Harper
Houf Peterson
Righellis Inc.

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Planning Division
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SW Denny Road

WAS-39

Preliminary Stormwater Management Report

February 2024

Prepared For:

City of Beaverton

WAS-39

Prepared By:

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EXPIRES: 6/30/2024

HHPR

ENGINEERS ◆ PLANNERS
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PROJECT OVERVIEW

The City of Beaverton, in partnership with Washington County, is proposing to improve the Denney Road right-of-way between SW 105th Avenue and Scholls Ferry Road. The proposed improvements include adding bike lanes, curb and gutters, concrete driveways and sidewalks and landscaping along the project corridor. Overall the project is adding 0.48 acres of impervious area to the corridor and will disturb 2.32 acres of land. The project area falls within City of Beaverton (COB) jurisdiction. The COB has adopted the current version of Clean Water Services Design and Construction Standards for stormwater management.

The purpose of this stormwater management report is to present stormwater best management practices (BMP) for conveyance, hydromodification and water quality treatment to be installed as part of the Denny Road retrofit project. This study demonstrates that the proposed design meets or exceeds requirements and guidelines for CWS standards per CWS R&O 19-5 as amended by R&O 19-22 and COB Design and Construction standards. **Table 1** below summarize these requirements.

Table 1. CWS R&O 19-5 (As Amended by R&O 19-22) & COB Requirements

Design Requirement	CWS & COB Governing Criteria
Soil & Hydrologic Soil Group	Aloha Silt Loam, Soil Group C/D
Risk Level	Moderate
Development Class	Developed Area
Project Size	Large (>80,000 sf)
Project Category	Category 2
Hydromodification	SBUH Peak-Flow Matching Detention per CWS design section 4.03.5b(2)
Treatment Area	New Impervious Area + 3 x (Modified Impervious – Permanently Removed Impervious) per CWS
Treatment Storm	0.36 inches of precipitation falling in 4 hours with an average storm return period of 96 hours per CWS & COB
Flow Control	Match post-developed discharge rate to one-half the 2-year pre-developed flow. Match pre- and post-development discharge rate in the 10 and 25-year events.
Conveyance	25-Year; 24-hour SBUH Method for Pipe 25-Year; 24-hour SBUH Method for Open Channel Provide 1’ minimum freeboard from roadway for the 25-year; 24-hour storm event ¼ mile downstream or to a distance where the project site contributes less than 5 percent of the total tributary drainage flow

Table 2 below summaries the design storm events and associated precipitation rates.

Table 2. Precipitation Frequency Estimates

CWS/COB		Return Period in Hydroflow Model for governing design storm
Event	Precip (in/hr)	
0.36" in 3 hrs (100% impervious)		1-yr (COB)
2-yr:	**2.5**	2-yr (CWS/COB)
5-yr:	**3.1**	5-yr (CWS/COB)
10-yr:	**3.45**	10-yr (CWS/COB)
25-yr:	**3.9**	25-yr (CWS/COB)
100-yr:	**4.5**	100-yr (CWS/COB)

BASIN CHARACTERISTICS

Existing Conditions

SW Denny Road project stormwater runoff between OR 217 and SW Schools Ferry Road flows to a low point along the project corridor, where it is collected and outfalls north via a 24" pipe to a Fanno Creek tributary. Approximately 12.7 acres of additional offsite stormwater runoff is collected and routed through the project corridor to the outfall. HHPR proposes to maintain the existing conveyance system, outfall and flow patterns to the maximum extent practical.

The Natural Resource Conservation Service (NRCS) Soil Survey identifies the existing soils onsite to be a primarily Aloha Silt Loam and Huberly Silt Loam, which are both classified as Hydrologic Soil Groups C/D. Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. Due to existing soil, infiltration was not used as a viable disposal method for this project. The project assumes groundwater conditions to be at the ordinary high water of the Fanno Creek tributary, around approximately 190.00. See Appendix B for Soil Survey information.

The assumed curve numbers for this report are shown in **Table 3** below (see Appendix B for curve number information).

Table 3. Assumed Curve Numbers

Condition	Curve Number
Impervious Areas	98
Proposed Landscape Areas (Good Condition, Soil C/D)	75
Modified Existing Impervious Areas per CWS 4.08.6.d	75
Existing Pervious Areas (Fair Condition, Soil C/D)	79
Existing Impervious Gravel Areas (Soil C/D)	90

Proposed Conditions

The project will provide new sidewalks, bike lane and turn lane to the Denny Road corridor, resulting in 1.66 acres of new or modified impervious area. In general, the project will not have a significant increase in pollutant generating impervious area. The footprint of the bike lane and turn lane does extend beyond the existing road footprint. The existing and proposed impervious areas are outlined in **Table 4** below. Appendix A for existing and proposed basin delineation and impervious areas.

Table 4. Impervious & Pervious Basin Areas

Basin	Pre-Development		Post-Development		
	Impervious (ac)	Pervious (ac)	New/Modified Impervious (ac)	Existing Impervious (ac)	Pervious (ac)
A1	0.374	0.061	0.185	0.249	0.000
A2	1.039	0.524	0.789	0.545	0.230
A3	0.060	0.003	0.028	0.035	0.000
A4	0.061	0.006	0.036	0.031	0.000
A5	0.059	0.002	0.032	0.029	0.000
A6	0.059	0.006	0.030	0.030	0.005
A7	0.074	0.003	0.040	0.038	0.000
A8	0.213	0.093	0.092	0.116	0.099
A9	0.147	0.069	0.094	0.080	0.043
A10	0.392	0.161	0.312	0.185	0.056
A11	0.051	0.101	0.022	0.018	0.113
Total	**2.531**	**1.030**	**1.660**	**1.355**	**0.546**

STORMWATER MANAGEMENT

Water Quality

The COB and CWS treatment requirements and standards will be met by utilizing a LIDA extended dry basin and an existing regional proprietary treatment facility. The COB and CWS water quality approach requires the treatment of a storm event totaling 0.36 inches of precipitation falling in 3 hours, as modified by COB Chapter 5 Engineering Design Manual. The project stormwater treatment area is based on the following CWS equation, up to the total existing impervious surface on the site:

$$CWS\ Water\ Quality\ Area\ (sq.ft) = New\ Impervious + (3 \times Modified\ Impervious) =$$
$$25{,}935\ sq.ft + 3 * 46{,}384\ sq.ft = 165{,}087\ sq.ft\ (3.79\ ac)$$

The total new, modified and existing impervious area within the SW Denny Road project public basin is 131,334 sq. ft. (3.02 acres). Therefore, the maximum water quality area will be the total impervious area of the project corridor. Due to existing utilities, large offsite conveyance basins, existing flow patterns, and limited elevation at the project corridor low point, portions of the project corridor cannot be collected and directed to a stormwater facility. HHPR proposes to collect equivalent existing untreated and undetained impervious area for portions of the project unable to be managed.

Basin A1 drains north to an existing 8'x24' storm filter cartridge vault sized to handle the entire water quality flow within the basin limits. The entire impervious contribution will be treated within the basin. This basin assumes no detention and will be undetained.

Basin A2 and A11 are public ROW basins within the Denny Road corridor that will drain to the proposed extended dry basin (EDB). **Basins B1, B2, and B3** are offsite private and public basins that were identified as untreated and undetained and will be routed through the EDB for treatment and detention. These basins contribute to the existing conveyance system within Denny Road and will mitigate for portions along the corridor that are unable to be collected and routed to the proposed facility. Basin A2, B1, B2 and B3 were all modeled with a pre-development time of concentration of 11.0 minutes and a post-developed time of concentration of 5 minutes. The existing basin has existing drainage ditches, which resulted in the higher existing time of concentration within the basin.

The Applegrove subdivision to the south has an existing 12-inch pipe that intersects with the extended dry basin. The subdivision was analyzed and determined that it was 50% impervious area within the drainage basin, **Basin B4**. This impervious area was based on asbuilt data provided by the City of Beaverton, published zoning for the subdivision and aerial imaging. Based on the provided asbuilts, the existing subdivision currently discharges into Denny Road without any treatment or detention. The basin was determined that it could not be intercepted and routed around the proposed LIDA extended dry basin; therefore, HHPR has provided a design the treat and detain this existing subdivision.

The proposed 5 ft x 155 ft flat bottom EDB is 3.5 feet deep with orifice control for metered water quality treatment. A 60" pre-treatment manhole is installed upstream prior to outfalling into the facility. The bottom of the pond is set at 193.00 and will connect to the existing conveyance system within Denny Road and outfall to the Fanno Creek tributary to the north. The proposed pond will have 0.2' of dead storage and total 3.5 feet in height. The facility will be lined with 3:1 side slope within the treatment ponding area and vertical retaining walls surrounding over 50% of the proposed stormwater facility. The EDB has a total calculated water quality volume of 4,430 cu.ft, which would result in a water quality ponding depth of 2.26 ft within the proposed facility.

Table 5 below outlines the stormwater treatment plan for the project corridor. The project will treat 31,944 sq. ft. more than the required water quality area. Refer to Appendix A for basin delineation and proposed areas for all treated and untreated basins. This water quality area was determined for CWS water quality flow calculations only. The CWS water quality design flow anticipated from the water quality design storm is based on the following CWS formulas and modified by the COB Chapter 5 Engineering Design Manual.

$$Water\ Quality\ Volume\ (cf) = \frac{0.36\ (in) \times Area\ (sq.ft)}{12\ (in/ft)} = \frac{0.36\ (in) \times 144{,}342\ (sq.ft)}{12\ (in/ft)} = 4{,}430\ cu.ft$$

$$Water\ Quality\ Flow\ (cfs) = \frac{WQV\ (cu.ft.)}{10{,}800\ (s)} = \frac{4{,}430\ cu.ft}{10{,}800\ (s)} = 0.401\ \text{cfs}$$

Table 5. Water Quality Treatment Summary

Basins	Impervious Area	CWS Water Quality Volume	CWS Water Quality Flow	Proposed Treatment Method
A1	18,936 sq.ft	568 cu.ft	0.053 cfs	Existing 8'x24' storm filter vault
A2, A11, B1, B2, B3, B4	144,342 sq.ft	4,430 cu.ft	0.401 cfs	8,839 sf Extended Dry Basin
Total	**163,278 sq.ft**			

The orifice was sized based on CWS 4.09.5 equation for a 48-hour drawdown time.

$$EDB\ Orifice = 24\ \mathrm{x}\frac{\frac{Q}{C[2gH]^{0.5}}}{\pi}^{0.5} = 24\ \mathrm{x}\frac{\frac{0.401\ cfs}{0.62\left[2(32.2)(\frac{2}{3}2.13)\right]^{0.5}}}{\pi}^{0.5} = 3.5\ in$$

A 3.5 in orifice will meter the water quality event for the treated area and existing subdivision to the south, and a second orifice is set above the maximum water quality ponding depth to provide flow control for stormwater event above the water quality event.

Pollutants of concern related to commercial development and roadway construction include sediment, nutrients, pesticides, herbicides, fungicides, metals (zinc, copper, lead, etc.), oil, grease and other petroleum. DEQ's pollutant removal requirements (OAR 340-041-0345) identifies the required phosphorous removal efficiency of proposed improvements to be a minimum of 65%. The anticipated project phosphorus removal is within the required range. Section 4.04.3.c(1) of the current CWS design standards list extended dry basins as approved LIDA water quality facilities that meet the design efficiency standard for pollutant removal. These selected stormwater management best management practices (BMP) specifically target all pollutants of concern.

Basin A10 will have a 60" pre-treatment manhole to alleviate the flow contribution to the existing 72" pre-treatment manhole located directly upstream of the existing 24" outfall within SW Denny Road. The existing 72" pre-treatment manhole is undersized for the contributing 15.5 acres of total area. This basin will provide pre-treatment only and is not accounted in the total treated area for the project. Refer to Appendix C for pre-treatment manhole size calculations.

Hydromodification Assessment & Detention

A CWS hydromodification assessment has been conducted per CWS DCS section 4.03.3. Following the point of discharge to the receiving reach determines the site is located within the "Fanno Creek tributary" reach. This basin is considered "low risk". The development class lists the site within an "Developed" area. The total project re-developed impervious area is more than 80,000 sf, which per CWS DCS 4.03.3.c.2 is a "large" project. Finally, using the above information, CWS DCS 4.03.5 and CWS Table 4-2, the project is listed as hydromodification Category 2.

Projects in Category 2 represent those with a moderate anticipated hydromodification risk. Per CWS DCS section 4.03.5.b, any of the following approaches may be used to address hydromodification:

1. Infiltration facility, using the standard sizing described in Section 4.08.5
2. Peak-Flow Matching Detention, using design criteria described in Section 4.08.6.
3. Flow Duration Curve Matching Detention using the size methodology described in Section 4.08.7.

Considering the site's space constraints, the Santa-Barbara Hydrograph Peak-Flow Matching Detention approach was used to size the proposed stormwater facility. Detention shall comply with both COB and CWS requirements. The COB and CWS require the proposed discharge for the 2-year, 24-hour storm to be detained and reduced to half that of the existing discharge rates. COB and CWS also require that the post-development runoff rates from the site do not exceed the pre-development runoff rates for the 5,10 and 25-year events for peak flow matching.

As previously mentioned, portions of the public improvements are unable to be captured and routed to a detention facility. The proposed extended dry basin was sized to manage flows for the new or modified impervious area added to the project corridor, as well as the existing impervious area.

The flow will be controlled via a standard double ditch inlet and flow control manhole with a 3.5" orifice at 193.00, 5.0" orifice at 195.47 (above the water quality event), and overflow weir set at 196.15. The facility walls are designed to contain the entire volume for a 100-year storm event; however, no freeboard is provided with this design. The facility maximized that length within the available open space. The Basin B4, Applegrove subdivision, was unable to be routed around the proposed facility, providing additional contribution that prevents meeting the minimum freeboard requirement. A design exception is needed for not providing a minimum of 1.0 foot freeboard from the 25-year water surface elevation within the extended dry basin.

In the event the flow control structure becomes clogged, the stormwater will overtop the wall and flow north into the Denny Road to a catch basin at the low point, ultimately outflowing to the Fanno Creek tributary. The private properties bordering the south side of the stormwater facility are over 1 to 5 feet higher than the roadway. No stormwater will flow onto adjacent private property. Elevations correspond to the NGVD29 vertical datum.

The entire extended dry pond and structures will be publicly maintained per section 4.07.7 of the CWS standards by the City of Beaverton. The flow control manhole and double ditch inlets are within 19 feet from the side where the maintenance vehicle can drive and park along Denny Road and will be fully accessible to maintenance staff. Refer to Appendix E for the Operations and Maintenance plan for the proposed extended dry basin.
The onsite EDB is sized to ensure the project's total runoff (public and private improvements) does not exceed the allowable flow rate during any storm event. Refer to **Table 6** for the total project pre-developed and post-developed runoff rates. The proposed flows include both offsite conveyance basins and project basins to be managed. All A and B basins are reflected in overall flow analysis. Any basins that ultimately contribute and routed through the proposed facility were accounted for within the target flows. Additionally, undetained basins A1, A3, A4, A5, A6, A7, A8, A9 and A10 are included within the overall flow analysis. See Appendix B for individual basin flows and allowable targets and Appendix C for SBUH hydrographs summaries. (Full hydrographs can be made available upon request).

The project will meet all COB and CWS flow control standards for the entire proposed design and reduce runoff during all stormwater events.

Table 6. Overall Flow Analysis Pre-Development & Post-Development Runoff Rates

Design Storm Events	Pre-Development Flow (cfs)	Post-Development Flow Allowable Targets (cfs)	Detained Release Rate (cfs)	Difference
2-yr, 24-hr	2.378	2.249	1.536	-0.713
5-yr, 24-hr	3.245	3.245	2.174	-1.071
10-yr, 24-hr	3.769	3.769	2.958	-0.811
25-yr, 24-hr	4.463	4.463	4.456	-0.007

Conveyance

The pipe conveyance system was sized and/or analyzed using the undetained 25-year, 24-hour SBUH method (see Appendix A for conveyance basin map and Appendix D for conveyance hydrographs and pipe capacity calculations). **Table 7** below illustrates that the proposed stormwater conveyance system is adequately sized. The project maintains the existing conveyance system within Denny Road to the most extent possible. Portion of project is pulled offline to an extended dry basin before connecting back to the existing conveyance system and outfalling to a Fanno Creek tributary.

Table 7. Pipe Capacity Analysis

Pipe	Contributing Basins	25-YR Runoff[1] (cfs)	Pipe Size (in)	Min. Pipe Slope (%)	Pipe Capacity * (cfs)
1	Basin B1, B2, B3, A2	2.49	12	0.50	2.52
2	Basin A8, C4	0.42	12	5.38	8.26
3	Basin A9	0.17	12	0.61	2.78
4	Basin A11	0.07	12	15.00	13.80
5	Basin C5	0.22	12	5.71	8.51
6	Basin A10	0.47	12	1.00	3.56
7	Basin C1, A7	5.50	24	0.47	15.51
8	Basin B1, B2, B3, B4, A2, A11, C3	4.35	15	0.50	4.57
9	Basin B1, B2, B3, B4, A2, A10, A11, C3	4.75	24	0.50	16.00
10	Basin B1, B2, B3, B4, A2, A7, A9, A10, A11, C1, C3	10.35	24	0.83	20.61
11	Basin B1, B2, B3, B4, A2, A7, A8, A9, A10, C1, C3, C4, C5	10.99	24	0.50	16.00

(1) See Appendix A Pre-Developed Plan for pipe locations, Appendix C for hydrographs and Appendix D for pipe capacity calculations.

Downstream Analysis

To satisfy COB and CWS detention requirements, the project will provide detention which meets or exceeds COB and CWS flow control requirements (Post peak flow ≤ Pre peak flow). The proposed improvements will decrease the peak flows leaving the site during all storm events. During the 25-year storm event, the proposed outfall will have a net new increase of 0.43 cfs from the pre-development to the post-development undetained flow. This constitutes only 4 percent of the total tributary drainage flow at the outfall. Additionally, this increase is conservative, since it uses CWS pre-development curve number of 75 for all modified imperious area within the project limits. Additionally, HHPR provided a visual investigation of the downstream system from the project discharge point.

The project discharges into a natural creek tributary of Fanno Creek. The tributary has a defined channel for approximately 100 feet before widening to a marshy wetland with no real defined channel. The project outfalls into an established floodplain per FEMA. The area is heavily forested area with no

structures or culverts restricting flows downstream before it's confluence with Fanno Creek approximately 400 feet downstream.

The channel was not accessible to transverse, so visual inspection was only observed at the outfall and from adjacent private properties. Photographs of the vegetated corridor and wetlands were taken from the 9845 SW Denny Road complex walking trail going through the floodplain fringes. Photos can be found in Appendix D of this report. HHPR reviewed LIDAR and as-built data from adjacent properties along the floodplain, finding existing adjacent properties were all outside the floodplain. Refer to Appendix D for asbuilt grading plan of downstream properties.

The surrounding properties have no history of recent flooding. The CWS hydromodification tool identifies the tributary joining Fanno Creek in a "low" risk portion of the creek. HHPR will maintain the existing outfall and will not impact the vegetated corridor of the tributary or surrounding wetland areas. Since the project will match the pre-developed 25-year, 24-hour peak runoff flow rates, HHPR does not anticipate any surface water increase or adverse impacts to the downstream system.

Engineering Conclusion

The proposed stormwater management plan will achieve stormwater management to Clean Water Services R&O 19-22 Standards and City of Beaverton design standards.

