

PRELIMINARY STORMWATER REPORT

FOR

**DANIEL DANICIC
P.O. Box 466
NEWBERG, OR 97132**

**Del Boca Vista Subdivision
Sherwood, Oregon**

May 24, 2016



RENEWAL DATE: 6/30/2017



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Purpose

The purpose of this report is analyze the impacts the proposed development will have on the existing stormwater conveyance system. The report will also document the criteria and methodology by which the proposed system will be designed per the requirements by Clean Water Services (CWS) Design and Construction Standards (R&O 07-20). The report will also provide the preliminary hydraulic analysis results.

Existing Conditions

The site is bounded by Highway 99W to the north and residential development to the east and south. The site is outlined in **ORANGE** below. The topography slopes from the southwest to the northeast at slopes considered as "Rolling" per the ODOT Hydraulics Manual.



The land is currently undeveloped and is predominately urban pasture grass and weeds. Blackberry brush is also present throughout the site. The easterly side has an identified wetland and a drainage way that appears to be the headwaters of a tributary to Cedar Creek per the

attached City of Sherwood Stormwater Master Plan Watershed Map. A roadside ditch runs parallel to Highway 99W. Both drain into a 27-inch culvert that crosses under the highway and then follows the natural drainage path. Existing site plans have been attached in Appendix A for reference.

Soil Type

On-site soil classifications were obtained from the United States Department of Agriculture Natural Resources Conservation Service (NRCS) web site. A custom soil report for the site has been attached in Appendix B. The Table 1 below outlines the Hydrologic Soil Group (HSG) for each soil.

Table 1

NRCS Map Unit Number	Soil Classification	HSG Rating
1	Aloha Silt Loam	C/D
22	Huberly Silt Loam	C/D
37B	Quantama Silt Loam, 3 to 7 percent slopes	C
43	Wapato Silty Clay Loam	C/D

Per the NRCS soil report, if a soil is assigned to a dual hydrologic group (A/D, B/D or C/D), the first letter is for drained areas and the second is for undrained areas. Because the natural slope of the site and existing conveyance systems surrounding the area, a HSG C will be used in the analysis.

Proposed Conditions

The existing parcel is approximately 3.50 acres in size. Approximately 2.09 acres will be developed into a residential subdivision. The development will consist of 13-Lots, open space, a sensitive area that contains wetlands and a 50-foot wide wetlands buffer (vegetative corridor). A proposed site plan has been attached in Appendix A.

Design Methodology

Public facilities to serve the development will be constructed to governing jurisdictional standards. The proposed stormwater conveyance system will be sized to convey the peak flows for the 25-year storm event and have the capacity to serve the adjacent properties to the west.

Stormwater Analysis

In the hydrological analysis of the site, the SCS TR-20 runoff method was used to generate an SCS unit hydrograph. This technique is similar to the Santa Barbara Unit Hydrograph. The computer program "HydroCAD", by HydroCAD Software Systems LLC, was used to generate runoff quantities and hydrographs for the various storm events. A design storm of 24-hours duration based on the NRCS Type 1A rainfall distribution was used in the analysis. Table 2 shows the recurrence intervals and total precipitation. A computer generated output of the pre-developed analysis with assumptions is Appendix C and developed conditions in Appendix D.

Table 2

<i>Recurrence Interval (years)</i>	<i>Total Precipitation Depth (inches)</i>
2	2.50
5	3.10
10	3.45
25	3.90
50	4.20
100	4.50

Water quality flows and volumes in the design will be obtained from Clean Water Services (CWS) Design Standards (R&O 7-20) volume and flow equations in Chapter 4.

Stormwater Quality

It is anticipated that stormwater quality for the subdivision site will be provided by a water quality swale. This will be confirmed and refined during final engineering. A water quality

footprint is show on the proposed site plan in Appendix A. The water quality swale will be designed to CWS Design Standards that meets minimum residence time, maximum water depths, velocities, geometry and length. In event that during the final design stage it is determined that standards cannot be met, a Stormfilter by Contech® Stormwater Solutions will be designed to treat runoff for water quality flow rates.

Stormwater Detention

It is anticipated that stormwater detention for the subdivision site will be provided by underground detention pipes. The preliminary drainage analysis indicates that approximately 6,400 cubic feet of storage will be required to maintain pre-developed flow rates per CWS standards. This will be confirmed and refined during final engineering. The on-site detention system will likely consist of 500 lineal feet of 48-inch pipe with a manhole control structure.

The pre-developed and post developed site was considered a single drainage basin. Table 3 below shows the runoff release rates for both conditions. Developed release rates are anticipated to mirror pre-developed release rates to ensure avoidance of negative impacts to surrounding properties and downstream systems.

Table 3

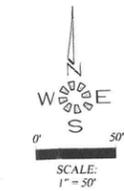
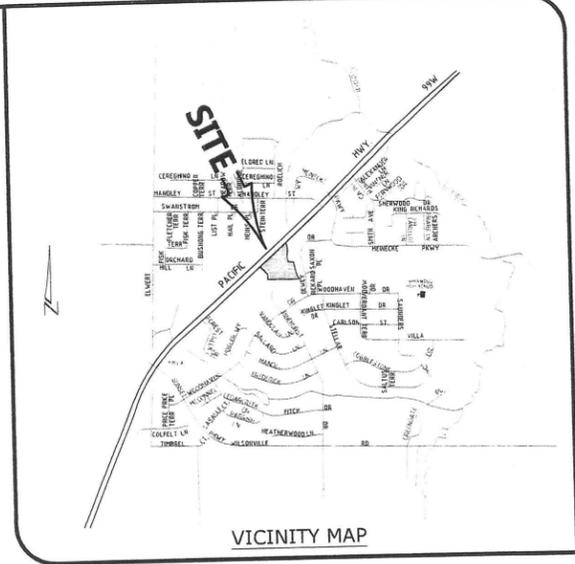
<i>Recurrence Interval (years)</i>	<i>Pre-Developed Flow Rate (cfs)</i>	<i>Pre-Developed Flow Rate (cfs)</i>
2	0.15	0.56
5	0.32	0.84
10	0.43	1.01
25	0.58	1.23

There are no known downstream flow restrictions within a quarter mile at this time. No downstream deficiencies within the quarter mile have been identified in the City of Sherwood Stormwater Master Plan. Plate 1 of the master plan has been attached in Appendix A for reference.

Appendix A

DEL BOCA VISTA SUBDIVISION

SEC. 31, T. 2 S., R. 1 W., W.M. - TAX LOT 201
CITY OF SHERWOOD
WASHINGTON COUNTY, OREGON



Owner / Developer:
MYERS, BOYD R and BASS LL
P.O. BOX 565
DUNDEE, OREGON 97115



ABBREVIATIONS	
A.C.	ASPHALTIC CONCRETE
ACMP	ALUMINIZED CMP
ASSY.	ASSEMBLY
B.O.	BLOW OFF
B.S.V.	BUTTERFLY VALVE
C & G	CURB & GUTTER
CATV	CABLE TELEVISION
C.B.	CATCH BASIN
C.B.C.O.	CATCH BASIN CLEANOUT
C.B.I.	CATCH BASIN INLET
C.L.	CENTERLINE
CMP	CORRUGATED METAL PIPE
C.O.	CLEANOUT
CONC.	CONCRETE
CONST.	CONSTRUCT
D.I.	DUCTILE IRON
DIA.	DIAMETER
DWG.	DRAWING
EASEMT.	EASEMENT
E.G.	EXIST. GRADE / GROUND
EOP, E.P.	EDGE OF PAVEMENT
ELEC.	ELECTRIC
ELEV. or EL.	ELEVATION
EX. or EXIST.	EXISTING
FT.	FEET
F.F.	FINISH FLOOR
F.G.	FINISH GRADE
F.H.	FIRE HYDRANT
F.M.	FORCE MAIN
GUT. or GTR.	GUTTER
G.V.	GATE VALVE
IMP.	IMPROVEMENT
INST.	INSERT
INV. or I-	INVERT
L	LENGTH, LINE
L.P.	LIGHT POLE
M	METER, MAIN
M.H.	MANHOLE
MTL	METAL
O.H.	OVERHEAD
PC	POINT OF CURVE
PCC	POINT OF CONTINUING CURVE
PCD	POINT OF REVERSE CURVE
PROP.	PROPOSED
PT	POINT OF TANGENCY
PUB.	PUBLIC
PUE	PUBLIC UTILITY EASMT.
PVC	POLYVINYL CHLORIDE
PVT.	PRIVATE
P.P.	POWER POLE
P.L.	PROPERTY LINE
R	RADIUS
R-	RM
RD	ROOF DRAIN
R.O.W.	RIGHT-OF-WAY
SAN.S. or S.S.	SANITARY SEWER
S	SLOPE
STA.	STATION
STD.	STANDARD
STL	STEEL
STM.DRN. or S.O.	STORM DRAIN
SVC.	SERVICE
SW	SIDEWALK
TEL	TOP OF CURB
TEL.	TELEPHONE
TYP.	TYPICAL
U.G.	UNDERGROUND
VLT.	VAULT
W.M.	WATER MAIN

