APPENDIX A: PROPERTY DEED AND TITLE REPORT

RECORDING REQUESTED BY:

GRANTOR:
Columbia Community Bank, now known as
Premier Community Bank an assumed business
name of Columbia Commercial Bancorp, an
Oregon corporation
314 E. Main Street
Hillsboro, OR 97213

GRANTEE:
Randall L. Killion and Jui-mei Killion, as tenants
by the entirety
11825 SW Katherine St.
Tigard, OR 97223

SEND TAX STATEMENTS TO:
Randall L. Killion and Jui-mei Killion
11825 SW KATHERINE STREET
TIGARD, OR 97223

AFTER RECORDING RETURN TO:
Randall L. Killion and Jui-mei Killion
11825 SW KATHERINE STREET
TIGARD, OR 97223

Escrow No: 3626057674AMS-TTPOR50

CODE 088.30
R2118790, 2S129D-01100
15104 SW Oregon Street
Sherwood, OR 97140

Recorded by TICOR TITLE

3626057674 ams-50

SPACE ABOVE THIS LINE FOR RECORDER'S USE

BARGAIN AND SALE DEED – STATUTORY FORM
(INDIVIDUAL or CORPORATION)

Columbia Community Bank, now known as Premier Community Bank an assumed business name of Columbia Commercial Bancorp, an Oregon corporation, Grantor, conveys to

Randall L. Killion and Jui-mei Killion, as tenants by the entirety, Grantee, the following described real property, situated in the County of Washington, State of Oregon,

> Parcel 3, PARTITION PLAT NO. 2003-030, in the City of Sherwood, County of Washington and State of Oregon.

The true consideration for this conveyance is $525,000.00. (See ORS 93.030).

BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON TRANSFERRING FEE TITLE SHOULD INQUIRE ABOUT THE PERSON'S RIGHTS, IF ANY, UNDER ORS 195.300, 195.301 AND 195.305 TO 195.336 AND SECTIONS 5 TO 11, CHAPTER 424, OREGON LAWS 2007, SECTIONS 2 TO 9 AND 17, CHAPTER 855, OREGON LAWS 2009, AND SECTIONS 2 TO 7, CHAPTER 8, OREGON LAWS 2010. THIS INSTRUMENT DOES NOT ALLOW USE OF THE PROPERTY DESCRIBED IN THIS INSTRUMENT IN VIOLATION OF APPLICABLE LAND USE LAWS AND REGULATIONS. BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON ACQUIRING FEE TITLE TO THE PROPERTY SHOULD CHECK WITH THE APPROPRIATE CITY OR COUNTY PLANNING DEPARTMENT TO VERIFY THAT THE UNIT OF LAND BEING TRANSFERRED IS A LAWFULLY ESTABLISHED LOT OR PARCEL, AS DEFINED IN ORS 92.010 OR 215.010, TO VERIFY THE APPROVED USES OF THE LOT OR PARCEL, TO DETERMINE ANY LIMITS ON LAWSUITS AGAINST FARMING OR FOREST PRACTICES, AS DEFINED IN ORS 30.930, AND TO INQUIRE ABOUT THE RIGHTS OF NEIGHBORING PROPERTY OWNERS, IF ANY, UNDER ORS 195.300, 195.301 AND 195.305 TO 195.336 AND SECTIONS 5 TO 11, CHAPTER 424, OREGON LAWS 2007, SECTIONS 2 TO 9 AND 17, CHAPTER 855, OREGON LAWS 2009, AND SECTIONS 2 TO 7, CHAPTER 8, OREGON LAWS 2010.

Dated: April 24, 2014

Premier Community Bank, an assumed business name of Columbia Commercial Bancorp, an Oregon corporation

By: Dan Wahlin - SVP
Its:

State of OREGON

County of Washington

This instrument was acknowledged before me on 4/24, 2014 by Dan Wahlin

as SVP of Premier Community Bank, an assumed business name of Columbia Commercial Bancorp, an Oregon corporation.

Notary Public - State of Oregon
My commission expires: 12/3/2014

OFFICIAL SEAL
SANDRA HUNTINGTON
NOTARY PUBLIC - OREGON
COMMISSION NO. 922950
MY COMMISSION EXPIRES DECEMBER 03, 2017

Sherwood.

Ticor Title Company
PRELIMINARY REPORT

In response to the application for a policy of title insurance referenced herein Ticor Title Company hereby reports that it is prepared to issue, or cause to be issued, as of the specified date, a policy or policies of title insurance describing the land and the estate or interest hereinafter set forth, insuring against loss which may be sustained by reason of any defect, lien or encumbrance not shown or referred to as an exception herein or not excluded from coverage pursuant to the printed Schedules, Conditions and Stipulations or Conditions of said policy forms.

The printed Exceptions and Exclusions from the coverage of said policy or policies are set forth in Exhibit A. The policy to be issued may contain an arbitration clause. When the Amount of Insurance is less than that set forth in the arbitration clause, all arbitrable matters shall be arbitrated at the option of either the Company or the Insured as the exclusive remedy of the parties. Copies of the policy forms should be read. They are available from the office which issued this report.

This report (and any supplements or amendments hereto) is issued solely for the purpose of facilitating the issuance of a policy of title insurance and no liability is assumed hereby.

The policy(s) of title insurance to be issued hereunder will be policy(s) of Chicago Title Insurance Company, a/an Nebraska corporation.

Please read the exceptions shown or referred to herein and the Exceptions and Exclusions set forth in Exhibit A of this report carefully. The Exceptions and Exclusions are meant to provide you with notice of matters which are not covered under the terms of the title insurance policy and should be carefully considered.

