete Selected Monthly FF

501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow

All Datasets | Flow | Stage | Precip | Evap | POC 1

Flood Frequency Method
- (•) Log Pearson Type III 17B
- ( ) Weibull
- ( ) Cunnane
- ( ) Gringorten

Flow Frequency

Flow(cfs)	Predeveloped	Mitigated
2 Year =	0.3414	0.1845
5 Year =	0.6177	0.2353
10 Year =	0.8422	0.2687
25 Year =	1.1720	0.3109
50 Year =	1.4510	0.3423
100 Year =	1.7583	0.3739

Annual Peaks

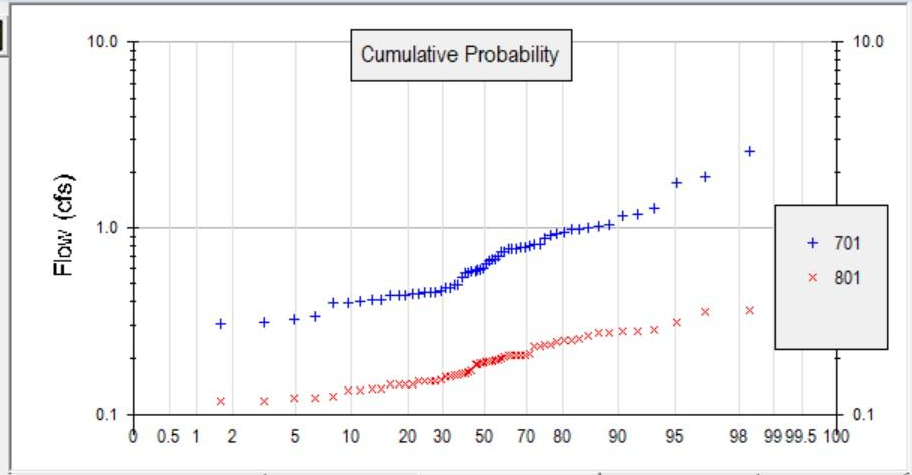
1949	0.5321	0.1674
1950	0.6132	0.2416
1951	0.2246	0.1881
1952	0.3441	0.1842
1953	0.4356	0.1977
1954	0.8400	0.2302
1955	0.5723	0.2750
1956	0.1930	0.1231
1957	0.5221	0.1935
1958	1.4095	0.3575
1959	0.2622	0.1651
1960	0.4403	0.1577
1961	2.0828	0.3506
1962	0.3837	0.1827
1963	0.7701	0.2605
1964	0.2996	0.1508
1965	0.0863	0.1243
1966	0.1413	0.1378
1967	0.2966	0.2498
1968	0.3456	0.2032
1969	1.4169	0.2782
1970	0.2330	0.1457
1971	0.4779	0.2359
1972	0.6988	0.3104
1973	0.4131	0.1897
1974	0.5875	0.2085
1975	0.4824	0.2044
1976	0.2256	0.1630

WWHM2012 Strawberry-Fields-001

File Edit View Help Summary Report

Analysis Help

Analysis



Stream Protection Duration | LID Duration | Flow Frequency | Water Quality | Hydrograph

Wetland Input Volumes | LID Report | Recharge Duration | Recharge Predeveloped | Recharge Mitigated

Analyze datasets Compact WDM Delete Selected Monthly FF

1 PUYALLUP DAILY EVAP W/JENSEN-HAIS
2 Everett
501 POC 1 Predeveloped flow
701 Inflow to POC 1 Mitigated
801 POC 1 Mitigated flow
1000 Field Base-Rock Gravel Bed ALL OUTLETS Mitigated
1001 Field Base-Rock Gravel Bed OUTLET 1 Mitigated
1002 Field Base-Rock Gravel Bed OUTLET 2 Mitigated

All Datasets | Flow | Stage | Precip | Evap | POC 1

Flood Frequency Method
- (•) Log Pearson Type III 17B
- ( ) Weibull
- ( ) Cunnane
- ( ) Gringorten

Flow Frequency

Flow(cfs)	0701 15m	0801 15m
2 Year =	0.6235	0.1845
5 Year =	0.9340	0.2353
10 Year =	1.1744	0.2687
25 Year =	1.5201	0.3109
50 Year =	1.8096	0.3423
100 Year =	2.1280	0.3739