SYMBOLS			
EXIST. PROP.	BLOW OFF ASSY.	EXIST. PROP.	MANHOLE SAN. SEWER
	CATCH BASIN		MANHOLE STORM DRAIN
	CATCH BASIN CLEANOUT		2' DIA. C.O. / M.H.
	CATCH BASIN INLET		MANHOLE TELEPHONE
	CATV PED. / BOX		MANHOLE WATER
	CLEANOUT		REDUCER / INCREASER
	ELEC. PED. / BOX		TEL. PED. / BOX
	FIRE HYDRANT		TRAFFIC PED. / BOX
	GAS LOCATION MARKER		UTILITY / POWER POLE
	GAS VALVE		WATER METER
	MAIL BOX		WATER VALVE
	CABLE TELEVISION		SANITARY SEWER EXIST.
	CENTERLINE		SANITARY SEWER PROP.
	DITCH C.L.		STORM DRAIN EXIST.
	ELECTRICAL LINE		STORM DRAIN PROP.
	GAS MAIN		WATER MAIN EXIST.
	TELEPHONE LINE		WATER MAIN PROP.

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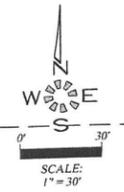
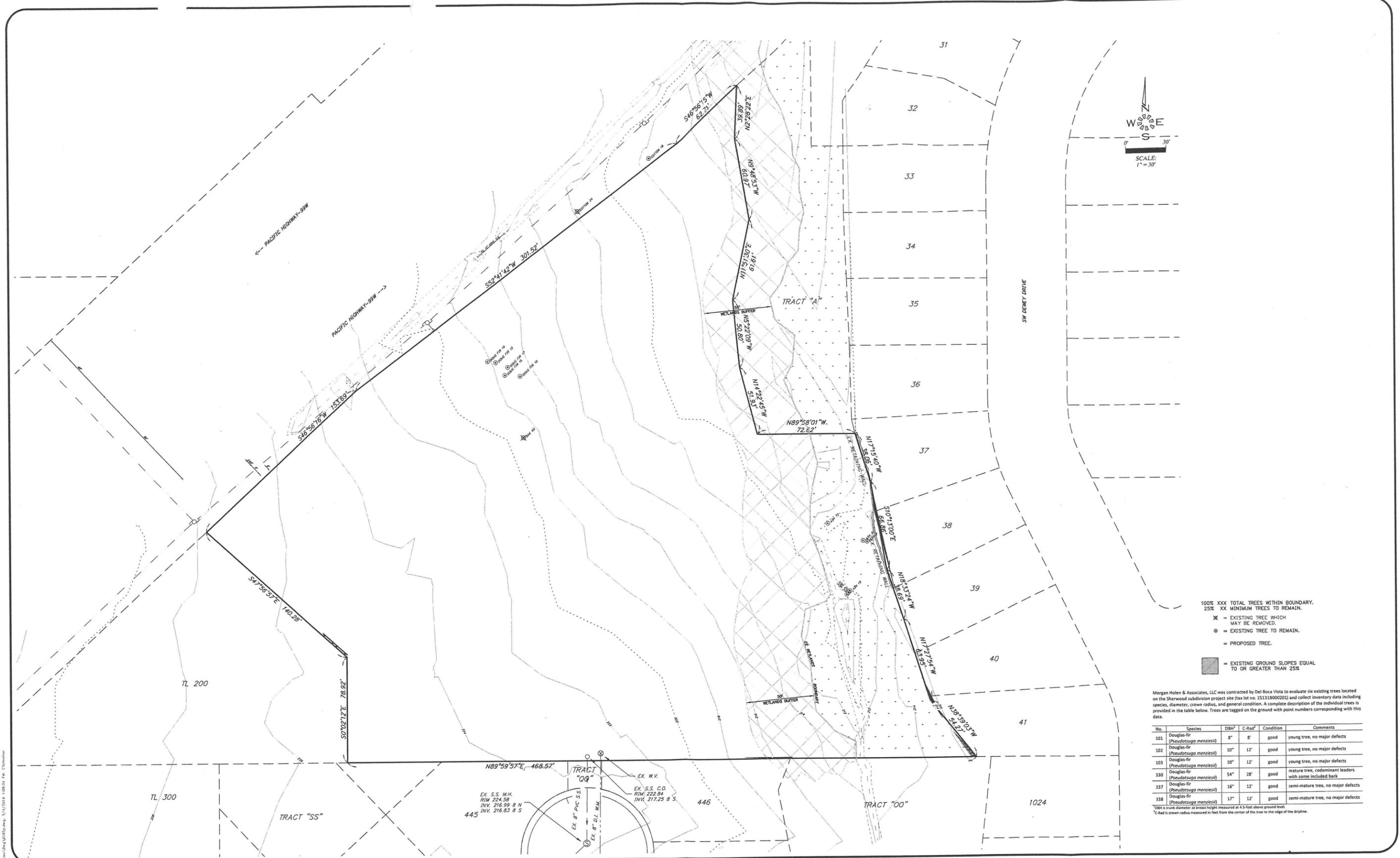
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Checked: Z.Z.Z.
Date: APRIL 2016
Scale: AS SHOWN
As-Built: _____

DEL BOCA VISTA SUBDIVISION

PRELIMINARY PLAN

Project Number
6165
Sheet Number
SDR-1



- 100% XXX TOTAL TREES WITHIN BOUNDARY.
- 25% XX MINIMUM TREES TO REMAIN.
- X = EXISTING TREE WHICH MAY BE REMOVED.
- o = EXISTING TREE TO REMAIN.
- = PROPOSED TREE.
- ▨ = EXISTING GROUND SLOPES EQUAL TO OR GREATER THAN 25%.

Morgan Holen & Associates, LLC was contracted by Del Boca Vista to evaluate six existing trees located on the Sherwood subdivision project site (tax lot no. 251318000201) and collect inventory data including species, diameter, crown radius, and general condition. A complete description of the individual trees is provided in the table below. Trees are tagged on the ground with point numbers corresponding with this data.

No.	Species	DBH ¹	C-Radius ²	Condition	Comments
101	Douglas-fir (Pseudotsuga menziesii)	8"	8'	good	young tree, no major defects
102	Douglas-fir (Pseudotsuga menziesii)	10"	12'	good	young tree, no major defects
103	Douglas-fir (Pseudotsuga menziesii)	10"	12'	good	young tree, no major defects
330	Douglas-fir (Pseudotsuga menziesii)	54"	28'	good	mature tree, codominant leaders with some included bark
337	Douglas-fir (Pseudotsuga menziesii)	16"	12'	good	semi-mature tree, no major defects
338	Douglas-fir (Pseudotsuga menziesii)	17"	12'	good	semi-mature tree, no major defects

¹DBH is trunk diameter at breast height measured at 4.5 feet above ground level.
²C-radius is crown radius measured in feet from the center of the tree to the edge of the drip-line.

