Oregon
Tina Kotek, Governor

Department of Transportation
Region 1 Geo-Environmental Unit
123 NW Flanders St.
Portland, Oregon 97209

INTEROFFICE MEMO

DATE: June 17, 2025

TO: Beth Dehn,
Heritage & Community
Assets Manager

FROM: David McDonald, P.E.
Professional Engineer

Renews: 12-31-2026

SUBJECT: **Hydraulic Design Recommendations**
I-84 Multnomah Falls Kiosk Replacement
MP 31.08, Multnomah County

The Region 1 Geo-Hydro-Hazmat Unit has prepared this memorandum to provide hydraulic design documentation in support of the I-84 Multnomah Falls Kiosk Replacement Project.

The kiosk is located adjacent to the I-84 Multnomah Falls median parking facility and is owned by the State. The project is designated as a facility improvement, consisting of removing and replacing the existing Kiosk structure and concrete foundation. The hydraulic design documentation included below is based on the proposed impacts to existing drainage patterns and structures. The information described below was generated based on field reconnaissance, as-built plans, and topographic survey.

Project area is outside Federal Emergency Management Administration (FEMA) floodplain boundary.

The project is located in Multnomah County, which utilizes County design standards for water quality and environmental resource impacts, with some overlap with City of Portland Bureau of Environment Services (BES) standards.

The project datum is the North American Vertical Datum of 1988 (NAVD 88).

As defined in the ODOT Hydraulics Design Manual, The project is located in ODOT Designated Climate Zone 4 (Oregon Cascades). The ODOT water quality design storm for the project area is equal to 50% of the cumulative rainfall from the 2-year, 24-hour event. The Santa Barbara Urban Hydrograph (SBUH) was used in estimating the runoff for the drainage area with the minimum time of concentration set at 5-minutes. An antecedent moisture condition (AMC) of 2 was used to represent normal base soil conditions. For the SBUH Method, the rain event was entered as a Type I-A storm with precipitation levels and frequencies as shown in

Chapter 7, Appendix A of the same document. Rainfall event depths were pulled from the TransGIS precipitation depth overlay. For Multnomah County detention requirements, the 2 through the 25-year, 24-hour design storm were evaluated.

Soils within the project area were found to have moderately high (0.20 to 0.57 in/hr) permeability according to the United States Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS) Web Soil Survey. The NRCS Soil Survey report describes the soils within the project area as corresponding to Hydrologic Soil Groups C and D. However, soil observations on site showed soils are predominantly sandy silt with low plasticity likely associated with embankment fill using dredged sand from the Columbia River.

Currently, stormwater sheet flows off the kiosks roof (573 sqft) and across the grassy infield area (2025 sqft) where it then infiltrates into adjacent soils. Excess runoff from the grassy area flows towards inlets within the parking area pavement. Stormwater runoff is then conveyed south via pipe 210 ft to Multnomah Creek, which is a tributary of Benson Lake to the west. Continuing west, Beson lake outfalls into Wahkeena Creek, which is connected to the Columbia River through a Culvert structure under I-84. Drainage basin characteristics for the individual surface drainage features and structures on the project were determined using existing topography.

Per the ODOT standards, water quality treatment is not required due to the size and type of impervious surface modification. However, water quality flows generated from the Kiosk would infiltrate into adjacent soil based on indicated infiltration rates in the NRCS soils report and HydroCAD modeling. This type of passive treatment qualifies as a Low Impact Development (LID) water quality treatment technique.

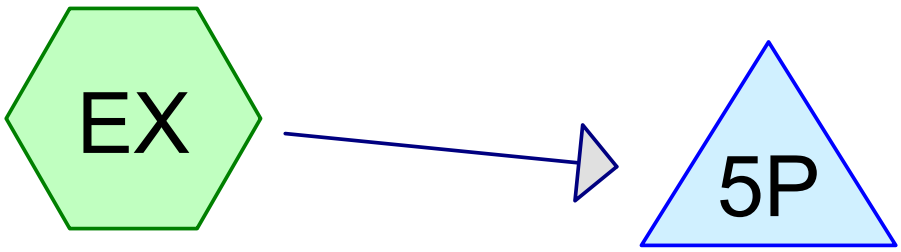
Flow control of the peak flow/volume is not required for this project. Multnomah County land development permit requires that the runoff rate from the 10-year, 24-our storm does not exceed the runoff rate prior to development when 500 SQFT or more of impervious surface is added or replaced. The net increase in impervious area within the project limits is 0.0 sqft (573 sqft - 573 sqft=0 sqft), which does not alter the pre vs post hydrography. Documentation of modified areas and hydrographs are included in Attachments.

Please contact David McDonald (503.704.5427) if you have any questions regarding this narrative.

Attachments:

NRCS Soils Report
HydroCAD Report
10-yr 24-hr Precipitation TransGIS Figure
Multnomah Falls Parking Area Figure
Romtec Plans

cc: Stephen Hay, RG, CEG – Region 1 GeoHydroHazmat Manager



EX1

Grass areas

Subcat Reach Pond Link

Routing Diagram for I84_MultFallsKiosk_Pre_Post_Mult_10yr
Prepared by Oregon DOT, Hydraulics, Printed 6/12/2025

Project Notes

EXISTING

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	0.5x2yr (WQ ODOT)	Type IA 24-hr		Default	24.00	1	1.79	2
2	2-yr (ODOT)	Type IA 24-hr		Default	24.00	1	3.59	2
3	10-yr 24 hour	Type IA 24-hr		Default	24.00	1	4.46	2
4	25-yr (ODOT)	Type IA 24-hr		Default	24.00	1	5.48	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.013	98	Pavement (EX)
0.046	78	Pervious Ground (EX)
0.060	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.060	Other	EX
0.060		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.013	0.013	Pavement	EX
0.000	0.000	0.000	0.000	0.046	0.046	Pervious Ground	EX
0.000	**0.000**	**0.000**	**0.000**	**0.060**	**0.060**	**TOTAL AREA**	

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

Subcatchment EX: EX1 Runoff Area=2,595 sf 21.97% Impervious Runoff Depth>0.63"
Tc=5.0 min CN=78/98 Runoff=0.01 cfs 0.003 af

Pond 5P: Grass areas Peak Elev=99.95' Storage=1 cf Inflow=0.01 cfs 0.003 af
Discarded=0.01 cfs 0.003 af Secondary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.003 af

Total Runoff Area = 0.060 ac Runoff Volume = 0.003 af Average Runoff Depth = 0.63"
78.03% Pervious = 0.046 ac 21.97% Impervious = 0.013 ac

Summary for Subcatchment EX: EX1

I-84 WB Highway no trail added, west of bridge

[49] Hint: Tc<2dt may require smaller dt

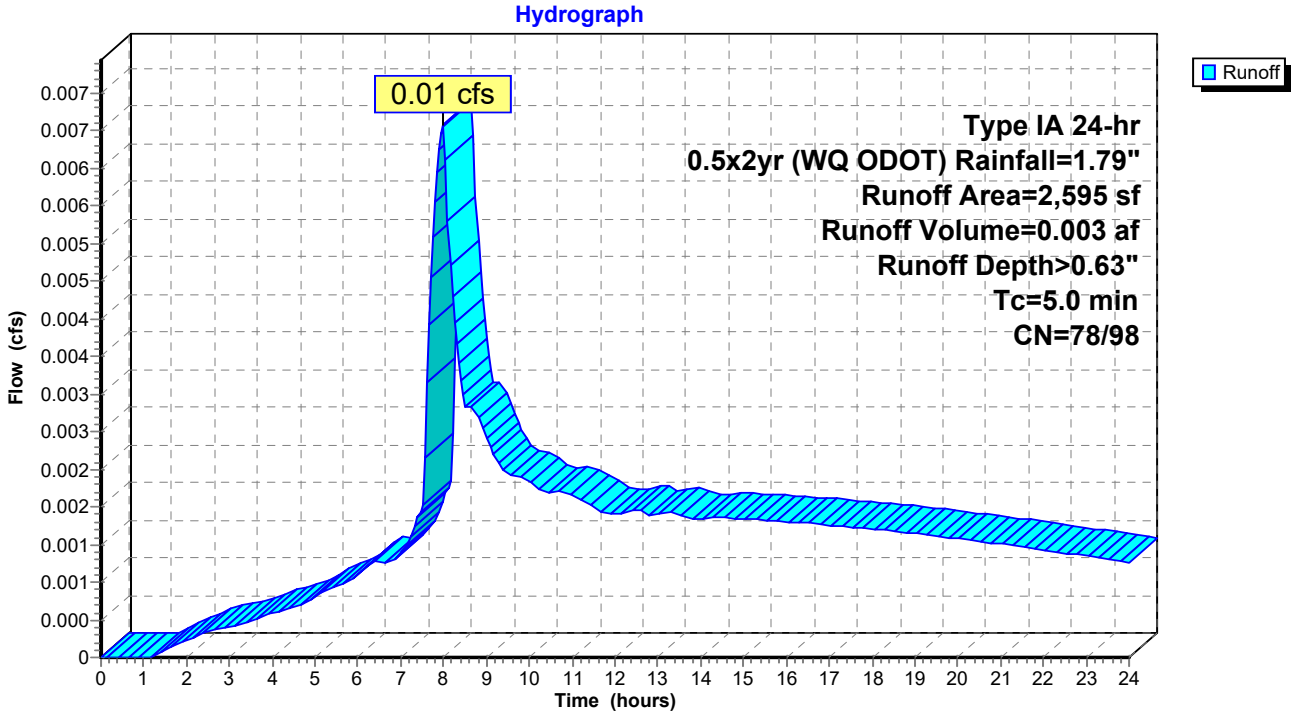
Runoff = 0.01 cfs @ 7.98 hrs, Volume= 0.003 af, Depth> 0.63"
Routed to Pond 5P : Grass areas

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 0.5x2yr (WQ ODOT) Rainfall=1.79"

	Area (sf)	CN	Description
*	570	98	Pavement
*	2,025	78	Pervious Ground
	2,595	82	Weighted Average
	2,025	78	78.03% Pervious Area
	570	98	21.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EX: EX1



Summary for Pond 5P: Grass areas

Inflow Area = 0.060 ac, 21.97% Impervious, Inflow Depth > 0.63" for 0.5x2yr (WQ ODOT) event
Inflow = 0.01 cfs @ 7.98 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 8.00 hrs, Volume= 0.003 af, Atten= 1%, Lag= 0.8 min
Discarded = 0.01 cfs @ 8.00 hrs, Volume= 0.003 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 99.95' @ 8.00 hrs Surf.Area= 2,025 sf Storage= 1 cf

Plug-Flow detention time= 1.4 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (793.6 - 792.7)

Volume	Invert	Avail.Storage	Storage Description
#1	99.95'	202 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

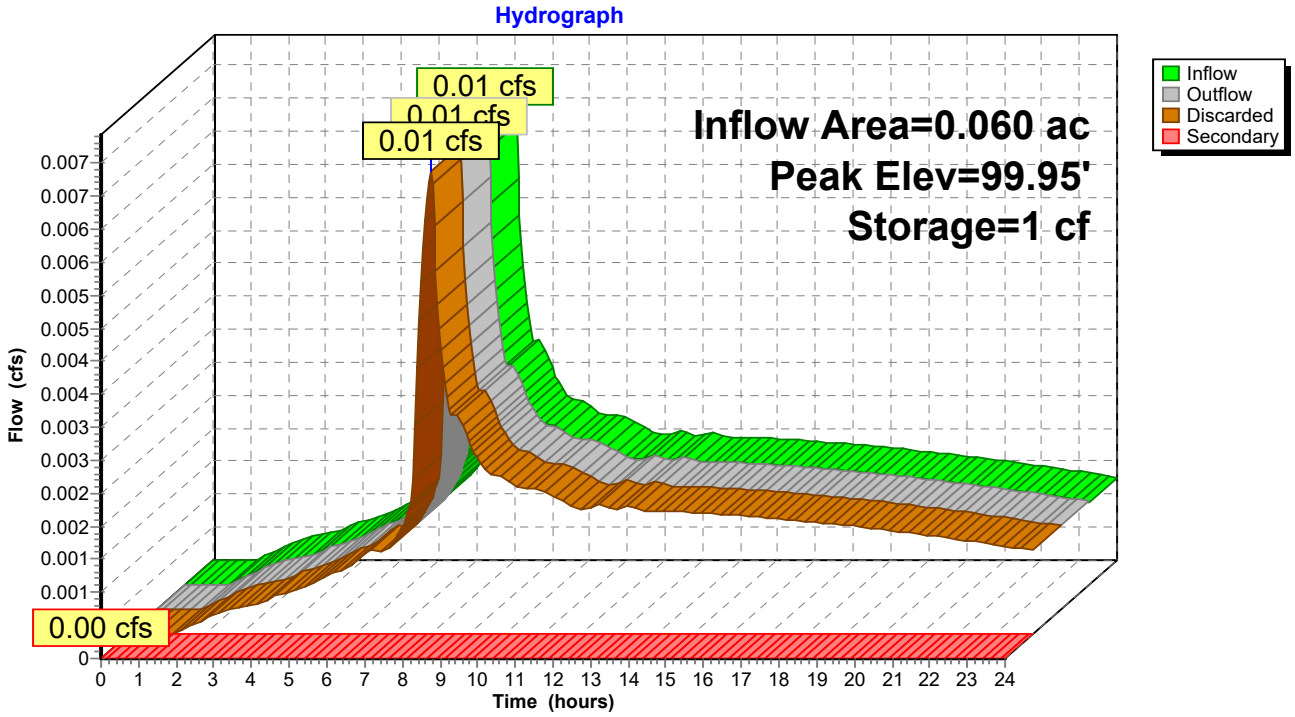
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.95	2,025	0	0
100.00	2,025	101	101
100.05	2,025	101	202