It is important to note that this preliminary report is not a written representation as to the condition of title and may not list all liens, defects and encumbrances affecting title to the land.

This preliminary report is for the exclusive use of the parties to the contemplated transaction, and the Company does not have any liability to any third parties nor any liability until the full premium is paid and a policy is issued. Until all necessary documents are placed of record, the Company reserves the right to amend or supplement this preliminary report.

Countersigned

Ticor Title Company
111 SW Columbia, Suite 1000, Portland, OR 97201
(503)242-1210 FAX (503)242-0770

PRELIMINARY REPORT

ESCROW OFFICER: Alli Swallow
TITLE OFFICER: Mark Davison

ORDER NO.: 3626057674AMS-TTPOR50

TO: Ticor Title Company
Attn: Alli Swallow
111 SW Columbia, Suite 1000
Portland, OR 97201

OWNER/SELLER: Columbia Community Bank

BUYER/BORROWER: To Follow

PROPERTY ADDRESS: 15104 SW Oregon Street
Sherwood, Oregon 97140

EFFECTIVE DATE: March 8, 2013, 08:00 AM

1. THE POLICY AND ENDORSEMENTS TO BE ISSUED AND THE RELATED CHARGES ARE:

	AMOUNT	PREMIUM
Governmental Service Fee		$ 25.00

2. THE ESTATE OR INTEREST IN THE LAND HEREINAFTER DESCRIBED OR REFERRED TO COVERED BY THIS REPORT IS:
   A Fee
3. TITLE TO SAID ESTATE OR INTEREST AT THE DATE HEREOF IS VESTED IN:
   Columbia Community Bank, an Oregon corporation
4. THE LAND REFERRED TO IN THIS REPORT IS SITUATED IN THE CITY OF SHERWOOD IN THE COUNTY OF WASHINGTON, STATE OF OREGON, AND IS DESCRIBED AS FOLLOWS:
   SEE EXHIBIT "ONE" ATTACHED HERETO AND MADE A PART HEREOF

PRELIMINARY REPORT
(Continued)

Order No.: 3626057674AMS-TTPOR50

EXHIBIT "ONE"

Parcel 3, PARTITION PLAT NO. 2003-030, in the City of Sherwood, County of Washington and State of Oregon.

APPENDIX B: CWS SERVICE PROVIDER LETTER

Clean Water Services File Number: 14-002802

CleanWater Services

Sensitive Area Pre-Screening Site Assessment

1. Jurisdiction: City of Sherwood Active tax lot: 2S129DC00800

2. Property Information (example 1S234AB01400)
Tax lot ID(s): #2S129D00 1100 historic tax lot.
Legal Description: Parcel 3, PARTITION PLAT No. 2003-030, Sherwood, Washington Co.
Site Address: 15104 SW Oregon Street
City, State, Zip: Sherwood, Oregon, 97140
Nearest Cross Street: SW Hall Street

3. Owner Information
Name: Randy Killion + Jui-mei Killion
Company:
Address: 11825 SW Katherine St.
City, State, Zip: Tigard, OR 97223
Phone/Fax: 503 704 6208 / (F) 503 524 6876
E-Mail: randykzone hotmail.com

4. Development Activity (check all that apply)
- ☐ Addition to Single Family Residence (rooms, deck, garage)
- ☐ Lot Line Adjustment
- ☐ Minor Land Partition
- ☐ Residential Condominium
- ☐ Commercial Condominium
- ☐ Residential Subdivision
- ☐ Commercial Subdivision
- ☒ Single Lot Commercial
- ☐ Multi Lot Commercial

Other

5. Applicant Information
Name: Brian Yee
Company: KH2A Engineering
Address: 5515 SE Milwaukie Avenue
City, State, Zip: Portland, Oregon, 97202
Phone/Fax: 503-230-9348 / 503-233-2051
E-Mail: byee@kh2aengineering.com

6. Will the project involve any off-site work? ☐ Yes ☒ No ☐ Unknown
Location and description of off-site work

7. Additional comments or information that may be needed to understand your project: This is a mitigated brownfield parcel suitable for industrial manufacturing use. Groundwater use is not allowed.

This application does NOT replace Grading and Erosion Control Permits, Connection Permits, Building Permits, Site Development Permits, DEQ 1200-C Permit or other permits as issued by the Department of Environmental Quality, Department of State Lands and/or Department of the Army COE. All required permits and approvals must be obtained and completed under applicable local, state, and federal law.

By signing this form, the Owner or Owner's authorized agent or representative, acknowledges and agrees that employees of Clean Water Services have authority to enter the project site at all reasonable times for the purpose of inspecting project site conditions and gathering information related to the project site. I certify that I am familiar with the informaton contained in this document, and to the best of my knowledge and belief, this information is true, complete, and accurate.

