

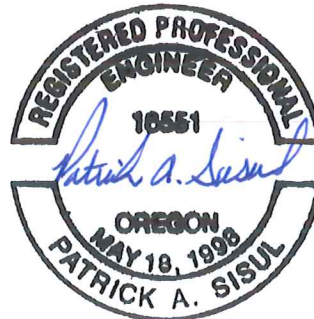
## VII. Storm Drainage Report

# *Territorial Rd. Multi-family*

J.O. SGL 16-087

November 22, 2021

## **PRELIMINARY STORM DRAINAGE REPORT**



EXPIRATION DATE: 6/30/2022

SIGNED: 11/22/2021

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**Territorial Rd. Multi-family Site:**

**THE SITE:** The Territorial Rd. Multi-family Site is in northeast Canby adjacent to and south of NE Territorial Road between NE Laurelwood Circle and NE Manzanita Street. The project will consist of 8 apartment units in two buildings of 4 units each, and will have associated parking areas, sidewalks, and driveways. NE Territorial Road along the project frontage is already improved to its full width, and has the concrete curb, planter strip, and sidewalk required for urban roadways. The grade of the site is a gentle fall from south to north toward Territorial Rd. Territorial Road falls at an approximate slope of 0.9 percent from west to east along the frontage of the site. The overall site area is 0.52 acres.

**PUBLIC STORM DRAINAGE SYSTEM:** Most of Canby is not served by a conveyance pipe storm drain system that carries runoff to a stream or river. This site is to drain to an onsite stormwater system. Territorial Road drains to an existing public storm drain system in Territorial Road.

**ONSITE STORM WATER DESIGN:** The onsite storm drain system for the project will be a private system of inlets, pipes, an LID rain garden, and a drywell. Groundwater underneath the site has been mapped at a depth of approximately 52 feet by the City of Canby Stormwater Master Plan Groundwater Protectiveness Demonstration. That depth is adequate to install underground drywell UIC's.

**DESIGN STORM:** The table in Section 4.301.a of the City of Canby Public Works Design Standards (June 2012) identifies that UIC facilities shall be designed using a design storm having a minimum recurrence interval of 10 years. The table also identifies that the following facilities shall be designed using a design storm having the following recurrence intervals:

LID facilities for infiltration systems	10 years
Minor: Streets, curbs, gutters, inlets, catch basin & connector drains	10 years
Major: Laterals (collectors) <250 tributary acres	10 years

1973 NOAA Atlas 2, Volume X and U.S. Department of Agriculture Isohyets for 24-hour storms in Oregon identify the 10-year, 24-hour storm event for Canby as having less than 3.5 inches of precipitation. The Regional Precipitation-Frequency Analysis and Spatial Mapping of 24-Hour Precipitation for Oregon performed for the Oregon Department of Transportation Research Unit (Final Report dated January, 2008) identifies a 10-year storm for this area as having 24-hour precipitation totaling 3.0-3.5 inches. We will use a 100-year storm with total rainfall of 4.5 inches for our analysis.

The Master Plan also states that, "The disposal capacity of dry wells must be based upon the percolation rate of the native soils at the disposal levels. Typically, this capacity is adequate for disposal of as much as one to two acres of impermeable area with the infiltration rates found in the Canby area, although this varies greatly with the underlying soil material encountered.

**SOIL:** Per the Web Soil Survey, prepared by the USDA Natural Resource Conservation Service, the soil underlying the Territorial Rd. Multi-family site consist of 100% 12A Canderly sandy loam, hydrologic soil group "A". Much of the City of Canby is underlain by Canderly sandy loam material, including about 60 percent of the city limits north of Highway 99E. These soils are typically appropriate for disposal by drywell. Surrounding streets and subdivisions uses drywells for stormwater disposal.

**DRYWELL INFILTRATION RATE:** An onsite geotechnical study has not been performed. Nearby geotechnical testing on drywells within 1500 feet of this site showed drywell infiltration rates ranging from 300 to 720 inches per hour.

For the purposes of this report, drywell capacity will be based 50% of the minimum rate found on nearby drywells, for a factor of safety of 2. 300 inches per hour x 50% = 150 inches per hour. The top 10 feet of the drywell will be assumed to be less porous than the deeper soils and therefore the top 10 feet of the drywell will be assumed to add no additional flow capacity.