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.95'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 50.00'
#2	Secondary	100.00'	**75.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 8.00 hrs HW=99.95' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.95' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Grass areas



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

Subcatchment EX: EX1 Runoff Area=2,595 sf 21.97% Impervious Runoff Depth>1.95"
Tc=5.0 min CN=78/98 Runoff=0.03 cfs 0.010 af

Pond 5P: Grass areas Peak Elev=99.95' Storage=5 cf Inflow=0.03 cfs 0.010 af
Discarded=0.02 cfs 0.010 af Secondary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.010 af

Total Runoff Area = 0.060 ac Runoff Volume = 0.010 af Average Runoff Depth = 1.95"
78.03% Pervious = 0.046 ac 21.97% Impervious = 0.013 ac

Summary for Subcatchment EX: EX1

I-84 WB Highway no trail added, west of bridge

[49] Hint: Tc<2dt may require smaller dt

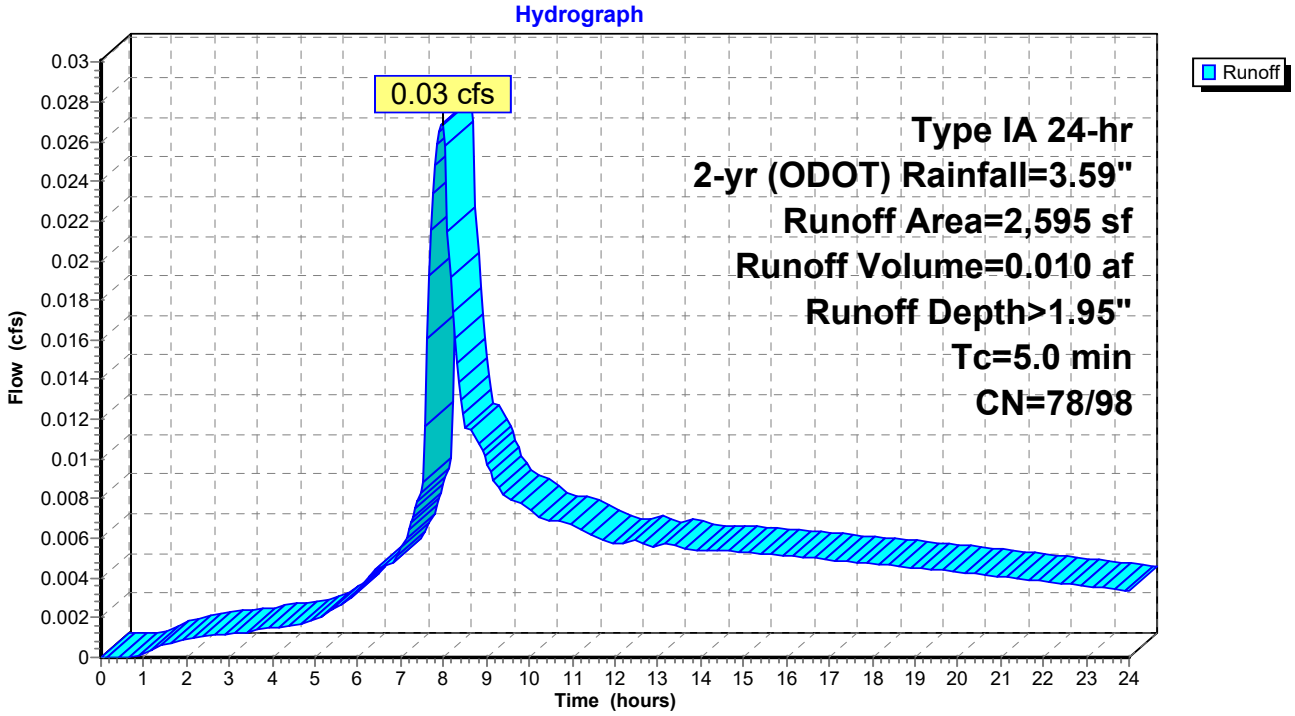
Runoff = 0.03 cfs @ 7.97 hrs, Volume= 0.010 af, Depth> 1.95"
Routed to Pond 5P : Grass areas

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr (ODOT) Rainfall=3.59"

	Area (sf)	CN	Description
*	570	98	Pavement
*	2,025	78	Pervious Ground
	2,595	82	Weighted Average
	2,025	78	78.03% Pervious Area
	570	98	21.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EX: EX1



Summary for Pond 5P: Grass areas

Inflow Area = 0.060 ac, 21.97% Impervious, Inflow Depth > 1.95" for 2-yr (ODOT) event
Inflow = 0.03 cfs @ 7.97 hrs, Volume= 0.010 af
Outflow = 0.02 cfs @ 8.07 hrs, Volume= 0.010 af, Atten= 13%, Lag= 5.9 min
Discarded = 0.02 cfs @ 8.07 hrs, Volume= 0.010 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 99.95' @ 8.07 hrs Surf.Area= 2,025 sf Storage= 5 cf

Plug-Flow detention time= 1.5 min calculated for 0.010 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (762.2 - 761.1)

Volume	Invert	Avail.Storage	Storage Description
#1	99.95'	202 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

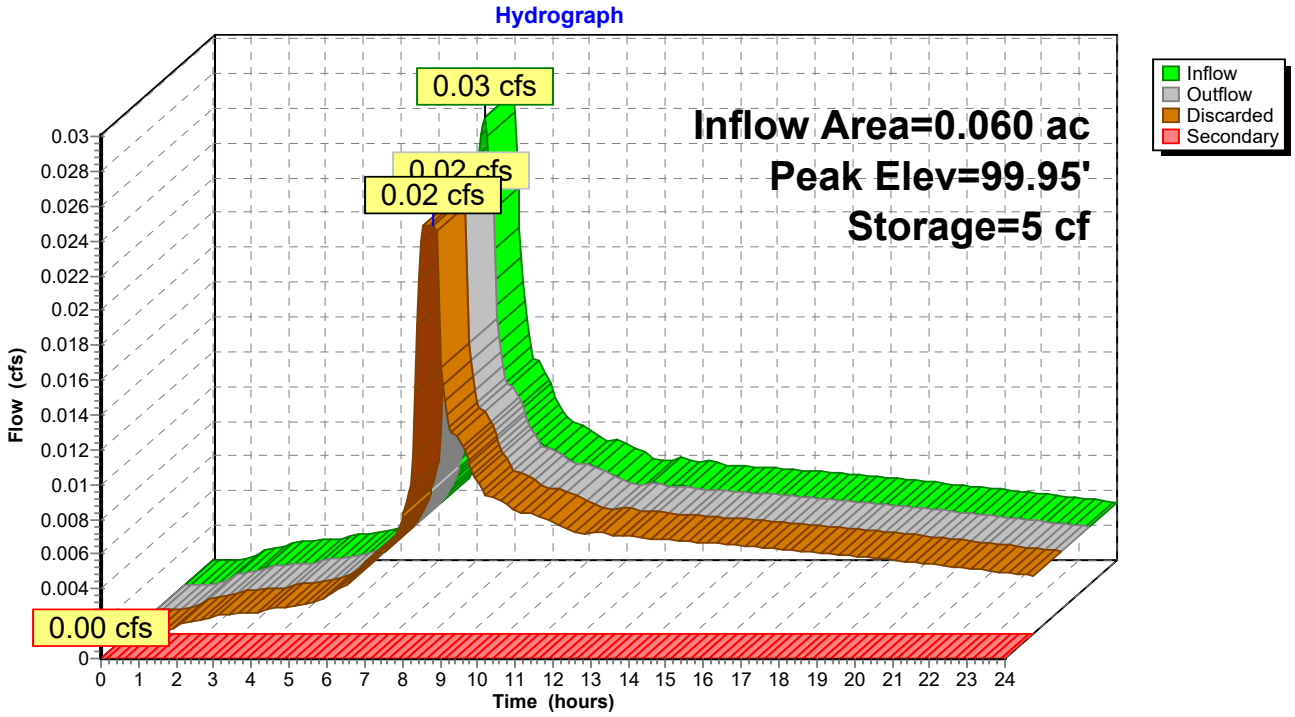
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.95	2,025	0	0
100.00	2,025	101	101
100.05	2,025	101	202

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.95'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 50.00'
#2	Secondary	100.00'	**75.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 8.07 hrs HW=99.95' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.95' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Grass areas



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

Subcatchment EX: EX1 Runoff Area=2,595 sf 21.97% Impervious Runoff Depth>2.69"
Tc=5.0 min CN=78/98 Runoff=0.04 cfs 0.013 af

Pond 5P: Grass areas Peak Elev=99.96' Storage=23 cf Inflow=0.04 cfs 0.013 af
Discarded=0.02 cfs 0.013 af Secondary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.013 af

Total Runoff Area = 0.060 ac Runoff Volume = 0.013 af Average Runoff Depth = 2.69"
78.03% Pervious = 0.046 ac 21.97% Impervious = 0.013 ac

Summary for Subcatchment EX: EX1

I-84 WB Highway no trail added, west of bridge

[49] Hint: Tc<2dt may require smaller dt

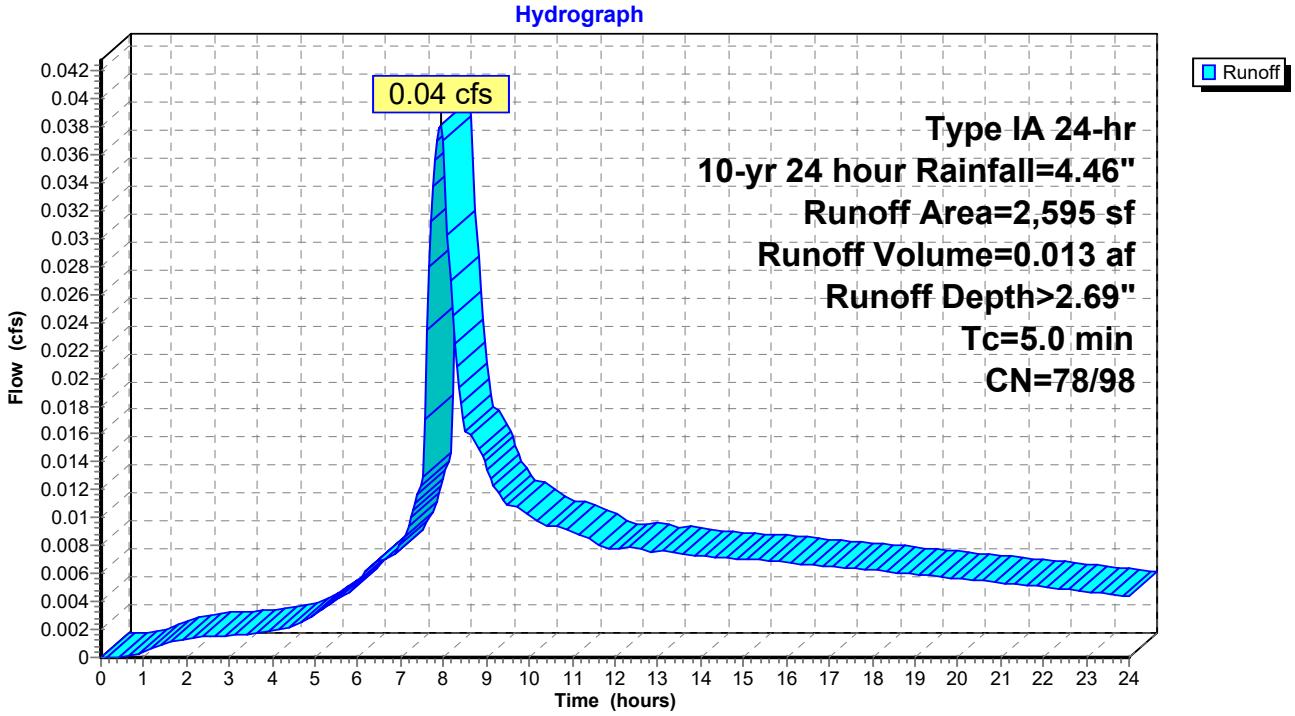
Runoff = 0.04 cfs @ 7.96 hrs, Volume= 0.013 af, Depth> 2.69"
Routed to Pond 5P : Grass areas

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr 24 hour Rainfall=4.46"