Print/Type Name: Randy Killion + Jui-mei Killion Print/Type Title: Jui-mei H. Killion

Signature: [signature] Date: 10/2/14

FOR DISTRICT USE ONLY

- ☐ Sensitive areas potentially exist on site or within 200' of the site. THE APPLICANT MUST PERFORM A SITE ASSESSMENT PRIOR TO ISSUANCE OF A SERVICE PROVIDER LETTER. If Sensitive Areas exist on the site or within 200 feet on adjacent properties, a Natural Resources Assessment Report may also be required.
- ☒ Based on review of the submitted materials and best available information Sensitive areas do not appear to exist on site or within 200' of the site. This Sensitive Area Pre-Screening Site Assessment does NOT eliminate the need to evaluate and protect water quality sensitive areas if they are subsequently discovered. This document will serve as your Service Provider letter as required by Resolution and Order 07-20, Section 3.02.1. All required permits and approvals must be obtained and completed under applicable local, State, and federal law.
- ☐ Based on review of the submitted materials and best available information the above referenced project will not significantly impact the existing or potentially sensitive area(s) found near the site. This Sensitive Area Pre-Screening Site Assessment does NOT eliminate the need to evaluate and protect additional water quality sensitive areas if they are subsequently discovered. This document will serve as your Service Provider letter as required by Resolution and Order 07-20, Section 3.02.1. All required permits and approvals must be obtained and completed under applicable local, state and federal law.
- ☐ This Service Provider Letter is not valid unless _____ CWS approved site plan(s) are attached.
- ☐ The proposed activity does not meet the definition of development or the lot was platted after 9/9/95 ORS 92.040(2). NO SITE ASSESSMENT OR SERVICE PROVIDER LETTER IS REQUIRED.

Reviewed by: Laurie Harris Date: 10/13/14

APPENDIX C: TRAFFIC IMPACT ANALYSIS REPORT

HDJ DESIGN GROUP PLLC
engineers | landscape architects | planners | surveyors

Date: December 29, 2015

To: Mr. AJ Shepard, Shepard Brothers Management

From: John Manix, PE

Re: Zenport Industrial Park – Traffic Impact Analysis

This Traffic Impact Analysis (TIA) has been prepared for submission to the City of Sherwood to provide an estimate of the number of trips generated by the proposed project and for distribution of those trips onto City streets. The driveway connections onto SW Oregon Street and at the intersection of SW Oregon Street and SW Hall Street have been analyzed for potential project impacts.

Project Description:

This project proposes to construct three buildings for Warehouse, Light Industrial, and Industrial Park use. The project will be built in phases. The analysis is for the completed development. The project vicinity map is shown on Figure 1. The site plan for Phase 1 is on Figure 2 and the completed three building development is on Figure 3.

Trip Generation:

The trip generation estimates are based on the *ITE Trip Generation Manual,* 9th Edition.

The land uses analyzed for this project are: "General Light Industrial" land use code 110, (Table 1), "Warehouse" land use code 150 (Table 2), and "Industrial Park" land use code 130 (Table 3). All three uses include minimal space for offices, thus the calculations for the office are included in each land use.

Even though General Light Industrial and Industrial Park generate the same number of daily trips, General Light Industrial generated a greater number of AM and PM peak hour trips, thus was selected for the trip generation to allow the developer the greatest flexibility with the property.

REGISTERED PROFESSIONAL ENGINEER
85811PE
OREGON
NOV 9, 2011
JOHN ANDREW MANIX
12/29/15

Table 1 – Trip Generation for General Light Industrial

Land Use:	General Light Industrial (110)	
Independent Variable:	1,000 Sq Ft	
Size:	39.75	
Average Weekday	277	
Total Trips	AM	PM
In	32	5
Out	4	34
Total	36	39

Table 2 – Trip Generation for Warehouse

Land Use:	Warehouse (150)	
Independent Variable:	1,000 Sq Ft	
Size:	39.75	
Average Weekday	142	
Total Trips	AM	PM
In	9	3
Out	3	10
Total	13	13

Table 3 – Trip Generation for General Office

Land Use:	Industrial Park (130)	
Independent Variable:	1000 Sq Ft	
Size:	39.75	
Average Weekday	277	
Total Trips	AM	PM
In	27	7
Out	6	27
Total	33	34

The trip generation calculations for General Light Industrial, Warehouse, and Industrial are included in Appendix A.

Trip Distribution:

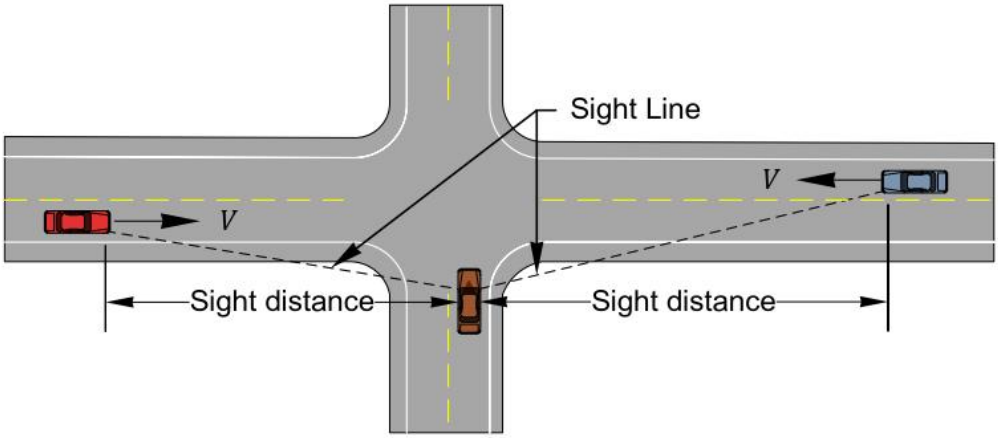
The trip distribution is based on the existing travel patterns in the area and engineering judgment. The development will utilize SW Oregon Street for outgoing and incoming trips. It is assumed that approximately 70% of the trips will travel east to Interstate 5 from SW Oregon Street to SW Tualatin Sherwood Road. It is anticipated that the remaining 30% will travel west toward highway 99. The site trips distribution are shown on Figure 4.

Sight Distance:

The proposed site access points onto SW Oregon Street require 240 feet of sight distance to the east and west to meet stopping and intersection sight distances per City standards. The 240 feet is based on the posted 25 MPH speed limit.