APPENDIX A - MAPS

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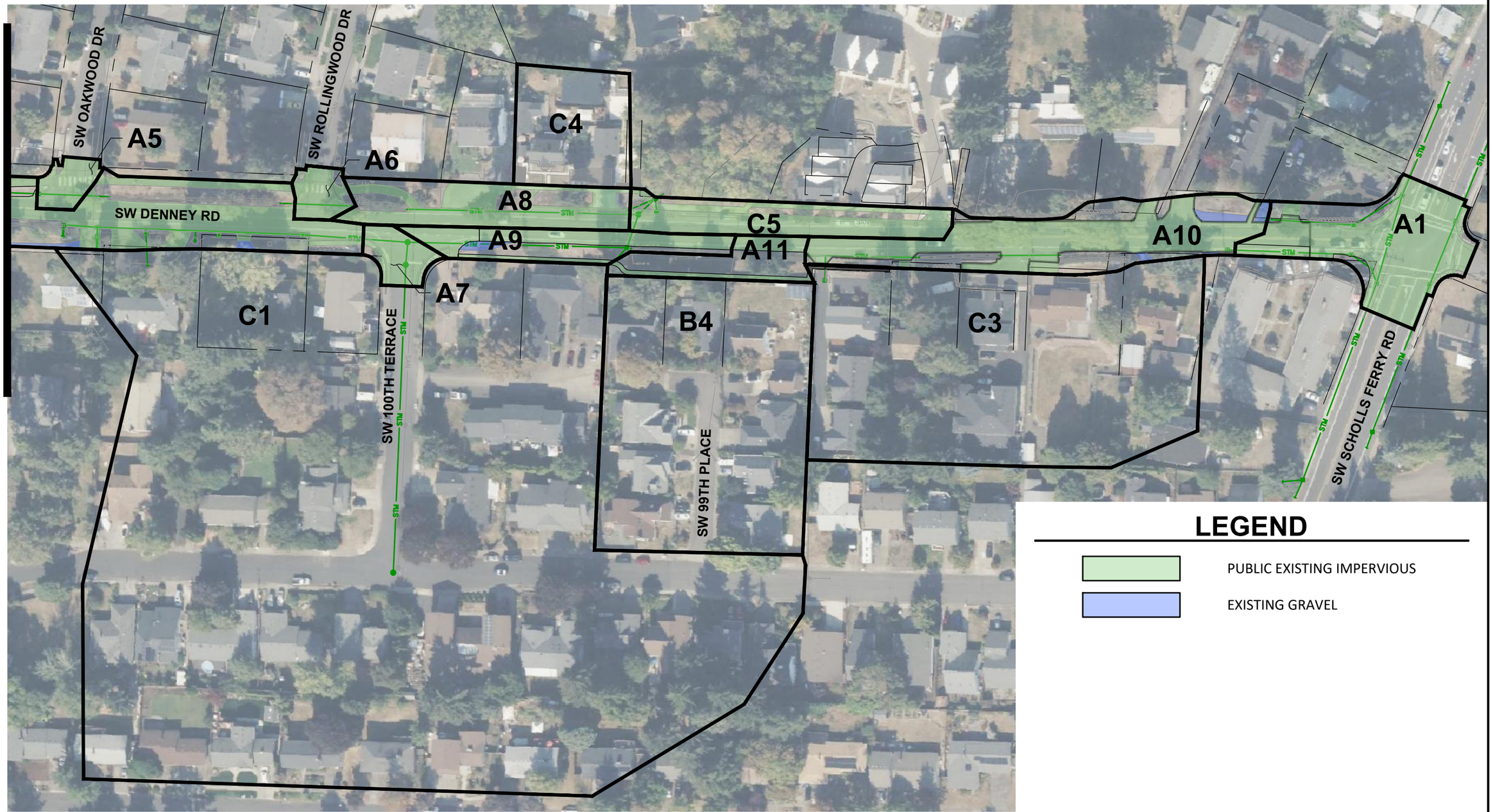
SEE SHEET 1



LEGEND

- PUBLIC EXISTING IMPERVIOUS
- EXISTING GRAVEL

N

0 25 50 100

SCALE: 1" =100'

DATE	NO.	DESCRIPTION

REVISIONS

DESIGNED: HHPR
DRAWN: MKA
CHECKED: HHPR
DATE: 02.12.24

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PRE-DEVELOPED BASIN MAP

SW DENNEY ROAD (SCHOLLS FERRY ROAD TO SW 105TH AVE)

BEAVERTON, OREGON

SHEET NO. 2 OF 2

JOB NO. WAS-39

LEGEND

PUBLIC EXISTING IMPERVIOUS

EXISTING GRAVEL

0 25 50 100

SCALE: 1" =100'

DATE	NO.	DESCRIPTION

REVISIONS

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PRE-DEVELOPED BASIN MAP

SW DENNEY ROAD (SCHOLLS FERRY ROAD TO SW 105TH AVE)

BEAVERTON, OREGON

SHEET NO. 1 OF 2

JOB NO. WAS-39

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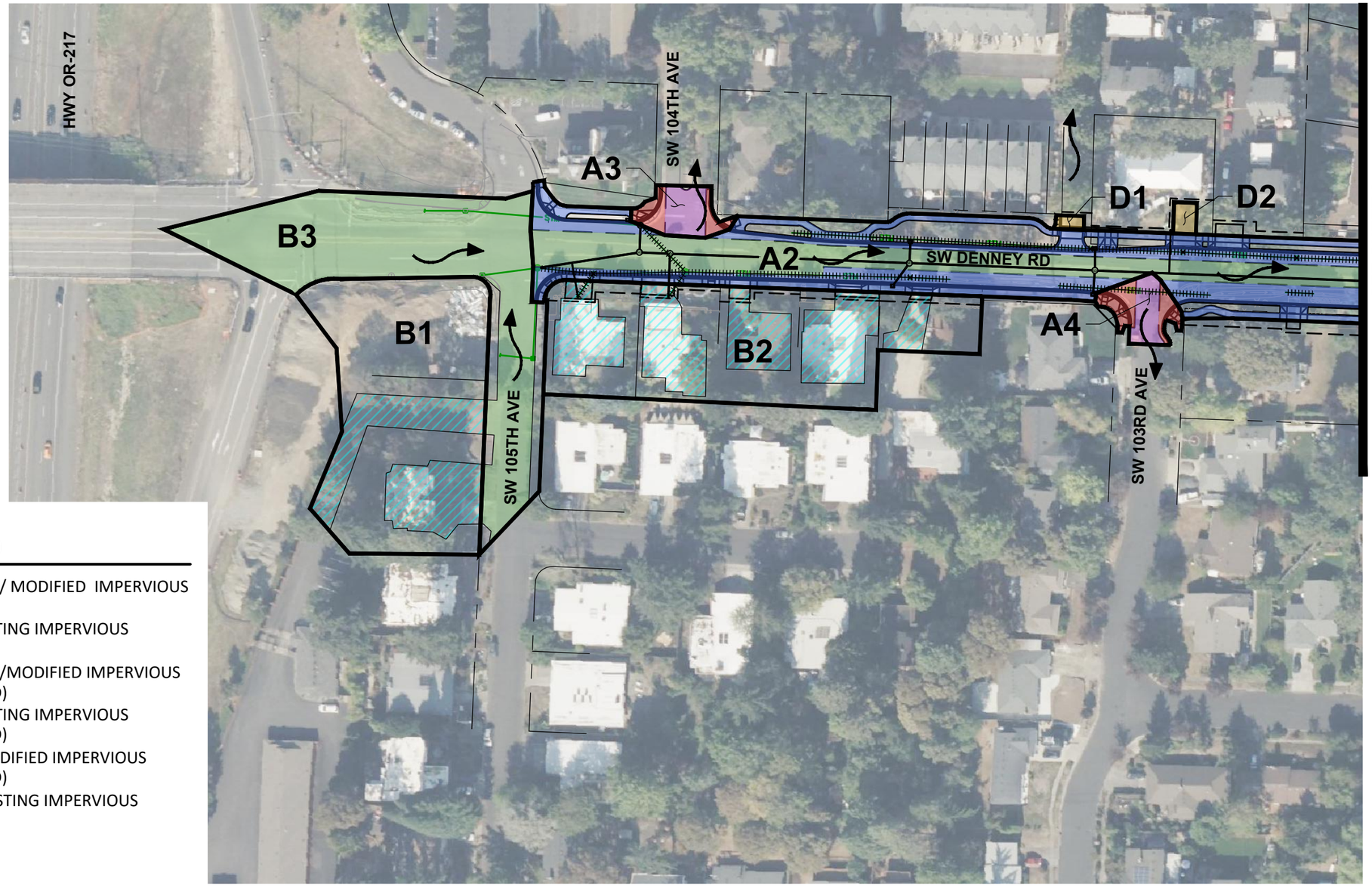

LEGEND

- PUBLIC NEW/ MODIFIED IMPERVIOUS (TREATED)
- PUBLIC EXISTING IMPERVIOUS (TREATED)
- PUBLIC NEW/MODIFIED IMPERVIOUS (UNTREATED)
- PUBLIC EXISTING IMPERVIOUS (UNTREATED)
- PRIVATE MODIFIED IMPERVIOUS (UNTREATED)
- PRIVATE EXISTING IMPERVIOUS (TREATED)

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0 25 50 100

SCALE: 1" =100'

DATE	NO.	DESCRIPTION

REVISIONS

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POST-DEVELOPED BASIN MAP

SW DENNEY ROAD (SCHOLLS FERRY ROAD TO SW 105TH AVE)

BEAVERTON, OREGON

SHEET NO. 1 OF 2

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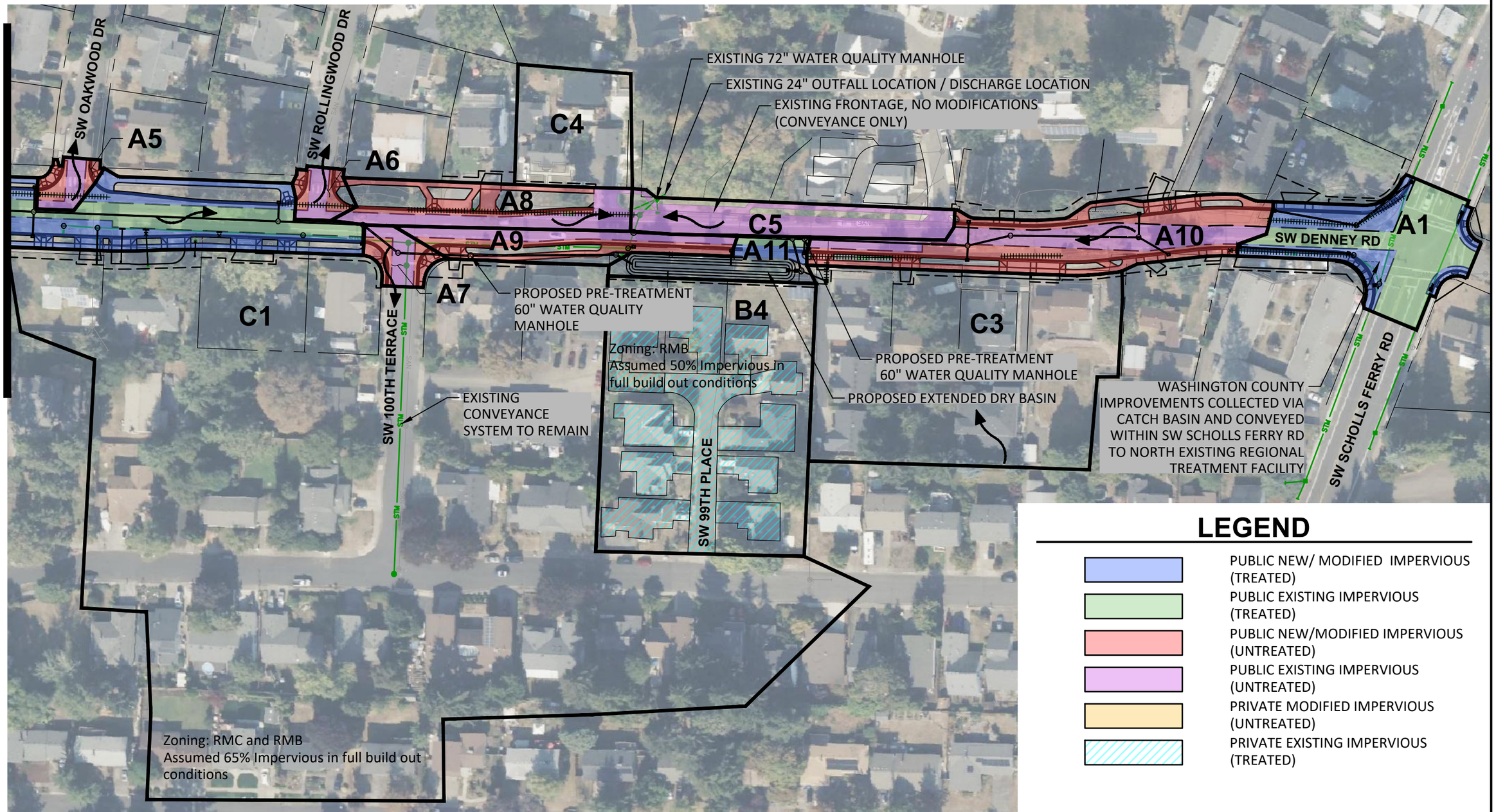
SEE SHEET 1



LEGEND

- PUBLIC NEW/ MODIFIED IMPERVIOUS (TREATED)
- PUBLIC EXISTING IMPERVIOUS (TREATED)
- PUBLIC NEW/MODIFIED IMPERVIOUS (UNTREATED)
- PUBLIC EXISTING IMPERVIOUS (UNTREATED)
- PRIVATE MODIFIED IMPERVIOUS (UNTREATED)
- PRIVATE EXISTING IMPERVIOUS (TREATED)

N

0 25 50 100

SCALE: 1" =100'

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POST-DEVELOPED BASIN MAP

SW DENNEY ROAD (SCHOLLS FERRY ROAD TO SW 105TH AVE)

BEAVERTON, OREGON

SHEET NO. 2 OF 2

JOB NO. WAS-39

APPENDIX B – SOILS AND BASIN DATA

Soil Map—Washington County, Oregon
(Denny Road)

Map Scale: 1:3,730 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

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: Washington County, Oregon
Survey Area Data: Version 21, 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: Apr 16, 2021—Apr 18, 2021

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
1	Aloha silt loam	5.5	90.3%
2225A	Huberly silt loam, 0 to 3 percent slopes	0.6	9.7%
Totals for Area of Interest		**6.1**	**100.0%**

Washington County, Oregon

1—Aloha silt loam

Map Unit Setting

National map unit symbol: 21x8
Elevation: 150 to 250 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 160 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Aloha and similar soils: 90 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aloha

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old loamy alluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 46 inches: silt loam
H3 - 46 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat 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 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.8 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: R002XC007OR - Valley Swale Group
Forage suitability group: Somewhat Poorly Drained (G002XY005OR)
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)

Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 21, Oct 27, 2021

Washington County, Oregon

2225A—Huberly silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2sv3y
Elevation: 150 to 260 feet
Mean annual precipitation: 39 to 51 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Huberly and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huberly

Setting

Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Silty glaciolacustrine deposits

Typical profile

A - 0 to 8 inches: silt loam
BAg - 8 to 15 inches: silt loam
Btg - 15 to 25 inches: silt loam
2Btx1 - 25 to 38 inches: silt loam
2Btx2 - 38 to 59 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.01 in/hr)
Depth to water table: About 0 to 8 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: R002XC007OR - Valley Swale Group
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)

Hydric soil rating: Yes

Minor Components

Verboort

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 21, Oct 27, 2021

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

Existing and Proposed Conditions

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

Existing Conditions: 79, 75

Proposed Conditions

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Denny Road Improvement Project

Time of Concentration Calculations

Prepared by Harper Houf Peterson Righellis Inc.
Job No. WAS-39
February 2024

Notes: Time of Concentration (tc) calculated to the treatment discharge location
2-Year, 24-Hour Rainfall = 2.5 inches

EXISTING

A2, B1, B2, B3			**A10**		
t_c sheet flow:			t_c sheet flow:		
L =	248	ft	L =	100	ft
S =	4.0	%	S =	1.7	%
n =	0.011	Paved	n =	0.011	Paved
t_{c1} =	**0.01**	**Min**	**t_{c1} =**	**0.00**	**Min**
t_c Pipe flow:			t_c Pipe flow:		
L =	1160	ft	L =	64	ft
S =	0.7	%	S =	0.56	%
n =	0.013	Pipe	n =	0.013	Pipe
D =	12	in	D =	12	in
V =	3.89	fps	V =	3.38	fps
t_{c2} =	**4.97**	**Min**	**t_{c2} =**	**0.32**	**Min**
t_c Open Channel flow:			t_c Open Channel flow:		
L =	260	ft	L =	260	ft
a =	0.27	ft^2	a =	0.27	ft^2
P =	1.80	ft	P =	1.26	ft
n =	0.03	average for gravel	n =	0.03	average for gravel
S =	0.03	ft/ft	S =	0.030	ft/ft
t_{c3} =	**1.96**	**Min**	**t_{c3} =**	**2.72**	**Min**
t_c Pipe flow:			t_c Pipe flow:		
L =	149	ft	L =	119	ft
S =	1.6	%	S =	2.78	%
n =	0.013	Pipe	n =	0.013	Pipe
D =	12	in	D =	12	in
V =	5.79	fps	V =	7.53	fps
t_{c4} =	**0.43**	**Min**	**t_{c4} =**	**0.26**	**Min**
t_c Open Channel flow:			t_c Open Channel flow:		
L =	65	ft	L =	180	ft
a =	0.27	ft^2	a =	0.27	ft^2
P =	1.70	ft	P =	1.26	ft
n =	0.03	average for gravel	n =	0.03	average for gravel
S =	0.02	ft/ft	S =	0.030	ft/ft
t_{c5} =	**1.82**	**Min**	**t_{c3} =**	**2.72**	**Min**
t_c Pipe flow:			t_c Pipe flow:		
L =	245	ft	L =	70	ft
S =	1	%	S =	1.8	%
n =	0.013	Pipe	n =	0.013	Pipe
D =	12	in	D =	24	in
V =	5.35	fps	V =	9.62	fps
t_{c6} =	**0.76**	**Min**	**t_{c6} =**	**0.12**	**Min**
t_c Pipe flow:					
L =	108	ft	**$t_c = t_{c1} + t_{c2} + t_{c3}$ =**	**6.1**	**Min**
S =	1	%			
n =	0.013	Pipe			
D =	15	in			
V =	6.20	fps			
t_{c7} =	**0.29**	**Min**			
t_c Pipe flow:					
L =	296	ft			
S =	0.8	%			
n =	0.013	Pipe			
D =	24	in			
V =	6.41	fps			
t_{c7} =	**0.77**	**Min**			
$t_c = t_{c1} + t_{c2} + t_{c3}$ =	**11.0**	**Min**			

Denny RD

Basin Parameters

Prepared by Harper Houf Peterson Righellis Inc.
Job No. WAS-39
February 2024

NRCS Curve Numbers (CN) used:

Ground Cover	C	Condition
Pre-Development Modified Imp	75	Existing
Wood-Grass Combo (Fair Conc	79	Existing
Wood-Grass Combo (Good Co	75	Proposed
Impervious	98	Proposed
Gravel	90	Existing

Hydrologic Gro C/D

Pre-Developed Project Basins:

Basin	Total Area (SF)	Total Area (AC)	Impervious Area (SF) CN=75/98	Impervious Area (AC)	Gravel Area (SF) CN=90	Gravel Area (AC)	Pervious Area (SF) CN=79	Pervious Area (AC)	t_c (min)	EX 2-yr Flow (cfs)	2-yr Allowable Flow (cfs)	EX 5-yr Flow (cfs)	EX 10-yr Flow (cfs)	EX 25-yr Flow (cfs)
A1	18936	0.435	16290	0.374	0	0.000	2646	0.061	5.0	0.164	0.155	0.219	0.252	0.295
A2	68102	1.563	44006	1.010	1266	0.029	22830	0.524	11.0	0.419	0.357	0.593	0.700	0.842
A3	2763	0.063	2625	0.060	0	0.000	138	0.003	5.0	0.022	0.022	0.030	0.034	0.040
A4	2916	0.067	2675	0.061	0	0.000	241	0.006	5.0	0.022	0.020	0.030	0.034	0.040
A5	2643	0.061	2556	0.059	0	0.000	87	0.002	5.0	0.020	0.019	0.027	0.031	0.041
A6	2857	0.066	2578	0.059	0	0.000	279	0.006	5.0	0.021	0.019	0.029	0.033	0.040
A7	3373	0.077	3232	0.074	0	0.000	141	0.003	5.0	0.026	0.024	0.035	0.041	0.048
A8	13341	0.306	9288	0.213	0	0.000	4053	0.093	5.0	0.103	0.093	0.140	0.163	0.193
A9	9439	0.217	6063	0.139	352	0.008	3024	0.069	5.0	0.065	0.056	0.091	0.107	0.128
A10	24090	0.553	16098	0.370	968	0.022	7024	0.161	6.1	0.155	0.132	0.220	0.260	0.312
A11	6638	0.152	2235	0.051	0	0.000	4403	0.101	5.0	0.041	0.034	0.060	0.071	0.086
Total	**155098**	**3.561**	**107646**	**2.471**	**2586**	**0.059**	**44866**	**1.030**	**62**	**1.058**	**0.929**	**1.474**	**1.726**	**2.065**

Pre-Developed Offsite Basins:

Basin	Total Area (SF)	Total Area (AC)	Impervious Area (SF) CN=98	Impervious Area (AC)	Pervious Area (SF) CN=79	Pervious Area (AC)	t_c (min)	2-yr Flow (cfs)	5-yr Flow (cfs)	10-yr Flow (cfs)	25-Yr Flow (cfs)
B1	33132	0.761	10008	0.230	23124	0.531	11.0	0.200	0.287	0.340	0.410
B2	34029	0.781	16603	0.381	17426	0.400	11.0	0.263	0.356	0.413	0.487
B3	30603	0.703	27804	0.638	2799	0.064	11.0	0.353	0.447	0.502	0.573
C2	60254	1.383	30127	0.692	30127	0.692	5.0	0.504	0.681	0.788	0.928
Total	**158018**	**3.628**	**84542**	**1.941**	**73476**	**1.687**		**1.320**	**1.771**	**2.043**	**2.398**

Denny RD

Basin Parameters

Prepared by Harper Houf Peterson Righellis Inc.
Job No. WAS-39
February 2024

NRCS Curve Numbers (CN) used:

Ground Cover	C	Condition
Pre-Development Modified Impervio	75	Existing
Wood-Grass Combo (Fair Condition)	79	Existing
Wood-Grass Combo (Good Conditio	75	Proposed
Impervious	98	Proposed
Gravel	90	Existing

Hydrologic Group: C/D

Post-Developed Project Basins:

Basin	Total Area (SF)	Total Area (AC)	New Impervious Area (SF) CN=98	New Impervious Area (AC)	Modified Impervious Area (SF) CN=98	Modified Impervious Area (AC)	Non-Modified Existing Impervious Area(SF) CN=98	Non-Modified Existing Impervious Area(AC)	Pervious Area (SF) CN=75	Pervious Area (AC)	t_c (min)	2-yr Flow (cfs)	5-yr Flow (cfs)	10-yr Flow (cfs)	25-Yr Flow (cfs)
A1	18936	0.435	2646	0.061	5424	0.125	10866	0.249	0	0.000	5.0	0.250	0.313	0.350	0.398
A2	68102	1.563	14086	0.323	20276	0.465	23730	0.545	10010	0.230	5.0	0.789	1.006	1.133	1.297
A3	2763	0.063	138	0.003	1082	0.025	1543	0.035	0	0.000	5.0	0.036	0.046	0.051	0.058
A4	2916	0.067	241	0.006	1323	0.030	1352	0.031	0	0.000	5.0	0.039	0.048	0.054	0.061
A5	2643	0.061	87	0.002	1313	0.030	1243	0.029	0	0.000	5.0	0.035	0.044	0.049	0.056
A6	2857	0.066	40	0.001	1274	0.029	1304	0.030	239	0.005	5.0	0.035	0.044	0.05	0.057
A7	3373	0.077	141	0.003	1585	0.036	1647	0.038	0	0.000	5.0	0.045	0.056	0.063	0.071
A8	13341	0.306	915	0.021	3086	0.071	5044	0.116	4296	0.099	5.0	0.129	0.168	0.192	0.223
A9	9439	0.217	1520	0.035	2595	0.060	3468	0.080	1856	0.043	5.0	0.104	0.134	0.151	0.174
A10	24090	0.553	5559	0.128	8049	0.185	8049	0.185	2433	0.056	5.0	0.291	0.369	0.415	0.474
A11	6638	0.152	562	0.013	377	0.009	769	0.018	4930	0.113	5.0	0.034	0.050	0.061	0.074
Total	**155098**	**3.561**	**25935**	**0.595**	**46384**	**1.065**	**59015**	**1.355**	**23764**	**0.546**		**1.787**	**2.278**	**2.569**	**2.943**

Post-Developed Offsite Basins:

Basin	Total Area (SF)	Total Area (AC	Impervious Area (SF) CN=98	Impervious Area (AC)	Pervious Area (SF) CN=79	ervious Area (A	t_c (min)	2-yr Flow (cfs)	5-yr Flow (cfs)	10-yr Flow (cfs)	25-Yr Flow (cfs)
B1	33132	0.761	10008	0.230	23124	0.531	5.0	0.215	0.307	0.363	0.438
B2	34029	0.781	16603	0.381	17426	0.400	5.0	0.281	0.38	0.440	0.519
B3	30603	0.703	27804	0.638	2799	0.064	5.0	0.071	0.138	0.181	0.240
B4	60254	1.383	30127	0.692	30127	0.692	5.0	0.504	0.681	0.788	0.928
Total	**158018**	**3.628**	**84542**	**1.941**	**73476**	**1.687**		**1.071**	**1.506**	**1.772**	**2.125**

Denny RD

Basin Parameters

Prepared by Harper Houf Peterson Righellis Inc.
Job No. WAS-39
February 2024

NRCS Curve Numbers (CN) used:

Ground Cover	C	Condition
Pre-Development Modified Impervio	75	Existing
Wood-Grass Combo (Fair Condition)	79	Existing
Wood-Grass Combo (Good Conditior	75	Proposed
Impervious	98	Proposed
Gravel	90	Existing

Hydrologic Group: C/D

Conveyance Offsite Basins:

Basin	Total Area (SF)	Total Area (AC)	Non-Modified Existing Impervious Area(SF) CN=98	Non-Modified Existing Impervious Area(AC) CN=98	Pervious Area (SF) CN=75	Pervious Area (AC)	t_c (min)	2-yr Flow (cfs)	5-yr Flow (cfs)	10-yr Flow (cfs)	25-Yr Flow (cfs)
C1	309178	7.098	200966	4.614	108212	2.484	5.0	3.033	3.979	4.543	5.280
C3	60632	1.392	23040	0.529	37592	0.863	5.0	0.437	0.609	0.714	0.853
C4	14234	0.327	5409	0.124	8825	0.203	5.0	0.103	0.143	0.168	0.200
C5	11547	0.265	9300	0.213	2247	0.052	5.0	0.131	0.167	0.189	0.217
D1	290	0.007	290	0.007	0	0.000	5.0	0.004	0.005	0.006	0.006
D2	548	0.013	548	0.013	0	0.000	5.0	0.007	0.009	0.010	0.012
Total	**396429**	**9.101**	**239552.78**	**5.499**	**156876**	**3.601**		**3.715**	**4.912**	**5.630**	**6.568**

APPENDIX C – WATER QUANTITY

(Full Hydrographs can be made available upon request)

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.143	2	474	2,052	------	------	------	PRE-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.013	2	480	295	------	------	------	PRE-DEVELOPED A1 MOD IMP
3	SBUH Runoff	0.010	2	480	185	------	------	------	PRE-DEVELOPED A1 PERV
4	Combine	0.164	2	476	2,533	1, 2, 3	------	------	PRE-DEVELOPED A1 - COMBINED
6	SBUH Runoff	0.294	2	480	4,492	------	------	------	PRE-DEVELOPED A2 EX IMP
7	SBUH Runoff	0.041	2	482	1,098	------	------	------	PRE-DEVELOPED A2 MOD IMP
8	SBUH Runoff	0.075	2	480	1,593	------	------	------	PRE-DEVELOPED A2 PERV
9	SBUH Runoff	0.010	2	480	153	------	------	------	PRE-DEVELOPED A2 GRAVEL
10	Combine	0.419	2	480	7,336	6, 7, 8, 9	------	------	PRE-DEVELOPED A2 - COMBINED
12	SBUH Runoff	0.020	2	474	288	------	------	------	PRE-DEVELOPED A3 EX IMP
13	SBUH Runoff	0.003	2	480	59	------	------	------	PRE-DEVELOPED A3 MOD IMP
14	SBUH Runoff	0.000	2	480	9	------	------	------	PRE-DEVELOPED A3 PERV
15	Combine	0.022	2	476	348	12, 13,	------	------	PRE-DEVELOPED A3- COMBINED
17	SBUH Runoff	0.018	2	474	256	------	------	------	PRE-DEVELOPED A4 EX IMP
18	SBUH Runoff	0.003	2	480	71	------	------	------	PRE-DEVELOPED A4 MOD IMP
19	SBUH Runoff	0.001	2	480	18	------	------	------	PRE-DEVELOPED A4 PERV
20	Combine	0.022	2	476	345	17, 18, 19	------	------	PRE-DEVELOPED A4 - COMBINED
22	SBUH Runoff	0.017	2	474	239	------	------	------	PRE-DEVELOPED A5 EX IMP
23	SBUH Runoff	0.003	2	480	71	------	------	------	PRE-DEVELOPED A5 MOD IMP
24	SBUH Runoff	0.000	2	480	6	------	------	------	PRE-DEVELOPED A5 PERV
25	Combine	0.020	2	476	316	22, 23, 24	------	------	PRE-DEVELOPED A5 - COMBINED
27	SBUH Runoff	0.017	2	474	247	------	------	------	PRE-DEVELOPED A6 EX IMP
28	SBUH Runoff	0.003	2	480	68	------	------	------	PRE-DEVELOPED A6 MOD IMP
29	SBUH Runoff	0.001	2	480	18	------	------	------	PRE-DEVELOPED A6 PERV
30	Combine	0.021	2	476	334	27, 28, 29	------	------	PRE-DEVELOPED A6 -COMBINED
32	SBUH Runoff	0.022	2	474	313	------	------	------	PRE-DEVELOPED A7 EX IMP
33	SBUH Runoff	0.004	2	480	85	------	------	------	PRE-DEVELOPED A7 MOD IMP
34	SBUH Runoff	0.000	2	480	9	------	------	------	PRE-DEVELOPED A7 PERV
35	Combine	0.026	2	476	407	32, 33, 34	------	------	PRE-DEVELOPED A7 - COMBINED
37	SBUH Runoff	0.082	2	474	1,170	------	------	------	PRE-DEVELOPED A8 EX IMP

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
38	SBUH Runoff	0.007	2	480	168	------	------	------	PRE-DEVELOPED A8 MOD IMP
39	SBUH Runoff	0.015	2	480	283	------	------	------	PRE-DEVELOPED A8 PERV
40	Combine	0.103	2	476	1,621	37, 38, 39	------	------	PRE-DEVELOPED A8 - COMBINED
42	SBUH Runoff	0.046	2	474	659	------	------	------	PRE-DEVELOPED A9 EX IMP
43	SBUH Runoff	0.006	2	480	142	------	------	------	PRE-DEVELOPED A9 MOD IMP
44	SBUH Runoff	0.011	2	480	210	------	------	------	PRE-DEVELOPED A9 PERV
45	SBUH Runoff	0.003	2	478	42	------	------	------	PRE-DEVELOPED A9 GRAVEL
46	Combine	0.065	2	478	1,053	42, 43, 44, 45	------	------	PRE-DEVELOPED A9 - COMBINED
48	SBUH Runoff	0.025	2	474	354	------	------	------	PRE-DEVELOPED A11 EX IMP
49	SBUH Runoff	0.001	2	480	21	------	------	------	PRE-DEVELOPED A11 MOD IMP
50	SBUH Runoff	0.016	2	480	307	------	------	------	PRE-DEVELOPED A11 PERV
51	Combine	0.041	2	478	683	48, 49, 50	------	------	PRE-DEVELOPED A11 - COMBINED
53	SBUH Runoff	0.106	2	474	1,525	------	------	------	PRE-DEVELOPED A10 EX IMP
54	SBUH Runoff	0.018	2	480	437	------	------	------	PRE-DEVELOPED A10 MOD IMP
55	SBUH Runoff	0.026	2	480	489	------	------	------	PRE-DEVELOPED A10 PERV
56	SBUH Runoff	0.008	2	478	116	------	------	------	PRE-DEVELOPED A10 GRAVEL
57	Combine	0.155	2	478	2,567	53, 54, 55, 56	------	------	PRE-DEVELOPED A10 - COMBINED
59	SBUH Runoff	0.056	2	482	1,507	------	------	------	PRE-DEVELOPED A1 EX IMP
60	SBUH Runoff	0.009	2	480	195	------	------	------	PRE-DEVELOPED A1 PERV
62	SBUH Runoff	0.124	2	480	1,896	------	------	------	PRE-DEVELOPED B1 IMP
63	SBUH Runoff	0.076	2	480	1,614	------	------	------	PRE-DEVELOPED B1 PERV
64	Combine	0.200	2	480	3,510	62, 63	------	------	PRE-DEVELOPED B1 - COMBINED
66	SBUH Runoff	0.206	2	480	3,141	------	------	------	PRE-DEVELOPED B2 IMP
67	SBUH Runoff	0.057	2	480	1,216	------	------	------	PRE-DEVELOPED B2 PERV
68	Combine	0.263	2	480	4,356	66, 67	------	------	PRE-DEVELOPED B2 - COMBINED
70	SBUH Runoff	0.344	2	480	5,259	------	------	------	PRE-DEVELOPED B3 IMP
71	SBUH Runoff	0.009	2	480	195	------	------	------	PRE-DEVELOPED B3 PERV
72	Combine	0.353	2	480	5,453	70, 71	------	------	PRE-DEVELOPED B3 - COMBINED

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.180	2	474	2,592	------	------	------	PRE-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.024	2	480	466	------	------	------	PRE-DEVELOPED A1 MOD IMP
3	SBUH Runoff	0.017	2	480	279	------	------	------	PRE-DEVELOPED A1 PERV
4	Combine	0.219	2	476	3,338	1, 2, 3	------	------	PRE-DEVELOPED A1 - COMBINED
6	SBUH Runoff	0.369	2	480	5,674	------	------	------	PRE-DEVELOPED A2 EX IMP
7	SBUH Runoff	0.081	2	480	1,733	------	------	------	PRE-DEVELOPED A2 MOD IMP
8	SBUH Runoff	0.129	2	480	2,401	------	------	------	PRE-DEVELOPED A2 PERV
9	SBUH Runoff	0.014	2	480	210	------	------	------	PRE-DEVELOPED A2 GRAVEL
10	Combine	0.593	2	480	10,017	6, 7, 8, 9	------	------	PRE-DEVELOPED A2 - COMBINED
12	SBUH Runoff	0.025	2	474	364	------	------	------	PRE-DEVELOPED A3 EX IMP
13	SBUH Runoff	0.005	2	480	93	------	------	------	PRE-DEVELOPED A3 MOD IMP
14	SBUH Runoff	0.001	2	480	14	------	------	------	PRE-DEVELOPED A3 PERV
15	Combine	0.030	2	476	458	12, 13,	------	------	PRE-DEVELOPED A3- COMBINED
17	SBUH Runoff	0.022	2	474	323	------	------	------	PRE-DEVELOPED A4 EX IMP
18	SBUH Runoff	0.006	2	480	112	------	------	------	PRE-DEVELOPED A4 MOD IMP
19	SBUH Runoff	0.002	2	480	27	------	------	------	PRE-DEVELOPED A4 PERV
20	Combine	0.030	2	476	462	17, 18, 19	------	------	PRE-DEVELOPED A4 - COMBINED
22	SBUH Runoff	0.021	2	474	302	------	------	------	PRE-DEVELOPED A5 EX IMP
23	SBUH Runoff	0.006	2	480	112	------	------	------	PRE-DEVELOPED A5 MOD IMP
24	SBUH Runoff	0.001	2	480	9	------	------	------	PRE-DEVELOPED A5 PERV
25	Combine	0.027	2	476	423	22, 23, 24	------	------	PRE-DEVELOPED A5 - COMBINED
27	SBUH Runoff	0.022	2	474	312	------	------	------	PRE-DEVELOPED A6 EX IMP
28	SBUH Runoff	0.006	2	480	108	------	------	------	PRE-DEVELOPED A6 MOD IMP
29	SBUH Runoff	0.002	2	480	27	------	------	------	PRE-DEVELOPED A6 PERV
30	Combine	0.029	2	476	448	27, 28, 29	------	------	PRE-DEVELOPED A6 -COMBINED
32	SBUH Runoff	0.027	2	474	396	------	------	------	PRE-DEVELOPED A7 EX IMP
33	SBUH Runoff	0.007	2	480	134	------	------	------	PRE-DEVELOPED A7 MOD IMP
34	SBUH Runoff	0.001	2	480	14	------	------	------	PRE-DEVELOPED A7 PERV
35	Combine	0.035	2	476	544	32, 33, 34	------	------	PRE-DEVELOPED A7 - COMBINED
37	SBUH Runoff	0.103	2	474	1,478	------	------	------	PRE-DEVELOPED A8 EX IMP

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
38	SBUH Runoff	0.014	2	480	265	------	------	------	PRE-DEVELOPED A8 MOD IMP
39	SBUH Runoff	0.025	2	480	426	------	------	------	PRE-DEVELOPED A8 PERV
40	Combine	0.140	2	476	2,169	37, 38, 39	------	------	PRE-DEVELOPED A8 - COMBINED
42	SBUH Runoff	0.058	2	474	833	------	------	------	PRE-DEVELOPED A9 EX IMP
43	SBUH Runoff	0.012	2	480	224	------	------	------	PRE-DEVELOPED A9 MOD IMP
44	SBUH Runoff	0.019	2	480	316	------	------	------	PRE-DEVELOPED A9 PERV
45	SBUH Runoff	0.004	2	476	58	------	------	------	PRE-DEVELOPED A9 GRAVEL
46	Combine	0.091	2	476	1,430	42, 43, 44, 45	------	------	PRE-DEVELOPED A9 - COMBINED
48	SBUH Runoff	0.031	2	474	448	------	------	------	PRE-DEVELOPED A11 EX IMP
49	SBUH Runoff	0.002	2	480	34	------	------	------	PRE-DEVELOPED A11 MOD IMP
50	SBUH Runoff	0.027	2	480	463	------	------	------	PRE-DEVELOPED A11 PERV
51	Combine	0.060	2	478	944	48, 49, 50	------	------	PRE-DEVELOPED A11 - COMBINED
53	SBUH Runoff	0.132	2	474	1,926	------	------	------	PRE-DEVELOPED A10 EX IMP
54	SBUH Runoff	0.036	2	480	690	------	------	------	PRE-DEVELOPED A10 MOD IMP
55	SBUH Runoff	0.043	2	480	738	------	------	------	PRE-DEVELOPED A10 PERV
56	SBUH Runoff	0.011	2	478	159	------	------	------	PRE-DEVELOPED A10 GRAVEL
57	Combine	0.220	2	478	3,512	53, 54, 55, 56	------	------	PRE-DEVELOPED A10 - COMBINED
59	SBUH Runoff	0.111	2	480	2,378	------	------	------	PRE-DEVELOPED A1 EX IMP
60	SBUH Runoff	0.016	2	480	293	------	------	------	PRE-DEVELOPED A1 PERV
62	SBUH Runoff	0.156	2	480	2,394	------	------	------	PRE-DEVELOPED B1 IMP
63	SBUH Runoff	0.131	2	480	2,433	------	------	------	PRE-DEVELOPED B1 PERV
64	Combine	0.287	2	480	4,827	62, 63	------	------	PRE-DEVELOPED B1 - COMBINED
66	SBUH Runoff	0.258	2	480	3,966	------	------	------	PRE-DEVELOPED B2 IMP
67	SBUH Runoff	0.099	2	480	1,833	------	------	------	PRE-DEVELOPED B2 PERV
68	Combine	0.356	2	480	5,799	66, 67	------	------	PRE-DEVELOPED B2 - COMBINED
70	SBUH Runoff	0.431	2	480	6,642	------	------	------	PRE-DEVELOPED B3 IMP
71	SBUH Runoff	0.016	2	480	293	------	------	------	PRE-DEVELOPED B3 PERV
72	Combine	0.447	2	480	6,935	70, 71	------	------	PRE-DEVELOPED B3 - COMBINED

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.201	2	474	2,907	------	------	------	PRE-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.032	2	480	575	------	------	------	PRE-DEVELOPED A1 MOD IMP
3	SBUH Runoff	0.021	2	480	338	------	------	------	PRE-DEVELOPED A1 PERV
4	Combine	0.252	2	476	3,820	1, 2, 3	------	------	PRE-DEVELOPED A1 - COMBINED
6	SBUH Runoff	0.412	2	480	6,364	------	------	------	PRE-DEVELOPED A2 EX IMP
7	SBUH Runoff	0.108	2	480	2,138	------	------	------	PRE-DEVELOPED A2 MOD IMP
8	SBUH Runoff	0.164	2	480	2,905	------	------	------	PRE-DEVELOPED A2 PERV
9	SBUH Runoff	0.016	2	480	243	------	------	------	PRE-DEVELOPED A2 GRAVEL
10	Combine	0.700	2	480	11,650	6, 7, 8, 9	------	------	PRE-DEVELOPED A2 - COMBINED
12	SBUH Runoff	0.028	2	474	409	------	------	------	PRE-DEVELOPED A3 EX IMP
13	SBUH Runoff	0.006	2	480	115	------	------	------	PRE-DEVELOPED A3 MOD IMP
14	SBUH Runoff	0.001	2	480	17	------	------	------	PRE-DEVELOPED A3 PERV
15	Combine	0.034	2	476	524	12, 13,	------	------	PRE-DEVELOPED A3- COMBINED
17	SBUH Runoff	0.025	2	474	362	------	------	------	PRE-DEVELOPED A4 EX IMP
18	SBUH Runoff	0.008	2	480	138	------	------	------	PRE-DEVELOPED A4 MOD IMP
19	SBUH Runoff	0.002	2	480	33	------	------	------	PRE-DEVELOPED A4 PERV
20	Combine	0.034	2	476	533	17, 18, 19	------	------	PRE-DEVELOPED A4 - COMBINED
22	SBUH Runoff	0.023	2	474	339	------	------	------	PRE-DEVELOPED A5 EX IMP
23	SBUH Runoff	0.008	2	480	138	------	------	------	PRE-DEVELOPED A5 MOD IMP
24	SBUH Runoff	0.001	2	480	11	------	------	------	PRE-DEVELOPED A5 PERV
25	Combine	0.031	2	476	488	22, 23, 24	------	------	PRE-DEVELOPED A5 - COMBINED
27	SBUH Runoff	0.024	2	474	350	------	------	------	PRE-DEVELOPED A6 EX IMP
28	SBUH Runoff	0.007	2	480	133	------	------	------	PRE-DEVELOPED A6 MOD IMP
29	SBUH Runoff	0.002	2	480	33	------	------	------	PRE-DEVELOPED A6 PERV
30	Combine	0.033	2	476	517	27, 28, 29	------	------	PRE-DEVELOPED A6 -COMBINED
32	SBUH Runoff	0.031	2	474	444	------	------	------	PRE-DEVELOPED A7 EX IMP
33	SBUH Runoff	0.009	2	480	166	------	------	------	PRE-DEVELOPED A7 MOD IMP
34	SBUH Runoff	0.001	2	480	17	------	------	------	PRE-DEVELOPED A7 PERV
35	Combine	0.041	2	476	626	32, 33, 34	------	------	PRE-DEVELOPED A7 - COMBINED
37	SBUH Runoff	0.115	2	474	1,658	------	------	------	PRE-DEVELOPED A8 EX IMP

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
38	SBUH Runoff	0.018	2	480	326	------	------	------	PRE-DEVELOPED A8 MOD IMP
39	SBUH Runoff	0.032	2	480	516	------	------	------	PRE-DEVELOPED A8 PERV
40	Combine	0.163	2	476	2,500	37, 38, 39	------	------	PRE-DEVELOPED A8 - COMBINED
42	SBUH Runoff	0.065	2	474	934	------	------	------	PRE-DEVELOPED A9 EX IMP
43	SBUH Runoff	0.015	2	480	276	------	------	------	PRE-DEVELOPED A9 MOD IMP
44	SBUH Runoff	0.023	2	480	383	------	------	------	PRE-DEVELOPED A9 PERV
45	SBUH Runoff	0.005	2	476	67	------	------	------	PRE-DEVELOPED A9 GRAVEL
46	Combine	0.107	2	476	1,660	42, 43, 44, 45	------	------	PRE-DEVELOPED A9 - COMBINED
48	SBUH Runoff	0.035	2	474	502	------	------	------	PRE-DEVELOPED A11 EX IMP
49	SBUH Runoff	0.002	2	480	41	------	------	------	PRE-DEVELOPED A11 MOD IMP
50	SBUH Runoff	0.034	2	480	560	------	------	------	PRE-DEVELOPED A11 PERV
51	Combine	0.071	2	478	1,103	48, 49, 50	------	------	PRE-DEVELOPED A11 - COMBINED
53	SBUH Runoff	0.148	2	474	2,160	------	------	------	PRE-DEVELOPED A10 EX IMP
54	SBUH Runoff	0.047	2	480	851	------	------	------	PRE-DEVELOPED A10 MOD IMP
55	SBUH Runoff	0.054	2	480	893	------	------	------	PRE-DEVELOPED A10 PERV
56	SBUH Runoff	0.013	2	478	185	------	------	------	PRE-DEVELOPED A10 GRAVEL
57	Combine	0.260	2	478	4,088	53, 54, 55, 56	------	------	PRE-DEVELOPED A10 - COMBINED
59	SBUH Runoff	0.148	2	480	2,933	------	------	------	PRE-DEVELOPED A1 EX IMP
60	SBUH Runoff	0.020	2	480	355	------	------	------	PRE-DEVELOPED A1 PERV
62	SBUH Runoff	0.174	2	480	2,686	------	------	------	PRE-DEVELOPED B1 IMP
63	SBUH Runoff	0.166	2	480	2,944	------	------	------	PRE-DEVELOPED B1 PERV
64	Combine	0.340	2	480	5,629	62, 63	------	------	PRE-DEVELOPED B1 - COMBINED
66	SBUH Runoff	0.288	2	480	4,449	------	------	------	PRE-DEVELOPED B2 IMP
67	SBUH Runoff	0.125	2	480	2,218	------	------	------	PRE-DEVELOPED B2 PERV
68	Combine	0.413	2	480	6,666	66, 67	------	------	PRE-DEVELOPED B2 - COMBINED
70	SBUH Runoff	0.482	2	480	7,450	------	------	------	PRE-DEVELOPED B3 IMP
71	SBUH Runoff	0.020	2	480	355	------	------	------	PRE-DEVELOPED B3 PERV
72	Combine	0.502	2	480	7,804	70, 71	------	------	PRE-DEVELOPED B3 - COMBINED