**CALCULATION OF STORMWATER FLOWS:** Stormwater flow from the completed site will be calculated using the Santa Barbara Urban Hydrograph (SBUH) method using a Type 1A SCS storm.

**RUNOFF CURVE NUMBERS:** The site is Type A soils. CN numbers for the site are identified below:

Paved streets, Sidewalks, Driveway	CN = 98
Landscaping areas (assume fair condition landscaping)	
Type A soils = 77	CN = 77

**CONTRIBUTING DEVELOPMENT AREA:** Contributing site area for the development is as follows:

	Area	CN
Roofs	5,059 square feet	98
Paving & sidewalks	8,344 square feet	98
<u>Landscaping (fair condition)</u>	<u>9,275 square feet</u>	<u>77</u>
Total	22,678 square feet	
Pervious Area/CN	9,275 sf (0.21 Ac)	77
Impervious Area/CN	13,403 sf (0.31 Ac)	98

**TIME OF CONCENTRATION:** Time of concentration will be a combination of sheet flow, shallow concentrated flow and pipe flow. The time of concentration is from the hydraulically most distance point in the drainage basin. Following development, sheet flow distances will be minimal. We will assume the minimum time of concentration of 5.0 minutes.

Time of Concentration = 5.0 minutes

**KING COUNTY SBUH COMPUTATIONS FOR 100-YEAR, 24-HOUR STORM: OVERALL SITE**

SBUH/SCS METHOD FOR COMPUTING RUNOFF HYDROGRAPH

STORM OPTIONS:

- 1 - S.C.S. TYPE-1A
- 2 - 7-DAY DESIGN STORM
- 3 - STORM DATA FILE

SPECIFY STORM OPTION: 1

S.C.S. TYPE-1A RAINFALL DISTRIBUTION

ENTER: FREQ(YEAR), DURATION(HOUR), PRECIP(INCHES)  
 100,24,4.5

-----  
 \*\*\*\*\* S.C.S. TYPE-1A DISTRIBUTION \*\*\*\*\*  
 \*\*\*\*\* 100-YEAR 24-HOUR STORM \*\*\*\* 4.50" TOTAL PRECIP. \*\*\*\*\*  
 -----

ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO. 1  
 0.21,77,0.31,98,5.0

DATA PRINT-OUT:

AREA (ACRES)	PERVIOUS		IMPERVIOUS		TC (MINUTES)
	A	CN	A	CN	
0.5	.2	77.0	.3	98.0	5.0

PEAK-Q (CFS)	T-PEAK (HRS)	VOL (CU-FT)
.48	7.67	6483

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:  
 16-87.100

**DRYWELL ROUTING:**

One drywell is proposed to be centrally located within the site. The drywell is proposed to be 26 feet in depth, similar to surrounding public drywells. The drywell will have a 4-foot interior diameter, a 5-foot exterior diameter, and will have a 24-inch wide granular zone surrounding the exterior drywell wall.

Drywell routing is performed using the Santa Barbara Urban Hydrograph (SBUH) Method. (KING COUNTY DEPARTMENT OF PUBLIC WORKS Surface Water Management Division, HYDROGRAPH PROGRAMS Version 4.20)

RESERVOIR ROUTING INFLOW/OUTFLOW ROUTINE

SPECIFY [d:][path]filename[.ext] OF ROUTING DATA 16-087-1.dat  
 DISPLAY ROUTING DATA (Y or N)? y

ROUTING DATA:

STAGE (FT)	DISCHARGE (CFS)	STORAGE (CU-FT)	PERM-AREA (SQ-FT)
.00	.00	.0	.0
1.00	.10	25.8	.0
2.00	.20	51.5	.0
3.00	.29	77.2	.0
4.00	.39	103.0	.0
5.00	.49	128.7	.0
6.00	.59	154.5	.0
7.00	.69	180.2	.0
8.00	.79	206.0	.0
9.00	.88	231.7	.0
10.00	.98	257.5	.0
11.00	1.08	283.2	.0
12.00	1.18	309.0	.0
13.00	1.28	334.7	.0
14.00	1.37	365.5	.0

15.00	1.47	386.2	.0
16.00	1.57	412.0	.0
17.00	1.57	437.7	.0
18.00	1.57	463.5	.0
19.00	1.57	489.2	.0
20.00	1.57	515.0	.0
21.00	1.57	540.7	.0
22.00	1.57	566.5	.0
23.00	1.57	592.2	.0
24.00	1.57	618.0	.0
25.00	1.57	643.7	.0
26.00	1.57	669.5	.0