The sight distance at the eastern entrance would have restricted visibility both east and west due to existing trees. The western entrance has restricted visibility to the east also due to existing trees.

The final design should assure the 240 foot sight distance triangle is unrestricted and follows City standards.



Driveway Spacing:

There are two proposed driveway connections onto SW Oregon Street from the development. Per City standards the driveway spacing for SW Oregon Street, a collector, is 200 feet minimum and the minimum distance for driveway corner clearance for a collector with a 25 MPH speed limit is 150 feet.

The eastern connection will act as the fourth leg to the SW Oregon Street/SW Hall Street intersection. There are no access spacing issues with this connection. The western connection is approximately 170 feet east of an existing driveway on the south side of SW Oregon Street. The proposed connections are over 250 feet apart. The City driveway spacing requirements are met with the proposal.

Safety:

Collision data for the project vicinity was obtained from the Oregon State Department of Transportation for a five year period (2010 – 2014). There was one reported, low severity collision in the vicinity of the project. With the low number of collisions, and relatively low volume of trips generated by the proposal, no further analysis is recommended. The collision data is included in Appendix B.

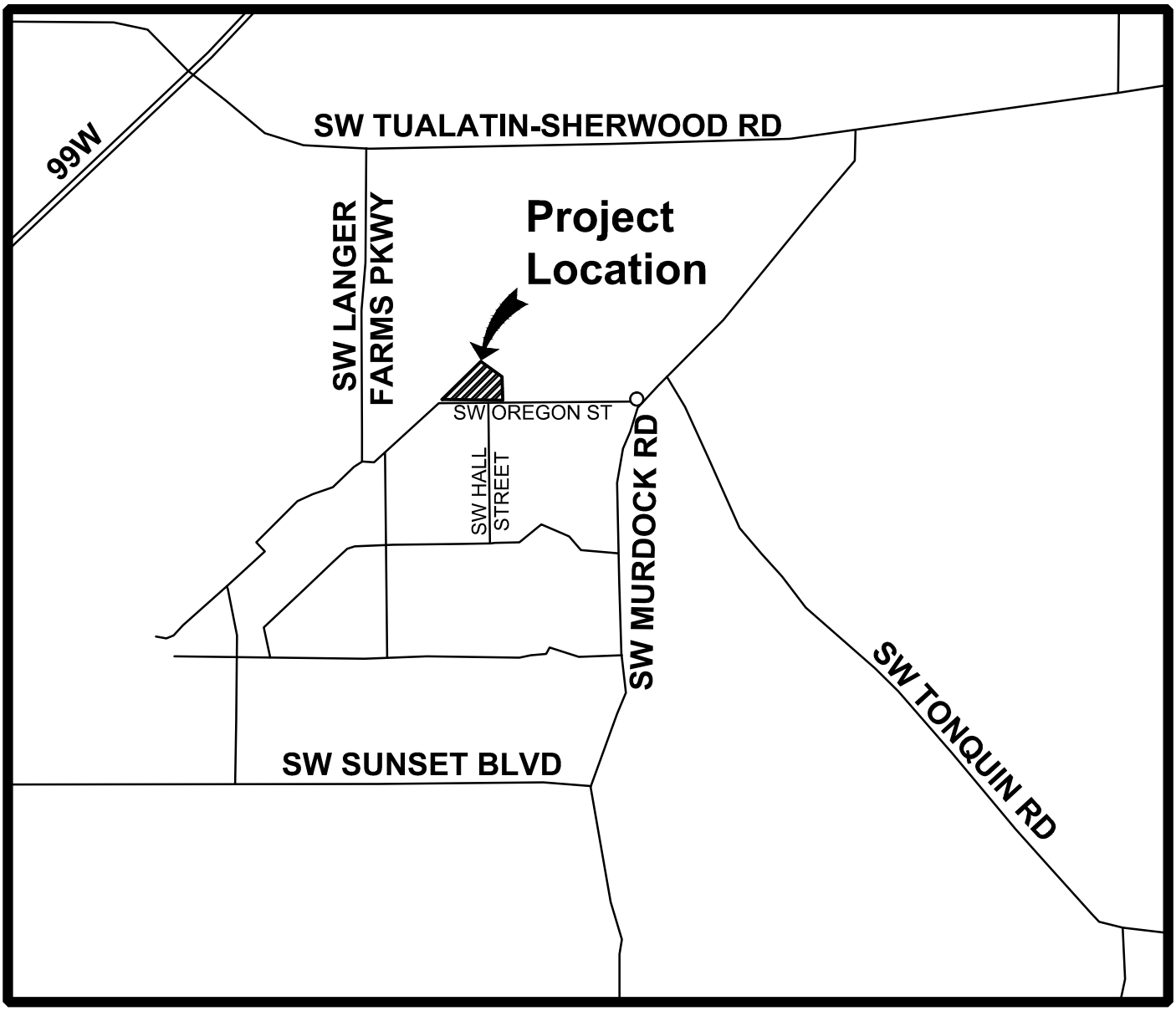
SW Oregon Street/SW Hall Street Intersection:

With the low collision history and moderate increase in traffic volumes on SW Oregon Street, no impacts to the operation of the SW Oregon Street/SW Hall intersection are anticipated.

Conclusion:

The proposed Zenport Industrial Park will generate approximately 40 trips in the PM peak hour and the majority will travel west to Murdock Road. The proposed driveway meet City spacing and sight distance standards with the removal to trees near the west driveway. The collision history did not indicate any safety problems and the development will not any impacts on the SW Oregon Street/Hall Street intersection. No further traffic analysis is needed and no off-site traffic improvement are needed.