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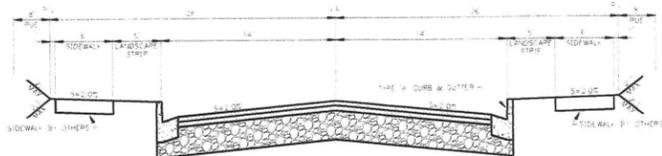
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DEL BOCA VISTA SUBDIVISION

EXISTING CONDITIONS PLAN

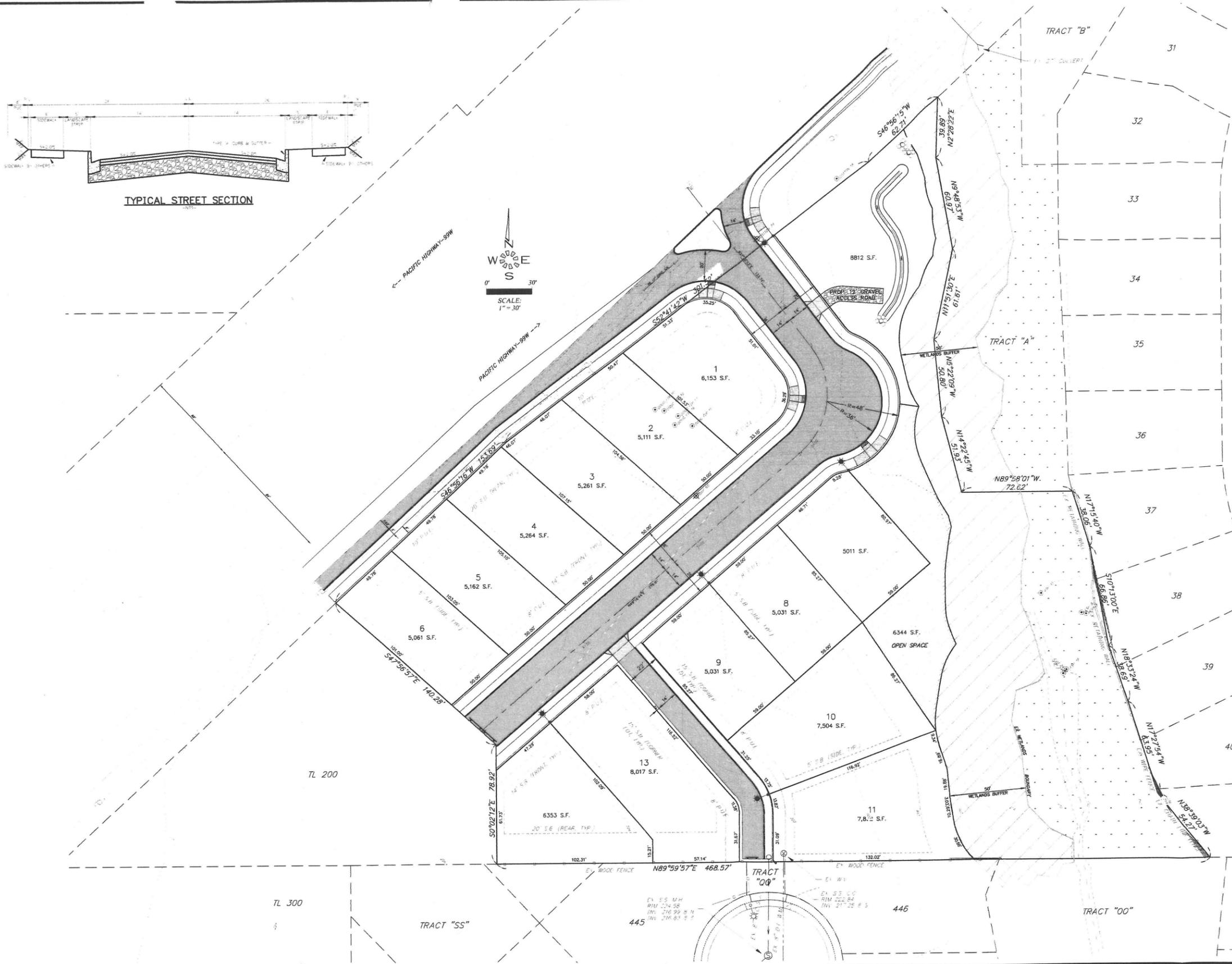
Project Number
6165
 Sheet Number
SDR-2



TYPICAL STREET SECTION



SCALE:
1" = 30'



PARCEL SIZE:

GROSS AREA	152,510 SQ.FT. (3.50 AC.)
DEVELOPABLE AREA	91,149 SQ.FT. (2.09 AC.)
NUMBER OF UNITS	13
DENSITY	6.22 UNITS/ACRE
LARGEST	7,832 LOTSQ. FT.
SMALLEST	5,030 LOTSQ. FT.
AVERAGE	5,848 SQ. FT.
OPEN SPACE	6,498 LOTSQ. FT. (7.13 %)
WETLAND BUFFER	17,466 SQ.FT.

EXISTING ZONE _____
COMPREHENSIVE DESG. _____

UTILITIES:

CABLE	COMCAST CABLE SERVICES
POWER	P.G.E.
PHONE	CENTURY LINK
GAS	N.W. NATURAL
STORM DRAIN	CITY OF SHERWOOD
SANITARY SEWER, WATER.	

- OPEN SPACE
- DEVELOPABLE AREA
- WETLAND BUFFER
- WETLAND AREA
- PAVED AREA
- WESTBROOK STREET LIGHTS (SEE DETAIL RD-57)

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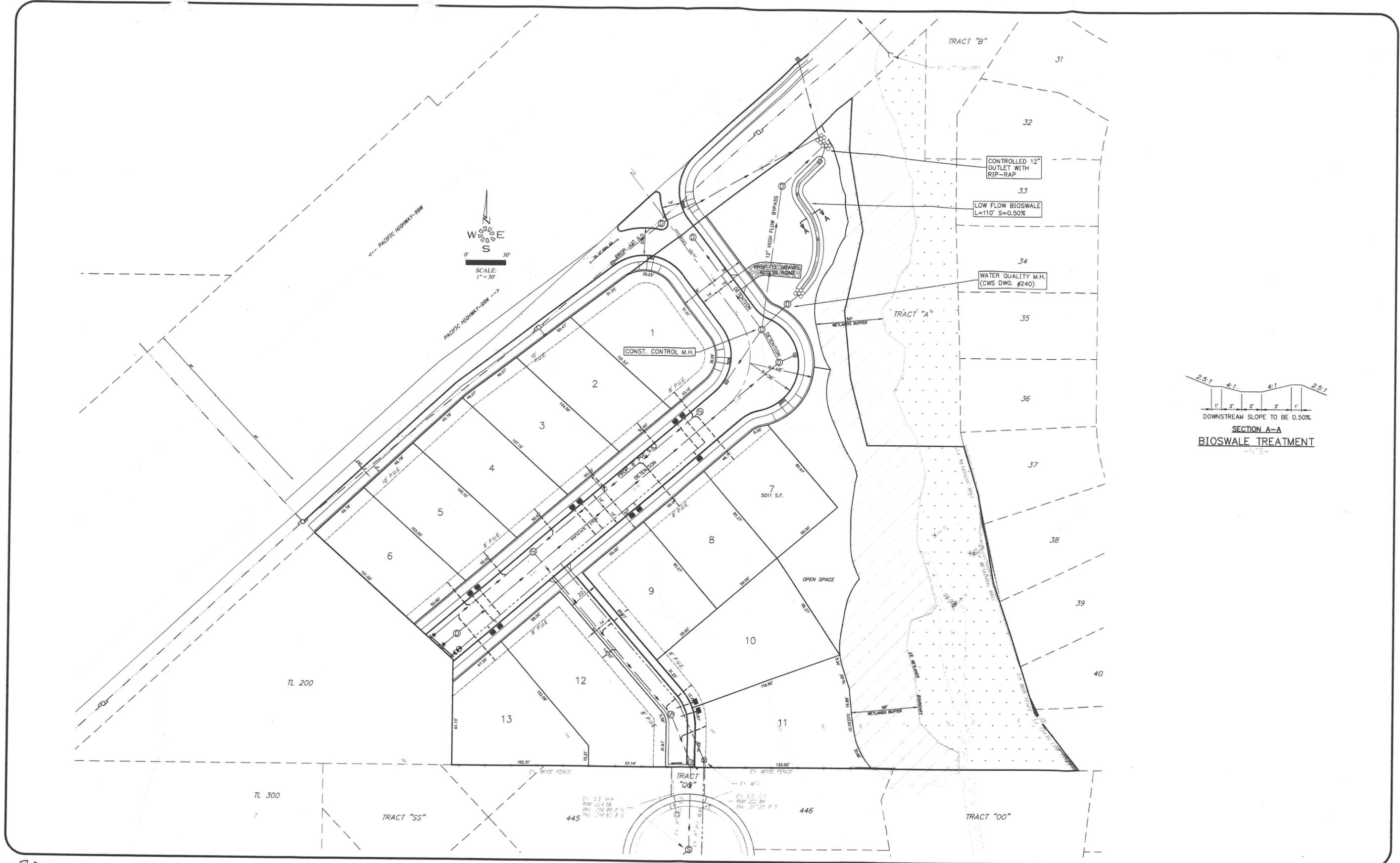
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61659/PL07.1 SDR3-SITE
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Drawn: C.D.S.
Checked: Z.Z.Z.
Date: APRIL 2016
Scale: AS SHOWN
As-Built: _____