	Area (sf)	CN	Description
*	570	98	Pavement
*	2,025	78	Pervious Ground
	2,595	82	Weighted Average
	2,025	78	78.03% Pervious Area
	570	98	21.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EX: EX1



Summary for Pond 5P: Grass areas

Inflow Area = 0.060 ac, 21.97% Impervious, Inflow Depth > 2.69" for 10-yr 24 hour event
Inflow = 0.04 cfs @ 7.96 hrs, Volume= 0.013 af
Outflow = 0.02 cfs @ 8.23 hrs, Volume= 0.013 af, Atten= 39%, Lag= 16.0 min
Discarded = 0.02 cfs @ 8.23 hrs, Volume= 0.013 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 99.96' @ 8.23 hrs Surf.Area= 2,025 sf Storage= 23 cf

Plug-Flow detention time= 3.2 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 2.7 min (752.1 - 749.4)

Volume	Invert	Avail.Storage	Storage Description
#1	99.95'	202 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

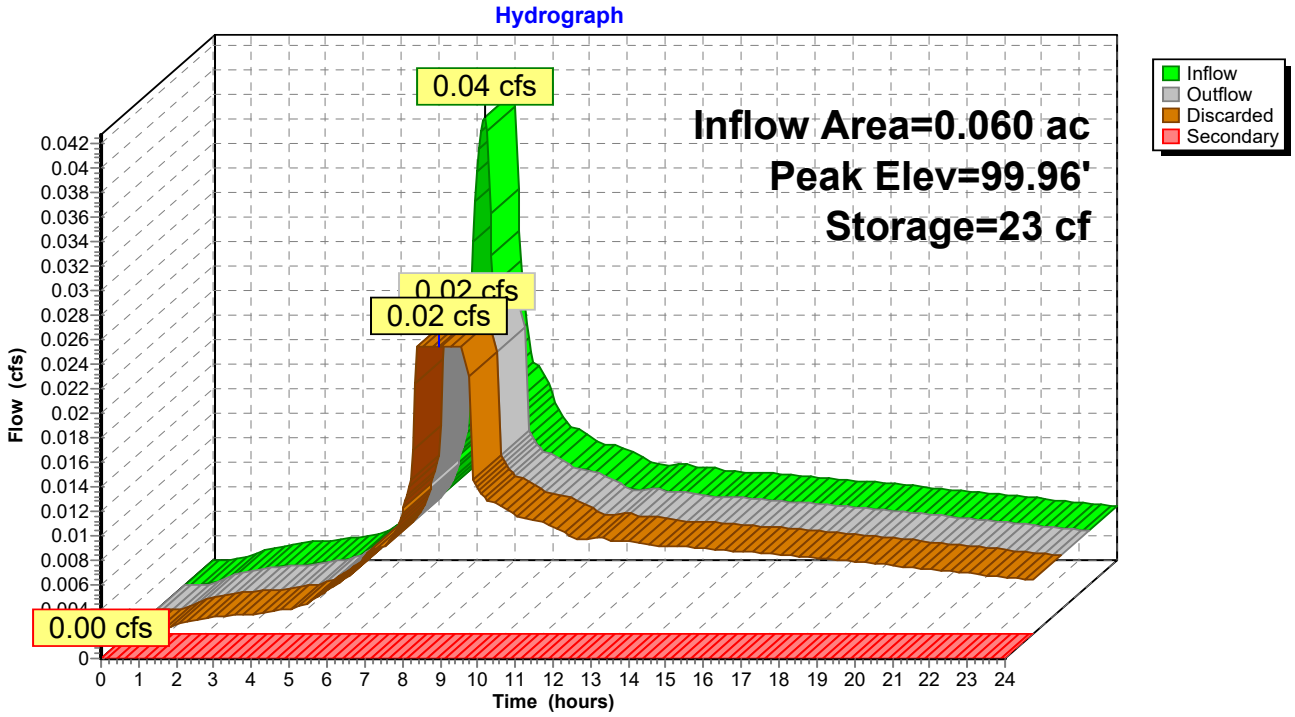
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.95	2,025	0	0
100.00	2,025	101	101
100.05	2,025	101	202

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.95'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 50.00'
#2	Secondary	100.00'	**75.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 8.23 hrs HW=99.96' (Free Discharge)
↑**1=Exfiltration** (Controls 0.02 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.95' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Grass areas



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

Subcatchment EX: EX1 Runoff Area=2,595 sf 21.97% Impervious Runoff Depth>3.58"
Tc=5.0 min CN=78/98 Runoff=0.05 cfs 0.018 af

Pond 5P: Grass areas Peak Elev=99.98' Storage=54 cf Inflow=0.05 cfs 0.018 af
Discarded=0.02 cfs 0.018 af Secondary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.018 af

Total Runoff Area = 0.060 ac Runoff Volume = 0.018 af Average Runoff Depth = 3.58"
78.03% Pervious = 0.046 ac 21.97% Impervious = 0.013 ac

Summary for Subcatchment EX: EX1

I-84 WB Highway no trail added, west of bridge

[49] Hint: Tc<2dt may require smaller dt

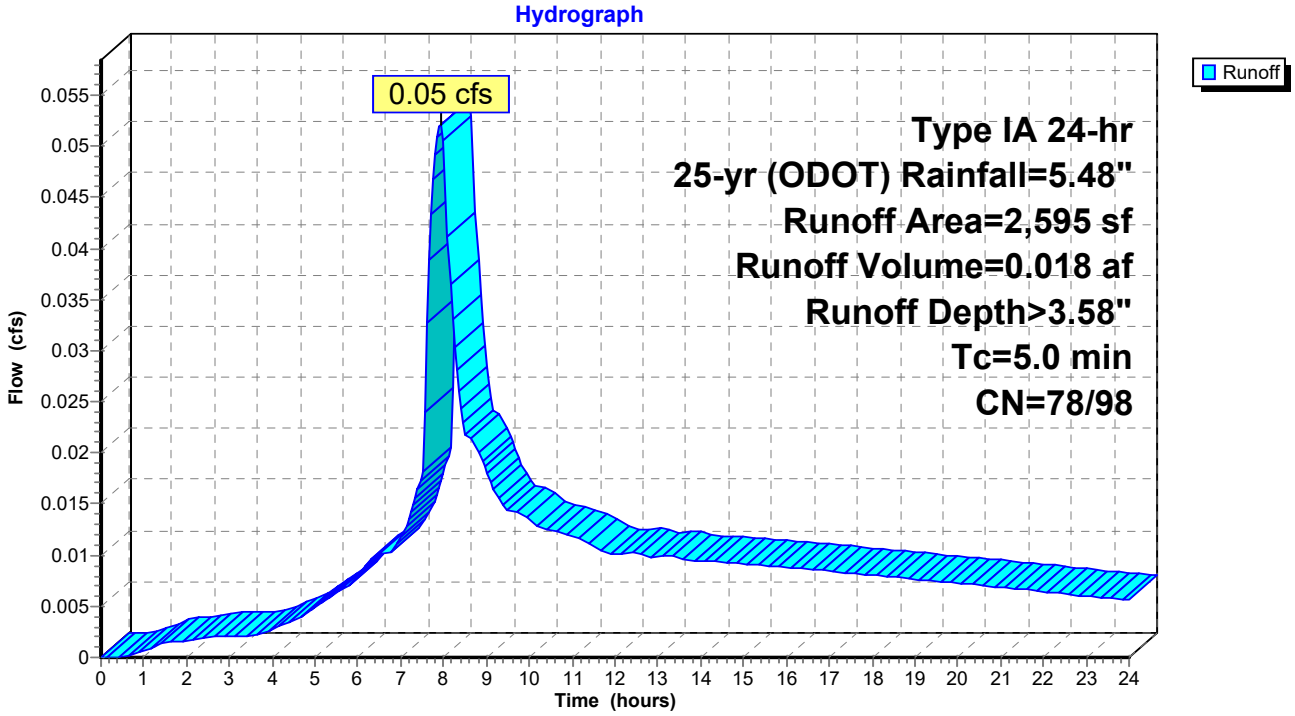
Runoff = 0.05 cfs @ 7.95 hrs, Volume= 0.018 af, Depth> 3.58"
Routed to Pond 5P : Grass areas

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-yr (ODOT) Rainfall=5.48"

	Area (sf)	CN	Description
*	570	98	Pavement
*	2,025	78	Pervious Ground
	2,595	82	Weighted Average
	2,025	78	78.03% Pervious Area
	570	98	21.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EX: EX1



Summary for Pond 5P: Grass areas

Inflow Area = 0.060 ac, 21.97% Impervious, Inflow Depth > 3.58" for 25-yr (ODOT) event
Inflow = 0.05 cfs @ 7.95 hrs, Volume= 0.018 af
Outflow = 0.02 cfs @ 8.43 hrs, Volume= 0.018 af, Atten= 55%, Lag= 29.1 min
Discarded = 0.02 cfs @ 8.43 hrs, Volume= 0.018 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 99.98' @ 8.43 hrs Surf.Area= 2,025 sf Storage= 54 cf

Plug-Flow detention time= 8.4 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 8.0 min (746.3 - 738.3)

Volume	Invert	Avail.Storage	Storage Description
#1	99.95'	202 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

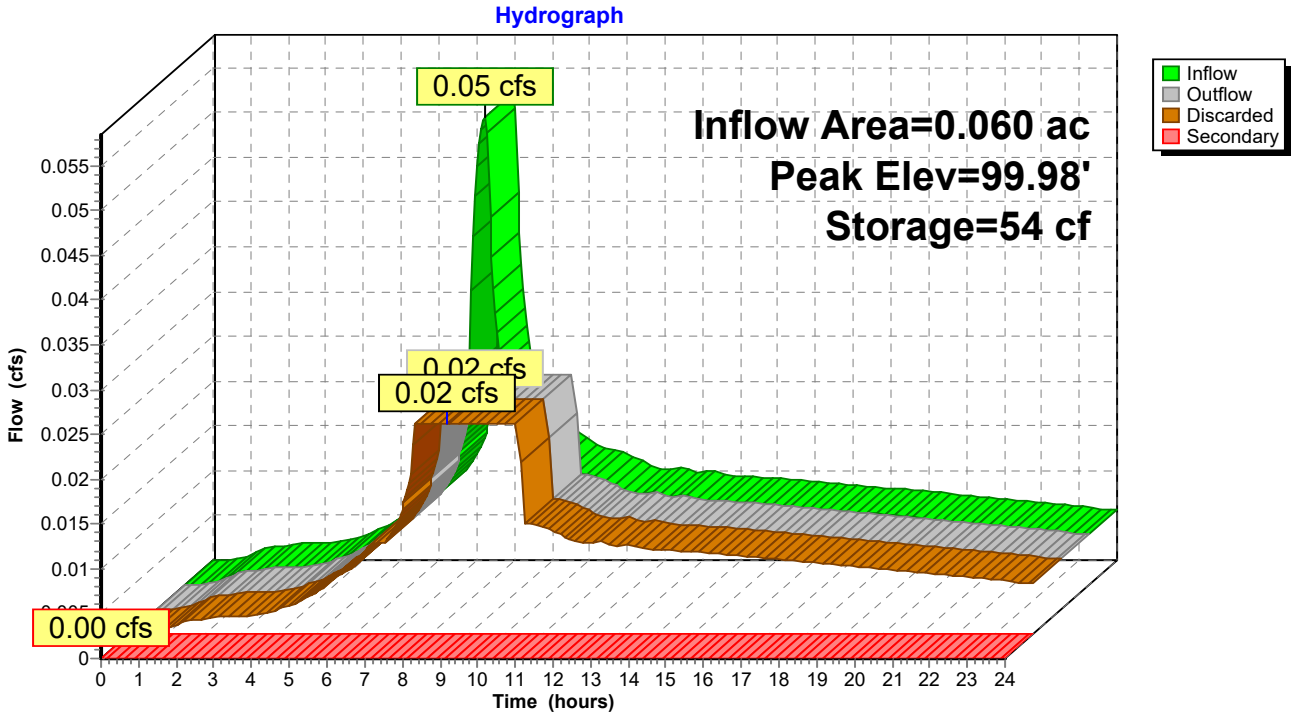
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.95	2,025	0	0
100.00	2,025	101	101
100.05	2,025	101	202

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.95'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 50.00'
#2	Secondary	100.00'	**75.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 8.43 hrs HW=99.98' (Free Discharge)
1=Exfiltration (Controls 0.02 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.95' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 5P: Grass areas



United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Multnomah County Area, Oregon