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.228	2	474	3,313	------	------	------	PRE-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.043	2	480	722	------	------	------	PRE-DEVELOPED A1 MOD IMP
3	SBUH Runoff	0.026	2	480	417	------	------	------	PRE-DEVELOPED A1 PERV
4	Combine	0.295	2	476	4,452	1, 2, 3	------	------	PRE-DEVELOPED A1 - COMBINED
6	SBUH Runoff	0.467	2	480	7,251	------	------	------	PRE-DEVELOPED A2 EX IMP
7	SBUH Runoff	0.145	2	480	2,687	------	------	------	PRE-DEVELOPED A2 MOD IMP
8	SBUH Runoff	0.210	2	480	3,581	------	------	------	PRE-DEVELOPED A2 PERV
9	SBUH Runoff	0.019	2	480	287	------	------	------	PRE-DEVELOPED A2 GRAVEL
10	Combine	0.842	2	480	13,807	6, 7, 8, 9	------	------	PRE-DEVELOPED A2 - COMBINED
12	SBUH Runoff	0.032	2	474	466	------	------	------	PRE-DEVELOPED A3 EX IMP
13	SBUH Runoff	0.009	2	480	144	------	------	------	PRE-DEVELOPED A3 MOD IMP
14	SBUH Runoff	0.001	2	480	21	------	------	------	PRE-DEVELOPED A3 PERV
15	Combine	0.040	2	476	610	12, 13,	------	------	PRE-DEVELOPED A3- COMBINED
17	SBUH Runoff	0.028	2	474	412	------	------	------	PRE-DEVELOPED A4 EX IMP
18	SBUH Runoff	0.010	2	480	173	------	------	------	PRE-DEVELOPED A4 MOD IMP
19	SBUH Runoff	0.003	2	480	41	------	------	------	PRE-DEVELOPED A4 PERV
20	Combine	0.041	2	476	627	17, 18, 19	------	------	PRE-DEVELOPED A4 - COMBINED
22	SBUH Runoff	0.027	2	474	386	------	------	------	PRE-DEVELOPED A5 EX IMP
23	SBUH Runoff	0.010	2	480	173	------	------	------	PRE-DEVELOPED A5 MOD IMP
24	SBUH Runoff	0.001	2	480	14	------	------	------	PRE-DEVELOPED A5 PERV
25	Combine	0.037	2	476	573	22, 23, 24	------	------	PRE-DEVELOPED A5 - COMBINED
27	SBUH Runoff	0.027	2	474	399	------	------	------	PRE-DEVELOPED A6 EX IMP
28	SBUH Runoff	0.010	2	480	168	------	------	------	PRE-DEVELOPED A6 MOD IMP
29	SBUH Runoff	0.003	2	480	41	------	------	------	PRE-DEVELOPED A6 PERV
30	Combine	0.040	2	476	608	27, 28, 29	------	------	PRE-DEVELOPED A6 -COMBINED
32	SBUH Runoff	0.035	2	474	506	------	------	------	PRE-DEVELOPED A7 EX IMP
33	SBUH Runoff	0.012	2	480	208	------	------	------	PRE-DEVELOPED A7 MOD IMP
34	SBUH Runoff	0.001	2	480	21	------	------	------	PRE-DEVELOPED A7 PERV
35	Combine	0.048	2	476	734	32, 33, 34	------	------	PRE-DEVELOPED A7 - COMBINED
37	SBUH Runoff	0.130	2	474	1,889	------	------	------	PRE-DEVELOPED A8 EX IMP

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
38	SBUH Runoff	0.024	2	480	410	------	------	------	PRE-DEVELOPED A8 MOD IMP
39	SBUH Runoff	0.040	2	480	636	------	------	------	PRE-DEVELOPED A8 PERV
40	Combine	0.193	2	476	2,935	37, 38, 39	------	------	PRE-DEVELOPED A8 - COMBINED
42	SBUH Runoff	0.073	2	474	1,064	------	------	------	PRE-DEVELOPED A9 EX IMP
43	SBUH Runoff	0.021	2	480	347	------	------	------	PRE-DEVELOPED A9 MOD IMP
44	SBUH Runoff	0.030	2	480	472	------	------	------	PRE-DEVELOPED A9 PERV
45	SBUH Runoff	0.006	2	476	79	------	------	------	PRE-DEVELOPED A9 GRAVEL
46	Combine	0.128	2	476	1,962	42, 43, 44, 45	------	------	PRE-DEVELOPED A9 - COMBINED
48	SBUH Runoff	0.039	2	474	572	------	------	------	PRE-DEVELOPED A11 EX IMP
49	SBUH Runoff	0.003	2	480	52	------	------	------	PRE-DEVELOPED A11 MOD IMP
50	SBUH Runoff	0.044	2	480	690	------	------	------	PRE-DEVELOPED A11 PERV
51	Combine	0.086	2	476	1,314	48, 49, 50	------	------	PRE-DEVELOPED A11 - COMBINED
53	SBUH Runoff	0.168	2	474	2,461	------	------	------	PRE-DEVELOPED A10 EX IMP
54	SBUH Runoff	0.063	2	480	1,069	------	------	------	PRE-DEVELOPED A10 MOD IMP
55	SBUH Runoff	0.069	2	480	1,100	------	------	------	PRE-DEVELOPED A10 PERV
56	SBUH Runoff	0.015	2	478	218	------	------	------	PRE-DEVELOPED A10 GRAVEL
57	Combine	0.312	2	478	4,849	53, 54, 55, 56	------	------	PRE-DEVELOPED A10 - COMBINED
59	SBUH Runoff	0.199	2	480	3,687	------	------	------	PRE-DEVELOPED A1 EX IMP
60	SBUH Runoff	0.026	2	480	437	------	------	------	PRE-DEVELOPED A1 PERV
62	SBUH Runoff	0.197	2	480	3,060	------	------	------	PRE-DEVELOPED B1 IMP
63	SBUH Runoff	0.213	2	480	3,629	------	------	------	PRE-DEVELOPED B1 PERV
64	Combine	0.410	2	480	6,689	62, 63	------	------	PRE-DEVELOPED B1 - COMBINED
66	SBUH Runoff	0.327	2	480	5,069	------	------	------	PRE-DEVELOPED B2 IMP
67	SBUH Runoff	0.160	2	480	2,734	------	------	------	PRE-DEVELOPED B2 PERV
68	Combine	0.487	2	480	7,803	66, 67	------	------	PRE-DEVELOPED B2 - COMBINED
70	SBUH Runoff	0.547	2	480	8,489	------	------	------	PRE-DEVELOPED B3 IMP
71	SBUH Runoff	0.026	2	480	437	------	------	------	PRE-DEVELOPED B3 PERV
72	Combine	0.573	2	480	8,926	70, 71	------	------	PRE-DEVELOPED B3 - COMBINED

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

of Sandy)\SDY-06 (Bell Street - 362nd Avenue)\SDY06-DOCS\Reports\Stormwater\Resources\CityofSandy_NMFS.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	1.00	2.50	1.05	3.10	3.45	3.90	5.00	4.50
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	6.50	8.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	6.00	7.10

Pond Report

Pond No. 5 - LIDA EDB FINAL - Contour w/Walls

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 193.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	193.00	775	0	0
0.50	193.50	1,262	504	504
1.00	194.00	1,763	753	1,257
1.50	194.50	2,279	1,008	2,265
2.00	195.00	2,808	1,269	3,534
2.50	195.50	3,351	1,538	5,072
3.00	196.00	3,909	1,813	6,885
3.50	196.70	3,909	1,954	8,839

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	3.52	5.00	Inactive
Span (in)	= 15.00	3.52	5.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 193.00	193.00	195.47	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.33	5.00	Inactive	Inactive
Crest El. (ft)	= 196.15	196.15	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	105 degV	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	193.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.50	504	193.50	0.18 ic	0.18 ic	0.00	---	0.00	0.00	---	---	---	---	0.181
1.00	1,257	194.00	0.29 ic	0.28 ic	0.00	---	0.00	0.00	---	---	---	---	0.283
1.50	2,265	194.50	0.37 ic	0.36 ic	0.00	---	0.00	0.00	---	---	---	---	0.360
2.00	3,534	195.00	0.43 ic	0.42 ic	0.00	---	0.00	0.00	---	---	---	---	0.424
2.50	5,072	195.50	0.48 ic	0.48 ic	0.00 ic	---	0.00	0.00	---	---	---	---	0.483
3.00	6,885	196.00	0.90 ic	0.52 ic	0.37 ic	---	0.00	0.00	---	---	---	---	0.893
3.50	8,839	196.70	4.36 ic	0.52 ic	0.66 ic	---	3.16	5.30	---	---	---	---	9.650

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.143	2	474	2,052	------	------	------	POST-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.107	2	474	1,525	------	------	------	POST-DEVELOPED A1 IMP
3	Combine	0.250	2	474	3,577	1, 2	------	------	POST-DEVELOPED A1 - COMBINE
5	SBUH Runoff	0.314	2	474	4,492	------	------	------	POST-DEVELOPED A2 EX IMP
6	SBUH Runoff	0.455	2	474	6,504	------	------	------	POST-DEVELOPED A2 IMP
7	SBUH Runoff	0.023	2	480	543	------	------	------	POST-DEVELOPED A2 PERV
8	Combine	0.789	2	474	11,539	5, 6, 7	------	------	POST-DEVELOPED A2 - COMBINE
10	SBUH Runoff	0.020	2	474	288	------	------	------	POST-DEVELOPED A3 EX IMP
11	SBUH Runoff	0.016	2	474	231	------	------	------	POST-DEVELOPED A3 IMP
12	Combine	0.036	2	474	519	10, 11	------	------	POST-DEVELOPED A3- COMBINED
14	SBUH Runoff	0.018	2	474	256	------	------	------	POST-DEVELOPED A4 EX IMP
15	SBUH Runoff	0.021	2	474	297	------	------	------	POST-DEVELOPED A4 IMP
16	Combine	0.039	2	474	552	14, 15	------	------	POST-DEVELOPED A4 - COMBINE
18	SBUH Runoff	0.017	2	474	239	------	------	------	POST-DEVELOPED A5 EX IMP
19	SBUH Runoff	0.018	2	474	264	------	------	------	POST-DEVELOPED A5 IMP
20	Combine	0.035	2	474	503	18, 19	------	------	POST-DEVELOPED A5 - COMBINE
22	SBUH Runoff	0.017	2	474	247	------	------	------	POST-DEVELOPED A6 EX IMP
23	SBUH Runoff	0.017	2	474	247	------	------	------	POST-DEVELOPED A6 IMP
24	SBUH Runoff	0.001	2	480	12	------	------	------	POST-DEVELOPED A6 PERV
25	Combine	0.035	2	474	506	22, 23, 24	------	------	POST-DEVELOPED A6 -COMBINED
27	SBUH Runoff	0.022	2	474	313	------	------	------	POST-DEVELOPED A7 EX IMP
28	SBUH Runoff	0.023	2	474	330	------	------	------	POST-DEVELOPED A7 IMP
29	Combine	0.045	2	474	643	27, 28	------	------	POST-DEVELOPED A7 - COMBINE
31	SBUH Runoff	0.067	2	474	956	------	------	------	POST-DEVELOPED A8 EX IMP
32	SBUH Runoff	0.053	2	474	758	------	------	------	POST-DEVELOPED A8 IMP
33	SBUH Runoff	0.010	2	480	234	------	------	------	POST-DEVELOPED A8 PERV
34	Combine	0.129	2	474	1,948	31, 32, 33	------	------	POST-DEVELOPED A8 - COMBINE
36	SBUH Runoff	0.046	2	474	659	------	------	------	POST-DEVELOPED A9 EX IMP
37	SBUH Runoff	0.054	2	474	775	------	------	------	POST-DEVELOPED A9 IMP
38	SBUH Runoff	0.004	2	480	102	------	------	------	POST-DEVELOPED A9 PERV

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
39	Combine	0.104	2	474	1,536	36, 37, 38	------	------	POST-DEVELOPED A9 - COMBINE
41	SBUH Runoff	0.010	2	474	148	------	------	------	POST-DEVELOPED A11 EX IMP
42	SBUH Runoff	0.013	2	474	181	------	------	------	POST-DEVELOPED A11 IMP
43	SBUH Runoff	0.011	2	480	267	------	------	------	POST-DEVELOPED A11 PERV
44	Combine	0.034	2	480	597	41, 42, 43	------	------	POST-DEVELOPED A11 - COMBINE
46	SBUH Runoff	0.107	2	474	1,525	------	------	------	POST-DEVELOPED A10 EX IMP
47	SBUH Runoff	0.180	2	474	2,572	------	------	------	POST-DEVELOPED A10 IMP
48	SBUH Runoff	0.006	2	480	132	------	------	------	POST-DEVELOPED A10 PERV
49	Combine	0.291	2	474	4,229	46, 47, 48	------	------	POST-DEVELOPED A10 - COMBINE
51	SBUH Runoff	0.133	2	474	1,896	------	------	------	B1 EX IMP
52	SBUH Runoff	0.085	2	480	1,614	------	------	------	B1 PER
53	Combine	0.215	2	478	3,510	51, 52	------	------	B1 - COMBINED
55	SBUH Runoff	0.220	2	474	3,141	------	------	------	B2 EX IMP
56	SBUH Runoff	0.064	2	480	1,216	------	------	------	B2 PER
57	Combine	0.281	2	476	4,356	55, 56	------	------	B2 - COMBINED
59	SBUH Runoff	0.065	2	480	1,507	------	------	------	B3 EX IMP
60	SBUH Runoff	0.006	2	480	151	------	------	------	B3 PERV
61	Combine	0.071	2	480	1,658	59, 60	------	------	B3 - COMBINED
63	SBUH Runoff	0.399	2	474	5,704	------	------	------	B4 EX IMP
64	SBUH Runoff	0.111	2	480	2,104	------	------	------	B4 PER
65	Combine	0.504	2	476	7,808	63, 64	------	------	B4 - COMBINED
67	SBUH Runoff	2.659	2	474	38,032	------	------	------	C1 EX IMP
68	SBUH Runoff	0.400	2	480	7,551	------	------	------	C1 PER
69	Combine	3.033	2	476	45,583	67, 68	------	------	C1 - COMBINED
71	SBUH Runoff	0.305	2	474	4,360	------	------	------	C3 EX IMP
72	SBUH Runoff	0.139	2	480	2,623	------	------	------	C3 PER
73	Combine	0.437	2	478	6,984	71, 72	------	------	C3 - COMBINED
75	SBUH Runoff	0.071	2	474	1,022	------	------	------	C4 EX IMP
76	SBUH Runoff	0.033	2	480	617	------	------	------	C4 PER

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
77	Combine	0.103	2	478	1,639	75, 76	------	------	C4 - COMBINED
79	SBUH Runoff	0.123	2	474	1,756	------	------	------	C5 EX IMP
80	SBUH Runoff	0.008	2	480	158	------	------	------	C5 PERV
81	Combine	0.131	2	474	1,914	79, 80	------	------	C5 - COMBINED
83	Combine	1.886	2	476	29,467	8, 44, 53, 57, 61, 83	------	------	EDB Contribution
84	Reservoir	0.561	2	556	29,458		195.63	5,548	Extended Dry Basin

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.180	2	474	2,592	------	------	------	POST-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.134	2	474	1,926	------	------	------	POST-DEVELOPED A1 IMP
3	Combine	0.313	2	474	4,518	1, 2	------	------	POST-DEVELOPED A1 - COMBINE
5	SBUH Runoff	0.394	2	474	5,674	------	------	------	POST-DEVELOPED A2 EX IMP
6	SBUH Runoff	0.570	2	474	8,214	------	------	------	POST-DEVELOPED A2 IMP
7	SBUH Runoff	0.045	2	480	857	------	------	------	POST-DEVELOPED A2 PERV
8	Combine	1.006	2	474	14,745	5, 6, 7	------	------	POST-DEVELOPED A2 - COMBINE
10	SBUH Runoff	0.025	2	474	364	------	------	------	POST-DEVELOPED A3 EX IMP
11	SBUH Runoff	0.020	2	474	291	------	------	------	POST-DEVELOPED A3 IMP
12	Combine	0.046	2	474	656	10, 11	------	------	POST-DEVELOPED A3- COMBINED
14	SBUH Runoff	0.022	2	474	323	------	------	------	POST-DEVELOPED A4 EX IMP
15	SBUH Runoff	0.026	2	474	375	------	------	------	POST-DEVELOPED A4 IMP
16	Combine	0.048	2	474	697	14, 15	------	------	POST-DEVELOPED A4 - COMBINE
18	SBUH Runoff	0.021	2	474	302	------	------	------	POST-DEVELOPED A5 EX IMP
19	SBUH Runoff	0.023	2	474	333	------	------	------	POST-DEVELOPED A5 IMP
20	Combine	0.044	2	474	635	18, 19	------	------	POST-DEVELOPED A5 - COMBINE
22	SBUH Runoff	0.022	2	474	312	------	------	------	POST-DEVELOPED A6 EX IMP
23	SBUH Runoff	0.022	2	474	312	------	------	------	POST-DEVELOPED A6 IMP
24	SBUH Runoff	0.001	2	480	19	------	------	------	POST-DEVELOPED A6 PERV
25	Combine	0.044	2	474	643	22, 23, 24	------	------	POST-DEVELOPED A6 -COMBINED
27	SBUH Runoff	0.027	2	474	396	------	------	------	POST-DEVELOPED A7 EX IMP
28	SBUH Runoff	0.029	2	474	416	------	------	------	POST-DEVELOPED A7 IMP
29	Combine	0.056	2	474	812	27, 28	------	------	POST-DEVELOPED A7 - COMBINE
31	SBUH Runoff	0.084	2	474	1,208	------	------	------	POST-DEVELOPED A8 EX IMP
32	SBUH Runoff	0.066	2	474	958	------	------	------	POST-DEVELOPED A8 IMP
33	SBUH Runoff	0.019	2	480	369	------	------	------	POST-DEVELOPED A8 PERV
34	Combine	0.168	2	474	2,534	31, 32, 33	------	------	POST-DEVELOPED A8 - COMBINE
36	SBUH Runoff	0.058	2	474	833	------	------	------	POST-DEVELOPED A9 EX IMP
37	SBUH Runoff	0.068	2	474	979	------	------	------	POST-DEVELOPED A9 IMP
38	SBUH Runoff	0.008	2	480	160	------	------	------	POST-DEVELOPED A9 PERV

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
39	Combine	0.134	2	474	1,972	36, 37, 38	------	------	POST-DEVELOPED A9 - COMBINE
41	SBUH Runoff	0.013	2	474	187	------	------	------	POST-DEVELOPED A11 EX IMP
42	SBUH Runoff	0.016	2	474	229	------	------	------	POST-DEVELOPED A11 IMP
43	SBUH Runoff	0.022	2	480	421	------	------	------	POST-DEVELOPED A11 PERV
44	Combine	0.050	2	478	838	41, 42, 43	------	------	POST-DEVELOPED A11 - COMBINE
46	SBUH Runoff	0.134	2	474	1,926	------	------	------	POST-DEVELOPED A10 EX IMP
47	SBUH Runoff	0.225	2	474	3,248	------	------	------	POST-DEVELOPED A10 IMP
48	SBUH Runoff	0.011	2	480	209	------	------	------	POST-DEVELOPED A10 PERV
49	Combine	0.369	2	474	5,383	46, 47, 48	------	------	POST-DEVELOPED A10 - COMBINE
51	SBUH Runoff	0.166	2	474	2,394	------	------	------	B1 EX IMP
52	SBUH Runoff	0.144	2	480	2,433	------	------	------	B1 PER
53	Combine	0.307	2	478	4,827	51, 52	------	------	B1 - COMBINED
55	SBUH Runoff	0.275	2	474	3,966	------	------	------	B2 EX IMP
56	SBUH Runoff	0.108	2	480	1,833	------	------	------	B2 PER
57	Combine	0.380	2	476	5,799	55, 56	------	------	B2 - COMBINED
59	SBUH Runoff	0.125	2	480	2,378	------	------	------	B3 EX IMP
60	SBUH Runoff	0.013	2	480	239	------	------	------	B3 PERV
61	Combine	0.138	2	480	2,617	59, 60	------	------	B3 - COMBINED
63	SBUH Runoff	0.500	2	474	7,204	------	------	------	B4 EX IMP
64	SBUH Runoff	0.187	2	480	3,170	------	------	------	B4 PER
65	Combine	0.681	2	476	10,374	63, 64	------	------	B4 - COMBINED
67	SBUH Runoff	3.333	2	474	48,033	------	------	------	C1 EX IMP
68	SBUH Runoff	0.673	2	480	11,380	------	------	------	C1 PER
69	Combine	3.979	2	474	59,414	67, 68	------	------	C1 - COMBINED
71	SBUH Runoff	0.382	2	474	5,507	------	------	------	C3 EX IMP
72	SBUH Runoff	0.234	2	480	3,954	------	------	------	C3 PER
73	Combine	0.609	2	476	9,461	71, 72	------	------	C3 - COMBINED
75	SBUH Runoff	0.090	2	474	1,291	------	------	------	C4 EX IMP
76	SBUH Runoff	0.055	2	480	930	------	------	------	C4 PER

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
77	Combine	0.143	2	476	2,221	75, 76	------	------	C4 - COMBINED
79	SBUH Runoff	0.154	2	474	2,217	------	------	------	C5 EX IMP
80	SBUH Runoff	0.014	2	480	238	------	------	------	C5 PERV
81	Combine	0.167	2	474	2,456	79, 80	------	------	C5 - COMBINED
83	Combine	2.552	2	476	39,199	8, 44, 53, 57, 61, 83	------	------	EDB Contribution
84	Reservoir	0.938	2	532	39,190		196.07	7,164	Extended Dry Basin