DEL BOCA VISTA SUBDIVISION

PRELIMINARY SITE PLAN

Project Number
6165
Sheet Number
SDR-3



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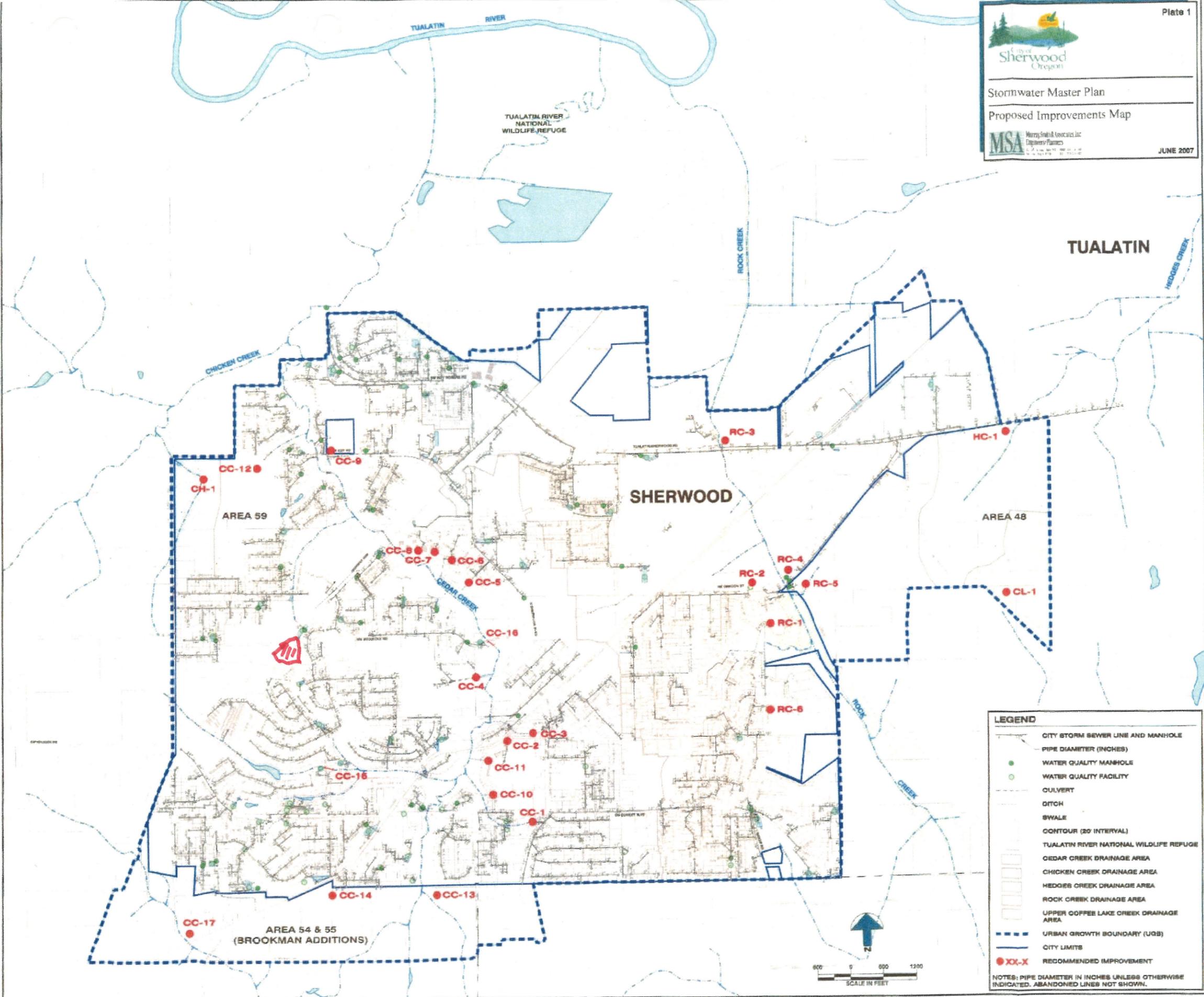
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61659/PLOT:1 SDR4-UT
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 Checked: Z.Z.Z.
 Date: APRIL 2016
 Scale: AS SHOWN
 As-Built: _____