I-84 Multnomah Fall Kiosk

June 11, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

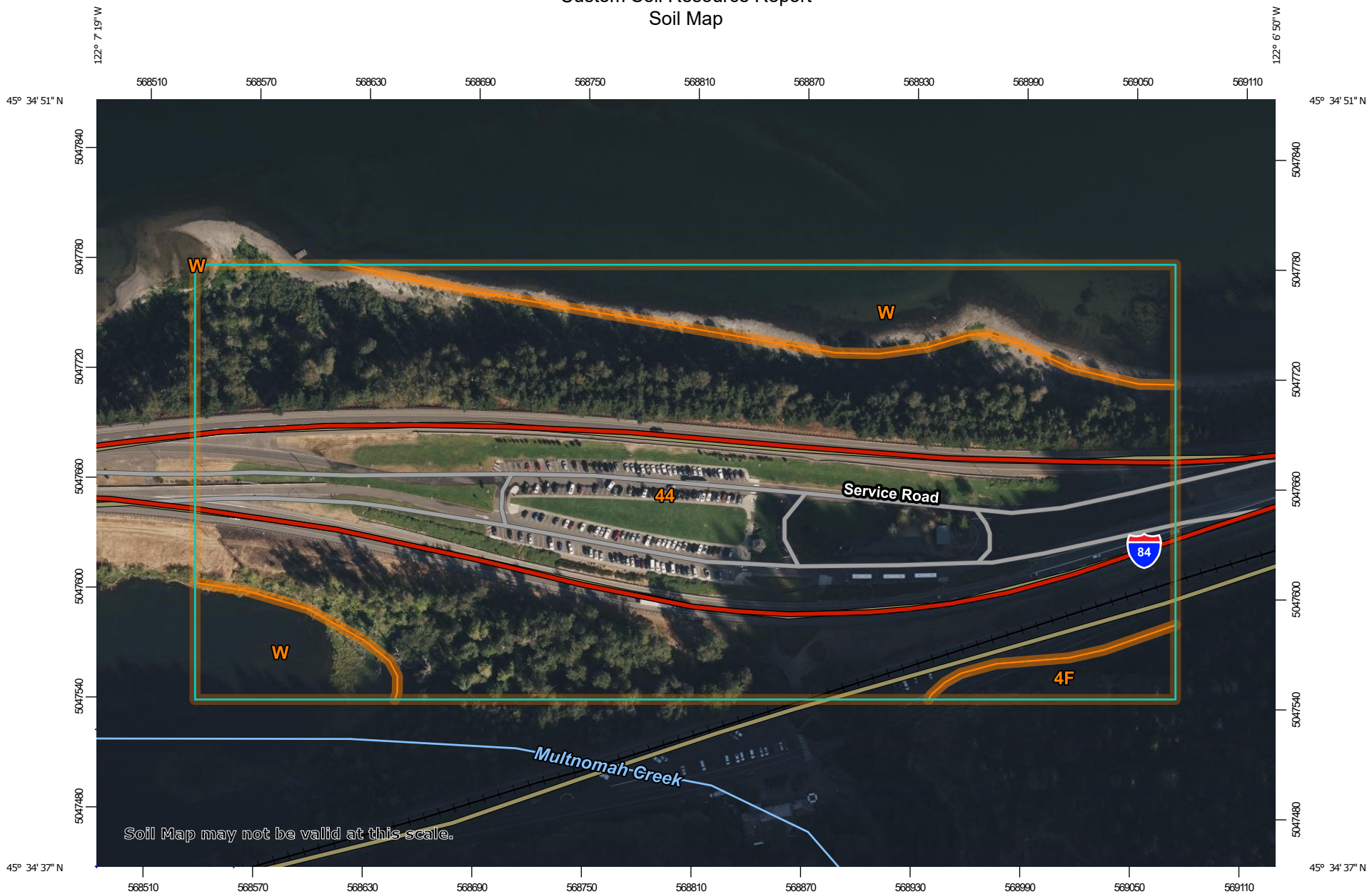
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,950 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 40 80 160 240

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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 1:20,000.

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: Multnomah County Area, Oregon
Survey Area Data: Version 23, Aug 28, 2024

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

Date(s) aerial images were photographed: Sep 26, 2022—Oct 11, 2022

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
4F	Aschoff-Rock outcrop-Wahkeena association, very steep	0.8	2.4%
44	Sauvie silt loam	25.5	80.8%
W	Water	5.3	16.8%
Totals for Area of Interest		**31.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Multnomah County Area, Oregon

4F—Aschoff-Rock outcrop-Wahkeena association, very steep

Map Unit Setting

National map unit symbol: 22bt
Elevation: 50 to 2,800 feet
Mean annual precipitation: 60 to 100 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 100 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Aschoff and similar soils: 50 percent
Rock outcrop: 25 percent
Wahkeena and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aschoff

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, concave
Across-slope shape: Convex, concave
Parent material: Colluvium derived from andesite and basalt mixed with volcanic ash

Typical profile

Oi - 0 to 3 inches: slightly decomposed plant material
Oa - 3 to 4 inches: highly decomposed plant material
H1 - 4 to 16 inches: cobbly loam
H2 - 16 to 64 inches: very cobbly loam

Properties and qualities

Slope: 60 to 90 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F003XC003OR - Glaciated Middle Cascades Mesic Udic Forest Group
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 60 to 90 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Wahkeena

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium derived from basalt and andesite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 6 inches: very cobbly clay loam
H2 - 6 to 61 inches: extremely cobbly clay loam

Properties and qualities

Slope: 60 to 90 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F003XC003OR - Glaciated Middle Cascades Mesic Udic Forest Group
Hydric soil rating: No

44—Sauvie silt loam

Map Unit Setting

National map unit symbol: 22bl
Elevation: 0 to 20 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Sauvie and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sauvie

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium with some mixing of volcanic ash

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 39 inches: silty clay loam
H3 - 39 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 2 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 (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D
Ecological site: R002XB001OR - Backswamp Group
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Sauvie, silty clay loam surface
Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Moag
Percent of map unit: 3 percent
Landform: Flood plains
Hydric soil rating: Yes

Rafton
Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

W—Water

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Multnomah County Area, Oregon														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
4F—Aschoff-Rock outcrop-Wahkeena association, very steep														
Aschoff	50	B	0-3	Slightly decomposed plant material	PT	A-8	0- 0- 0	0- 0- 0	100-100-100	100-100-100	60-75-100	50-65-90	—	—
			3-4	Highly decomposed plant material	PT	A-8	0- 0- 0	0- 0- 0	100-100-100	100-100-100	60-75-100	50-65-90	—	—
			4-16	Cobbly loam	GM, SM, ML	A-4	0- 0- 0	20-25-30	70-83-95	70-80-90	55-70-85	40-63-85	25-28-30	NP-3 -5
			16-64	Very cobbly loam, very cobbly silt loam, extremely cobbly silt loam, extremely cobbly loam	GM, SM, ML	A-2, A-4	0- 0- 0	30-45-60	45-60-75	40-55-70	35-53-70	25-45-65	25-30-35	NP-3 -5
Rock outcrop	25	D	0-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—
Wahkeena	15	A	0-1	Slightly decomposed plant material	PT	A-8	0- 0- 0	0- 0- 0	100-100-100	100-100-100	60-75-100	50-65-90	—	—
			1-6	Very cobbly clay loam, very cobbly loam	GM	A-7, A-2	0- 0- 0	30-38-45	55-60-65	45-53-60	40-48-55	30-40-50	40-45-50	10-13-15
			6-61	Extremely cobbly clay loam, extremely cobbly loam, very cobbly clay loam	GM	A-7, A-2	0- 0- 0	50-55-60	30-45-60	25-38-50	20-35-50	15-28-40	40-45-50	10-13-15

Engineering Properties–Multnomah County Area, Oregon														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
44—Sauvie silt loam														
Sauvie	90	C/D	0-15	Silt loam	ML	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	85-90-95	30-35-40	5-10-15
			15-39	Silty clay loam	ML	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	85-90-95	35-38-40	10-13-15
			39-60	Stratified sandy loam to silt loam, very fine sandy loam	SM, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	80-88-95	45-55-65	20-25-30	NP-3 -5

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Physical Soil Properties–Multnomah County Area, Oregon														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
4F—Aschoff-Rock outcrop-Wahkeena association, very steep														
Aschoff	0-3	-35-	-50-	0-15- 25	0.10-0.30	42.00-705.00	0.30-0.60	—	60.0-95.0			5	6	48
	3-4	-35-	-50-	0-15- 25	0.10-0.30	42.00-705.00	0.30-0.60	—	60.0-95.0					
	4-16	-46-	-46-	7- 9- 10	0.85-0.95	4.00-14.00	0.07-0.10	0.0-2.9	7.0-12.0	.24	.43			
	16-64	-43-	-43-	10-14- 18	0.85-0.95	4.00-14.00	0.07-0.10	0.0-2.9	0.2-7.0	.15	.43			
Rock outcrop	0-60	—	—	—	—	—	—	—	—					
Wahkeena	0-1	-35-	-50-	0-15- 25	0.10-0.30	42.00-705.00	0.30-0.60	—	60.0-95.0			5	8	0
	1-6	-34-	-37-	25-30- 35	1.20-1.40	14.00-42.00	0.10-0.14	0.0-2.9	5.0-12.0	.10	.20			
	6-61	-34-	-37-	25-30- 35	1.20-1.40	14.00-42.00	0.06-0.11	0.0-2.9	0.2-5.0	.05	.24			
44—Sauvie silt loam														
Sauvie	0-15	- 9-	-66-	15-25- 35	1.20-1.40	1.40-4.00	0.19-0.21	0.0-2.9	2.0-4.0	.43	.43	5	6	48
	15-39	- 7-	-62-	27-31- 35	1.20-1.40	1.40-4.00	0.19-0.21	3.0-5.9	1.0-2.0	.43	.43			
	39-60	-60-	-27-	7-14- 20	1.20-1.40	14.00-42.00	0.15-0.17	0.0-2.9	0.0-1.0	.49	.49			
W—Water														
Water	—	—	—	—	—	—	—	—	—					