Annual Peaks

1949	0.8046	0.1674
1950	0.8809	0.2416
1951	0.5818	0.1881
1952	0.5754	0.1842
1953	0.8185	0.1977
1954	1.1919	0.2302
1955	0.8174	0.2750
1956	0.3111	0.1231
1957	0.6679	0.1935
1958	1.8870	0.3575
1959	0.5438	0.1651
1960	0.6795	0.1577
1961	2.5800	0.3506
1962	0.5742	0.1827
1963	1.0179	0.2605
1964	0.4385	0.1508
1965	0.4078	0.1243
1966	0.4737	0.1378
1967	0.9558	0.2498
1968	0.6347	0.2032
1969	1.7635	0.2782
1970	0.4379	0.1457
1971	0.7818	0.2359
1972	1.0336	0.3104
1973	0.7684	0.1897
1974	0.9843	0.2085
1975	0.7884	0.2044
1976	0.4371	0.1630

APPENDIX D
CONVEYANCE CAPACITY CALCULATIONS

TECHNICAL INFORMATION REPORT
Strawberry Fields Conversion
Marysville, Washington

CEKO PN: 22007.01

CEKO

CEKO PN: 2207.01 **Project Name:** Strawberry Fields - Field #2 Conversion **Page:** 1 **of** 1

Subject: Conveyance Capacity Calculations

Prepared By: CPK **Date:** 10/18/2022

CONVEYANCE CAPACITY CALCULATIONS (PHASE 1 - FIELD #2 CONVERTED, FIELDS #1 & #3 REMAIN GRASS)
USING WWHM DATA FOR FLOWS AND THE MANNING EQUATION FOR CONVEYNACE

Run: **Site** Storm: **100** YEAR, 24 HOUR

TOTAL RAINFALL IN INCHES: 3.5

COEFFICIENTS FOR "i" EQUATION: a= 3.50 b= 0.63

Location From	Location To	Inc Area (Acre)	Runoff Coef	A*C	Sum A*C	Time of Concen (min.)	Rain Intens (In/hr)	Runoff (cfs)	n Value	Diam (in.)	Slope (%)	Length (ft)	Pipe Capac (cfs)	% Capac Used	Veloc Full (ft/sec)	Flow Time (min)	Remarks	CAPACITY CHECK	VELOC CHECK	SLOPE CHECK
Field #2 - West Side																				
CB-06	CB-05							**0.20**	0.014	8	0.275	154	0.6	**34.0**	1.69	1.52		OK	LOW	OK
CB-05	CB-04							**0.20**	0.014	8	0.275	155	0.6	**34.0**	1.69	1.53		OK	LOW	OK
CB-04	CB-03							**0.20**	0.014	8	0.275	36	0.6	**34.0**	1.69	0.36		OK	LOW	OK
Field #3 - West Out																				
CB-03	CB-02							**0.20**	0.014	10	0.250	109	1.0	**19.7**	1.87	0.97		OK	LOW	OK
CB-02	CB-01							**0.20**	0.014	10	0.250	171	1.0	**19.7**	1.87	1.53		OK	LOW	OK
CB-01	OUTFALL							**0.20**	0.014	10	0.250	37	1.0	**19.7**	1.87	0.33		OK	LOW	OK
Field #2 - East Side																				
CB-12	CB-11							**0.20**	0.014	8	0.275	162	0.6	**34.0**	1.69	1.60		OK	LOW	OK
CB-11	CB-10							**0.20**	0.014	8	0.275	157	0.6	**34.0**	1.69	1.55		OK	LOW	OK
CB-10	CB-09							**0.20**	0.014	12	0.560	36	2.5	**8.1**	3.15	0.19		OK	OK	OK
Field #3 - East Out																				
CB-09	CB-08							**0.20**	0.014	12	0.250	172	1.7	**12.1**	2.11	1.36		OK	OK	OK
CB-08	CB-07							**0.20**	0.014	12	0.250	162	1.7	**12.1**	2.11	1.28		OK	OK	OK
CB-07	OUTFALL							**0.20**	0.014	12	0.250	43	1.7	**12.1**	2.11	0.34		OK	OK	OK

CEKO

CEKO PN: 2207.01 **Project Name:** Strawberry Fields - Field #2 Conversion **Page:** 1 **of** 1

Subject: Conveyance Capacity Calculations

Prepared By: CPK **Date:** 10/18/2022

CONVEYANCE CAPACITY CALCULATIONS (PHASE 2 - FIELDS #1, #2, & #3 CONVERTED)
USING WWHM DATA FOR FLOWS AND THE MANNING EQUATION FOR CONVEYNACE