DEL BOCA VISTA SUBDIVISION

PRELIMINARY UTILITY PLAN

Project Number
6165
 Sheet Number
SDR-4

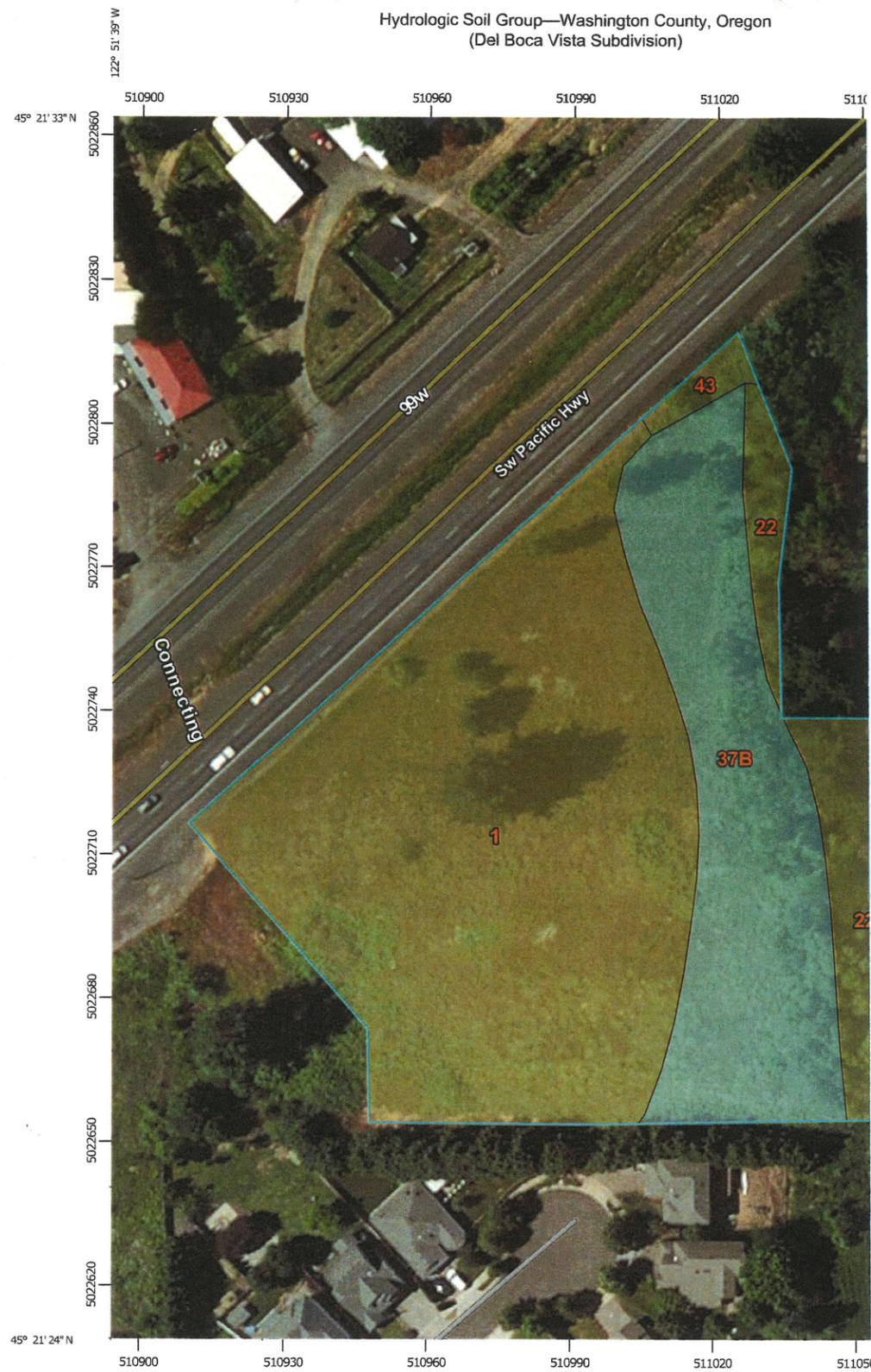


LEGEND

- CITY STORM SEWER LINE AND MANHOLE
- PIPE DIAMETER (INCHES)
- WATER QUALITY MANHOLE
- WATER QUALITY FACILITY
- CULVERT
- DITCH
- SWALE
- CONTOUR (20' INTERVAL)
- TUALATIN RIVER NATIONAL WILDLIFE REFUGE
- CEDAR CREEK DRAINAGE AREA
- CHICKEN CREEK DRAINAGE AREA
- HEDGES CREEK DRAINAGE AREA
- ROCK CREEK DRAINAGE AREA
- UPPER COFFEE LAKE CREEK DRAINAGE AREA
- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMITS
- XX-X** RECOMMENDED IMPROVEMENT

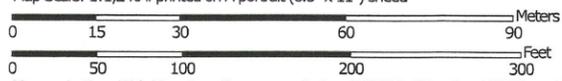
NOTES: PIPE DIAMETER IN INCHES UNLESS OTHERWISE INDICATED. ABANDONED LINES NOT SHOWN.

Hydrologic Soil Group—Washington County, Oregon
(Del Boca Vista Subdivision)



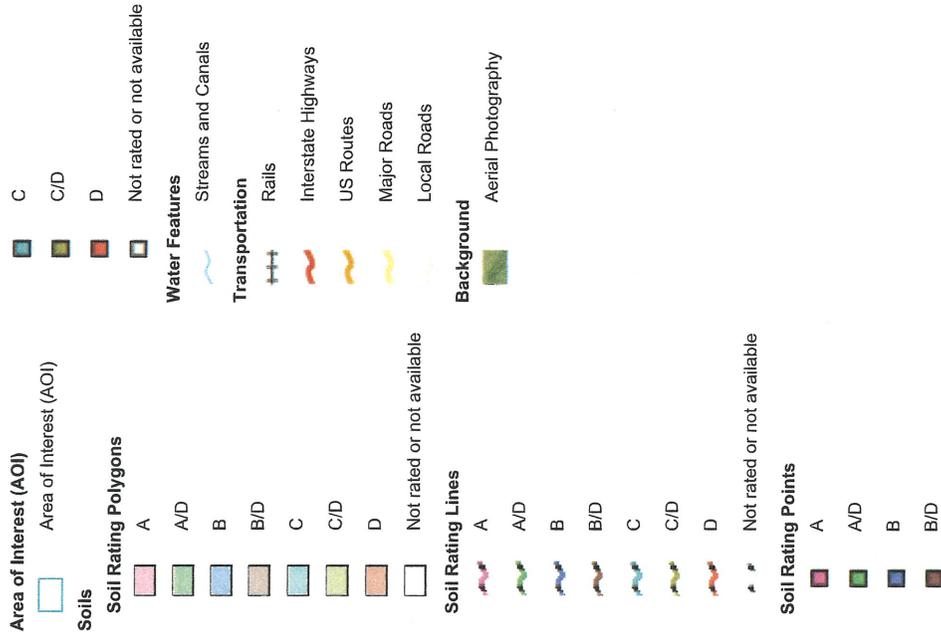
Appendix B

Map Scale: 1:1,240 if printed on A portrait (8.5" x 11") sheet.



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

MAP LEGEND



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: <http://websoilsurvey.nrcs.usda.gov>
 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 13, Sep 18, 2015

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Washington County, Oregon (OR067)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Aloha silt loam	C/D	2.3	61.1%
22	Huberly silt loam	C/D	0.4	10.5%
37B	Quatama loam, 3 to 7 percent slopes	C	1.0	27.2%
43	Wapato silty clay loam	C/D	0.0	1.2%
Totals for Area of Interest			3.7	100.0%

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

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.

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

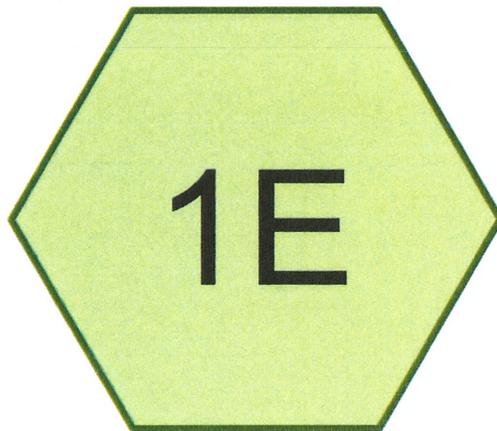
Hydrologic Soil Group and Surface Runoff—Washington County, Oregon			
Map symbol and soil name	Pct. of map unit	Surface Runoff	Hydrologic Soil Group
1—Aloha silt loam			
Aloha	90	—	C/D

Hydrologic Soil Group and Surface Runoff--Washington County, Oregon			
Map symbol and soil name	Pct. of map unit	Surface Runoff	Hydrologic Soil Group
22—Huberty silt loam			
Huberty	90	— C/D	
37B—Quatama loam, 3 to 7 percent slopes			
Quatama	85	— C	
43—Wapato silty clay loam			
Wapato	85	— C/D	
Labish	3	— C/D	

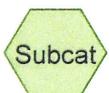
Data Source Information

Soil Survey Area: Washington County, Oregon
 Survey Area Data: Version 13, Sep 18, 2015

Appendix C



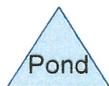
Existing Conditions



Subcat



Reach



Pond



Link

Routing Diagram for Predeveloped Conditions

Prepared by {enter your company name here}, Printed 5/23/2016
HydroCAD® 10.00-17 s/n 09412 © 2016 HydroCAD Software Solutions LLC

Predeveloped Conditions

Prepared by {enter your company name here}

HydroCAD® 10.00-17 s/n 09412 © 2016 HydroCAD Software Solutions LLC

Type IA 24-hr 2-Year Rainfall=2.50"

Printed 5/23/2016

Summary for Subcatchment 1E: Existing Conditions

Runoff = 0.15 cfs @ 8.27 hrs, Volume= 4,615 cf, Depth= 0.61"