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.201	2	474	2,907	------	------	------	POST-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.149	2	474	2,160	------	------	------	POST-DEVELOPED A1 IMP
3	Combine	0.350	2	474	5,068	1, 2	------	------	POST-DEVELOPED A1 - COMBINE
5	SBUH Runoff	0.440	2	474	6,364	------	------	------	POST-DEVELOPED A2 EX IMP
6	SBUH Runoff	0.637	2	474	9,213	------	------	------	POST-DEVELOPED A2 IMP
7	SBUH Runoff	0.059	2	480	1,057	------	------	------	POST-DEVELOPED A2 PERV
8	Combine	1.133	2	474	16,634	5, 6, 7	------	------	POST-DEVELOPED A2 - COMBINE
10	SBUH Runoff	0.028	2	474	409	------	------	------	POST-DEVELOPED A3 EX IMP
11	SBUH Runoff	0.023	2	474	327	------	------	------	POST-DEVELOPED A3 IMP
12	Combine	0.051	2	474	736	10, 11	------	------	POST-DEVELOPED A3- COMBINED
14	SBUH Runoff	0.025	2	474	362	------	------	------	POST-DEVELOPED A4 EX IMP
15	SBUH Runoff	0.029	2	474	420	------	------	------	POST-DEVELOPED A4 IMP
16	Combine	0.054	2	474	782	14, 15	------	------	POST-DEVELOPED A4 - COMBINE
18	SBUH Runoff	0.023	2	474	339	------	------	------	POST-DEVELOPED A5 EX IMP
19	SBUH Runoff	0.026	2	474	374	------	------	------	POST-DEVELOPED A5 IMP
20	Combine	0.049	2	474	712	18, 19	------	------	POST-DEVELOPED A5 - COMBINE
22	SBUH Runoff	0.024	2	474	350	------	------	------	POST-DEVELOPED A6 EX IMP
23	SBUH Runoff	0.024	2	474	350	------	------	------	POST-DEVELOPED A6 IMP
24	SBUH Runoff	0.001	2	480	23	------	------	------	POST-DEVELOPED A6 PERV
25	Combine	0.050	2	474	724	22, 23, 24	------	------	POST-DEVELOPED A6 -COMBINED
27	SBUH Runoff	0.031	2	474	444	------	------	------	POST-DEVELOPED A7 EX IMP
28	SBUH Runoff	0.032	2	474	467	------	------	------	POST-DEVELOPED A7 IMP
29	Combine	0.063	2	474	911	27, 28	------	------	POST-DEVELOPED A7 - COMBINE
31	SBUH Runoff	0.094	2	474	1,354	------	------	------	POST-DEVELOPED A8 EX IMP
32	SBUH Runoff	0.074	2	474	1,074	------	------	------	POST-DEVELOPED A8 IMP
33	SBUH Runoff	0.025	2	480	455	------	------	------	POST-DEVELOPED A8 PERV
34	Combine	0.192	2	474	2,884	31, 32, 33	------	------	POST-DEVELOPED A8 - COMBINE
36	SBUH Runoff	0.065	2	474	934	------	------	------	POST-DEVELOPED A9 EX IMP
37	SBUH Runoff	0.076	2	474	1,098	------	------	------	POST-DEVELOPED A9 IMP
38	SBUH Runoff	0.011	2	480	198	------	------	------	POST-DEVELOPED A9 PERV

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
39	Combine	0.151	2	474	2,229	36, 37, 38	------	------	POST-DEVELOPED A9 - COMBINE
41	SBUH Runoff	0.015	2	474	210	------	------	------	POST-DEVELOPED A11 EX IMP
42	SBUH Runoff	0.018	2	474	257	------	------	------	POST-DEVELOPED A11 IMP
43	SBUH Runoff	0.029	2	480	520	------	------	------	POST-DEVELOPED A11 PERV
44	Combine	0.061	2	478	987	41, 42, 43	------	------	POST-DEVELOPED A11 - COMBINE
46	SBUH Runoff	0.149	2	474	2,160	------	------	------	POST-DEVELOPED A10 EX IMP
47	SBUH Runoff	0.252	2	474	3,643	------	------	------	POST-DEVELOPED A10 IMP
48	SBUH Runoff	0.014	2	480	257	------	------	------	POST-DEVELOPED A10 PERV
49	Combine	0.415	2	474	6,061	46, 47, 48	------	------	POST-DEVELOPED A10 - COMBINE
51	SBUH Runoff	0.186	2	474	2,686	------	------	------	B1 EX IMP
52	SBUH Runoff	0.181	2	480	2,944	------	------	------	B1 PER
53	Combine	0.363	2	476	5,629	51, 52	------	------	B1 - COMBINED
55	SBUH Runoff	0.308	2	474	4,449	------	------	------	B2 EX IMP
56	SBUH Runoff	0.136	2	480	2,218	------	------	------	B2 PER
57	Combine	0.440	2	476	6,666	55, 56	------	------	B2 - COMBINED
59	SBUH Runoff	0.164	2	480	2,933	------	------	------	B3 EX IMP
60	SBUH Runoff	0.016	2	480	294	------	------	------	B3 PERV
61	Combine	0.181	2	480	3,227	59, 60	------	------	B3 - COMBINED
63	SBUH Runoff	0.559	2	474	8,080	------	------	------	B4 EX IMP
64	SBUH Runoff	0.235	2	480	3,836	------	------	------	B4 PER
65	Combine	0.788	2	476	11,916	63, 64	------	------	B4 - COMBINED
67	SBUH Runoff	3.724	2	474	53,875	------	------	------	C1 EX IMP
68	SBUH Runoff	0.845	2	480	13,771	------	------	------	C1 PER
69	Combine	4.543	2	474	67,646	67, 68	------	------	C1 - COMBINED
71	SBUH Runoff	0.427	2	474	6,177	------	------	------	C3 EX IMP
72	SBUH Runoff	0.294	2	480	4,784	------	------	------	C3 PER
73	Combine	0.714	2	476	10,961	71, 72	------	------	C3 - COMBINED
75	SBUH Runoff	0.100	2	474	1,448	------	------	------	C4 EX IMP
76	SBUH Runoff	0.069	2	480	1,125	------	------	------	C4 PER

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
77	Combine	0.168	2	476	2,573	75, 76	------	------	C4 - COMBINED
79	SBUH Runoff	0.172	2	474	2,487	------	------	------	C5 EX IMP
80	SBUH Runoff	0.018	2	480	288	------	------	------	C5 PERV
81	Combine	0.189	2	474	2,775	79, 80	------	------	C5 - COMBINED
83	Combine	2.956	2	476	45,060	8, 44, 53, 57, 61, 83	------	------	EDB Contribution
84	Reservoir	1.566	2	498	45,050		196.24	7,808	Extended Dry Basin

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	0.228	2	474	3,313	------	------	------	POST-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.169	2	474	2,461	------	------	------	POST-DEVELOPED A1 IMP
3	Combine	0.398	2	474	5,774	1, 2	------	------	POST-DEVELOPED A1 - COMBINE
5	SBUH Runoff	0.499	2	474	7,251	------	------	------	POST-DEVELOPED A2 EX IMP
6	SBUH Runoff	0.723	2	474	10,498	------	------	------	POST-DEVELOPED A2 IMP
7	SBUH Runoff	0.079	2	480	1,329	------	------	------	POST-DEVELOPED A2 PERV
8	Combine	1.297	2	474	19,078	5, 6, 7	------	------	POST-DEVELOPED A2 - COMBINE
10	SBUH Runoff	0.032	2	474	466	------	------	------	POST-DEVELOPED A3 EX IMP
11	SBUH Runoff	0.026	2	474	373	------	------	------	POST-DEVELOPED A3 IMP
12	Combine	0.058	2	474	838	10, 11	------	------	POST-DEVELOPED A3- COMBINED
14	SBUH Runoff	0.028	2	474	412	------	------	------	POST-DEVELOPED A4 EX IMP
15	SBUH Runoff	0.033	2	474	479	------	------	------	POST-DEVELOPED A4 IMP
16	Combine	0.061	2	474	891	14, 15	------	------	POST-DEVELOPED A4 - COMBINE
18	SBUH Runoff	0.027	2	474	386	------	------	------	POST-DEVELOPED A5 EX IMP
19	SBUH Runoff	0.029	2	474	426	------	------	------	POST-DEVELOPED A5 IMP
20	Combine	0.056	2	474	812	18, 19	------	------	POST-DEVELOPED A5 - COMBINE
22	SBUH Runoff	0.027	2	474	399	------	------	------	POST-DEVELOPED A6 EX IMP
23	SBUH Runoff	0.027	2	474	399	------	------	------	POST-DEVELOPED A6 IMP
24	SBUH Runoff	0.002	2	480	29	------	------	------	POST-DEVELOPED A6 PERV
25	Combine	0.057	2	474	827	22, 23, 24	------	------	POST-DEVELOPED A6 -COMBINED
27	SBUH Runoff	0.035	2	474	506	------	------	------	POST-DEVELOPED A7 EX IMP
28	SBUH Runoff	0.037	2	474	532	------	------	------	POST-DEVELOPED A7 IMP
29	Combine	0.071	2	474	1,038	27, 28	------	------	POST-DEVELOPED A7 - COMBINE
31	SBUH Runoff	0.106	2	474	1,543	------	------	------	POST-DEVELOPED A8 EX IMP
32	SBUH Runoff	0.084	2	474	1,224	------	------	------	POST-DEVELOPED A8 IMP
33	SBUH Runoff	0.034	2	480	572	------	------	------	POST-DEVELOPED A8 PERV
34	Combine	0.223	2	474	3,340	31, 32, 33	------	------	POST-DEVELOPED A8 - COMBINE
36	SBUH Runoff	0.073	2	474	1,064	------	------	------	POST-DEVELOPED A9 EX IMP
37	SBUH Runoff	0.086	2	474	1,251	------	------	------	POST-DEVELOPED A9 IMP
38	SBUH Runoff	0.015	2	480	249	------	------	------	POST-DEVELOPED A9 PERV

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
39	Combine	0.174	2	474	2,564	36, 37, 38	------	------	POST-DEVELOPED A9 - COMBINE
41	SBUH Runoff	0.016	2	474	239	------	------	------	POST-DEVELOPED A11 EX IMP
42	SBUH Runoff	0.020	2	474	293	------	------	------	POST-DEVELOPED A11 IMP
43	SBUH Runoff	0.039	2	480	653	------	------	------	POST-DEVELOPED A11 PERV
44	Combine	0.074	2	478	1,185	41, 42, 43	------	------	POST-DEVELOPED A11 - COMBINE
46	SBUH Runoff	0.169	2	474	2,461	------	------	------	POST-DEVELOPED A10 EX IMP
47	SBUH Runoff	0.286	2	474	4,151	------	------	------	POST-DEVELOPED A10 IMP
48	SBUH Runoff	0.019	2	480	324	------	------	------	POST-DEVELOPED A10 PERV
49	Combine	0.474	2	474	6,936	46, 47, 48	------	------	POST-DEVELOPED A10 - COMBINE
51	SBUH Runoff	0.211	2	474	3,060	------	------	------	B1 EX IMP
52	SBUH Runoff	0.230	2	480	3,629	------	------	------	B1 PER
53	Combine	0.438	2	476	6,689	51, 52	------	------	B1 - COMBINED
55	SBUH Runoff	0.349	2	474	5,069	------	------	------	B2 EX IMP
56	SBUH Runoff	0.173	2	480	2,734	------	------	------	B2 PER
57	Combine	0.519	2	476	7,803	55, 56	------	------	B2 - COMBINED
59	SBUH Runoff	0.218	2	480	3,687	------	------	------	B3 EX IMP
60	SBUH Runoff	0.022	2	480	370	------	------	------	B3 PERV
61	Combine	0.240	2	480	4,057	59, 60	------	------	B3 - COMBINED
63	SBUH Runoff	0.634	2	474	9,207	------	------	------	B4 EX IMP
64	SBUH Runoff	0.300	2	480	4,729	------	------	------	B4 PER
65	Combine	0.928	2	476	13,936	63, 64	------	------	B4 - COMBINED
67	SBUH Runoff	4.226	2	474	61,390	------	------	------	C1 EX IMP
68	SBUH Runoff	1.077	2	480	16,976	------	------	------	C1 PER
69	Combine	5.280	2	474	78,366	67, 68	------	------	C1 - COMBINED
71	SBUH Runoff	0.485	2	474	7,038	------	------	------	C3 EX IMP
72	SBUH Runoff	0.374	2	480	5,898	------	------	------	C3 PER
73	Combine	0.853	2	476	12,936	71, 72	------	------	C3 - COMBINED
75	SBUH Runoff	0.114	2	474	1,650	------	------	------	C4 EX IMP
76	SBUH Runoff	0.088	2	480	1,387	------	------	------	C4 PER

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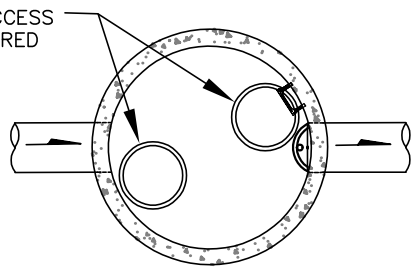
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
77	Combine	0.200	2	476	3,037	75, 76	------	------	C4 - COMBINED
79	SBUH Runoff	0.195	2	474	2,834	------	------	------	C5 EX IMP
80	SBUH Runoff	0.023	2	480	355	------	------	------	C5 PERV
81	Combine	0.217	2	474	3,189	79, 80	------	------	C5 - COMBINED
83	Combine	3.489	2	476	52,749	8, 44, 53, 57, 61, 83	------	------	EDB Contribution
84	Reservoir	2.859	2	484	52,739		196.34	8,232	Extended Dry Basin



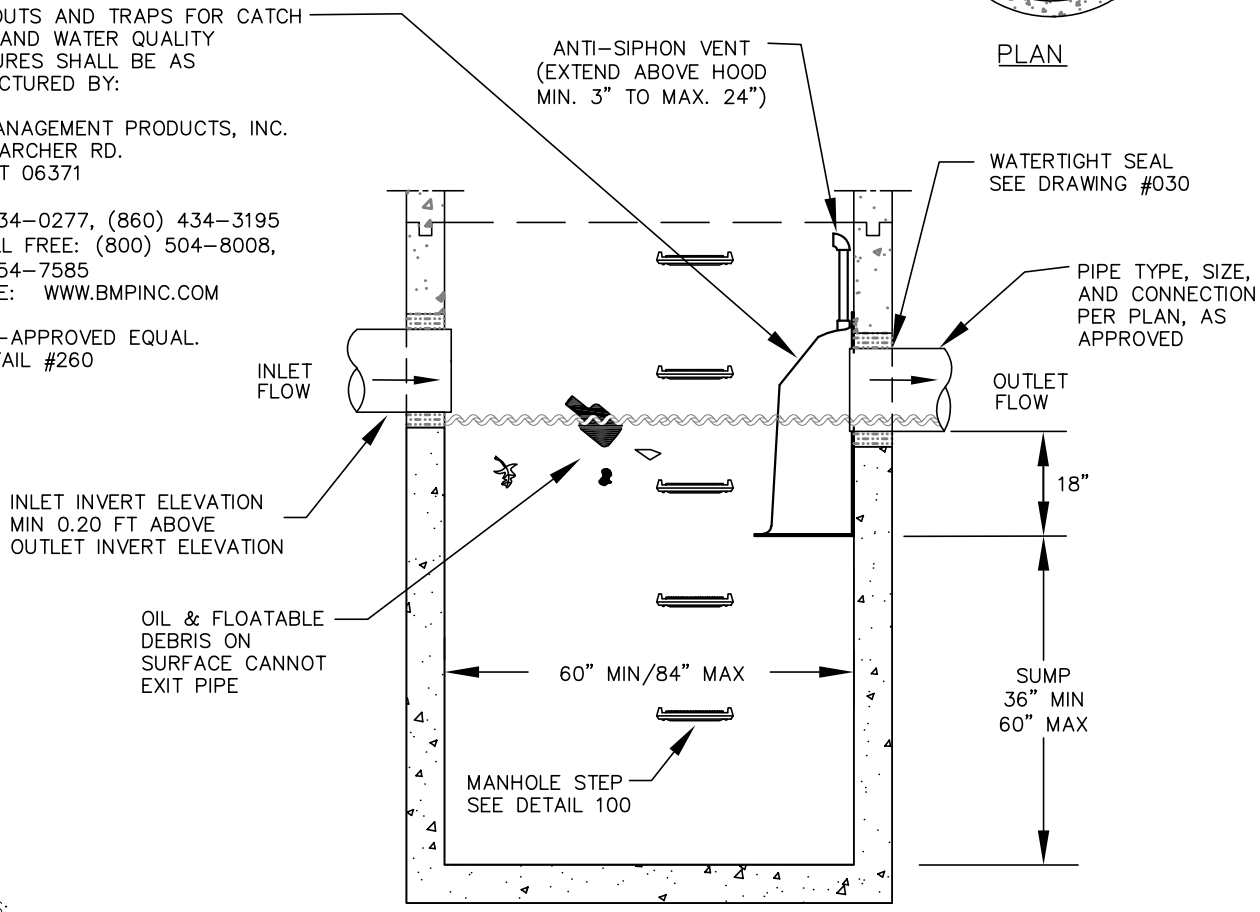
PLAN

ALL SNOUTS AND TRAPS FOR CATCH BASINS AND WATER QUALITY STRUCTURES SHALL BE AS MANUFACTURED BY:

BEST MANAGEMENT PRODUCTS, INC.
53 MT. ARCHER RD.
LYME, CT 06371

(860) 434-0277, (860) 434-3195
FAX TOLL FREE: (800) 504-8008,
(888) 354-7585
WEB SITE: WWW.BMPINC.COM

OR PRE-APPROVED EQUAL.
SEE DETAIL #260



NOTES:

1. ALL MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478 AND APPLICABLE PROVISIONS OF STD. MANHOLE DRAWING NO. 010.
2. INLET AND OUTLET PIPE NOT TO EXCEED 18" DIA.
3. PROVIDE SPECIAL DETAIL FOR SNOUT, EXCEEDING 18" DIA.
4. THE SIZE AND POSITION OF THE HOOD SHALL BE DETERMINED BY THE OUTLET PIPE SIZE AS PER MANUFACTURER'S RECOMMENDATIONS.
5. ANCHORING HARDWARE FOR THE HOOD SHALL BE EMBEDDED INTO CONCRETE; ANCHORING INTO GROUT IS NOT AUTHORIZED.
6. THE SURFACE OF THE STRUCTURE WHERE THE HOOD IS MOUNTED SHALL BE FINISHED SMOOTH AND FREE OF LOOSE MATERIAL.
7. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
8. ALL MANHOLE FLAT TOPS SHALL CONFORM TO ASTM C-478 AND ARE DESIGNED TO MEET H-20 TRAFFIC LOADING.

SUMP VOLUME AVAILABLE PER DEPTH OF SUMP

	36" MINIMUM	60" MAXIMUM
60" M.H.=	58.9 CF	98.1 CF
72" M.H.=	84.8 CF	141.3 CF
84" M.H.=	115.4 CF	192.4 CF

PROVIDE SPECIAL DETAIL FOR VOLUME REQUIREMENTS EXCEEDING 192.4 CF

SUMP VOLUME REQUIREMENTS
20 CF/1.0 CFS OF INFLOW
58.9 CF MINIMUM REQUIRED

WATER QUALITY MANHOLE (SNOUT) A

DRAWING NO. 250

REVISED 10-31-19

Clean Water Services

Denny RD

Basin Parameters

Prepared by Harper Houf Peterson Righellis Inc.
Job No. WAS-39
February 2024

Basin A10

Total 25-Year Peak Flow =	0.474	cfs
Sump Volume 20 CF/ 1.0 CFS		
Total Minimum Sump Volume =	9.48	CF
60" MH with 36" Sump =	58.9	CF

60" Pre-Treatment MH with 36" Sump

Existing 72" Manhole at outfall

Total 25-Year Peak Flow =	10.99	cfs
Sump Volume 20 CF/ 1.0 CFS		
Total Minimum Sump Volume =	219.8	CF
72" MH with 60" Sump =	141.3	CF

72" Pre-Treatment MH with 60" Sump is undersized

APPENDIX D – CONVEYANCE/ DOWNSTREAM ANALYSIS

Denny RD

Basin Parameters

Prepared by Harper Houf Peterson Righellis Inc.
Job No. WAS-39
February 2024

Pipe	Contributing Basins/Pipes	Total Undetained 25-YR Runoff (CFS)	Min. Pipe Size (in)	Min. Pipe Slope (%)	Pipe Capacity * (CFS)	Flow Capacity Met? (TRUE/FALSE)
1	Basin B1, B2, B3, A2	2.494	12	0.50	2.52	**TRUE**
2	Basin A8, C4	0.423	12	5.38	8.26	**TRUE**
3	Basin A9	0.174	12	0.61	2.78	**TRUE**
4	Basin A11	0.074	12	15.00	13.80	**TRUE**
5	Basin C5	0.217	12	5.71	8.51	**TRUE**
6	Basin A10	0.474	12	1.00	3.56	**TRUE**
7	Basin C1, A7	5.503	24	0.47	15.51	**TRUE**
8	Basin B1, B2, B3, B4, A2, A11, C3	4.349	15	0.50	4.57	**TRUE**
9	Basin B1, B2, B3, B4, A2, A10, A11, C3	4.749	24	0.50	16.00	**TRUE**
10	Basin B1, B2, B3, B4, A2, A7, A9, A10, A11, C1, C3	10.348	24	0.83	20.61	**TRUE**
11	Basin B1, B2, B3, B4, A2, A7, A8, A9, A10, C1, C3, C4, C5	10.988	24	0.50	16.00	**TRUE**

* See Civil Tool Output in Appendix D for Pipe Capacity flows

Pipe Calculations

25- Year Undetained Peak Flows

Sewer Pipes

CIVIL TOOLS PRO
English Units
02-13-2024 17:15:42

Results

Flow (cfs)	Diameter (in)	Manning's N	Slope (%)	Velocity (fps)
2.52	12.00	0.013	0.50	3.21
8.26	12.00	0.013	5.38	10.52
2.78	12.00	0.013	0.61	3.54
13.80	12.00	0.013	15.00	17.57
8.51	12.00	0.013	5.71	10.84
3.56	12.00	0.013	1.00	4.54
15.51	24.00	0.013	0.47	4.94
4.57	15.00	0.013	0.50	3.72
16.00	24.00	0.013	0.50	5.09
20.61	24.00	0.013	0.83	6.56