Run: **Site** Storm: **100** YEAR, 24 HOUR

TOTAL RAINFALL IN INCHES: 3.5

COEFFICIENTS FOR "i" EQUATION: a= 3.50 b= 0.63

Location From	Location To	Inc Area (Acre)	Runoff Coef	A*C	Sum A*C	Time of Concen (min.)	Rain Intens (In/hr)	Runoff (cfs)	n Value	Diam (in.)	Slope (%)	Length (ft)	Pipe Capac (cfs)	% Capac Used	Veloc Full (ft/sec)	Flow Time (min)	Remarks	CAPACITY CHECK	VELOC CHECK	SLOPE CHECK
Field #1 - West Side																				
CB-14	CB-13							**0.20**	0.014	8	0.275	188	0.6	**34.0**	1.69	1.86		OK	LOW	OK
CB-13	CB-10A							**0.20**	0.014	8	0.275	155	0.6	**34.0**	1.69	1.53		OK	LOW	OK
Field #1 - East Side																				
CB-17	CB-16							**0.20**	0.014	8	0.275	146	0.6	**34.0**	1.69	1.44		OK	LOW	OK
CB-16	CB-15							**0.20**	0.014	8	0.275	174	0.6	**34.0**	1.69	1.72		OK	LOW	OK
CB-15	CB-10A							**0.20**	0.014	8	0.275	227	0.6	**34.0**	1.69	2.24		OK	LOW	OK
CB-10A	CB-10							**0.40**	0.014	10	0.275	16	1.1	**37.5**	1.96	0.14		OK	LOW	OK
Field #2 - West Side																				
CB-06	CB-05							**0.20**	0.014	8	0.275	154	0.6	**34.0**	1.69	1.52		OK	LOW	OK
CB-05	CB-04							**0.20**	0.014	8	0.275	155	0.6	**34.0**	1.69	1.53		OK	LOW	OK
CB-04	CB-03							**0.20**	0.014	8	0.275	36	0.6	**34.0**	1.69	0.36		OK	LOW	OK
Field #3 - West Out																				
CB-03	CB-02							**0.40**	0.014	10	0.250	109	1.0	**39.3**	1.87	0.97		OK	LOW	OK
CB-02	CB-01							**0.40**	0.014	10	0.250	171	1.0	**39.3**	1.87	1.53		OK	LOW	OK
CB-01	OUTFALL							**0.40**	0.014	10	0.250	37	1.0	**39.3**	1.87	0.33		OK	LOW	OK
Field #2 - East Side																				
CB-12	CB-11							**0.20**	0.014	8	0.275	162	0.6	**34.0**	1.69	1.60		OK	LOW	OK
CB-11	CB-10							**0.20**	0.014	8	0.275	157	0.6	**34.0**	1.69	1.55		OK	LOW	OK
CB-10	CB-09							**0.60**	0.014	12	0.560	36	2.5	**24.2**	3.15	0.19		OK	OK	OK
Field #3 - East Out																				
CB-09	CB-08							**0.80**	0.014	12	0.250	172	1.7	**48.4**	2.11	1.36		OK	OK	OK
CB-08	CB-07							**0.80**	0.014	12	0.250	162	1.7	**48.4**	2.11	1.28		OK	OK	OK
CB-07	OUTFALL							**0.80**	0.014	12	0.250	43	1.7	**48.4**	2.11	0.34		OK	OK	OK

BACKWATER PIPE SIZING

(Runoff Calculated from WWHM Modeling)
(Pipe Capacity and Freeboard Estimated by King County Backwater Method)