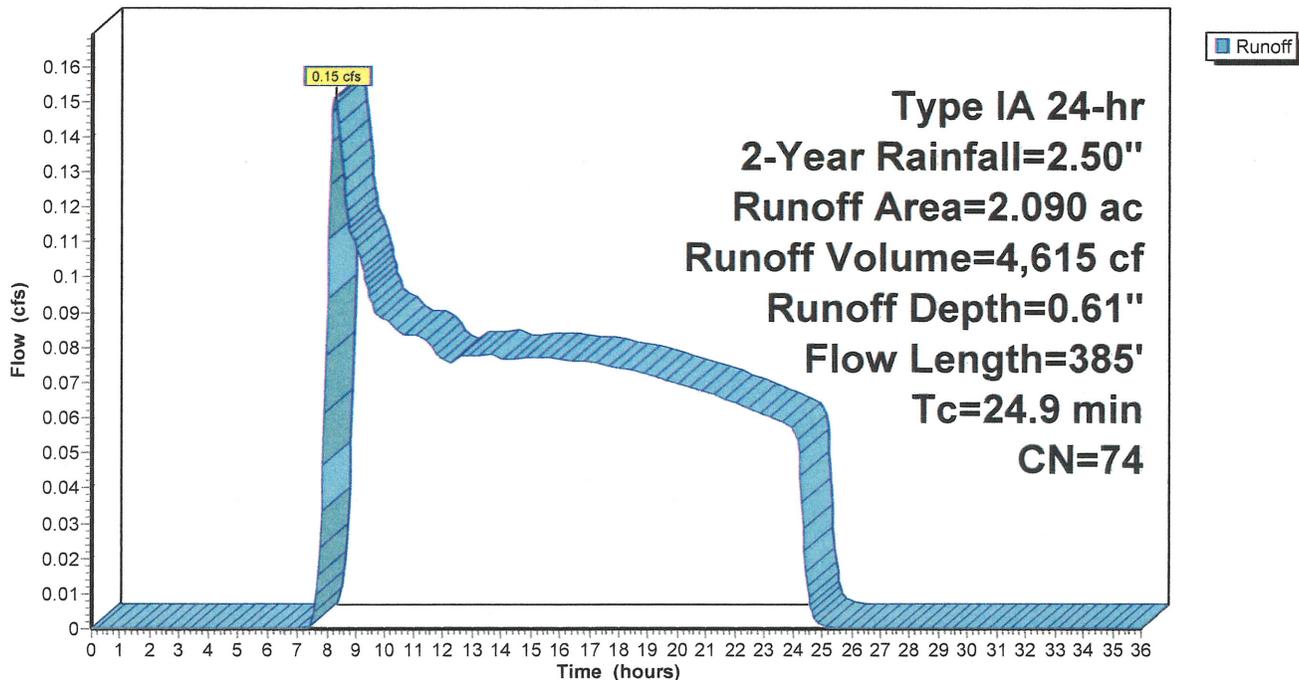
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=2.50"

Area (ac)	CN	Description
2.090	74	>75% Grass cover, Good, HSG C
2.090	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.4	225	0.0400	0.16		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	160	0.0625	1.75		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
24.9	385	Total			

Subcatchment 1E: Existing Conditions

Hydrograph



Predeveloped Conditions

Type IA 24-hr 5-Year Rainfall=3.10"

Prepared by {enter your company name here}

Printed 5/23/2016

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Summary for Subcatchment 1E: Existing Conditions

Runoff = 0.32 cfs @ 8.22 hrs, Volume= 7,376 cf, Depth= 0.97"

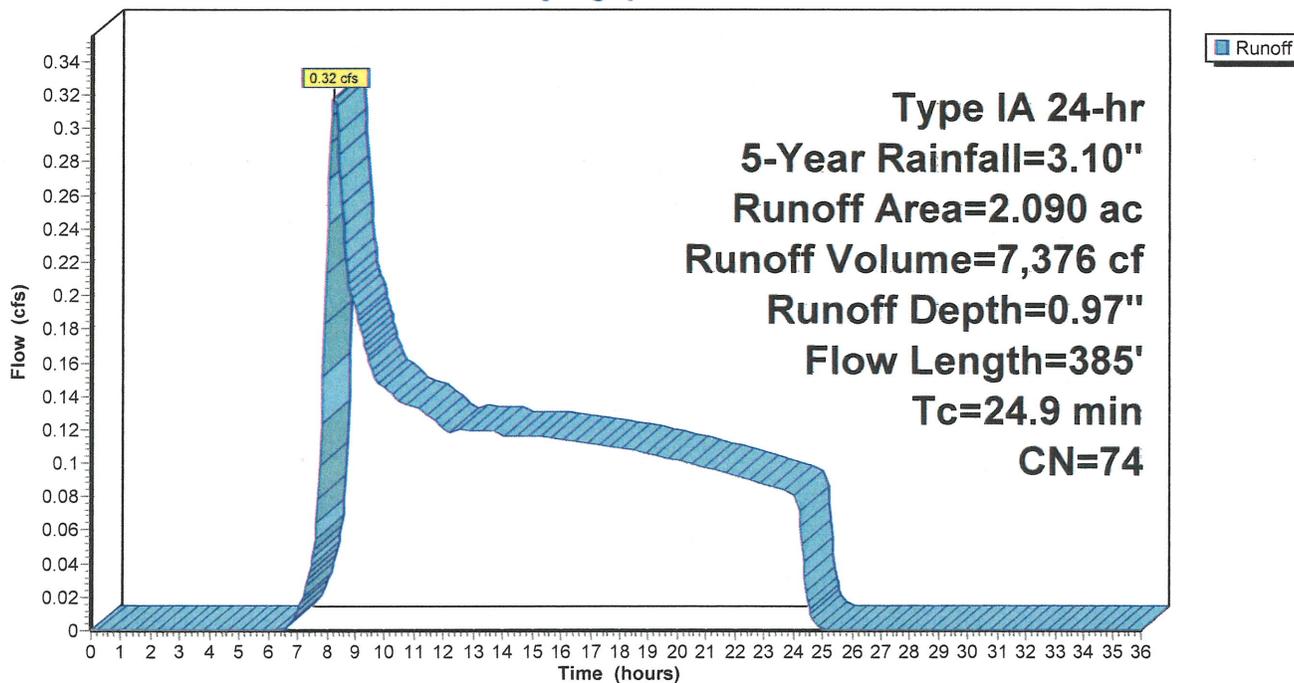
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5-Year Rainfall=3.10"

Area (ac)	CN	Description
2.090	74	>75% Grass cover, Good, HSG C
2.090	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.4	225	0.0400	0.16		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	160	0.0625	1.75		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
24.9	385	Total			

Subcatchment 1E: Existing Conditions

Hydrograph



Predeveloped Conditions

Prepared by {enter your company name here}

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Type IA 24-hr 10-Year Rainfall=3.45"

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Summary for Subcatchment 1E: Existing Conditions

Runoff = 0.43 cfs @ 8.21 hrs, Volume= 9,146 cf, Depth= 1.21"

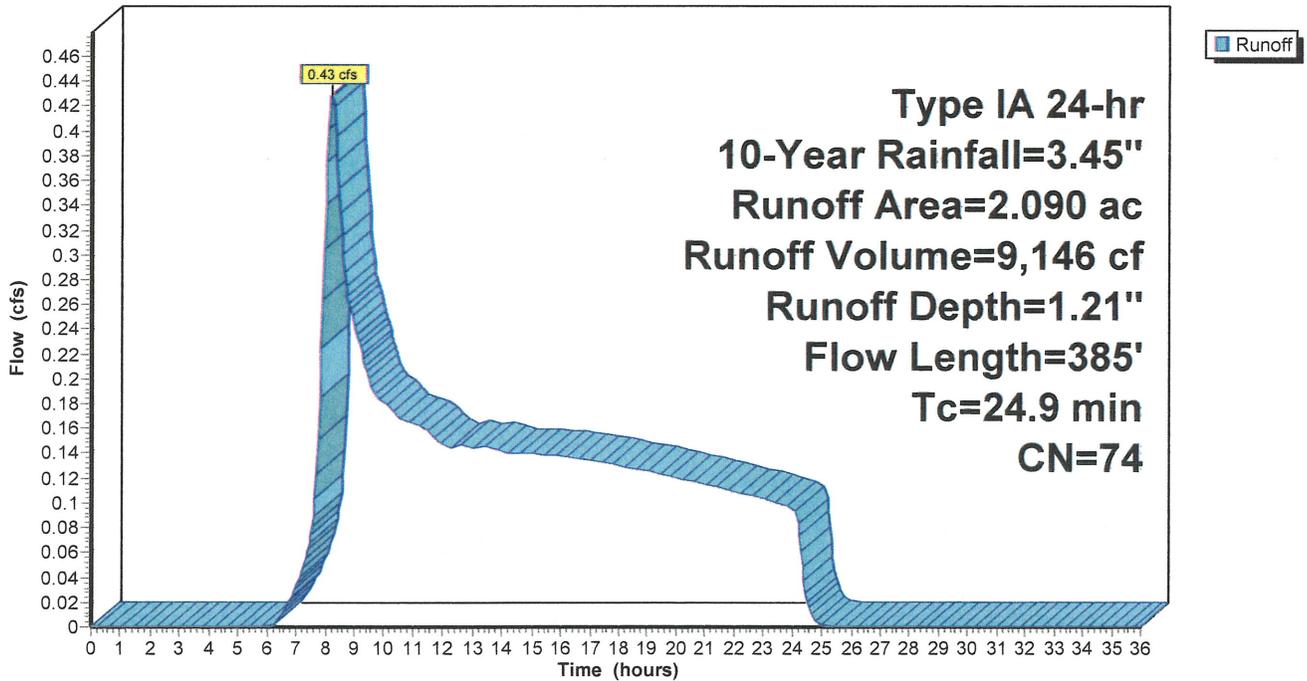
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=3.45"