References

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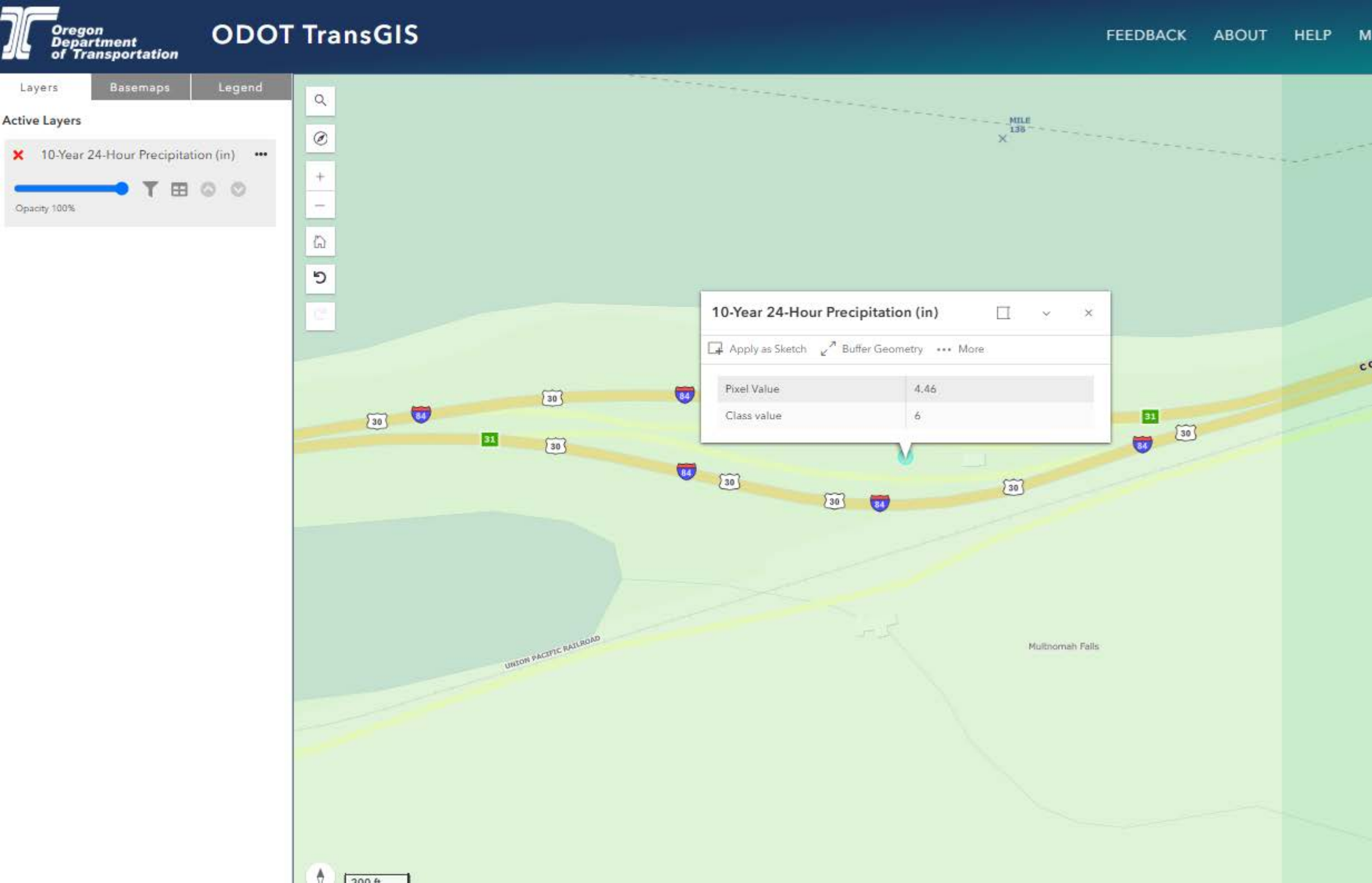
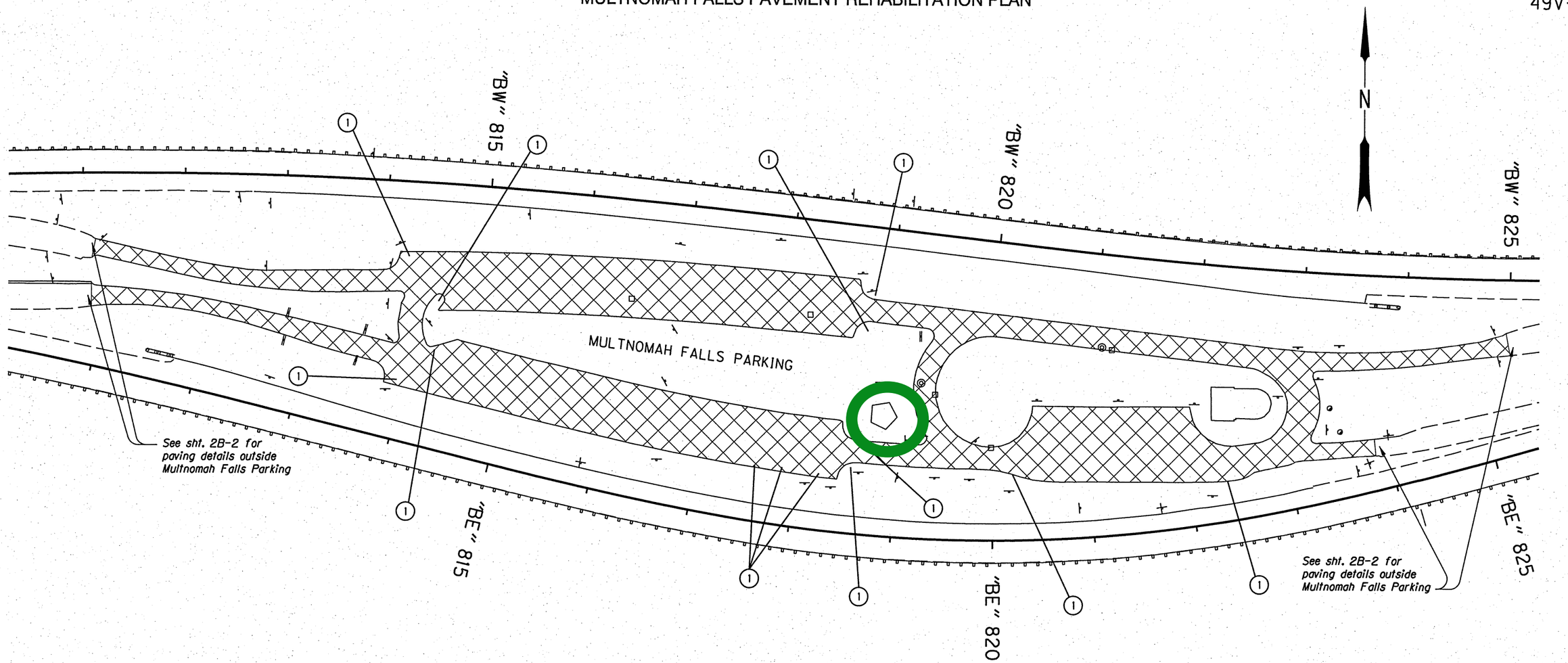

Oregon Department of Transportation
ODOT TransGIS
FEEDBACK
ABOUT
HELP
Layers
Basemaps
Legend
Active Layers
10-Year 24-Hour Precipitation (in)
Opacity 100%
10-Year 24-Hour Precipitation (in)
Apply as Sketch
Buffer Geometry
More
Pixel Value
4.46
Class value
6
MILE 138
UNION PACIFIC RAILROAD
Multnomah Falls

MULTNOMAH FALLS PAVEMENT REHABILITATION PLAN

49V-037



SCALE 1" = 100'

100 50 0 100

FEET

(1) *Retrofit conc. sidewalk ramps - 13*
Yellow truncated domes, cast-in-place
(See drg. nos. RD720 & RD759)

NOTE:
Detectable warnings shall be QPL-approved wet-set, rigid devices.

2" Cold Plane Pavement Removal (CPPR)
2" Level 4, 1/2" ACP Lime Treated Wearing Course (PG 70-22ER)
(Total area approx. 11,300 sq. yd.)

REGISTERED PROFESSIONAL ENGINEER
81254
OREGON
MARCH 11, 2008
CHRIS ANTHONY BORES
EXPIRES: 12-31-2017

OREGON DEPARTMENT OF TRANSPORTATION

REGION 1 - ROADWAY ENGINEERING SECTION

I-84: JORDAN ROAD - MULTNOMAH FALLS SEC.
COLUMBIA RIVER HIGHWAY
MULTNOMAH COUNTY

Design Team Leader - John Wolf
Designed By - Chris Bores
Drafted By - Carolyn Allen

DETAILS

SHEET NO. 2B-4

G:\18802_I-84_Jordan-Mult_Falls\2_Final\18802_PL_DT.dgn :: Default 1/20/2016 9:03:04 AM hwyr12y

T IN, R6E, W.M.
SEC. 7

N

COLUMBIA RIVER

MATCH LINE - SEE SHEET 33

MATCH LINE - SEE SHEET 35

ALTS. 2,7,12
ALT. 11
ALTS. 2,7,12
ALT. 11
ALT. 12
APPROX. LIMITS OF EXISTING ENCROACHMENT
ALTS. 2,7
ALT. 11
ALT. 12
SANITARY SEWER EMERGENCY OVERFLOW
ALT. 11
ALT. 12
APPROX. LIMITS OF EXISTING ENCROACHMENT
ALT. 11
ALT. 12
ALT. 12
ALT. 11

APPROX. PARK LIMITS

LOT 4

BENSON LAKE

DRAIN FIELDS

CASCADE UTILITIES TELEPHONE

APPROX. LOCATION 6" PVC WATER LINE FROM WELL TO LODGE AREA

DRAIN FIELDS

KIOSK

I.R.R. CONTROLS

ANNOMETER

18" CMP

R.R. R/W

RR. R/W

ALTS. 2,7

ALTS. 11, 12

WATER MH

ALTS. 7, 11, 12

ALT. 2

18" CMP OUTLET EL. 30

NEW WATER WELL

ALTS. 2,7,11

ALT. 7

UNDERGROUND RR POWER AND COMMUNICATIONS

ALTS. 7, 12

CASCADE LOCKS OVERHEAD POWER LINES

CREEK

MULTNOMAH

FLOW

ALTS. 2,7,11,12

ALT. 12

R.R. BRIDGE

13800 V 3ϕ

EXISTING ENCROACHMENT LINE (FROM AUGUST 1958 AS-BUILTS)

R.R. R/W

U.P.R.R. POWER AND COMMUNICATION

LODGE PARKING AREA

FOOT BRIDGE

BRIDGE

TEL. & ELEC. ON BRIDGE

UNDERGROUND TELEPHONE

LOT 3

LOT 2

13,800 VOLT 3ϕ

6"W

3"W

MH

SEPTIC TANK

100 KVA

UNITED TELEPHONE SYSTEM - BURIED TELEPHONE

CABLE UNDER GAS PRESSURE
AVERAGE CABLE DEPTH = 30"
BELOW ROADWAY SURFACES = 48"
RECORDS INDICATE A 2nd CABLE
BURIED BELOW 1st CABLE

MULTNOMAH FALLS LODGE

WATER STORAGE TANK THIS AREA

VIEW POINT

LOWER FALLS

FOOT BRIDGE

NOTES:

1. MAJOR FEATURES OF IRRIGATION SYSTEM FOR PARKING AREA SHOWN ONLY. SPRINKLER HEADS, FEEDER LINES AND CONTROL WIRES ARE NOT SHOWN.
2. UNDERGROUND UTILITIES ARE FROM AS-BUILTS UTILITY FIELD LOCATE IS REQUIRED TO ACCURATELY DETERMINE GROUND POSITION.

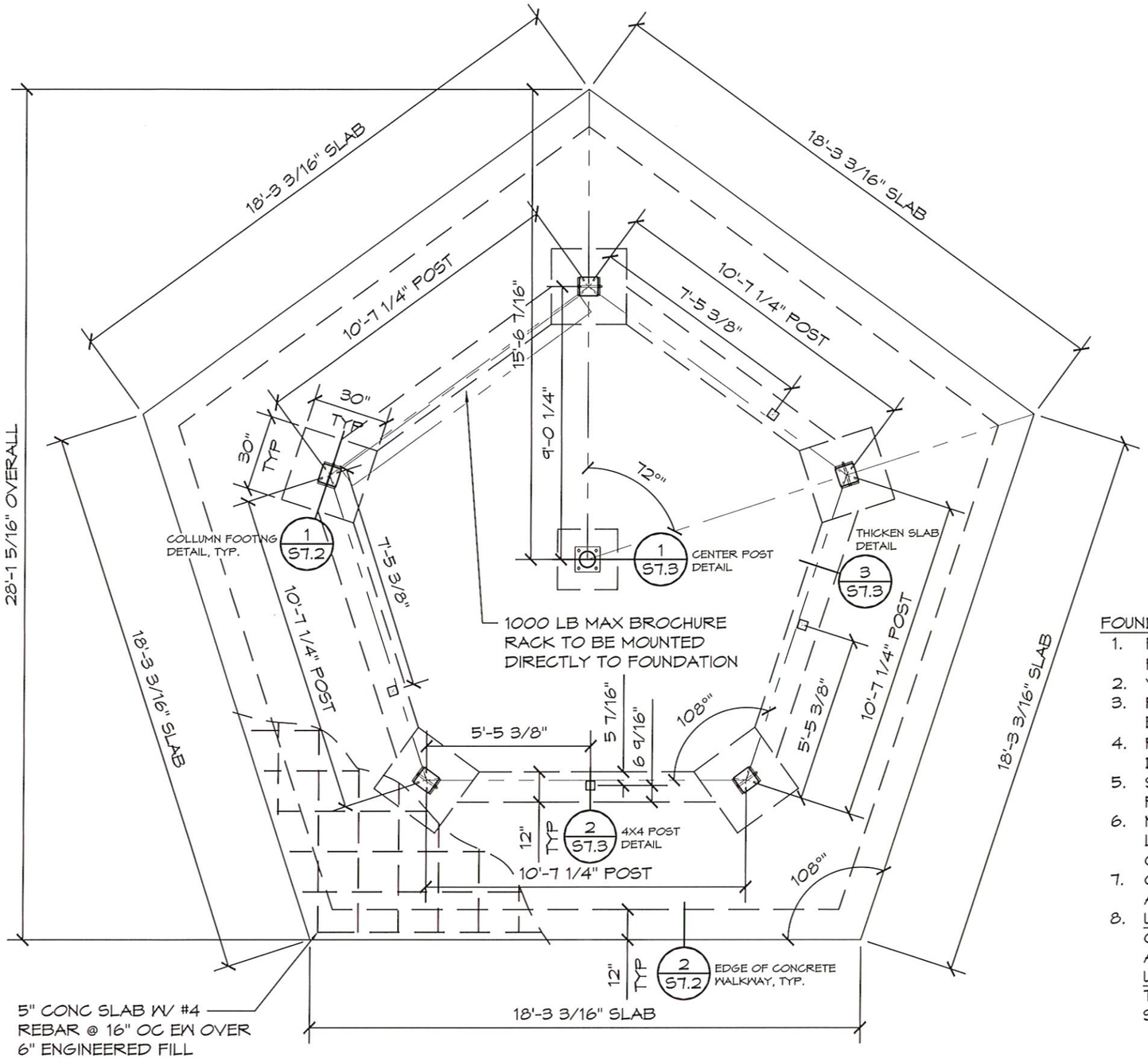
PRELIMINARY
DATE SEP 16 1988 - 1
FOR REVIEW ONLY

L & A LIN & ASSOCIATES CONSULTING ENGINEERS

NO.	DATE	REVISION	APPROVAL

OREGON DEPARTMENT OF TRANSPORTATION

DESIGNED BY R.N.P.	MULTNOMAH FALLS INTERCHANGE COLUMBIA RIVER HIGHWAY (I-84) MULTNOMAH COUNTY
DRAWN BY W.L. J.A.S. / K.B. M.L.	
CHECKED BY B.S.K.	RIGHT OF WAY, EXISTING UTILITIES & DRAINAGE STA. 161+00 TO 183+00
SCALE 1"=50'	
DATE 9/16/88	
SHEET NUMBER 34 OF 35	TAMS CONSULTANTS, INC. ENGINEERS AND PLANNERS 1220 S.W. MORRISON STREET SUITE 435 PORTLAND, OREGON 97205 (503) 221-0735



1 FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

RECYCLE

RECYCLE ALL USED SHIPPING MATERIALS AND LEFT OVER BUILDING MATERIALS

FOUNDATION NOTES:

1. FINISH FLOOR SLOPE IS 2% (1/4" PER FT) MAX & 1% (1/8" PER FT) MIN
2. VERIFY SIDEWALKS W/ OWNER
3. PROVIDE BLOCK-OUTS FOR PLUMBING, MECHANICAL, & ELECTRICAL AS REQD. CO-ORDINATE W/ SUBS.
4. REBAR MIN. BEND SHALL BE NOT LESS THAN 6db INSIDE DIA. AS PER ACI 318 SECTION 7.2
5. SAW JOINTS BY CONTRACTOR. SLAB APPEARANCE IS A PRIORITY. LOCATE JOINTS AT 10' O.C. MAX. SEE 3/S7.3.
6. MAXIMUM SLOPE OF EXCAVATION MAY BE LIMITED BY LOCAL SOIL CONDITIONS. INCREASE DEPTH OF FORMED CONCRETE AS REQD.
7. CONCRETE SLAB BENEATH FLOOR MOUNTED FIXTURES ARE TO BE GROUTED LEVEL AND SMOOTH.
8. UNDER FOOTINGS: UNDISTURBED NATIVE SOIL OR 12" FILL COMPACTED TO 90% ASTM D 1557 TO MEET OR EXCEED ALLOWABLE BEAR PRESSURE ON SHEET G2.
   UNDER SLAB: 6" FILL COMPACTED TO 90% ASTM D 1557 TO MEET OR EXCEED ALLOWABLE BEAR PRESSURE ON SHEET G2.