CEKO

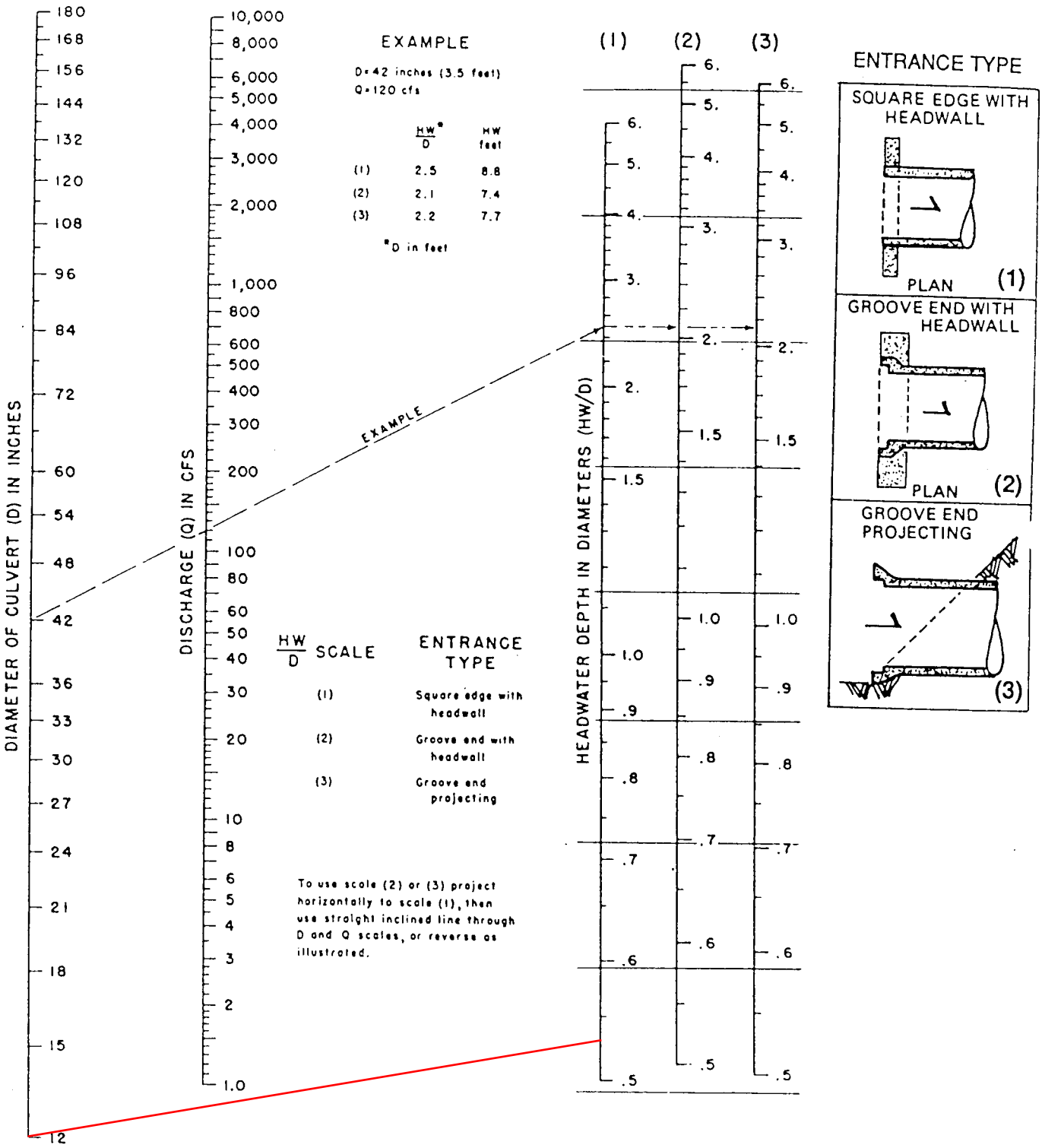
CEKO PN: 22007.01 **Project Name:** Strawberry Fields - Field #2 Conversion **Page:** 1 **of** 1
Subject: Conveyance Capacity Calculations
Prepared By: CPK **Date:** 10/25/2022

RUN(S): **All (Phase 2)**
STORM: **100-year**

ENTRANCE HEAD LOSS: Ke FROM Tbl 4.3.5A KCSWDM
INLET CONTROL: Hw/D FROM Fig 4.3.5C OR Fig 4.3.5D KCSWDM
BEND HEAD LOSS: Kb FROM Fig 4.3.4E KCSWDM
JUNCTION HEAD LOSS: FROM Fig 4.3.4F KCSWDM