Attachments



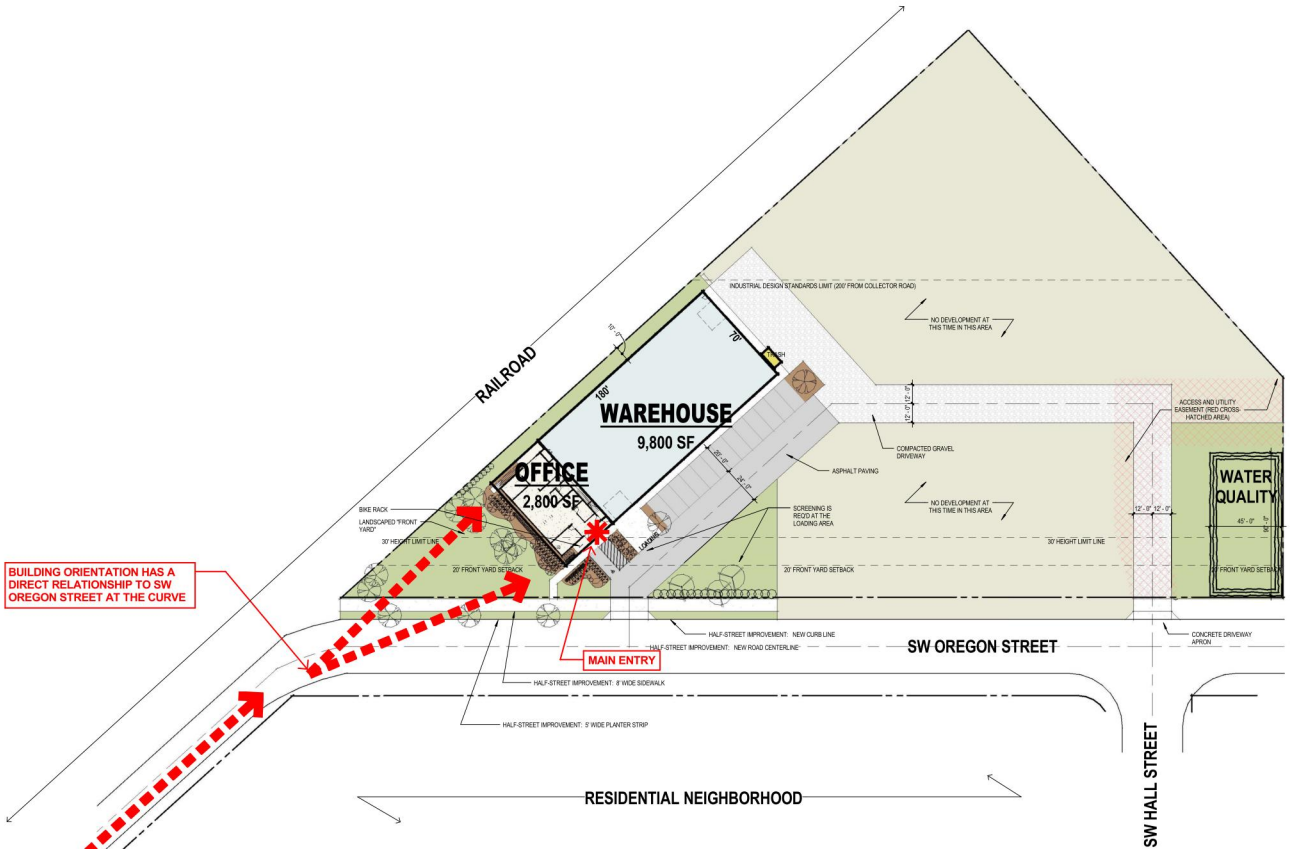
NTS

FIGURE 1

HDJ DESIGN GROUP PLLC
engineers | landscape architects | planners | surveyors
314 W 15th Street
Vancouver, WA 98660-2927
360/695-3488
503/924-4005
360/695-8767 fax
Internet: www.hdjdg.com