8/06/2024

REGISTERED PROFESSIONAL ENGINEER
87534PE
OREGON
FEB 07, 2014
RALPH M. HALL

EXPIRES: 6/30/2025

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Info@structure1.com

ROMTEC
18240 NORTH BANK ROAD
ROSEBURG, OR 97470
(541)-496-3541 FAX (541)-496-0803

PROJECT: GETTINGS CREEK REST AREA KIOSK
CRESWELL, OREGON

SHEET TITLE: FOUNDATION PLAN

PLAN SET# MFK01

DATE: 03/27/2024

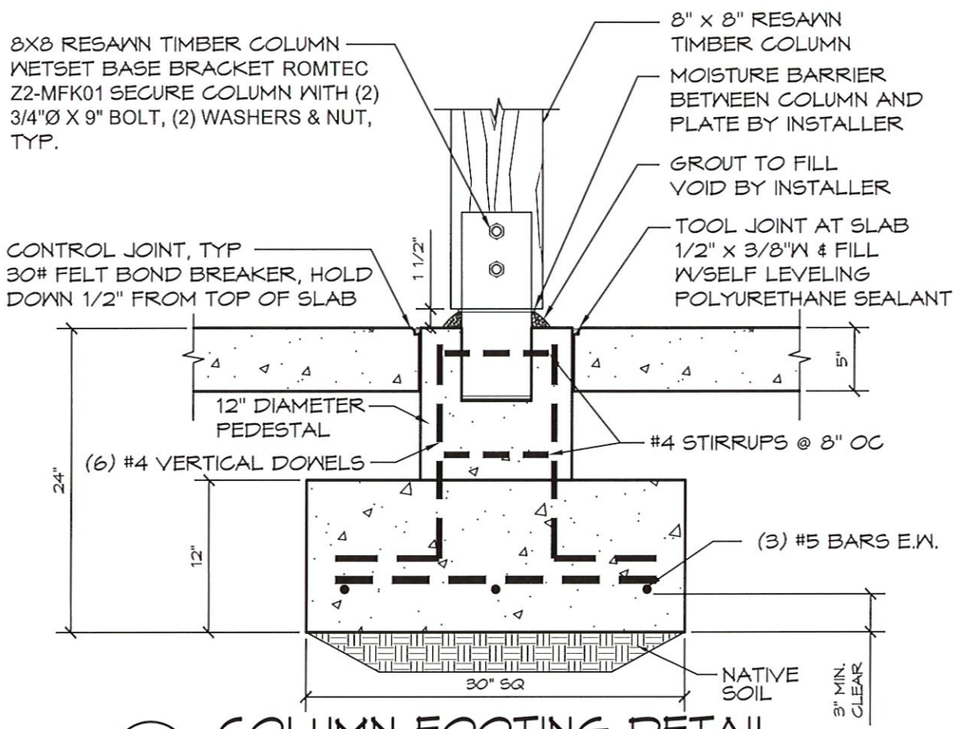
REVISIONS

REV.	DATE:	BY
2	02-12-2024	ZW
3	04-24-2024	ZW

DRAWN BY: ZW

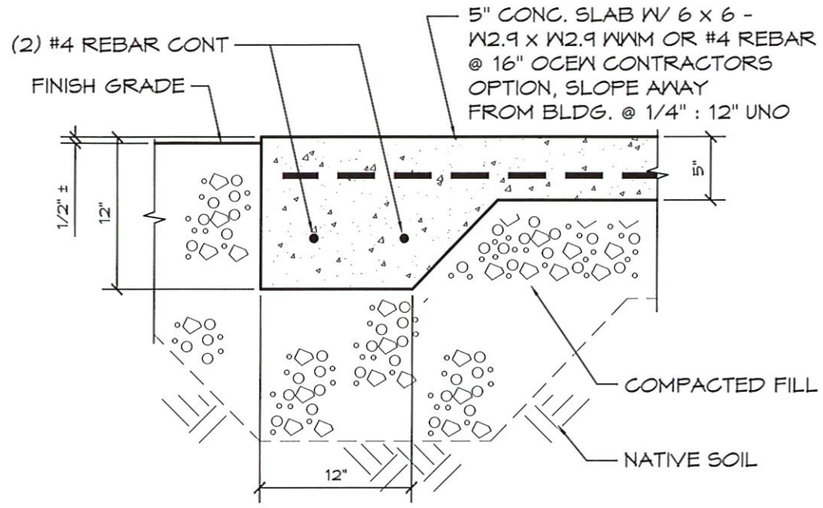
SHEET NO. S7.1

JOB CREATED: 8/6/2024 - LAST SAVED BY: zweiser ON 8/6/2024 - LAST PRINTED: 8/6/2024 - LOCATION: O:\Engineering RI\Plan Sets\MFK01-Gettings Creek Area Kiosk, OR\MFK01-Gettings Creek Resk Area Kiosk, OR 240802.dwg



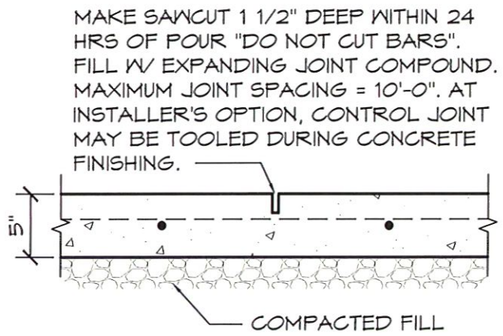
1 COLUMN FOOTING DETAIL

SCALE: 1" = 1'-0"



2 EDGE OF CONC. WALKWAY

SCALE: 1" = 1'-0"



3 SAWCUT JOINT

SCALE: 1" = 1'-0"

8/06/2024

REGISTERED PROFESSIONAL ENGINEER
87534PE
OREGON
FEB 07, 2014
RALPH M. HALL

EXPIRES: 6/30/2025

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ROMTEC 224-003

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PROJECT:
GETTINGS CREEK REST AREA KIOSK
CRESWELL, OREGON

SHEET TITLE: FOUNDATION DETAILS

PLAN SET# MFK01

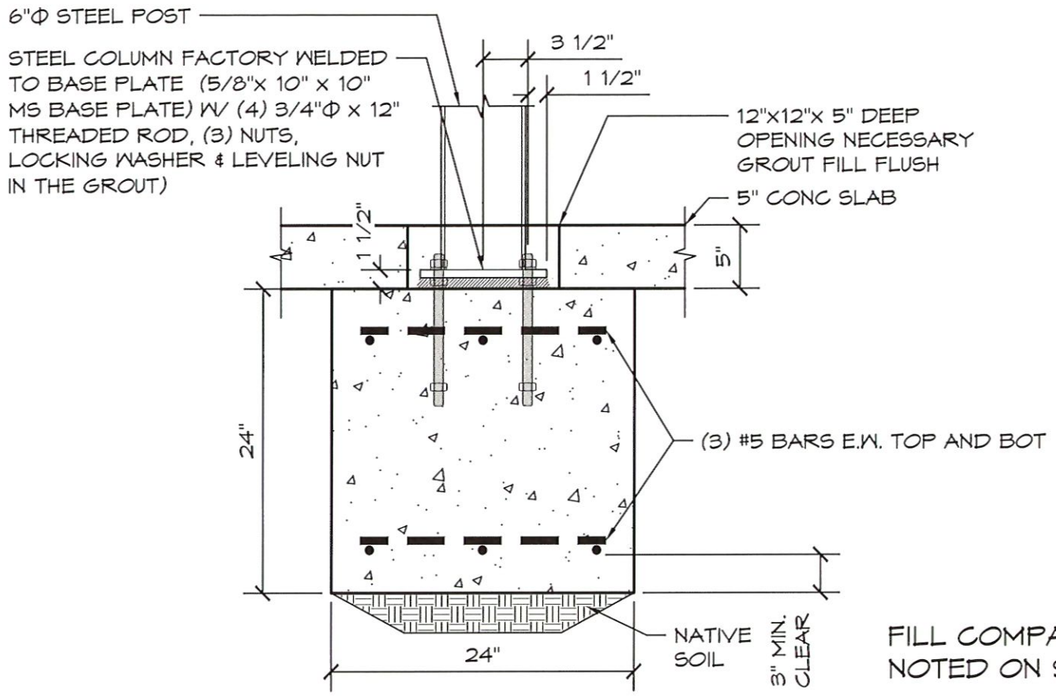
DATE: 03/27/2024

REVISIONS

REV.	DATE:	BY
1	01-12-2024	ZW

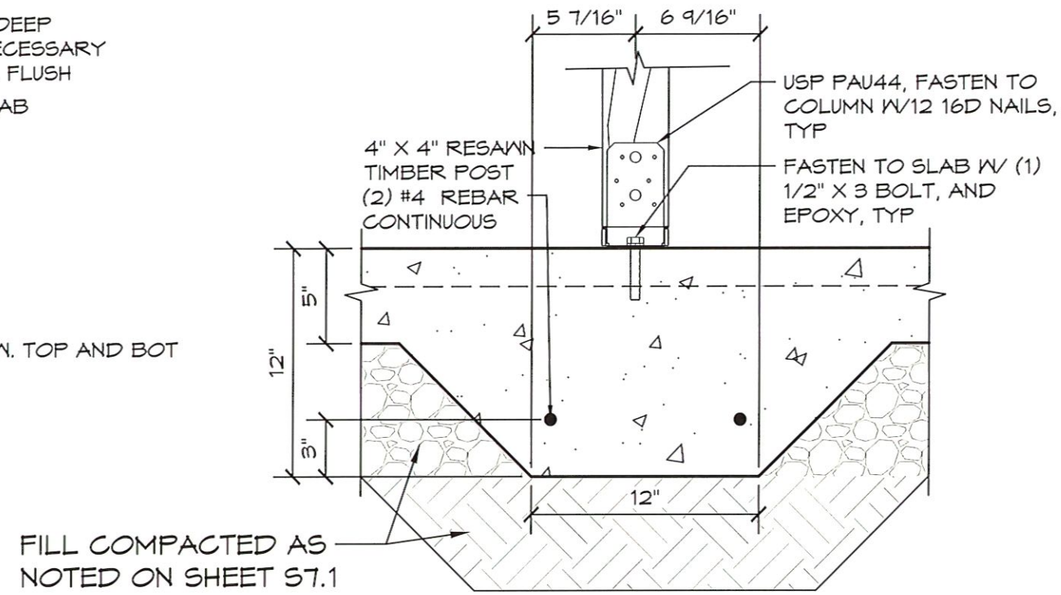
DRAWN BY: ZW

SHEET NO.
S7.2



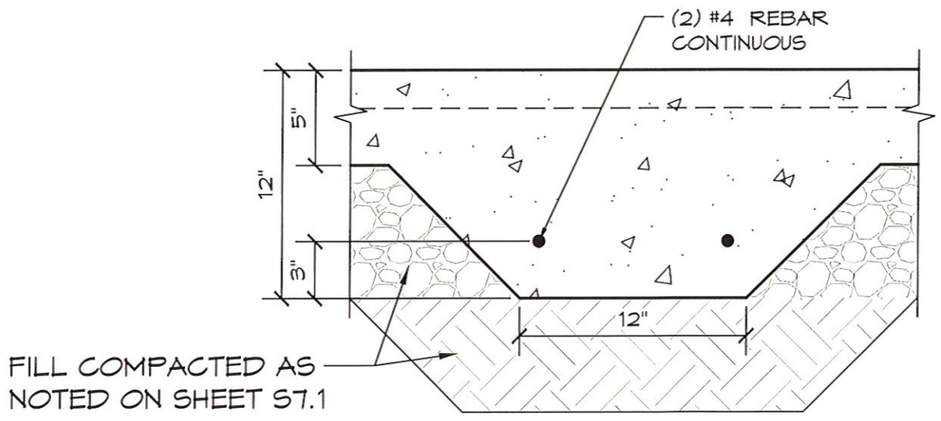
1 CENTER POST FOOTING DETAIL

SCALE: 1" = 1'-0"