PIPE SEGMENT CB to CB		(1) Q (cfs)	(2) RUN LEN (ft)	(3) PIPE SIZE (in)	(4) "n"	(5) OUTLET ELEV (ft)	(6) INLET ELEV (ft)	PIPE So (%)	(7) BARREL AREA (sq ft)	(8) BARREL VEL (fps)	(9) BARREL VEL HEAD (ft)	(10) TW ELEV (ft)	FRICT. SLOPE Sf (%)	(11) FRIC LOSS (ft)	(12) ENTR HGL ELEV (ft)	Ke	(13) ENTR HEAD LOSS (ft)	(14) EXIT HEAD LOSS (ft)	(15) OUTLET CONTROL ELEV (ft)	Hw/D	Hw (ft)	(16) INLET CONTROL ELEV (ft)	USE CONTROL ELEV (ft)	(17) APPR VEL HEAD (ft)	Kb	(18) BEND HEAD LOSS (ft)	(19) JUNC HEAD LOSS (ft)	(20) HEAD LOSS FROP-T BED K=0.5 (ft)	(21) HGL ELEV (ft)	CB NO.	DEPTH TO INVERT (ft)	CB RIM ELEV (ft)	FREEBOARD (ft)
Outlet	CB-07	0.80	43	12	0.012	105.50	105.61	0.26%	0.79	1.02	0.02	106.75	0.04%	0.02	106.77	0.20	0.00	0.02	106.79	0.54	0.54	106.15	106.79	-0.02	0.00	0.000	0.00	0.00	106.77	CB-07	1.16	109.40	2.63
CB-07	CB-08	0.80	162	12	0.012	105.61	106.02	0.25%	0.79	1.02	0.02	106.77	0.04%	0.07	106.84	0.20	0.00	0.02	106.86	0.54	0.54	106.56	106.86	-0.02	0.00	0.000	0.00	0.00	106.84	CB-08	0.82	109.40	2.56
CB-08	CB-09	0.80	172	12	0.012	106.02	106.45	0.25%	0.79	1.02	0.02	106.84	0.04%	0.07	106.92	0.20	0.00	0.02	106.94	0.54	0.54	106.99	106.99	-0.02	0.00	0.000	0.00	0.00	106.97	CB-09	0.52	109.40	2.43
CB-09	CB-010	0.80	36	12	0.012	106.45	106.65	0.56%	0.79	1.02	0.02	106.97	0.04%	0.02	106.99	0.20	0.00	0.02	107.01	0.54	0.54	107.19	107.19	0.00	0.00	0.000	0.00	0.00	107.19	CB-010	0.54	109.40	2.21

FIGURE 4.3.5C HEADWATER DEPTH FOR SMOOTH INTERIOR PIPE CULVERTS WITH INLET CONTROL



APPENDIX E
OPERATION AND MAINTENANCE DOCUMENTATION

TECHNICAL INFORMATION REPORT
Strawberry Fields Conversion
Marysville, Washington

CEKO PN: 22007.01

V-4.6 Maintenance Standards for Drainage Facilities

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants	Any evidence of oil,	No contaminants or pol-

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	and Pollution	gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	lutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure (s); e.g.,rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Ponds Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement	Dike is built back to the design elevation.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with	Piping eliminated. Erosion potential resolved.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	
Emergency Overflow/Spillway	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(8) Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet

Table V-4.5.2(8) Maintenance Standards - Typical Biofiltration Swale (continued)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.

Table V-4.5.2(8) Maintenance Standards - Typical Biofiltration Swale (continued)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, over-seed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

Table V-4.5.2(9) Maintenance Standards - Wet Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site.

Table V-4.5.2(9) Maintenance Standards - Wet Biofiltration Swale (continued)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
		by very dense clumps of cattail, which do not allow water to flow through the clumps.	Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
	Trash and Debris Accumulation	See "Detention Ponds" (No. 1).	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

Table V-4.5.2(11) Maintenance Standards - Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per	Trash and debris removed from pond.

Table V-4.5.2(11) Maintenance Standards - Wetponds (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		1000-SF of pond area.	
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of

Table V-4.5.2(11) Maintenance Standards - Wetponds (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
			berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Table V-4.5.2(20) Maintenance Standards - Compost Amended Vegetated Filter Strip (CAVFS) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint				
Earthen side slopes and berms	B, S		Erosion (gullies/rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				depth), temporary erosion control measures should be put in place until permanent repairs can be made. • Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3	Restore to design height

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			inches (relative to undisturbed sections of berm)	
	A, S		Downstream face of berm wet, seeps or leaks evident	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm	• Eradicate rodents (see "Pest control") • Fill holes and compact (may require consultation with engineer, particularly for larger berms)
Concrete sidewalls	A		Cracks or failure of concrete sidewalls	• Repair/ seal cracks • Replace if repair is insufficient
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Facility area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		Accumulated sediment to extent that infiltration rate is	• Remove excess sediment • Replace any vegetation damaged or