Vicinity Map

Zenport Industrial Park



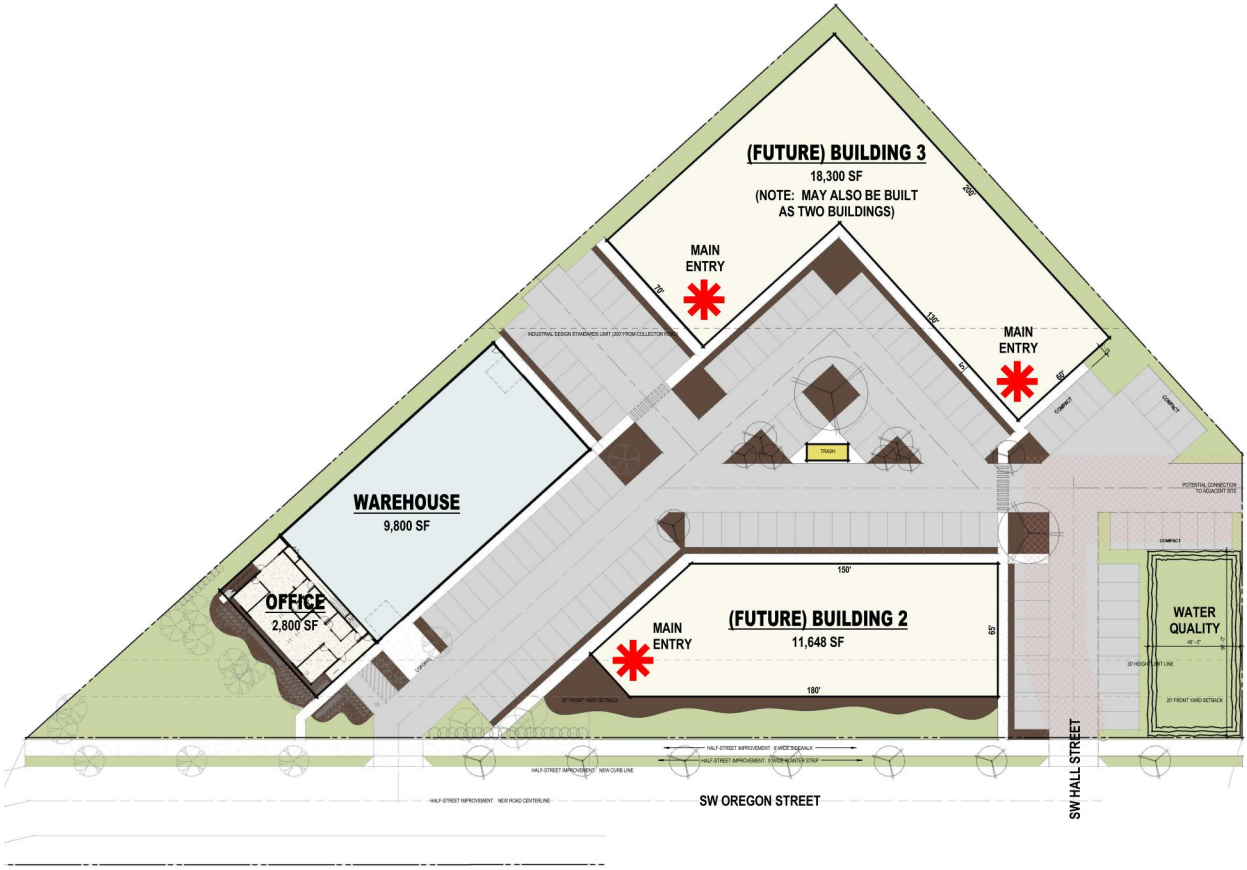
NTS

FIGURE 2

HDJ DESIGN GROUP PLLC
engineers | landscape architects | planners | surveyors
314 W 15th Street
Vancouver, WA 98660-2927
360/695-3488
503/924-4005
360/695-8767 fax
Internet: www.hdjdg.com