AVERAGE PERM-RATE: .0 MINUTES/INCH

ENTER [d:][path]filename[.ext] OF COMPUTED HYDROGRAPH:  
16-87.100

INFLOW/OUTFLOW ANALYSIS:

PEAK-INFLOW (CFS)	PEAK-OUTFLOW (CFS)	OUTFLOW-VOL (CU-FT)
.48	.47	6408
INITIAL-STAGE (FT)	TIME-OF-PEAK (HRS)	PEAK-STAGE-ELEV (FT)
116.35	7.83	121.16
PEAK STORAGE:	120 CU-FT	

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:  
16-87.det

**DRYWELL ROUTING SUMMARY:**

Routing the 100-year, 24-hour storm event through the drywell system result in a peak stage elevation of 116.16 feet, 5 feet above the base of the drywell and approximately 17 feet below the perforated pipe in the bottom of the LID facility. Thus, the drywell is adequate to manage the runoff generated from the proposed development in a 100-year storm event.

Adequate ✓

**CONCLUSION:**

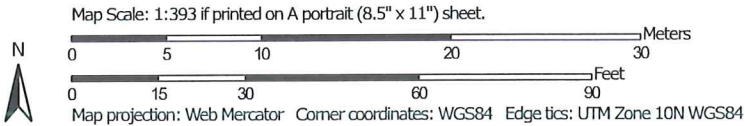
The proposed private drywell on the Territorial Road Multi-family site will manage the onsite stormwater runoff for a 100-year, 24-hour storm drain event, totaling 4.5 inches, through underground infiltration. The water level in the drywell will reach a maximum depth of 5 feet and will remain approximately 17 feet below the perforated pipe in the bottom of the LID facility. The assumed infiltration rate for the drywell is 50% of the minimum tested rate found from 4 drywells within 1500 feet of this site. The public storm drainage system for NE Territorial Road is an existing public system maintained by the City of Canby. No additional impacts to the public system will be created by this development.

# ***SUPPORTING PAGES***


# ***SOIL DATA***



Soil Map—Clackamas County Area, Oregon  
(351 NE Territorial Rd.)



## MAP LEGEND

 Area of Interest (AOI)	 Spoil Area
 Soils	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
 Special Point Features	 Special Line Features
 Blowout	 Streams and Canals
 Borrow Pit	 Transportation
 Clay Spot	 Rails
 Closed Depression	 Interstate Highways
 Gravel Pit	 US Routes
 Gravelly Spot	 Major Roads
 Landfill	 Local Roads
 Lava Flow	 Background
 Marsh or swamp	 Aerial Photography
 Mine or Quarry	
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

## 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: Clackamas County Area, Oregon  
Survey Area Data: Version 18, Oct 27, 2021

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

Date(s) aerial images were photographed: Aug 1, 2019—Sep 12, 2019

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
12A	Canderly sandy loam, 0 to 3 percent slopes	0.5	100.0%
<b>Totals for Area of Interest</b>		<b>0.5</b>	<b>100.0%</b>

## Clackamas County Area, Oregon

### 12A—Canderly sandy loam, 0 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2232  
*Elevation:* 120 to 250 feet  
*Mean annual precipitation:* 40 to 50 inches  
*Mean annual air temperature:* 52 to 54 degrees F  
*Frost-free period:* 165 to 210 days  
*Farmland classification:* Prime farmland if irrigated

#### Map Unit Composition

*Canderly and similar soils:* 90 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Canderly

##### Setting

*Landform:* Terraces  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Stratified glaciolacustrine deposits

##### Typical profile

*H1 - 0 to 7 inches:* sandy loam  
*H2 - 7 to 46 inches:* sandy loam  
*H3 - 46 to 60 inches:* stratified gravelly sand to coarse sandy loam

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Somewhat excessively 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:* Moderate (about 6.4 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 2s  
*Land capability classification (nonirrigated):* 2s  
*Hydrologic Soil Group:* A  
*Ecological site:* F002XB003OR - Gravelly Terrace Group

*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Clackamas County Area, Oregon