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			reduced (see "Ponded water") or surface storage capacity significantly impacted	destroyed by sediment accumulation and removal • Mulch newly planted vegetation • Identify and control the sediment source (if feasible) • If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet
		During/after fall leaf drop	Accumulated leaves in facility	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded
Low permeability check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage
	A, S		Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	A		Grade board or top of weir damaged or not level	Restore to level position
Ponded water	B, S		Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Determine cause and resolve in the following order: 1. Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2. Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3. Check for other water inputs (e.g., groundwater, illicit connections). 4. Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem,

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.
Bioretention soil media	As needed		Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint	• Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. • Never drive equipment or apply heavy loads in facility footprint. • Because the risk of compaction is higher during saturated soil

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance	Recommended Frequency [a]		Condition when Maintenance is Needed	Action Needed (Procedures)
				conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. â€¢ Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. â€¢ If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.
Inlets/Outlets/Pipes				
Splash block inlet	A		Water is not being directed properly to the facility and away from the inlet structure	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M during the wet season and before severe storm	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	is forecasted			
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		A	Maintain access for inspections	• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Erosion control at inlet	A		Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				cut or swale)
Trash rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	• Plant roots, sediment or debris reducing capacity of underdrain • Prolonged surface ponding (see "Ponded water"	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring		Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more	• Determine cause of poor vegetation growth and correct condition • Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jur-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			or less than 75% survival rate).	isdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound). • Confirm that plant selection is appropriate for site growing conditions • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Vegetation (general)	As needed		Presence of diseased plants and plant material	• Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • See Pacific North-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				west Plant Disease Management Handbook for information on disease recognition and for additional resources • Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".
Trees and shrubs		All pruning seasons (timing varies by species)	Pruning as needed	• Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques • All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				shrubs, if necessary.

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Fall and Spring		Standing dead vegetation is present	• Remove standing dead vegetation • Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season) • If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately. • Determine cause of dead vegetation and address issue, if possible • If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.
	Fall and		Planting	• When working

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Spring		beneath mature trees	around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.
	Fall and Spring		Presence of or need for stakes and guys (tree growth, maturation, and support needs)	• Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage • Monitor tree support systems: Repair and adjust as needed to

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				provide support and prevent damage to tree. • Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. • Backfill stake holes after removal.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		Vegetation causes some visibility (line of sight) or driver safety issues	• Maintain appropriate height for sight clearance • When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location. • Remove or transplant if continual safety hazard • Consultation with a landscape architect is recommended for removal, transplant, or substitution of

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				plants
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	Vegetation compromises conveyance	Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)		Winter and Spring	Dead material from previous year's growing cycle or dead collapsed foliage	• Leave dry foliage for winter interest • Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow
Ornamental grasses (evergreen)		Fall and Spring	Dead growth present in spring	• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				• Clean, rake, and comb grasses when they become too tall • Cut back to ground or thin every 2-3 years as needed
Noxious weeds		M (March - October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions • Apply mulch after weed removal (see "Mulch")
Weeds		M (March - October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)
Excessive vegetation		Once in early to mid- May and once in early- to mid-September	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	• Edge or trim groundcovers and shrubs at facility edge • Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks • While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging
	As needed		Excessive vegetation density inhibits stormwater flow beyond design ponding or	• Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			becomes a hazard for pedestrian and vehicular circulation and safety	• Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow) • Remove plants that are weak, broken or not true to form; replace in-kind • Thin grass or plants impacting facility function without leaving visual holes or bare soil areas • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
	As needed		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	Remove vegetation and sediment buildup

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels) • Keep all mulch away from woody stems
Watering				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/located to properly water plants	Redirect sprinklers or move drip irrigation to desired areas
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present ◦ Pulse water to enhance soil absorption, when feasible ◦ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff • Add a tree bag or slow-release watering device (e.g.,

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present ◦ Pulse water to enhance soil absorption, when feasible ◦ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, fol-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				lowed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear • Water during drought conditions or more often if necessary to main-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				tain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority. • Use of pesticides or *Bacillus thuringiensis israelensis* (Bti) may be considered only as a temporary measure while addressing the standing water cause. If overflow to

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				a surface water will occur within 2 weeks after pesticide use, apply for coverage under the Aquatic Mosquito Control NPDES General Permit.
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				up pet waste.
Insect pests	Every site visit associated with vegetation management		Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	• Reduce hiding places for pests by removing diseased and dead plants • For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols)

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

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

IPM - Integrated Pest Management

ISA - International Society of Arboriculture