Site Plan - Phase 1

Zenport Industrial Park



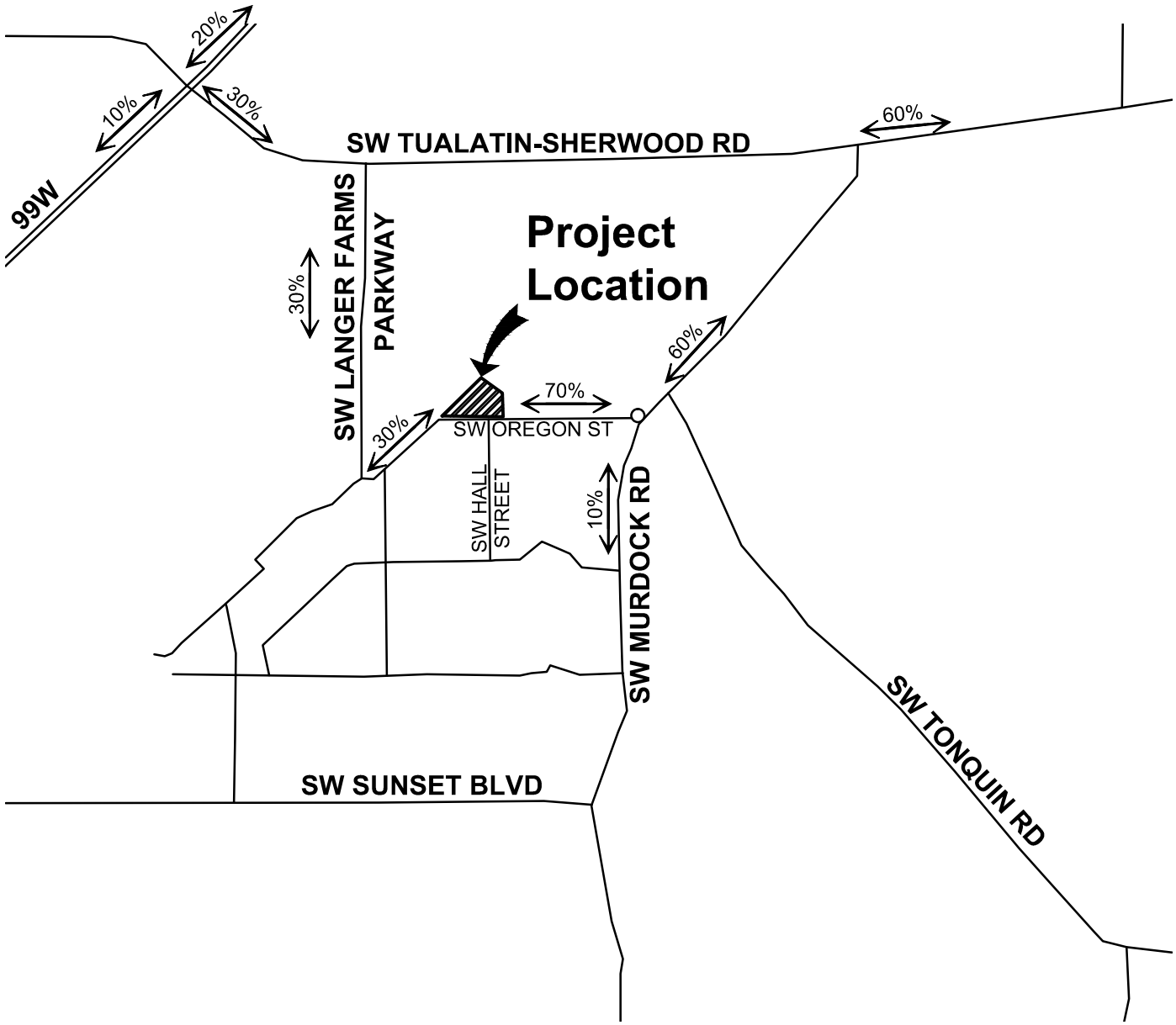
NTS

FIGURE 3

HDJ DESIGN GROUP PLLC
engineers | landscape architects | planners | surveyors
314 W 15th Street
Vancouver, WA 98660-2927
360/695-3488
503/924-4005
360/695-8767 fax
Internet: www.hdjdg.com

Site Plan - Future Build-Out

Zenport Industrial Park



NTS

FIGURE 4

HDJ DESIGN GROUP PLLC
engineers | landscape architects | planners | surveyors
314 W 15th Street
Vancouver, WA 98660-2927
360/695-3488
503/924-4005
360/695-8767 fax
Internet: www.hdjdg.com

Trip Distribution

Zenport Industrial Park

Appendix A

ITE Trip Generation

Trip Generation Based on Weighted Average Rates

HDJ Design Group

General			
Land Use Code	General Light Industrial (sf)		
Independent Variable	1,000 Sq Ft		
Size (X)		39.75	
Land Use Code		110	

Date: 12/17/2015

Analyst: Sharar

Zenport Ind

	In	Out	Total
Average Weekday	139	139	277
New Trips	139	139	277
Weekday AM Peak	32	4	37
New Trips	32	4	37
Weekday PM peak	5	34	39
New Trips	5	34	39

Per Trip Generation Manual, 9th Edition

Analysis Period	Weekday		
Average Rate	**Rate**		**Trips**
	6.97		277
Entering / Exiting			
% Entering	50%		139
% Exiting	50%		139
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		139	139
Internal Trips		0	0
Passby Trips	0	0	0
New Trips		139	139

Analysis Period	Weekday AM Peak for adjacent streets		
Average Rate	**Rate**		**Trips**
	0.92		37
Entering / Exiting			
% Entering	88%		32
% Exiting	12%		4
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		32	4
Internal Trips		0	0
Passby Trips		0	0
New Trips		32	4

Analysis Period	Weekday PM peak for adjacent s		
Average Rate	**Rate**		**Trips**
	0.97		39
Entering / Exiting			
% Entering	12%		5
% Exiting	88%		34
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		5	34
Internal Trips		0	0
Passby Trips		0	0
New Trips		5	34

ITE Trip Generation

Trip Generation Based on Weighted Average Rates

HDJ Design Group

General			
Land Use Code	Warehouse (SF) 9th Edition		
Independent Variable	1,000 Sq Ft		
Size (X)		39.75	
Land Use Code		150	

Date: 12/17/2015

Analyst: Sharar

Zenport Ind

	In	Out	Total
Average Weekday	71	71	142
New Trips	71	71	142
Weekday AM Peak	9	3	12
New Trips	9	3	12
Weekday PM peak	3	10	13
New Trips	3	10	13

Per Trip Generation Manual, 9th Edition

Analysis Period	Weekday		
Average Rate	**Rate**		**Trips**
	3.56		142
Entering / Exiting			
% Entering	50%		71
% Exiting	50%		71
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		71	71
Internal Trips		0	0
Passby Trips	0	0	0
New Trips		71	71

Analysis Period	Weekday AM Peak for adjacent streets		
Average Rate	**Rate**		**Trips**
	0.3		12
Entering / Exiting			
% Entering	79%		9
% Exiting	21%		3
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		9	3
Internal Trips		0	0
Passby Trips		0	0
New Trips		9	3

Analysis Period	Weekday PM peak for adjacent s		
Average Rate	**Rate**		**Trips**
	0.32		13
Entering / Exiting			
% Entering	25%		3
% Exiting	75%		10
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		3	10
Internal Trips		0	0
Passby Trips		0	0
New Trips		3	10

ITE Trip Generation

Trip Generation Based on Weighted Average Rates

HDJ Design Group

General			
Land Use Code	Industrial Park (sf)		
Independent Variable	1,000 Sq Ft		
Size (X)		39.75	
Land Use Code		130	

Date:	Analyst:	Project:
12/24/2015	Sharar	Zenport Ind

	In	Out	Total
Average Weekday	138	138	277
New Trips	138	138	277
Weekday AM Peak	27	6	33
New Trips	27	6	33
Weekday PM peak	7	27	34
New Trips	7	27	34

Per Trip Generation Manual, 9th Edition

Analysis Period	Weekday		
Average Rate	**Rate**		**Trips**
	6.96		277
Entering / Exiting			
% Entering	50%		138
% Exiting	50%		138
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		138	138
Internal Trips		0	0
Passby Trips	0	0	0
New Trips		138	138

Analysis Period	Weekday AM Peak for adjacent streets		
Average Rate	**Rate**		**Trips**
	0.84		33
Entering / Exiting			
% Entering	82%		27
% Exiting	18%		6
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		27	6
Internal Trips		0	0
Passby Trips		0	0
New Trips		27	6