Survey Area Data: Version 18, Oct 27, 2021

# ***FIGURES***







# ***EXHIBITS***

TABLE 3.5.2B SCS WESTERN WASHINGTON RUNOFF CURVE NUMBERS

SCS WESTERN WASHINGTON RUNOFF CURVE NUMBERS (Published by SCS in 1982)					
Runoff curve numbers for selected agricultural, suburban and urban land use for Type 1A rainfall distribution, 24-hour storm duration.					
LAND USE DESCRIPTION		CURVE NUMBERS BY HYDROLOGIC SOIL GROUP			
		A	B	C	D
Cultivated land(1):	winter condition	86	91	94	95
Mountain open areas:	low growing brush and grasslands	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	undisturbed or older second growth	42	64	76	81
Wood or forest land:	young second growth or brush	55	72	81	86
Orchard:	with cover crop	81	88	92	94
Open spaces, lawns, parks, golf courses, cemeteries, landscaping.					
good condition:	grass cover on 75% or more of the area	68	80	86	90
fair condition:	grass cover on 50% to 75% of the area	77	85	90	92
Gravel roads and parking lots		76	85	89	91
Dirt roads and parking lots		72	82	87	89
Impervious surfaces, pavement, roofs, etc.		98	98	98	98
Open water bodies: lakes, wetlands, ponds, etc.		100	100	100	100
Single Family Residential (2)					
Dwelling Unit/Gross Acre	% Impervious (3)				
1.0 DU/GA	15				
1.5 DU/GA	20				
2.0 DU/GA	25				
2.5 DU/GA	30				
3.0 DU/GA	34				
3.5 DU/GA	38				
4.0 DU/GA	42				
4.5 DU/GA	46				
5.0 DU/GA	48				
5.5 DU/GA	50				
6.0 DU/GA	52				
6.5 DU/GA	54				
7.0 DU/GA	56				
Planned unit developments, condominiums, apartments, commercial business and industrial areas.	% impervious must be computed				
		Separate curve number shall be selected for pervious and impervious portion of the site or basin			

- (1) For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, August 1972.
- (2) Assumes roof and driveway runoff is directed into street/storm system.
- (3) The remaining pervious areas (lawn) are considered to be in good condition for these curve numbers.



<b>Drywell Calculations</b>					
SGL 16-087					
Territorial Rd. Multi-family - One drywell					
Manhole Inside Diameter (ft) =	4.0	Infiltration rate	0.09818		
Manhole Outside Diameter (ft) =	5.0	per 1' section =			
Rock Thickness (ft) =	2.0				
Infiltration Rate (cubic in/sq. in/hr) =	300.0000				
Infiltration Rate (ft/sec) =	0.00694				
Factor of Safety =	2				
Wetted Area for 1' tall section (sf)	28.3				
Porosity of Rock =	40%				

Depth		One Drywell			
Below	Water		Drywell Storage	Rock Layer	Total Storage
Grade	Depth	Qout	Volume	Storage Volume	Volume
(ft)	(ft)	(cfs)	(cu. ft.)	(cu. ft.)	(cu. ft.)
26	0	0.00	0.00	0.00	0.00
25	1	0.10	12.56	13.19	25.75
24	2	0.20	25.12	26.38	51.50
23	3	0.29	37.68	39.56	77.24
22	4	0.39	50.24	52.75	102.99
21	5	0.49	62.80	65.94	128.74
20	6	0.59	75.36	79.13	154.49
19	7	0.69	87.92	92.32	180.24
18	8	0.79	100.48	105.50	205.98
17	9	0.88	113.04	118.69	231.73
16	10	0.98	125.60	131.88	257.48
15	11	1.08	138.16	145.07	283.23
14	12	1.18	150.72	158.26	308.98
13	13	1.28	163.28	171.44	334.72
12	14	1.37	175.84	184.63	360.47
11	15	1.47	188.40	197.82	386.22
10	16	1.57	200.96	211.01	411.97
9	17	1.57	213.52	224.20	437.72
8	18	1.57	226.08	237.38	463.46
7	19	1.57	238.64	250.57	489.21
6	20	1.57	251.20	263.76	514.96
5	21	1.57	263.76	276.95	540.71
4	22	1.57	276.32	290.14	566.46
3	23	1.57	288.88	303.32	592.20
2	24	1.57	301.44	316.51	617.95
1	25	1.57	314.00	329.70	643.70
0	26	1.57	326.56	342.89	669.45