2 4X4 POST FOOTING DETAIL

SCALE: 1 1/2" = 1'-0"



3 THICKEN SLAB DETAIL

SCALE: 1 1/2" = 1'-0"

8/06/2024

REGISTERED PROFESSIONAL ENGINEER
87534PE
OREGON
FEB 07, 2014
RALPH M. HALL

EXPIRES: 6/30/2025

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PROJECT: GETTINGS CREEK REST AREA KIOSK
CRESWELL, OREGON

SHEET TITLE: FOUNDATION DETAILS

PLAN SET# MFK01

DATE: 03/27/2024

REVISIONS

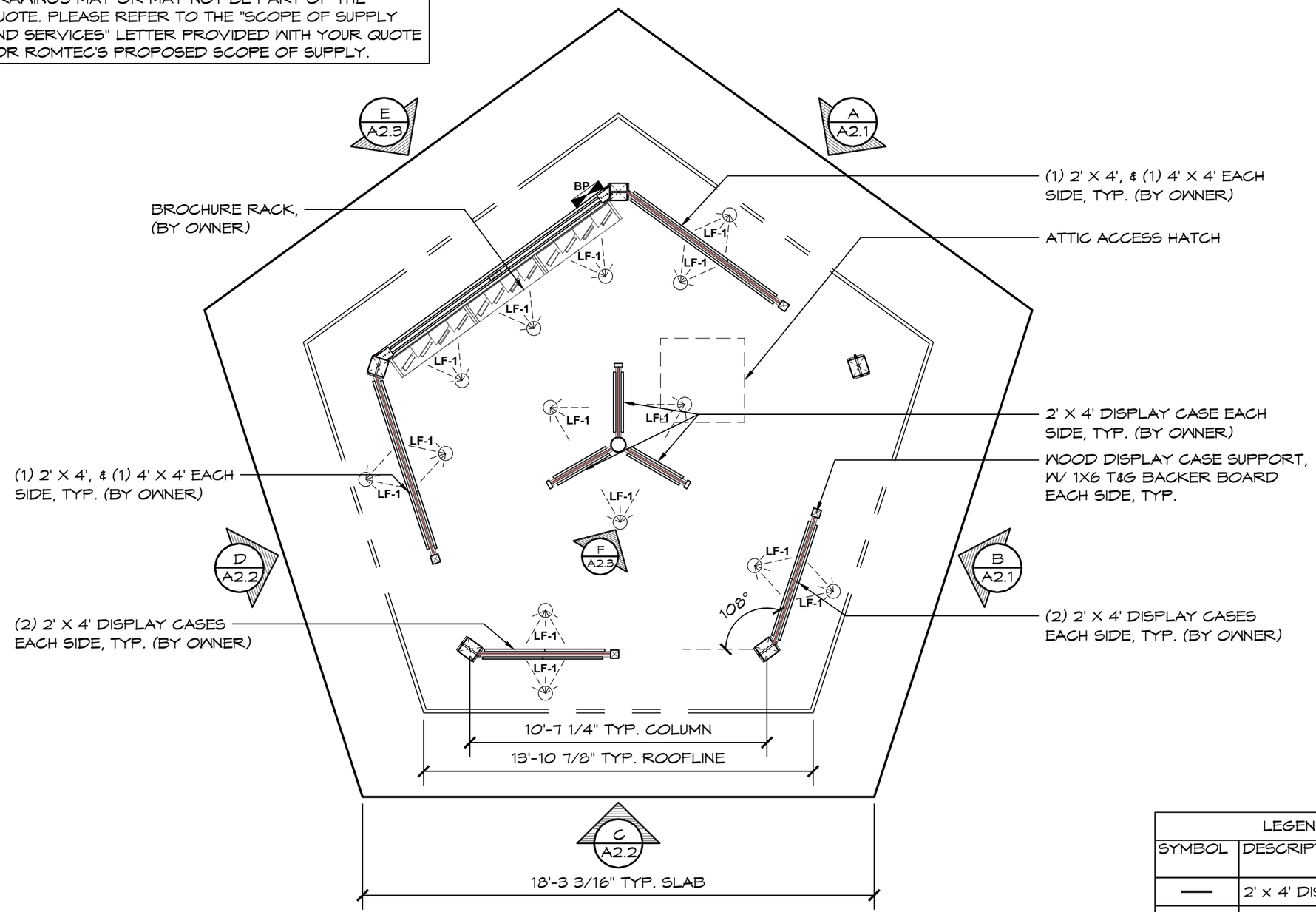
REV.	DATE:	BY
3	04-29-2024	ZW

DRAWN BY: ZW

SHEET NO. S7.3

THESE PLAN VIEW AND ELEVATION DRAWINGS ARE A PRELIMINARY ARCHITECTURAL REPRESENTATION OF THE BUILDING. ALL DIMENSIONS, FEATURES AND COMPONENTS SHOWN ON THESE PRELIMINARY DRAWINGS MAY OR MAY NOT BE PART OF THE QUOTE. PLEASE REFER TO THE "SCOPE OF SUPPLY AND SERVICES" LETTER PROVIDED WITH YOUR QUOTE FOR ROMTEC'S PROPOSED SCOPE OF SUPPLY.

NOT FOR CONSTRUCTION



LEGEND- BY OWNER		
SYMBOL	DESCRIPTION	AREA/ QUANTITY
——	2' x 4' DISPLAY CASE	18
——	4' x 4' DISPLAY CASE	4
▬▬	BROCHURE RACK	1

1 FLOOR PLAN

SCALE: 1/4" = 1'-0"

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PROJECT:
MULTNOMAH FALLS KIOSK
CASCADE LOCKS, OREGON

SHEET TITLE: FLOOR PLAN

PLAN SET# MFK01

DATE: 03/27/2024

REVISIONS

REV.	DATE:	BY

DRAWN BY: ZW

SHEET NO. A1.1

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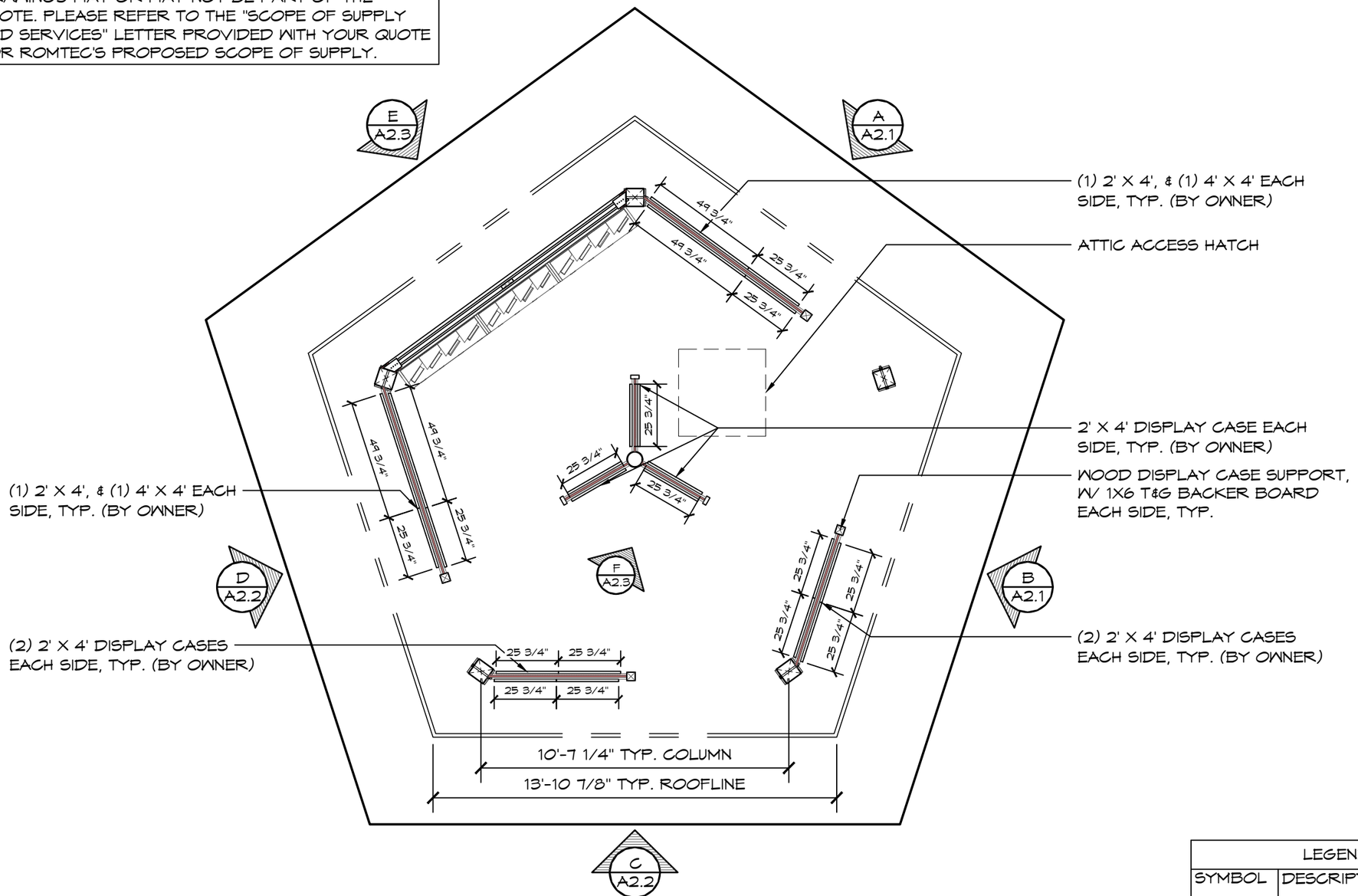

LEGEND- BY OWNER		
SYMBOL	DESCRIPTION	AREA/ QUANTITY
	2' x 4' DISPLAY CASE	18
	4' x 4' DISPLAY CASE	4
	BROCHURE RACK	1

1 DISPLAY CASE DIMENSIONS

SCALE: 1/4" = 1'-0"

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PROJECT:
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CASCADE LOCKS, OREGON