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1	SBUH Runoff	0.264	2	474	3,854	------	------	------	POST-DEVELOPED A1 EX IMP
2	SBUH Runoff	0.196	2	474	2,864	------	------	------	POST-DEVELOPED A1 IMP
3	Combine	0.460	2	474	6,718	1, 2	------	------	POST-DEVELOPED A1 - COMBINE
5	SBUH Runoff	0.578	2	474	8,436	------	------	------	POST-DEVELOPED A2 EX IMP
6	SBUH Runoff	0.837	2	474	12,212	------	------	------	POST-DEVELOPED A2 IMP
7	SBUH Runoff	0.106	2	480	1,712	------	------	------	POST-DEVELOPED A2 PERV
8	Combine	1.518	2	474	22,360	5, 6, 7	------	------	POST-DEVELOPED A2 - COMBINE
10	SBUH Runoff	0.037	2	474	542	------	------	------	POST-DEVELOPED A3 EX IMP
11	SBUH Runoff	0.030	2	474	433	------	------	------	POST-DEVELOPED A3 IMP
12	Combine	0.067	2	474	975	10, 11	------	------	POST-DEVELOPED A3- COMBINED
14	SBUH Runoff	0.033	2	474	480	------	------	------	POST-DEVELOPED A4 EX IMP
15	SBUH Runoff	0.038	2	474	557	------	------	------	POST-DEVELOPED A4 IMP
16	Combine	0.071	2	474	1,037	14, 15	------	------	POST-DEVELOPED A4 - COMBINE
18	SBUH Runoff	0.031	2	474	449	------	------	------	POST-DEVELOPED A5 EX IMP
19	SBUH Runoff	0.034	2	474	495	------	------	------	POST-DEVELOPED A5 IMP
20	Combine	0.065	2	474	944	18, 19	------	------	POST-DEVELOPED A5 - COMBINE
22	SBUH Runoff	0.032	2	474	464	------	------	------	POST-DEVELOPED A6 EX IMP
23	SBUH Runoff	0.032	2	474	464	------	------	------	POST-DEVELOPED A6 IMP
24	SBUH Runoff	0.002	2	480	37	------	------	------	POST-DEVELOPED A6 PERV
25	Combine	0.066	2	474	966	22, 23, 24	------	------	POST-DEVELOPED A6 -COMBINED
27	SBUH Runoff	0.040	2	474	588	------	------	------	POST-DEVELOPED A7 EX IMP
28	SBUH Runoff	0.042	2	474	619	------	------	------	POST-DEVELOPED A7 IMP
29	Combine	0.083	2	474	1,207	27, 28	------	------	POST-DEVELOPED A7 - COMBINE
31	SBUH Runoff	0.123	2	474	1,795	------	------	------	POST-DEVELOPED A8 EX IMP
32	SBUH Runoff	0.098	2	474	1,424	------	------	------	POST-DEVELOPED A8 IMP
33	SBUH Runoff	0.046	2	480	737	------	------	------	POST-DEVELOPED A8 PERV
34	Combine	0.265	2	474	3,956	31, 32, 33	------	------	POST-DEVELOPED A8 - COMBINE
36	SBUH Runoff	0.085	2	474	1,238	------	------	------	POST-DEVELOPED A9 EX IMP
37	SBUH Runoff	0.100	2	474	1,455	------	------	------	POST-DEVELOPED A9 IMP
38	SBUH Runoff	0.020	2	480	320	------	------	------	POST-DEVELOPED A9 PERV

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
39	Combine	0.204	2	474	3,013	36, 37, 38	------	------	POST-DEVELOPED A9 - COMBINE
41	SBUH Runoff	0.019	2	474	279	------	------	------	POST-DEVELOPED A11 EX IMP
42	SBUH Runoff	0.023	2	474	341	------	------	------	POST-DEVELOPED A11 IMP
43	SBUH Runoff	0.052	2	480	841	------	------	------	POST-DEVELOPED A11 PERV
44	Combine	0.094	2	478	1,460	41, 42, 43	------	------	POST-DEVELOPED A11 - COMBINE
46	SBUH Runoff	0.196	2	474	2,864	------	------	------	POST-DEVELOPED A10 EX IMP
47	SBUH Runoff	0.331	2	474	4,829	------	------	------	POST-DEVELOPED A10 IMP
48	SBUH Runoff	0.026	2	480	417	------	------	------	POST-DEVELOPED A10 PERV
49	Combine	0.552	2	474	8,110	46, 47, 48	------	------	POST-DEVELOPED A10 - COMBINE
51	SBUH Runoff	0.244	2	474	3,560	------	------	------	B1 EX IMP
52	SBUH Runoff	0.300	2	478	4,581	------	------	------	B1 PER
53	Combine	0.542	2	476	8,141	51, 52	------	------	B1 - COMBINED
55	SBUH Runoff	0.404	2	474	5,897	------	------	------	B2 EX IMP
56	SBUH Runoff	0.226	2	478	3,451	------	------	------	B2 PER
57	Combine	0.627	2	476	9,348	55, 56	------	------	B2 - COMBINED
59	SBUH Runoff	0.295	2	480	4,749	------	------	------	B3 EX IMP
60	SBUH Runoff	0.030	2	480	476	------	------	------	B3 PERV
61	Combine	0.324	2	480	5,225	59, 60	------	------	B3 - COMBINED
63	SBUH Runoff	0.734	2	474	10,711	------	------	------	B4 EX IMP
64	SBUH Runoff	0.391	2	478	5,970	------	------	------	B4 PER
65	Combine	1.120	2	476	16,681	63, 64	------	------	B4 - COMBINED
67	SBUH Runoff	4.894	2	474	71,418	------	------	------	C1 EX IMP
68	SBUH Runoff	1.404	2	478	21,428	------	------	------	C1 PER
69	Combine	6.277	2	474	92,846	67, 68	------	------	C1 - COMBINED
71	SBUH Runoff	0.561	2	474	8,188	------	------	------	C3 EX IMP
72	SBUH Runoff	0.488	2	478	7,445	------	------	------	C3 PER
73	Combine	1.044	2	476	15,633	71, 72	------	------	C3 - COMBINED
75	SBUH Runoff	0.132	2	474	1,919	------	------	------	C4 EX IMP
76	SBUH Runoff	0.115	2	478	1,751	------	------	------	C4 PER

Hydrograph Summary Report

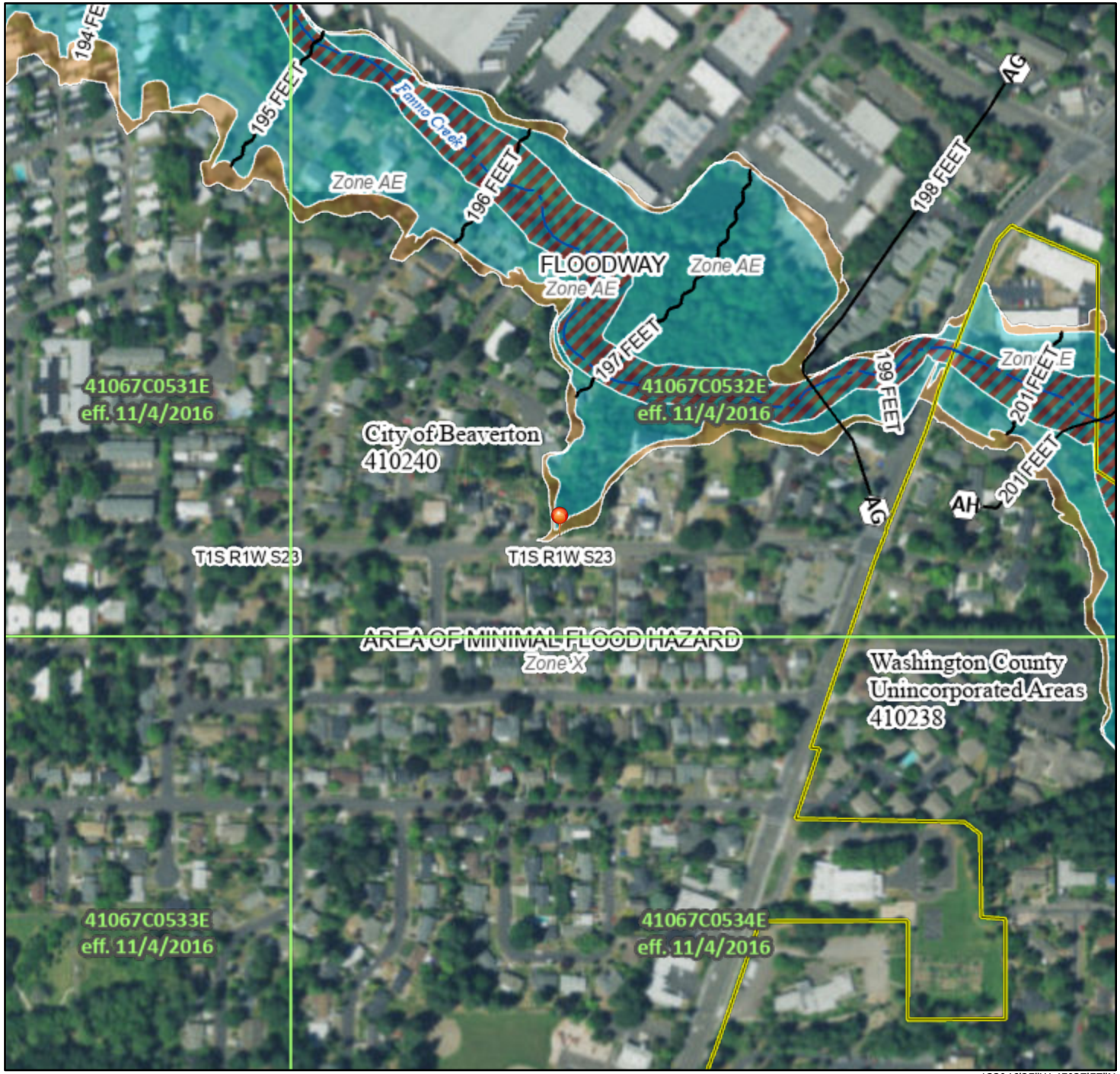
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
77	Combine	0.245	2	476	3,671	75, 76	------	------	C4 - COMBINED
79	SBUH Runoff	0.226	2	474	3,297	------	------	------	C5 EX IMP
80	SBUH Runoff	0.029	2	478	449	------	------	------	C5 PERV
81	Combine	0.255	2	474	3,745	79, 80	------	------	C5 - COMBINED
83	Combine	4.216	2	476	63,215	8, 44, 53, 57, 61, 83	------	------	EDB Contribution
84	Reservoir	4.094	2	480	63,205		196.42	8,543	Extended Dry Basin

National Flood Hazard Layer FIRMette

FEMA

122°47'2"W 45°28'23"N



122°46'25"W 45°27'57"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/13/2024 at 4:15 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

LEGEND:

- SA — EXISTING SEWER LINE
- ST — EXISTING STORM LINE
- W — EXISTING WATER LINE
- x — EXISTING FENCE
- PROPOSED STORM LINE
- SA — PROPOSED SEWER LINE
- W — PROPOSED WATER LINE
- (XXX.XX) — EXISTING SPOT ELEVATION
- XXX.XX — PROPOSED SPOT ELEVATION
- EXISTING STREET SIGN
- EXISTING TREE
- EXISTING CONCRETE SIDEWALK
- XXX — EXISTING CONTOUR
- XXX — PROPOSED CONTOUR
- EXISTING FIRE HYDRANT
- EXISTING CATCH BASIN
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING LIGHT POLE
- EXISTING POWER POLE
- WV — EXISTING WATER VALVE
- WM — EXISTING WATER METER
- PROPOSED CONCRETE SIDEWALK
- PROPOSED A.C. PAVEMENT
- PROPOSED FIRE HYDRANT
- PROPOSED CATCH BASIN
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- WV — PROPOSED WATER VALVE
- WM — PROPOSED WATER METER

SW MAPLECREST COURT

TL 1300

TL 1200

TL 100
MAP 1S1 23BC

TL 200

TL 1200
MAP 1S1 23BD

TL 1100
MAP 1S1 23BD

TL 1100

Downstream Adjacent Property Asbuilt of Fanno Creek Tributary.

Property Elevations approximately 6 feet higher than Fanno Creek Tributary Ordinary High Water Mark.

Asbuilts on different datum than HHPR survey.

EXISTING WETLANDS BUFFER

MODIFIED WETLANDS BUFFER

193.0 T.W./ 194.0 T.W./ 190.8 B.W.

198.0 T.W./ 196.0 T.W./ 191.0 B.W.

196.0 T.W./ 198.0 T.W./ 191.8 B.W.

197.0 T.W./ 191.5 B.W.

197.5 T.W./ 193.0 B.W.

198.0 T.W./ 194.0 B.W.

199.5 T.W./ 194.0 B.W.

193.0 T.W./ 192.5 B.W.

FILL IN FLOOD PLAIN 419 C.Y. (2)

CUT IN FLOOD PLAIN 419 C.Y. (2)

100 YR FLOOD PLAIN

EXISTING HOUSE TO REMAIN

PROPOSED R.O.W.

S.W. DENNEY RD.

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 INCH = 20 FT.

KEYED NOTES

1. MAX. 20% SLOPE ON PATH.
2. RETAINING WALL, COORDINATE WITH BUILDING FOUNDATION PLANS.
3. RETAINING WALL, INCLUDE EXISTING BUILDING SUPPORT. SEE BUILDING PLANS.

NOTE: RETAINING WALL TO BE LOCATED IN OPEN SPACE TRACT. PARTIES RESPONSIBLE FOR MAINTAINING OPEN SPACE SHALL BE REPSONSIBLE FOR MAINTAINING RETAINING WALL.

SYM	REVISION	BY	APPROVED	DATE
2	CITY OF BEAVERTON REVIEW COMMENTS	JM		1-31-07
3	RAISE END OF ROAD GRADE	JM		7-6-07
4	REVISED STORM OUTFALL	JM		7-10-07
	ASBUILT INFO ADDED	JM		12-6-07

AS BUILT

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1972
JOHN McL. MIDDLETON
EXPIRES: 12/31/2013

		DATE
DRAWN BY	JWS	6-5-06
CHECKED		
ENGR.	JMM	6-5-06
CHECKED		

ZTec ENGINEERS, INC.
3737 S.E. 8TH AVE., PORTLAND, OR. 97202
PHONE: (503) 235-8795
FAX: (503) 233-7889
EMAIL: ztec@ztecengineers.com

SUBTITLE: GRADING PLAN

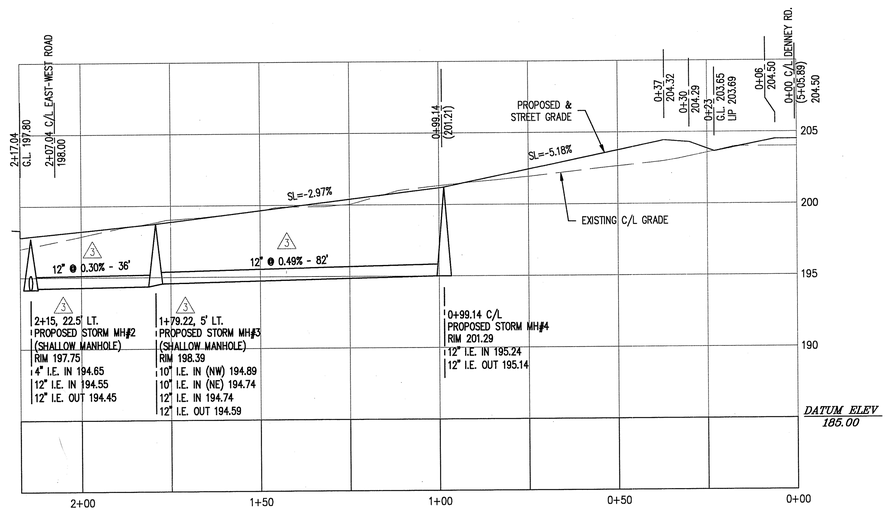
TITLE: DENNEY GARDENS
9845 S.W. DENNEY ROAD
BEAVERTON, OR

JOB NO.: N2518-2
DWG. NO.: N25182ASB.dwg
SCALE: 1"=20'
SHEET: C3

PLOT DATE: 4-3-13
ZTEC CAD FILE: \N2518-2\...

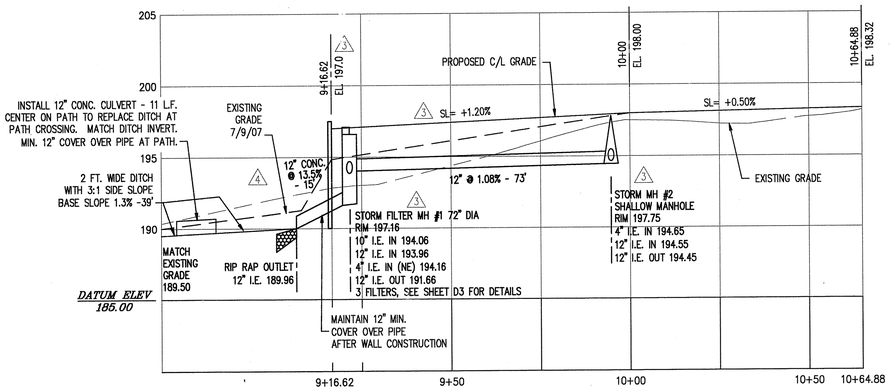
LEGEND:

- SA — EXISTING SEWER LINE
- ST — EXISTING STORM LINE
- W — EXISTING WATER LINE
- x — EXISTING FENCE
- PROPOSED STORM LINE
- SA — PROPOSED SEWER LINE
- W — PROPOSED WATER LINE
- (XXX.XX) — EXISTING SPOT ELEVATION
- XXX.XX — PROPOSED SPOT ELEVATION
- EXISTING STREET SIGN
- EXISTING TREE
- EXISTING CONCRETE SIDEWALK
- XXX — EXISTING CONTOUR
- XXX — PROPOSED CONTOUR
- EXISTING FIRE HYDRANT
- EXISTING CATCH BASIN
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING LIGHT POLE
- EXISTING POWER POLE
- WV ⊖ EXISTING WATER VALVE
- WM □ EXISTING WATER METER
- PROPOSED CONCRETE SIDEWALK
- PROPOSED A.C. PAVEMENT
- PROPOSED FIRE HYDRANT
- PROPOSED CATCH BASIN
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- WV ⊖ PROPOSED WATER VALVE
- WM □ PROPOSED WATER METER



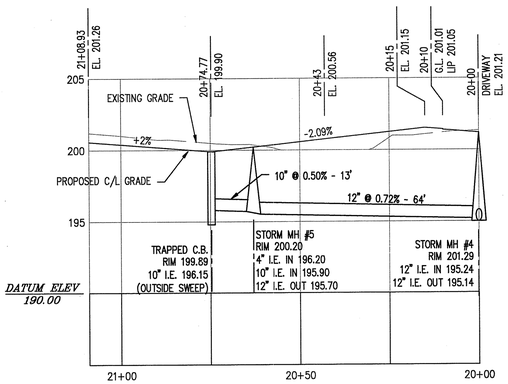
PRIVATE NORTH/SOUTH ROAD PROFILE

SCALE: 1"=20' HORIZ.
1"=5' VERT.



PRIVATE EAST/WEST ROAD PROFILE

SCALE: 1"=20' HORIZ.
1"=5' VERT.



DRIVEWAY PROFILE

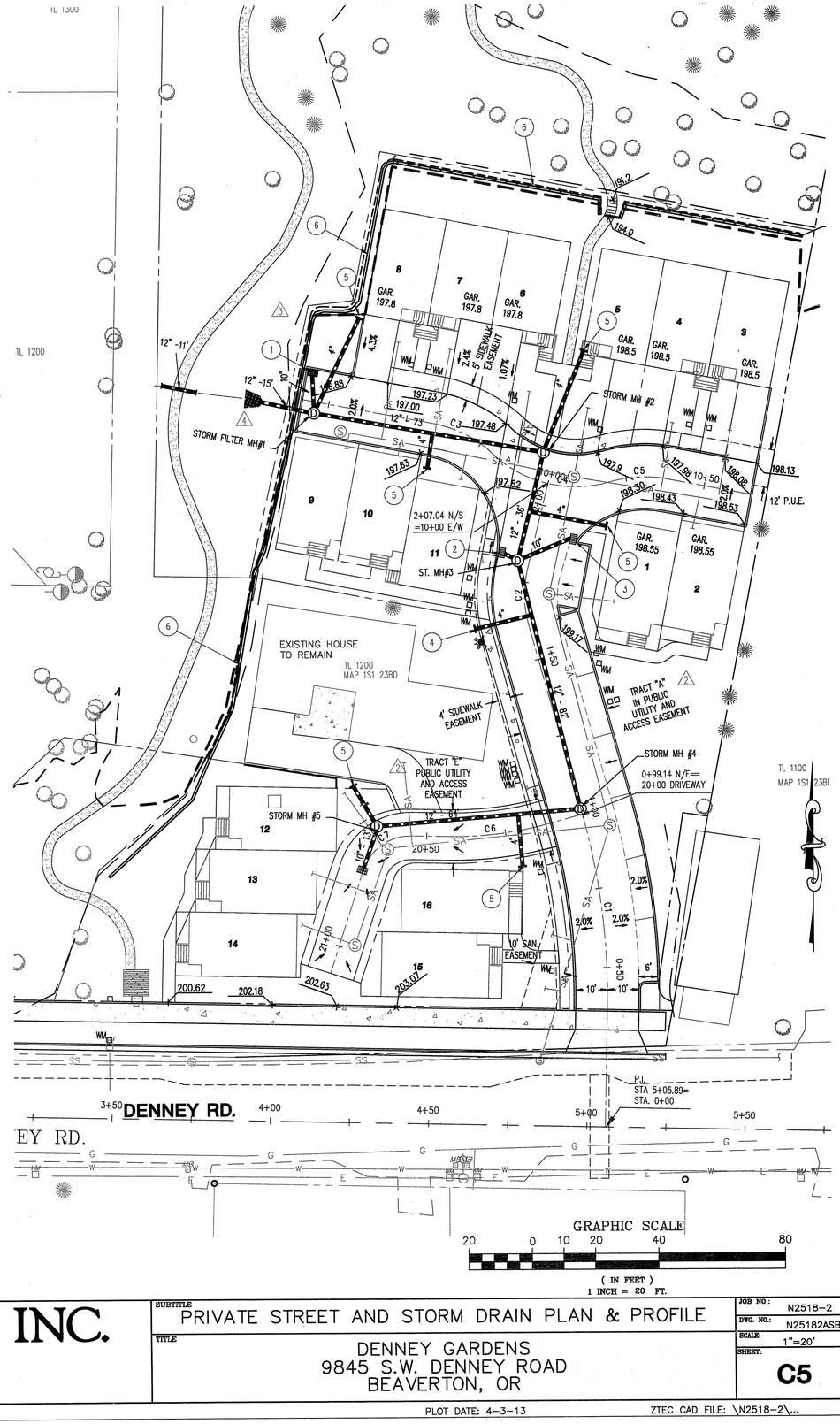
SCALE: 1"=20' HORIZ.
1"=5' VERT.