Area (ac)	CN	Description
2.090	74	>75% Grass cover, Good, HSG C
2.090	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.4	225	0.0400	0.16		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	160	0.0625	1.75		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
24.9	385	Total			

Subcatchment 1E: Existing Conditions

Hydrograph



Predeveloped Conditions

Type IA 24-hr 25-Year Rainfall=3.90"

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Summary for Subcatchment 1E: Existing Conditions

Runoff = 0.58 cfs @ 8.20 hrs, Volume= 11,557 cf, Depth= 1.52"

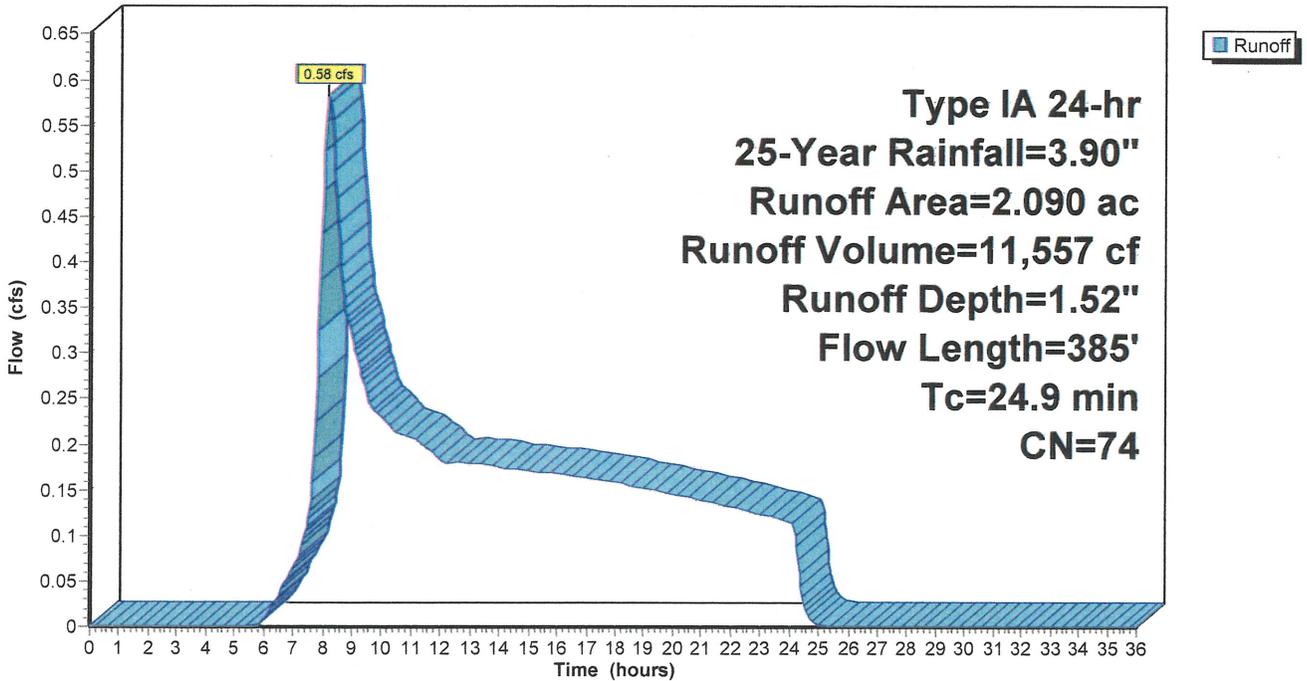
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-Year Rainfall=3.90"

Area (ac)	CN	Description
2.090	74	>75% Grass cover, Good, HSG C
2.090	74	100.00% Pervious Area

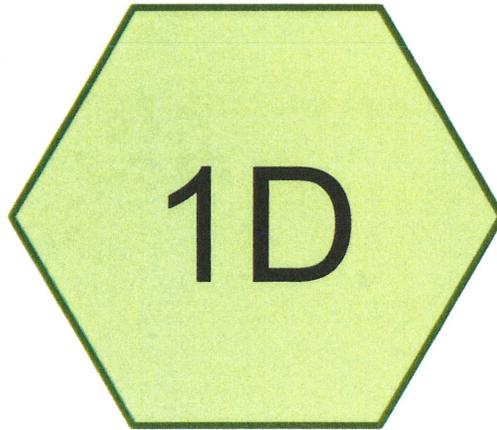
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.4	225	0.0400	0.16		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	160	0.0625	1.75		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
24.9	385	Total			

Subcatchment 1E: Existing Conditions

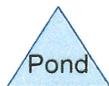
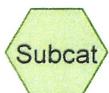
Hydrograph



Appendix D



Developed Conditions



Routing Diagram for Developed Conditions

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Developed Conditions

Type IA 24-hr 2-Year Rainfall=2.50"

Prepared by {enter your company name here}

Printed 5/23/2016

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Summary for Subcatchment 1D: Developed Conditions

Runoff = 0.56 cfs @ 8.02 hrs, Volume= 8,941 cf, Depth= 1.18"

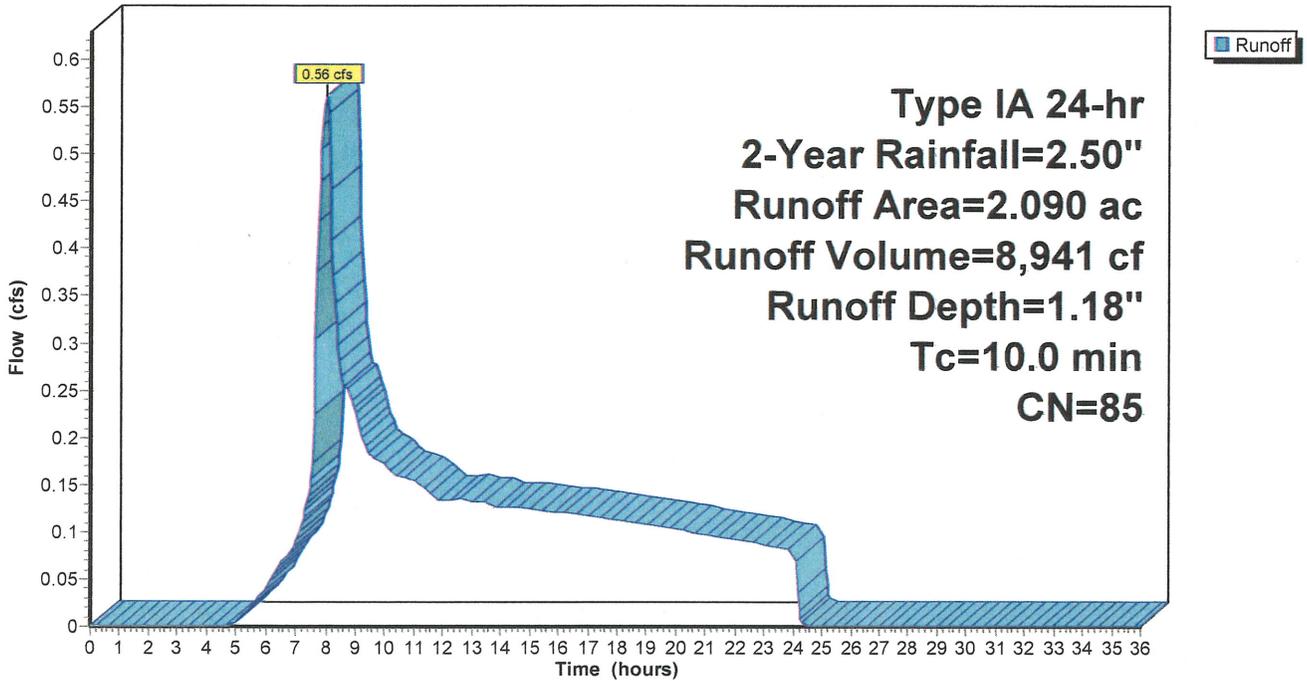
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=2.50"