SHEET TITLE: DISPLAY CASE DIMENSIONS

PLAN SET# MFK01

DATE: 03/27/2024

REVISIONS

REV.	DATE:	BY

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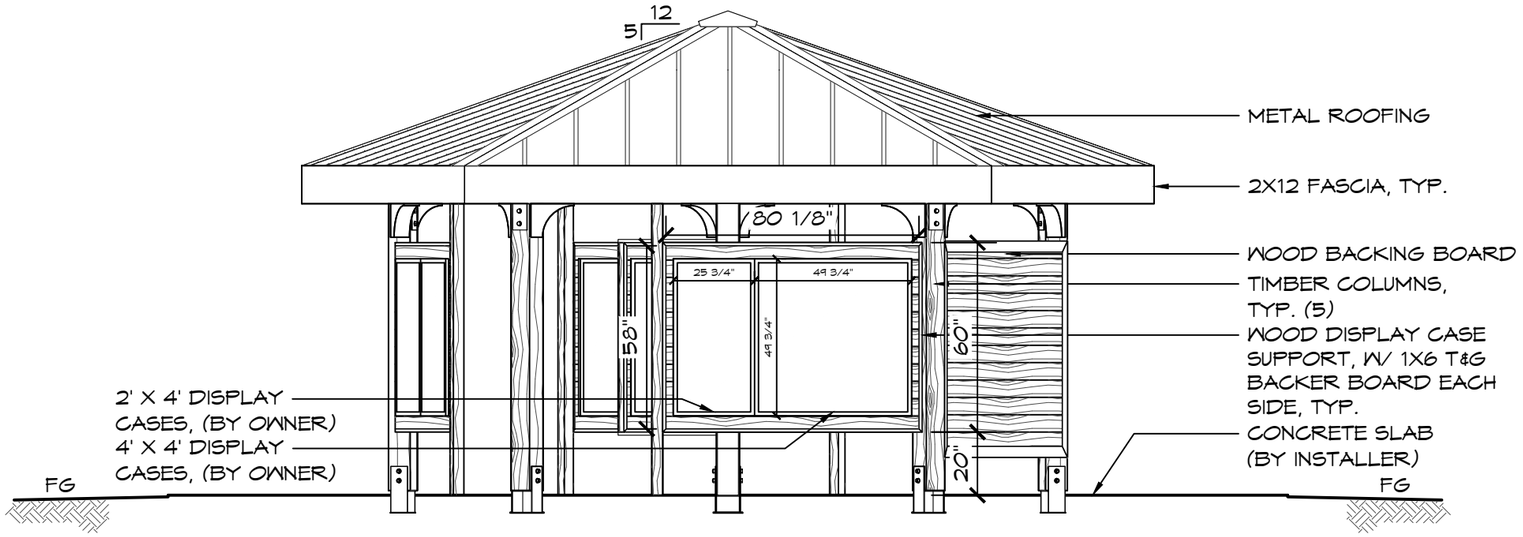
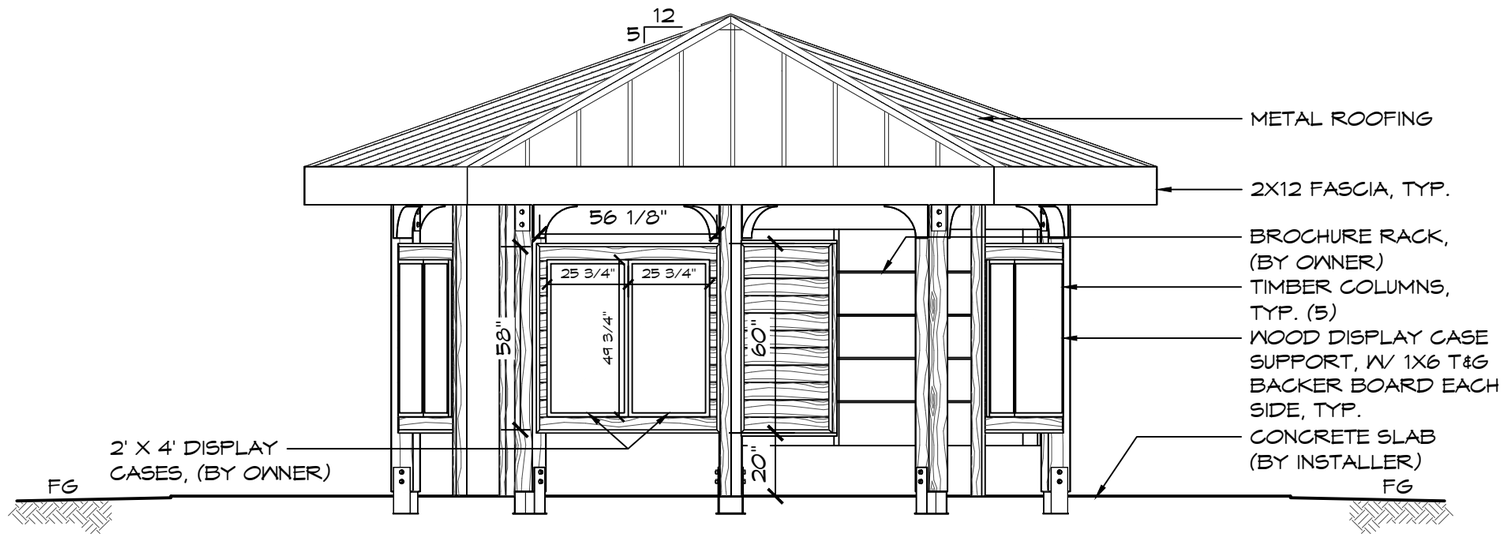
SHEET NO. A1.1



A ELEVATION VIEW

SCALE: 1/4" = 1'-0"



B ELEVATION VIEW

SCALE: 1/4" = 1'-0"

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PROJECT:
MULTNOMAH FALLS KIOSK
CASCADE LOCKS, OREGON

SHEET TITLE: EXTERIOR ELEVATION VIEWS

PLAN SET# MFK01

DATE: 03/27/2024

REVISIONS

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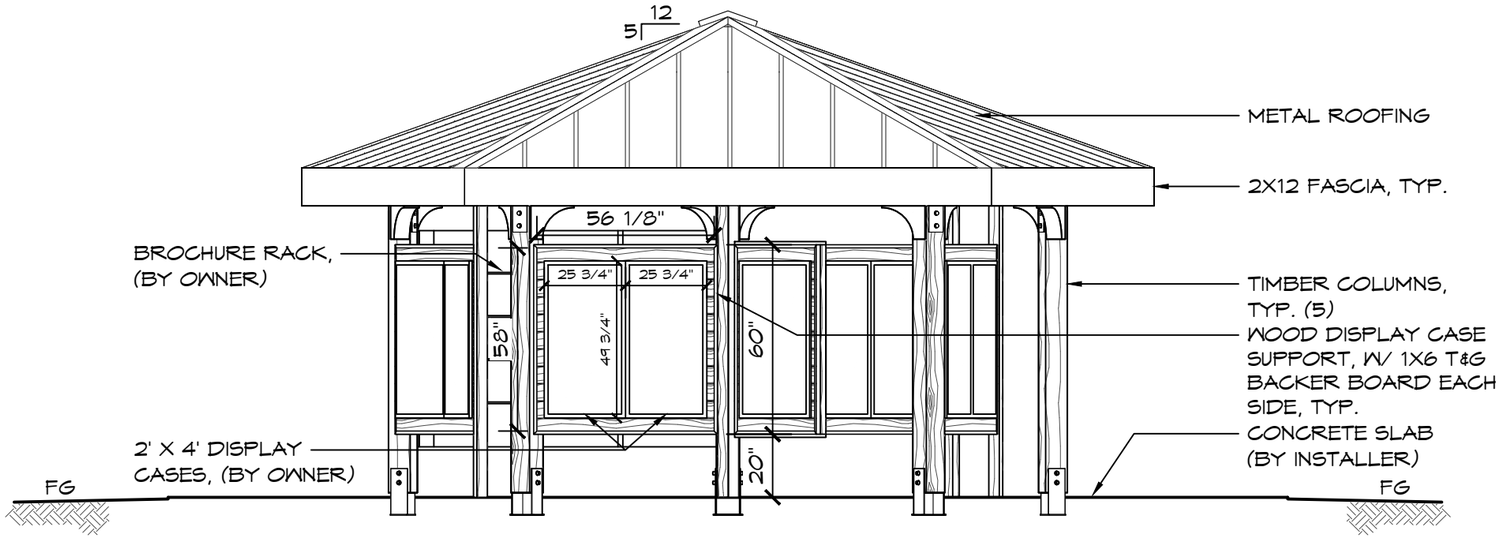
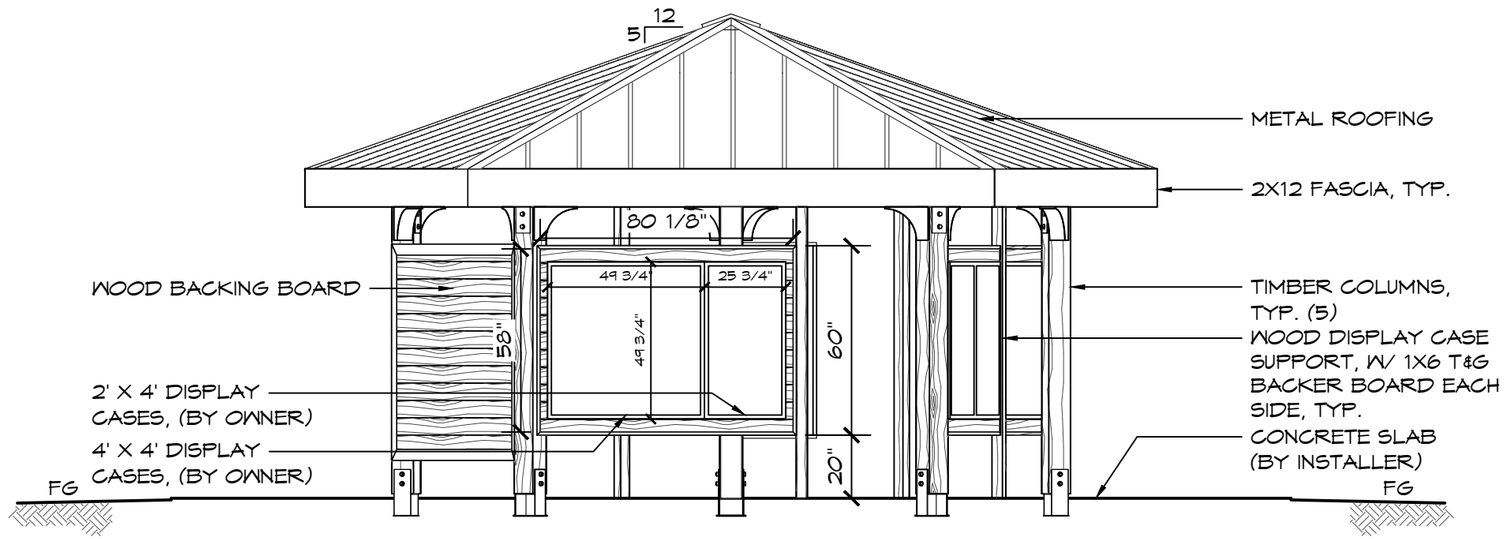


C ELEVATION VIEW

SCALE: 1/4" = 1'-0"



D ELEVATION VIEW

SCALE: 1/4" = 1'-0"

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PROJECT:
MULTNOMAH FALLS KIOSK
CASCADE LOCKS, OREGON

SHEET TITLE: EXTERIOR ELEVATION VIEWS

PLAN SET# MFK01

DATE: 03/27/2024

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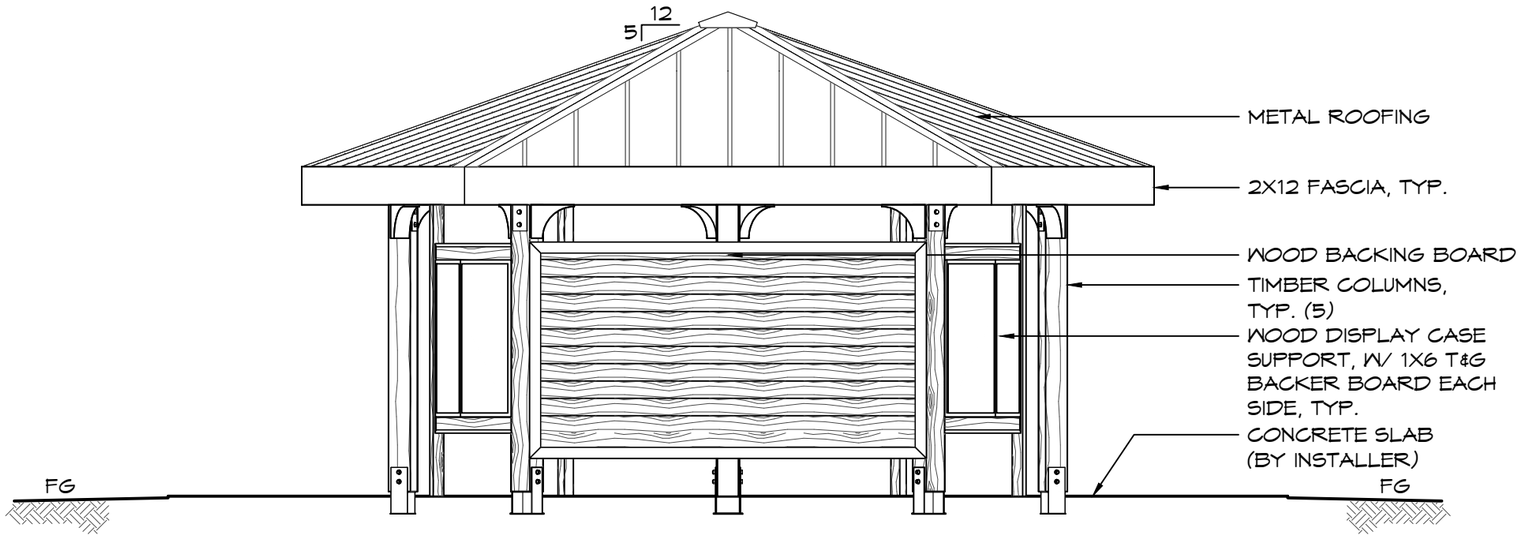
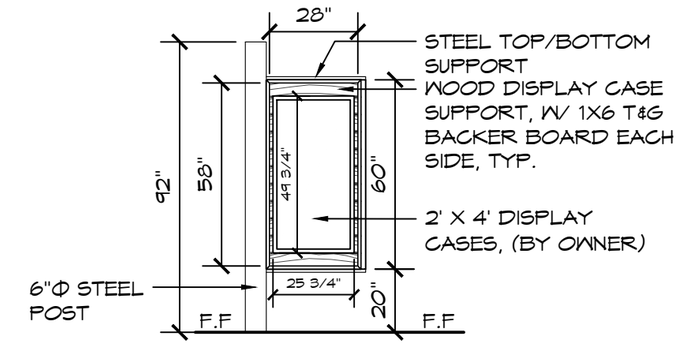
SHEET NO. A2.2



E ELEVATION VIEW

SCALE: 1/4" = 1'-0"



F CENTER POST SIGN DETAIL

SCALE: 1/4" = 1'-0"

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CASCADE LOCKS, OREGON

SHEET TITLE: EXTERIOR ELEVATION VIEWS

PLAN SET# MFK01

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