KEYED NOTES

△3
1. 9+15, 10' LT. TRAPPED CATCH BASIN RIM 196.61 10" I.E. 194.20 (OUTSIDE SWEEP)
2. PRC 1+79.22, 9' LT TRAPPED CATCH BASIN RIM 198.13 10" I.E. 195.50 (OUTSIDE SWEEP)
3. TRAPPED CATCH BASIN RIM 197.74 10" I.E. 195.00 (OUTSIDE SWEEP)
4. CONNECT DOWNSPOUT COLLECTION FROM EXISTING HOUSE TO NEW SERVICE.
5. CONNECT BUILDING DOWNSPOUT COLLECTION SYSTEM TO STORM DRAIN SERVICE.
6. RETAINING WALLS TO BE LOCATED IN OPEN TRACT. TRACT OWNERS RESPONSIBLE FOR WALL MAINTENANCE.

NOTE:
STORM DRAIN PIPE ON-SITE TO BE PVC AWWA C900 PIPE UNLESS OTHERWISE NOTED. INSTALL WITH CLASS 'B' BACKFILL UNDER FUTURE PAVING AND CLASS 'A' BACKFILL IN OPEN SPACES.

SEE SHEET C5.1 FOR CURVE DATA AND STREET SECTIONS.



SYM	REVISION	BY	APPROVED	DATE
2	CITY OF BEAVERTON REVIEW COMMENTS	JM		1-31-07
3	RAISE STORM GRADE TO CLEAR SAN. LATERALS	JM		7-6-07
4	REVISED STORM OUTFALL	JM		7-10-07
	ASBUILT INFO ADDED	JM		12-5-07

AS BUILT

REGISTERED PROFESSIONAL ENGINEER — OREGON — JULY 14, 1978 — JOHN McL. MIDDLETON

EXPIRES 12/31/2014

		DATE
DRAWN BY	JWS	6-5-06
CHECKED		
ENGR.	JMM	6-5-06
CHECKED		

ZTec ENGINEERS, INC.

3737 S.E. 8TH AVE., PORTLAND, OR. 97202
PHONE: (503) 235-8795
FAX: (503) 233-7889
EMAIL: ztec@ztecengineers.com

SUBTITLE: PRIVATE STREET AND STORM DRAIN PLAN & PROFILE

TITLE: DENNEY GARDENS
9845 S.W. DENNEY ROAD
BEAVERTON, OR

JOB NO.:	N2518-2
DWG. NO.:	N25182ASB.dwg
SCALE:	1"=20'
SHEET:	C5

PLOT DATE: 4-3-13

ZTEC CAD FILE: \N2518-2\...

APPENDIX E – OPERATIONS & MAINTENANCE PLAN

Extended Dry Basin Operation and Maintenance Plan

Annual inspections are required. It is recommended that the facility is inspected on a monthly basis to ensure proper function. The plan below describes inspection and maintenance activities, and may be used as an inspection log. Contact the design engineer, Clean Water Services or City representative for more information.

Identified Problem	Condition to Check for	Maintenance Activity	Maintenance Timing	✔ Task Complete Comments
Trash and Debris	Visual evidence of trash, debris or dumping	Remove trash and debris from facility. Dispose of properly		
Contamination and Pollution	Evidence of oil, gasoline, contaminants, or other pollutants. Look for sheens, odor or signs of contamination	Locate source of contamination and correct. Remove oil using oil-absorbent pads or vactor truck. If low levels of oil persist plant wetland plants that can uptake small concentrations of oil such as Juncus effuses. (soft rush) If high levels of contaminants or pollutants are present, coordinate removal/ cleanup with local jurisdiction		
Invasive vegetation as outlined in Appendix A.	Invasive vegetation found in facility. Examples include: Himalayan Blackberry, Reed Canary Grass, Teasel, English Ivy, Nightshade, Clematis, Cattail, Thistle, Scotch Broom	Remove excessive weeds and all invasive plants. Attempt to control even if complete eradication is not feasible; refer to Clean Water Services Integrated Pest Management Plan for appropriate control methods, including proper use of chemical treatment		
Obstructed Inlet/Outlet	Material such as vegetation, trash, sediment is blocking more than 10% of inlet/outlet pipe or basin opening	Remove blockages from facility	 Inspect after major storm (1-inch in 24 hours)	
Poor Vegetation Cover	80% survival of approved vegetation and no bare areas large enough to affect function of facility.	Determine cause of poor growth and correct the condition. Replant with plugs or containerized plants per the approved planting plan and applicable standards at time of construction. Remove excessive weeds and all invasive plants.	 Ideal time to plant is spring and fall seasons	

Extended Dry Basin Operation and Maintenance Plan (continued)

Annual inspections are required. It is recommended that the facility is inspected on a monthly basis to ensure proper function. The plan below describes inspection and maintenance activities, and may be used as an inspection log. Contact the design engineer, Clean Water Services or City representative for more information.

Identified Problem	Condition to Check for	Maintenance Activity	Maintenance Timing	✔ Task Complete Comments
Vector Control	Evidence of rodents or water piping through facility via rodent holes. Harmful insects present such as wasps and hornets that interfere with maintenance/ inspection activities	Repair facility if damaged. Remove harmful insects, use professional if needed. Refer to Clean Water Services Integrated Pest Management Plan for management options	As Needed	
Tree/Shrub Growth	Tree/shrub growth shades out wetland/ emergent grass in treatment area. Interferes with access for maintenance/ inspection	Prune trees and shrubs that block sun from reaching treatment area. Remove trees that block access points. Do not remove trees that are not interfering with access or maintenance without first contacting Clean Water Services or local City	 WINTER Ideal time for pruning is winter	
Hazard Trees	Observed dead, dying or diseased trees	Remove hazard trees. A certified Arborist may need to determine health of tree or removal requirements	As Needed	
Excessive Vegetation	Vegetation grows so tall that it competes with approved emergent wetland grass/shrubs, interferes with access or becomes a fire danger	Cut tall grass 4" to 6" and remove clippings. Prune emergent wetland grass/shrubs that have become overgrown.	 SPRING Ideal time to prune emergent wetland grass is spring. Cut grass in dry months	
Erosion	Erosion or channelization that impacts or effects the function of the facility or creates a safety concern	Repair eroded areas and stabilize using proper erosion control measures. Establish appropriate vegetation as needed	 FALL WINTER SPRING	

Extended Dry Basin Operation and Maintenance Plan (continued)

Annual inspections are required. It is recommended that the facility is inspected on a monthly basis to ensure proper function. The plan below describes inspection and maintenance activities, and may be used as an inspection log. Contact the design engineer, Clean Water Services or City representative for more information.

Identified Problem	Condition to Check for	Maintenance Activity	Maintenance Timing	✔ Task Complete Comments
Settlement of Pond Dike/ Berm	Look for any part of dike/berm that has settled 4 inches or more lower than the design elevation	Repair dike/berm to approved design specifications. A licensed civil engineer should be consulted to determine the source of the settlement	As Needed	
Blockage of Emergency Overflow/ Spillway	Blockage of overflow/ spillway by trees, vegetation or other material. Blockages may cause the berm to fail due to uncontrolled overtopping	Remove blockage. Small root system (base less than 4 inches) may be left in place; otherwise, roots are removed. A licensed civil engineer should be consulted for proper berm/spillway restoration.	 Inspect after major storm (1-inch in 24 hours)	
Erosion of Emergency Overflow/Spillway	Native soil is exposed at the spillway, or there is only one layer of rock in an area of 5 square feet or larger	Restore rock and pad depth to appropriate depth. Refer to design specifications	 Inspect after major storm (1-inch in 24 hours)	
Blockage of Overflow Structure/ Orifice Plate	Excessive standing water or water is not detained for required time.	Inspect and if needed clear orifice plate for proper drainage or re-install to ensure required detention.	 Inspect after major storm (1-inch in 24 hours)	
Sediment Accumulation in Pond Bottom	Sediment accumulation in pond bottom exceeds 6 inches or affects facility inlet/ outlet or plant growth in treatment area	Remove sediment from pond bottom. Re-establish designed pond shape and depth. Establish appropriate vegetation in treatment area	 Ideally in the dry season	

Extended Dry Basin Operation and Maintenance Plan (continued)

Annual inspections are required. It is recommended that the facility is inspected on a monthly basis to ensure proper function. The plan below describes inspection and maintenance activities, and may be used as an inspection log. Contact the design engineer, Clean Water Services or City representative for more information.

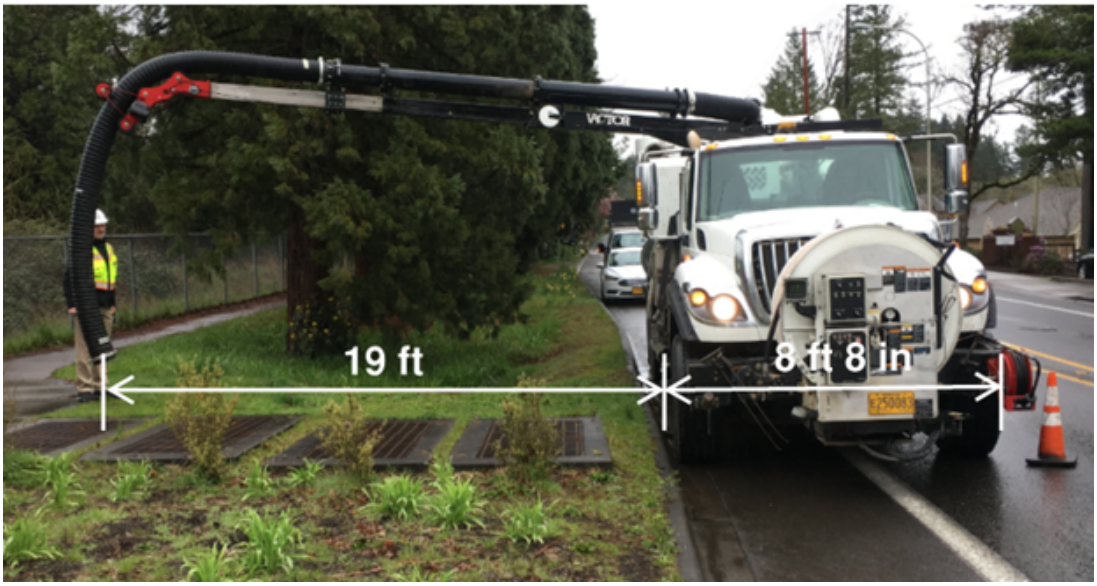
Identified Problem	Condition to Check for	Maintenance Activity	Maintenance Timing	✔ Task Complete Comments
Grate Damaged, missing or not in place	Grate is missing or only partially in place, may have missing or broken grate members.	Grate must be in place and meet design standards. Replace or repair any open structure, replace grate if missing	As Needed	
Damage to Outlet Structure	Damage to Frame or Top Slab. Frame not sitting flush on top slab (more than ¾ inch between frame and top slab); frame not securely attached	Ensure frame is firmly attached and sits flush on the riser rings or top slab	As Needed	
Damage to Outlet Structure	Fractures or Cracks in Walls or Bottom. Maintenance person determines the structure is unsound. Soil entering structure through cracks.	Structure replaced or repaired to design standards.	As Needed	
Damage to Outlet Structure	Settlement or Misalignment of Basin. Failure of basin has created a safety, function, or design problem	Structure replaced or repaired to design standards	As Needed	

Add:

11. ***SWM facilities that have structures that require periodic maintenance (such as, but not limited to, flow control structures/manholes, pretreatment structures/manholes, ditch inlets with sumps) shall have a geometric layout so that the structure(s) are located no further than 9-feet from the front tires, and 19-feet from the side of where the maintenance vehicle can drive and park. Other infrastructure such as signs, street lights, meter vaults, street trees, etc. must be located so as to not impede maintenance vehicle access. See images below.***

Figure 510.3 – Maintenance Vehicle Access

Figure 510.4 – Maintenance Vehicle Access



APPENDIX F – ASBUILT DESIGN DATA (PERTINENT PAGES ONLY)

CONSTRUCTION NOTES

THIS SHEET TO FACE SHT. 4A

AS-BUILT COPY
JUNE 24, 2013

AS-BUILT INFORMATION IS BASED ON FIELD, CONSTRUCTION, AND INSPECTOR NOTES. ACCURACY SHOULD BE CONFIRMED IN THE FIELD BY THE USER OF THESE PLANS. THE COUNTY MAKES NO REPRESENTATIONS OR WARRANTIES REGARDING ACCURACY OR CONTENT.

1. Const. P.C. Conc. Curb & Gutter (Modified)
(For Details, See Sht. 2B)

2. Const. P.C. Conc. Walk
(For Details, See Sht. 2B)

2A. Const. Sidewalk Ramp
(See Dwg. No. RD 757 and Sht. 2B)

3. Sta. 83+80 to Sta. 84+85 Lt.
Sta. 85+80 to Sta. 86+75 Lt.
Const. Reinf. Conc. Walk - 1620 SF
To Commercial Dwy. Section
(For Details, See Sht. 2B-4)

4. Remove Extg. Dwy. Culverts
Const. Commercial Dwy. - 2
Const. A.C. Dwy. Connection
(See Dwy. Table This Sheet)
(For Details, See Shts. 2B-15 And 2B-17, And Sht 2B-4)

5. Remove Extg. Bridge
Const. Bridge
(For Bridge Details & Location, See Shts "S")

6. Sawcut & Match Extg. Pavement
Install Pavement Overlay Geotextile
Const. Asph. Conc. Pvmt. Widening
(For Details & Limits, See Sht. 2)
Cold Plane Pvmt. Removal
(See Sht. 2B-2 For Cold Plane Details)
(Sawcut Incidental to Struct. & Obst. Item)

7. Const. Walls
Const. Fences/Railing
(For Wall Details & Location, See Shts "W")
(For Fence Details & Location, See Shts. "W")

8. Sta 84+07.24 Rt.
Const. Street Connection
(For Details, See Sht. 2B-18)

9. Relocate Extg. Utility Pole
(By Others)

10. Preserve & Protect Extg. Utility Pole

11. Adjust Extg. Water Meter Box - 2 Ea.
to Proposed Grade

12. Adjust Extg. Valve Box to
Proposed Grade
- Water By Contractor - 2 Ea.
- Gas By Others

13. Sta 86+41 Rt.
Sta 86+76 Rt.
Sta 86+84 Rt.
Sta 87+62 Rt.
Inst. 6" Roof Drain Connection
Inst. 6" Pipe - 90'
Inst. Cleanouts Behind Walk & Tie Into Storm Pipe as Directed
(Clean Out & Tie In With Tee Incidental to Pipe Item)
(For Details See Shts. 2B-11 & 2B-12)

14. Adjust Extg. Hydrant
to Proposed Grade
(By Others)

15. Sta 84+11.75 , 80.63 Rt.
Cont. Type CG-30 Inlet
Top Lid Elev. - 196.00 (Field Check)
I.E. Out (S) - 193.40
Inst. 10" Stm. Pipe - 31'
Pipe Slope - 0.60 %
(For Details, See Sht.'s 2B-8 & 2B-9)

16. Sta 83+81.85 , 72.41' Rt.
Cont. Type CG-30 Inlet
Top Lid Elev. - 196.00 (Field Check)
I.E. In (N) - 193.21
I.E. Out (W) - 193.11
Inst. 12" Stm. Pipe - 48'
Pipe Slope - 0.44 %

17. Sta 84+53, 26.39' Rt.
Cont. Type CG-30 Inlet
Top Lid Elev. - 197.58
I.E. Out (S) - 194.00
Inst. 12" Stm. Pipe - 58'
Pipe Slope - 1.00 %
(For Details, See Sht. 2B-9)

18. Sta 83+94, 26.0' Rt.
Const. Std. Manhole
Top Rim Elev. - 197.25
I.E. In (E) - 192.90
I.E. In (N) - 193.42
I.E. Out (S) - 192.80
Inst. 12" Stm. Pipe - 24'
Pipe Slope - 0.60%
(For Details, See Sht. 2B-6)

19. Sta 83+71, 27.50' Rt.
Const. Type Mod. CG-48 Manhole
Top Lid Elev. - 197.18
I.E. In (S) - 190.90
I.E. In (N) - 192.66
I.E. Out (W) - 190.80
Inst. 27" Stm. Pipe - 55'
Pipe Slope - 0.60%
(For Details, See Sht. 2B-10)

20. Sta 83+55, 23.0' Rt.
Remove Extg. Pipe to North
Const. Std. Manhole
Top Rim Elev. -196.79
I.E. In (S) Extg. Pipe - Field
I.E. Out (N) - 191.00
Inst. 24" Stm. Pipe - 16'
Pipe Slope - 0.60 %
Locate Manhole Over Extg. Pipe And Tie In Pipe From South.
(Removal Incidental To Structures & Obst. Item)
(Tie In Work Incidental to Manhole Item)

21. Sta 83+60, 31.0' Lt.
Remove Extg. Pipe to North
Const. Std. Manhole
Top Rim Elev. -197.30
I.E. In (S) Extg. Pipe - Field
I.E. Out (N) - 191.16
Inst. 18" Stm. Pipe - 16'
Pipe Slope - 1.00 %
Locate Manhole Over Extg. Pipe and Tie-In Pipe From South
(Removal Incidental to Structures & Obst. Item)
(Tie-In Work Incidental to Manhole Item)

22. Sta 83+76.38, 27.95' Lt.
Const. Type CG-48 MH - Control MH
Top Lid Elev. - 197.22
I.E. In (S) - 191.00
I.E. In (E) - 190.47
I.E. Out (N) - 189.00
I.E. Out (NW) - 190.37
Inst. 12" Stm. Pipe (Out NW) - 11'
Pipe Slope (12") - 1.00 %
Inst. 30" Stm. Pipe (Out N) - 55'
Pipe Slope (30") - 0.80 %
(Note 12"Out Pipe Not Centered On Structure)
(For Details, See Sht. 2B-21)

23. Sta 83+84, 36.0' Lt.
Const. Water Quality Manhole - 96" Ø (Snout)
With C.I.P. Ballast And Snout. 24F
Top Rim Elev. - 197.37
I.E. In (SE) - 190.26
I.E. Out (N) - 190.16
Bottom Sump - 183.0
Inst. 12" Stm. Pipe - 14'
Pipe Slope - 1.00 %
(For Details, See Sht.'s 2B-6, 2B-7 & 2B-8)
(For Location And Details See Sht. "RS")

24. Sta 84+12, 37.0' Lt.
Const. Storm Filter Vault - 8' x 24'
With C.I.P. Ballast
Top Lid Elev. - 197.48
I.E. In (S) - 190.02
I.E. Out (N) - 187.72
Inst. 12" Stm. Pipe - 32'
Pipe Slope - 1.00 %
(For Details, See Sht. "RS")

25. Sta 84+56, 45.0' Lt.
Pipe Outlet 12"
F.L. 12" Out - 187.34

DRIVEWAY TABLE

Type	Station	Appr. Type	Conc. Dwy Appr. Area	Throat Width	Extg. Surface	Finished Surface	*Length	Estimated Paved Area
Commercial	86+13 Rt.	Reinf. Conc.	147 Sf	21	A.C.	A.C.	± 60'	1730 Sf
Commercial	87+30 Rt.	Reinf. Conc.	140 Sf	20'	A.C.	A.C.	± 3'	54 Sf

* Length From Back of Sidewalk

DEPARTMENT OF LAND USE & TRANSPORTATION ENGINEERING
WASHINGTON COUNTY OREGON

PLOT STAMP: 07/24/13 5:03P ARNEA
CAD: 100089CN.DWG, TAB: 4
PATH: O:\100089\FINAL ENGR\DWG\

NO.	REVISIONS

S.W. SCHOLLS FERRY ROAD
FANNO CR. BRIDGE REPLACEMENT
WASHINGTON COUNTY

CONSTRUCTION NOTES

PROJECT NUMBER
100089

42 OF 111
SHEET TITLE
4

S E C. 2 3, T. 1 S., R. 1 W., W. M.

SCALE 20 10 0 20 40 FEET

NORTH

84+00 85+00 86+00 87+00 88+00

Existing regional treatment facility for basin A1

1S123BD00500
NELSON, GARY R
11295 SW 135TH
TIGARD, OR, 97223

1S123BD90000
SCHOLLSBRIDGE CONDOMINIUMS

11S123DB03204
LOEHR, WILLIAM N AND LORETTA C
6875 SW MERRY LN BEAVERTON
OR, 97008

1S123AC03301
EWELL, LANNY W & MARIAN S
12975 SW WATKINS AVE
TIGARD, OR, 97223

1S123AC03302
BROOKSIDE ESTATES LLC3
6750 SW SCHOLLS FERRY RD
BEAVERTON OR, 97008

MATCH LINE STA. 83+25
SEE SHT. 3A

MATCH LINE STA. 88+00
SEE SHT. 5A

S.W. SCHOLLS FERRY RD.

S.W. MERRY LN.