Area (ac)	CN	Description
* 2.090	85	1/6 acre lots, 45% imp, HSG C
1.149	74	55.00% Pervious Area
0.940	98	45.00% Impervious Area

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

Subcatchment 1D: Developed Conditions

Hydrograph



Developed Conditions

Type IA 24-hr 5-Year Rainfall=3.10"

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Summary for Subcatchment 1D: Developed Conditions

Runoff = 0.84 cfs @ 8.01 hrs, Volume= 12,689 cf, Depth= 1.67"

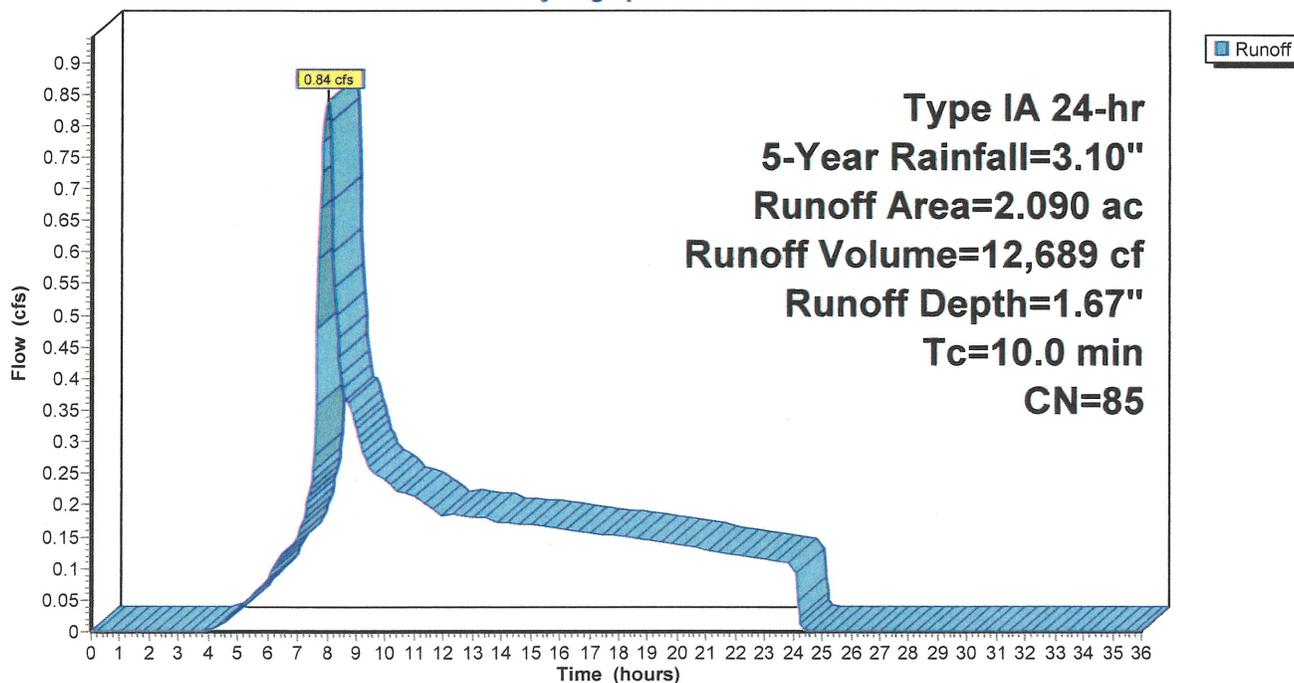
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5-Year Rainfall=3.10"

Area (ac)	CN	Description
* 2.090	85	1/6 acre lots, 45% imp, HSG C
1.149	74	55.00% Pervious Area
0.940	98	45.00% Impervious Area

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

Subcatchment 1D: Developed Conditions

Hydrograph



Developed Conditions

Type IA 24-hr 10-Year Rainfall=3.45"

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Summary for Subcatchment 1D: Developed Conditions

Runoff = 1.01 cfs @ 8.00 hrs, Volume= 14,968 cf, Depth= 1.97"

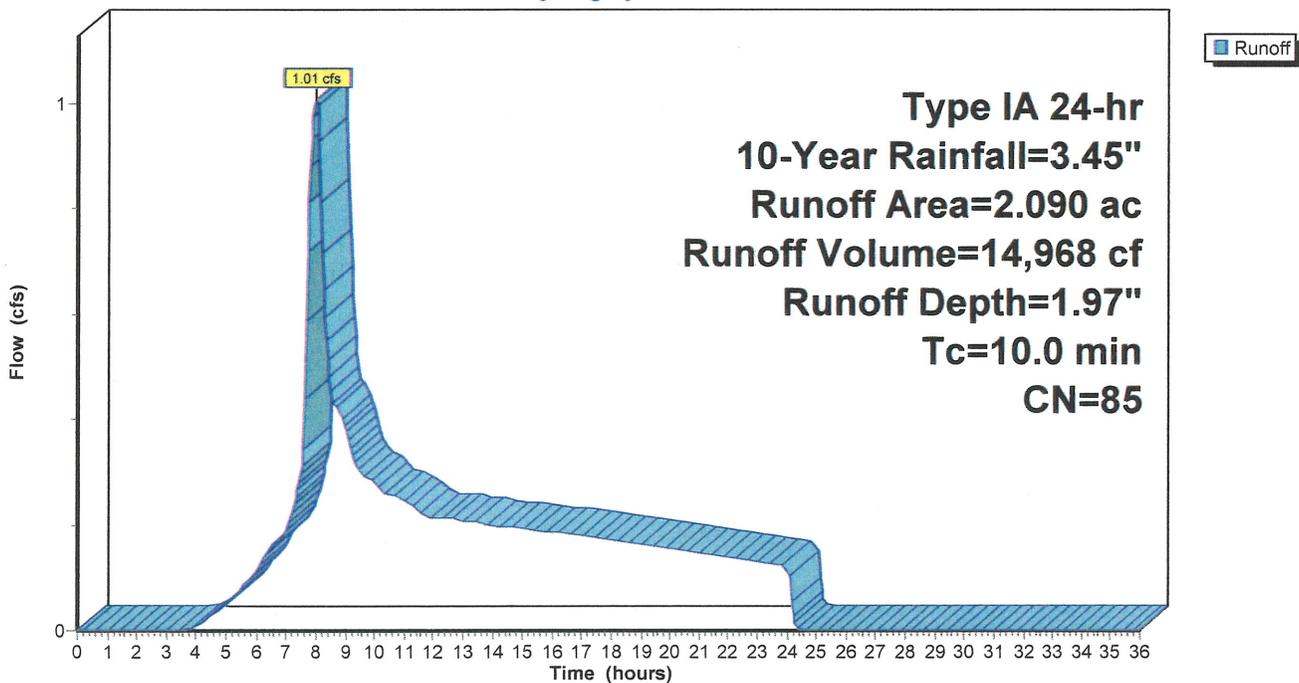
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 10-Year Rainfall=3.45"

Area (ac)	CN	Description
* 2.090	85	1/6 acre lots, 45% imp, HSG C
1.149	74	55.00% Pervious Area
0.940	98	45.00% Impervious Area

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

Subcatchment 1D: Developed Conditions

Hydrograph



Developed Conditions

Type IA 24-hr 25-Year Rainfall=3.90"

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Summary for Subcatchment 1D: Developed Conditions

Runoff = 1.23 cfs @ 7.99 hrs, Volume= 17,970 cf, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 25-Year Rainfall=3.90"

Area (ac)	CN	Description
* 2.090	85	1/6 acre lots, 45% imp, HSG C
1.149	74	55.00% Pervious Area
0.940	98	45.00% Impervious Area

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

Subcatchment 1D: Developed Conditions

Hydrograph