BRIDGE

Const. ℄

C.L. CURVE DATA
R = 600.00'
Δ = 24°27'35"
L = 256.1414

Saw Cut
Full Depth Const. Limits
Cold Plane/ Paving Limits
R/W / WORK LIMITS
WORK LIMITS
TCE
EXTG. R/W
N 20°55'10" E 409.62'

Remove Structures Shown Thus:

Remove Extg. Pipe Shown Thus:

For Superelevation Detail - See Sht. 2B-22

176.03 Cu. Yds. Exc.
256.78 Cu. Yds. Emb.
138.86 Cu. Yds. Exc.
208.96 Cu. Yds. Emb.

L 82.00 FT
K 26.42

+02.03

PVI 85+42.67
Elev 198.18

+85.03

L 60.00 FT
K 30.01

L 100.00 FT
K 26.44

Sta. 83+60, 31.0' Lt.
Const. Standard MH
I.E. In (S) - Field
I.E. Out (N) - 191.16

LO 83+63.69
Elev 197.42
PVT 83+96.90
Elev 197.45

Sta. 84+12, 37.0' Lt.
Const. Storm Filter Vault
I.E. In (S) - 190.02
I.E. In (N) - 187.72

Profile Grade @ Const. Centerline

+0.500%

Sta. 85+95, 28' Lt.
Const. Standard MH
I.E. In (W&N) - 188.45
I.E. Out (S) - 188.35

-0.500%

PVC 86+64.56
Elev 197.57
LO 86+79.57
Elev 197.53
PVT 87+24.56
Elev 197.87
PVC 87+53.13
Elev 198.30

+1.499%

PVI 83+55.90
Elev 197.25

SL. 1.00%
12"-11'

SL. 1.00%
12"-14'

8' x 24' Vault

Extg. Ground @ Const. Centerline

Sta. 84+55, 42.0' Lt.
Pipe Outlet
F.L. Out (N) - 188.18

30"-28'

Proposed Ground

Extg. Ground

Fanno Creek

SL. 1.00%
12"-32'

Sta. 84+56, 45.0' Lt.
Pipe Outlet
F.L. Out (N) - 187.34

8' x 18' Vault

SL. 0.50%
12"-6'

SL. 0.50%
12"-55'

SL. 3.40%
24"-31'

SL. 0.62%
24"-84'

PVI 86+94.56
Elev 197.42

SL. 3.25%
18"-128'

Sta. 83+76, 27.95' Lt.
Const. Mod CG-48 MH-Control
I.E. In (S) - 191.00
I.E. In (E) - 190.47
I.E. Out (N) - 189.00
I.E. Out (NW) - 190.37

Sta. 83+84, 36.0' Lt.
Const. 96" WQ MH
I.E. In (SE) - 190.26
I.E. Out (N) - 190.16

Sta. 84+31, 30.0' Lt.
Const. Std. 60" MH
I.E. In (SE) - 190.26
I.E. Out (N) - 190.16

Sta. 85+65.40, 17.78' Lt.
Pipe Outlet
F.L. 24" Out (S) - 187.30

Extg. 36" San. @ Const. C.L.

Sta. 86+02, 37.5' Lt.
Const. Storm Filter Vault
I.E. In (N) - 190.81
I.E. Out (E) - 188.51

Sta. 86+22, 37.0' Lt.
Const. 96" WQ MH
I.E. In (N) - 191.00
I.E. Out (S) - 190.84

Sta. 86+79.57, 27.50' Lt.
Const. Mod CG-48 Control MH
I.E. In (E&N) - 191.37
I.E. Out (SW) - 191.27
I.E. Out (S-24") - 188.97

210 205 200 195 190 185 180

83+25 83+50 84+00 84+50 85+00 85+50 86+00 86+50 87+00 87+50 88+00

AS-BUILT COPY
JUNE 24, 2013

AS-BUILT INFORMATION IS BASED ON FIELD, CONSTRUCTION, AND INSPECTOR NOTES. ACCURACY SHOULD BE CONFIRMED IN THE FIELD BY THE USER OF THESE PLANS. THE COUNTY MAKES NO REPRESENTATIONS OR WARRANTIES REGARDING ACCURACY OR CONTENT.

DEPARTMENT OF LAND USE & TRANSPORTATION ENGINEERING

WASHINGTON COUNTY OREGON

PLOT STAMP: 07/25/13 9:01A ARNEA
CAD: 100089PP.DWG, TAB: 4A
PATH: O:\100089\FINAL ENGR\DWG\

NO.	REVISIONS

S.W. SCHOLLS FERRY ROAD
FANNO CR. BRIDGE REPLACEMENT
WASHINGTON COUNTY

PLAN & PROFILE

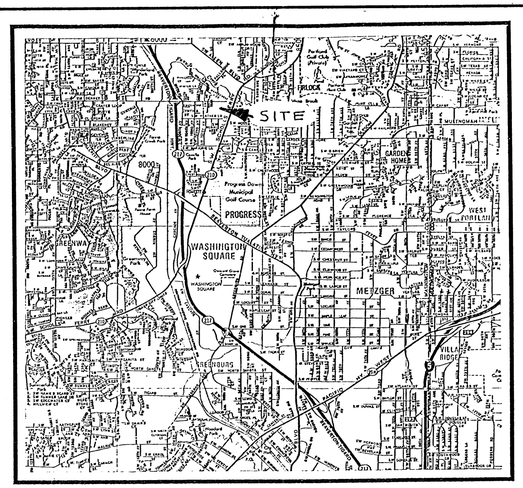
PROJECT NUMBER
100089

SHEET NO.
44 OF 111

SHEET TITLE
4A

APPLEGROVE

SUBDIVISION



VICINITY MAP

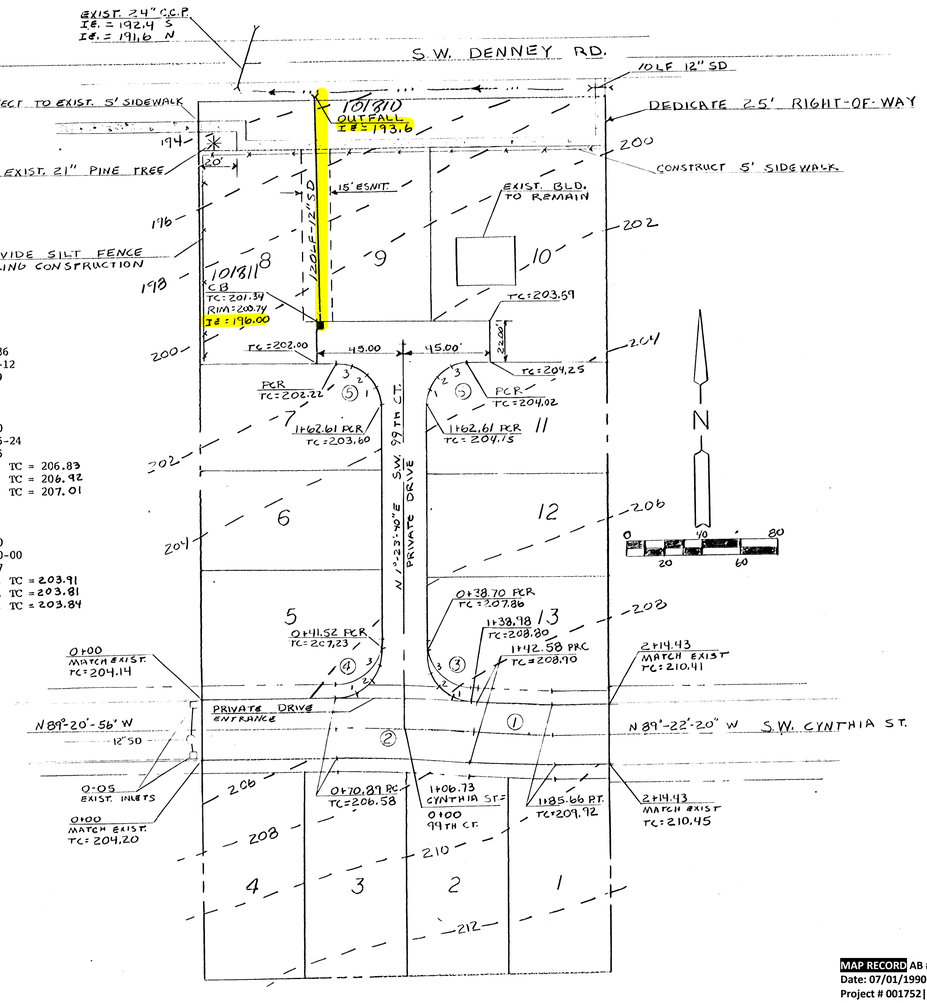
LEGEND

NEW		EXISTING
●	MANHOLE	○
■	CATCH BASIN	□
—►	DIRECTION OF GUTTER FLOW	
—SD—	STORM DRAIN	—SD—
—S—	SANITARY SEWER	—S—
	CURB RAMP	
—W—	WATER	—W—
⊢	TEE WITH THRUST BLOCK	
⊾	BEND WITH THRUST BLOCK	
⋈	GATE VALVE	
•	BLOW-OFF 1 - 2" G. V. 1 - 1/2" Automatic Drain. 2 - Valve Boxes. 4 - 1/2" - 2" Iron Pipes, Caps & Fittings.	
⊱	FIRE HYDRANT ASSEMBLY 1 - MJ x MJ x FL. Tee 2 - 3/4" Galv. Tie Rods field cut for pipe length 18' or less. If over 18' use thrust block and eliminate tie rods. 1 - 6" Gate valve FL x MJ 1 - Hyd. w/ 5-1/4" MVO. 1 - 4" N.S.T. 2 - 2-1/2" N.S.T. outlets.	
⊢	SINGLE 3/4" WATER SERVICE	
⊐⊢	DOUBLE WATER SERVICE 1 - 1" Muller Corp. stop 1 - Meter branch spreader Muller H-15362 2 - 3/4" Angle stops w/ lock ring, Ford or equal.	
———	RIGHT-OF-WAY	
———	CURB	

ABBREVIATIONS

TC	TOP OF CURB	V.P.I	VERTICAL POINT OF INTERSECTION	L.F.	LINEAL FEET
TP	TOP OF PAVEMENT	E.V.C.	END VERTICAL CURVE	FL	FLOWLINE
PCR	POINT OF CURB RETURN	CB	CATCH BASIN	CSP	CONCRETE SEWER PIPE
RP	RADIUS POINT	SDMH	STORM DRAIN MANHOLE	DI	DUCTILE IRON
BC	BEGIN CURVE	I.E.	INVERT ELEVATION	S	SLOPE
EC	END CURVE	S.D.	STORM DRAIN	T.B.	THRUST BLOCK
PRC	POINT OF REVERSE CURVE	C.C.P.	CONCRETE CULVERT PIPE	G.V.	GATE VALVE
PVM'T	PAVEMENT	ESM'T	EASEMENT		
A.C.	ASPHALTIC CONCRETE	SMH	SANITARY SEWER MANHOLE		
V.C.	VERTICAL CURVE	C.O.	CLEANOUT		
P.R.V.C.	POINT OF REVERSE VERTICAL CURVE	LAT	LATERAL		

Basin C2 subdivision contribution to proposed extended dry basin. Assumes 50% impervious area based on lot size and road contributions.



① R = 319.17
△ = 6-18-36
L = 43.08

② R = 653.36
△ = 6-17-12
L = 71.69

③ R = 25.00
△ = 84-46-21
L = 36.99
1. 1/4△ TC = 208.54
2. 1/2△ TC = 208.28
3. 3/4△ TC = 208.02

④ R = 25.00
△ = 89-15-24
L = 38.95
1. 1/4△ TC = 206.83
2. 1/2△ TC = 206.92
3. 3/4△ TC = 207.01

⑤ R = 25.00
△ = 90-00-00
L = 39.27
1. 1/4△ TC = 203.27
2. 1/2△ TC = 202.89
3. 3/4△ TC = 202.51

⑥ R = 25.00
△ = 90-00-00
L = 39.27
1. 1/4△ TC = 203.91
2. 1/2△ TC = 203.81
3. 3/4△ TC = 203.84

NOTE:
TOPOGRAPHIC SURVEY INFORMATION WAS PROVIDED BY ROSSETTI-MARRIS SURVEYORS AND WAS BASED ON WASHINGTON COUNTY BENCH MARK NO. 83, LOCATED AT THE INTERSECTION OF S.W. SCHOLLS FERRY AND S.W. HEATHER LANE.

GENERAL NOTES

1. ALL STREET WORK SHALL BE DONE IN CONFORMANCE WITH THE WASHINGTON COUNTY UNIFORM ROAD IMPROVEMENT DESIGN STANDARDS. THESE PLANS AND THE 1980 STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, OREGON CHAPTER APWA. ALL EROSION CONTROL, STORM AND SANITARY SEWER WORK SHALL CONFORM TO UNITED SEWERAGE AGENCY CONSTRUCTION REQUIREMENTS.
2. THE COMPLETED INSTALLATION SHALL CONFORM TO ALL APPLICABLE FEDERAL, STATE AND LOCAL CODES, ORDINANCES AND REGULATIONS INCLUDING NECESSARY PERMITS AND INSPECTIONS REQUIRED BY THE GOVERNING AUTHORITIES.
3. NO ITEM OR PHASE OF WORK SHALL BE CONSIDERED COMPLETE UNTIL ACCEPTED BY THE COUNTY, UNITED SEWERAGE AGENCY AND THE ENGINEER.
4. ALL PERMITS AND LICENSES NECESSARY FOR THE PROSECUTION AND COMPLETION OF THE WORK SHALL BE SECURED BY THE CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION. DEVELOPER TO OBTAIN PUBLIC WORKS CONSTRUCTION PERMIT.
5. THE LOCATION OF EXISTING UNDERGROUND FACILITIES SHOWN ON THE PLANS IS FOR INFORMATION ONLY AN IS NOT GUARANTEED TO BE ACCURATE.
6. BEFORE COMMENCING CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY ALL PERTINENT COMPANIES OR AGENCIES WITH UNDERGROUND FACILITIES IN THE PROJECT AREA SO THAT SAID FACILITIES MAY BE ACCURATELY LOCATED. POTHOLE ALL CROSSINGS AS NECESSARY BEFORE CONSTRUCTION TO PREVENT GRADE AND ALIGNMENT CONFLICTS.
7. NO TREES OVER 6" DIAMETER SHALL BE CUT WITHOUT COUNTY PERMISSION.

CONSTRUCTION NOTES

1. ALL OPEN-CUTTING OF EXISTING STREETS TO BE PATCHED WITH A.C. COLD OR HOT MIX AT CLOSE OF EACH WORKING DAY.
2. ALL SIGNING, FLAGGING, ETC., TO CONFORM TO THE LATEST EDITION OF THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES."
3. ALL MAIN LINE SEWER PIPE SHALL BE 8" AND ALL SERVICE LATERALS 4". ALL SERVICES ON LINE SHALL BE INSTALLED WITH "T's".
4. THE TERMINUS OF ALL SEWER SERVICE LATERALS SHALL BE MARKED WITH A 2" X 4" STAKE EXTENDING 18" ABOVE THE GROUND AND PAINTED WHITE.
5. THE LOCATION AND/OR STATIONING OF ALL SEWER SERVICE LATERALS SHALL BE RECORDED AND PROVIDED TO THE ENGINEER. THE VERTICAL DISTANCE FROM TOP OF FINISH GRADE TO THE I.E. OF THE LATERAL SHALL BE PROVIDED TO THE ENGINEER.
6. SEWER SERVICE LATERAL DEPTH SHOWN ON THE PLANS IS APPROXIMATE. MINIMUM GRADE SHALL BE 1/4-INCH PER FOOT.
7. NO VALVES WILL BE OPENED OR CLOSED WITHOUT THE METZGER WATER DISTRICT APPROVAL.
8. ALL WATER PIPE TO HAVE A MINIMUM 30" COVER TO FINISH STREET GRADE.
9. ALL WATER TEES, BENDS AND ENDS OF LINES TO BE BLOCKED WITH POURED-IN-PLACE CONCRETE.
10. ALL VALVES TO BE FLANGE-CONNECTED TO ADJACENT TEES OR TIED BACK WITH 3/4" THRUST RODS.
11. ALL WATER LINES SHALL BE THOROUGHLY FLUSHED AND CHLORINATED, AND POTABLE WATER TESTS APPROVED BY THE OREGON STATE HEALTH DEPARTMENT, PRIOR TO ANY METER HOOK-UP SERVICE.
12. MAINTAIN 10' HORIZONTAL DISTANCE BETWEEN PARALLEL WATER AND SEWER LINES.
13. SUBGRADE AND TRENCH BACKFILL SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698. FLOODING OR JETTING THE BACKFILLED TRENCHES WITH WATER IS NOT PERMITTED.

MATERIAL NOTES

1. SEWER PIPE ZONE MATERIAL SHALL BE 3/4" MINUS CRUSHED ROCK.
2. SEWER, STORM DRAIN AND WATER TRENCH BACKFILL SHALL BE CLASS "D", 3/4" MINUS COMPLETE GRANULAR BACKFILL IN STREET RIGHT-OF-WAYS.
3. STORM AND SANITARY SEWER PIPE SHALL BE CONCRETE PIPE CONFORMING TO ASTM C14, LATEST EDITION, WITH RUBBER RING JOINTS OR PVC PIPE CONFORMING WITH ASTM D3034-78.
4. STORM DRAIN PIPE ZONE MATERIAL SHALL BE 3/4" MINUS CRUSHED ROCK.
5. ALL 6" WATER PIPE TO BE DUCTILE IRON OR PVC, CL-51 OR CL-52, 150 PSI WORKING PRESSURE.
6. ALL GATE VALVES TO BE CAST IRON CLASS 200 NON-RISING STEM.
7. PIPE ZONE MATERIAL FOR WATER LINE SHALL BE 3/4" MINUS CRUSHED ROCK.
8. ALL MATERIALS SHALL BE NEW. THE USE OF MANUFACTURER'S NAMES, MODELS, AND NUMBERS IS INTENDED TO ESTABLISH STYLE, QUALITY, APPEARANCE AND USEFULNESS. PROPOSED SUBSTITUTIONS WILL REQUIRE WRITTEN APPROVAL.

MAP RECORD AB # WCAB1990-002
Date: 07/01/1990| QS: 3819
Project # 001752| Subdivision
Applegrove Subdivision

REVISION	DATE	DESCRIPTION	BY
	1-14-91	AS-BUILT	DJD

Dale Construction Co. P.O. Box 1577 Beaverton, OR 97075

JOB No. 101
DESIGNED BY: D.J.D.
TRACED BY: D.J.D.
CHECKED BY: D.J.D.
DATE: JULY 1, 1990

APPLEGROVE SUBDIVISION

STREET & STORM DRAINAGE IMPROVEMENT PLAN

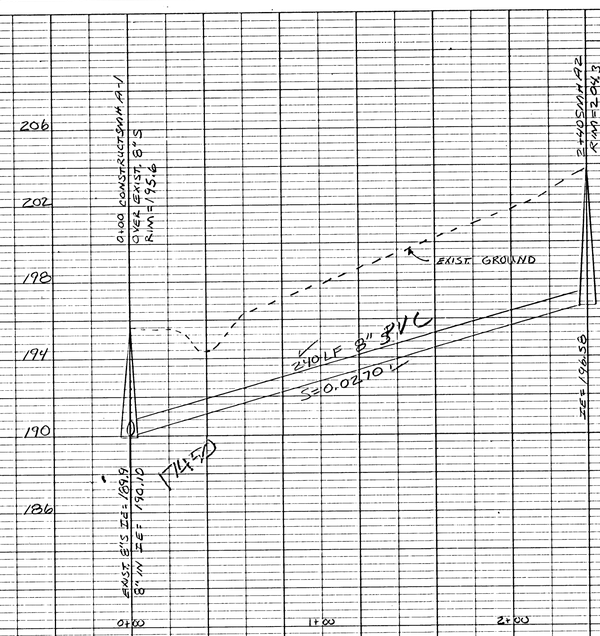
SCALE: 1"=40' SHEET 1 OF 4 DRAWING NUMBER 1

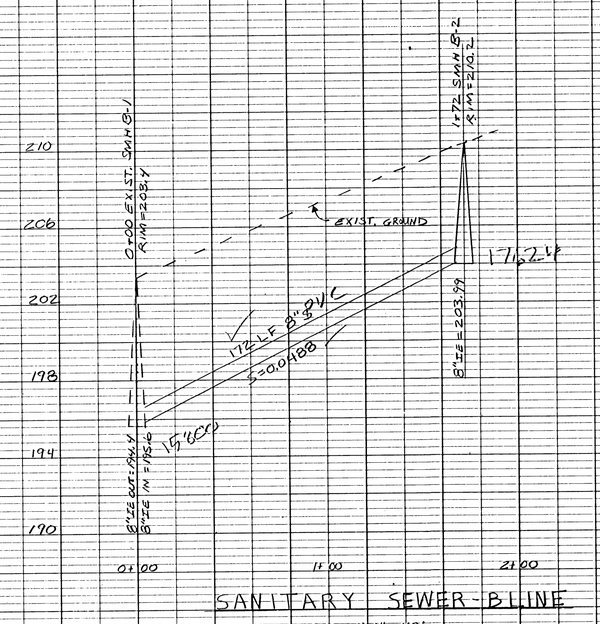
REGISTERED PROFESSIONAL ENGINEER 13,254 OREGON JULY 17, 1985 DAVID J. DeHARPPORT

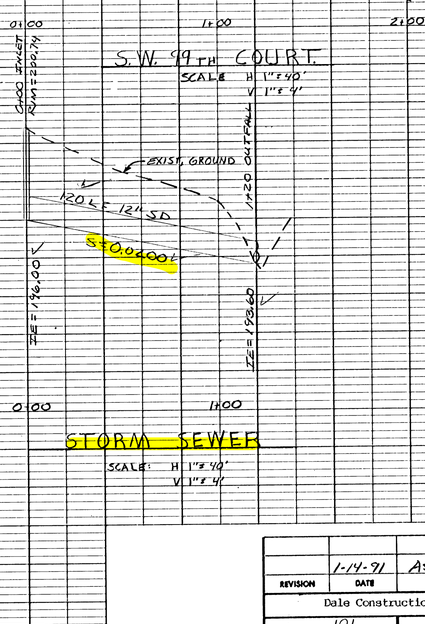
David J. DeHarpport
6767 S.W. 158th Beaverton, OR 97007
(503) 643-5108

STORM #1752

Drafting Specialties







REVISION	DATE	DESCRIPTION	BY
	1-14-91	AS-BUILT	DJD

Dale Construction Co. P.O. Box 1577 Beaverton, OR 97075

REGISTERED PROFESSIONAL ENGINEER 13,254 OREGON JULY 17, 1990 DAVID J. DeHARPPORT

JOB No.	101
DESIGNED BY.	D.J.D.
TRACED BY.	D.J.D.
CHECKED BY.	D.J.D.
DATE.	JULY 1, 1990

APPLEGROVE SUBDIVISION

SANITARY, STORM & STREET PROFILES

SCALE H 1"= 40' V 1"= 4' SHEET 3 OF 4

DRAWING NUMBER 3

David J. DeHarpport
6767 S.W. 158th Beaverton, OR 97007
(503) 643-5108

#1752