Analysis Period	Weekday PM peak for adjacent s		
Average Rate	**Rate**		**Trips**
	0.86		34
Entering / Exiting			
% Entering	21%		7
% Exiting	79%		27
New Trips			
% internal	0		
% pass by	0		
		In	Out
Total Trips		7	27
Internal Trips		0	0
Passby Trips		0	0
New Trips		7	27

Appendix B

OREGON.. DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
URBAN NON-SYSTEM CRASH LISTING

CITY OF SHERWOOD, WASHINGTON COUNTY

OREGON ST at MURDOCK RD, City of Sherwood, Washington County, 01/01/2010 to 12/31/2014

Total crash records: 1

SER# INVEST	SPE D	ALC N	DUG N	SLS N	CHL	WOR K	DATE DAY TIME	CLASS DIST FROM	CITY STREET FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYPE (MEDIAN) LEGS (#LANES)	INT-REL TRAF-CONTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH COLL SVRTY	V#	SPCL USE TRLR QTY OWNER TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
03681	N	N	N				07/01/2014	16	SW MURDOCK RD	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE							TU	0	SW OREGON ST	S		YIELD	Y	DRY	REAR		PRVTE	S -N									000		00
							6A			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	50	F	OR-Y OR<25		026	000		07
																02	NONE 0	STOP											
																	PRVTE	S -N									011		00
																	PSNGR CAR		01	DRVR	NONE	39	F	OR-Y OR<25		000	000		00

Disclaimer: The information contained in this report is compiled from individual driver and police crash reports submitted to the Oregon Department of Transportation as required in ORS 811.720. The Crash Analysis and Reporting Unit is committed to providing the highest quality crash data to customers. However, because submittal of crash report forms is the responsibility of the individual driver, the Crash Analysis and Reporting Unit can not guarantee that all qualifying crashes are represented nor can assurances be made that all details pertaining to a single crash are accurate. Note: Legislative changes to DMV's vehicle crash reporting requirement, effective 01/01/2004, may result in fewer property damage only crashes being eligible for inclusion in the Statewide Crash Data File.

OREGON.. DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
URBAN NON-SYSTEM CRASH LISTING

CITY OF SHERWOOD, WASHINGTON COUNTY

OREGON ST at HALL ST, City of Sherwood, Washington County, 01/01/2010 to 12/31/2014

No Rows to Display

SER# INVEST	S P E D	A L C	R U G S	S C L	W O H K	DATE DAY TIME	CLASS DIST FROM	CITY STREET FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYPE (MEDIAN) LEGS (#LANES)	INT-REL TRAF-CONTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH COLL SVRTY	V#	SPCL USE TRLR QTY OWNER TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE

Disclaimer: The information contained in this report is compiled from individual driver and police crash reports submitted to the Oregon Department of Transportation as required in ORS 811.720. The Crash Analysis and Reporting Unit is committed to providing the highest quality crash data to customers. However, because submittal of crash report forms is the responsibility of the individual driver, the Crash Analysis and Reporting Unit can not guarantee that all qualifying crashes are represented nor can assurances be made that all details pertaining to a single crash are accurate. Note: Legislative changes to DMV's vehicle crash reporting requirement, effective 01/01/2004, may result in fewer property damage only crashes being eligible for inclusion in the Statewide Crash Data File.

APPENDIX D: LETTER OF UNDERSTANDING

City of Sherwood Oregon

Home of the Tualatin River National Wildlife Refuge

City of Sherwood
22560 SW Pine St.
Sherwood, OR 97140
Tel 503-625-5522
Fax 503-625-5524
www.sherwoodoregon.gov

Mayor
Krisanna Clark

Council President
Jennifer Harris

Councilors
Renee Brouse
Linda Henderson
Dan King
Jennifer Kuiper
Sally Robinson

City Manager
Joseph Gall, ICMA-CM

Assistant City Manager
Tom Pessemier

March 21, 2016

Randy Killion
11825 SE Milwaukie Avenue
Portland, Oregon 97227

Re: ZENPORT DEVELOPMENT – PUBLIC FRONTAGE IMPROVEMENTS

Dear Even,

This letter is an understanding of the public frontage improvements we discussed and agreed to implement from our December 15th, 2015 meeting. The improvements will be established from a point 5-feet north of the current Zenport right-of-way line or 40-feet north of the monumented Oregon Street right-of-way centerline/quarter section boundary line. Specifically, the following criteria will be used for land use approval of the frontage improvements.

a) Dedication of 1-foot of right-of-way;

b) Grant of a 4-foot wide non-exclusive public sidewalk easement;

c) Construction of a 12-foot wide concrete multi-use sidewalk;

d) Construction of a 5-foot wide planter strip between the sidewalk and curbline, on the north side of Oregon Street along the property frontage;

e) No on-street parking on the north side of Oregon Street along the property frontage;

f) No bike lane will be required on the north side of Oregon Street along the property frontage, the proposed multi-use sidewalk (item c. above) will provide the dual function of pedestrian sidewalk and bikeway;

g) Pavement width to accommodate a 13-foot wide turn lane and an 11-foot wide travel lane.

In addition it is understood that the conversion of sidewalk easement may occur at a later date when the City establishes the right-of-way needs along adjacent properties to the east of the site, along the north side of Oregon Street.

As we discussed, the building setbacks are measured from the property line, not the easement line. Setbacks for the building will always be from the property line as opposed to the easement line, so while we will endeavor to work with the City Council to amend the overall profile for SW Oregon Street, we cannot say with 100 percent certainty that the setback from the right-of-way would be changed along this section of road to accommodate future buildings. However, it is important to remember that the property owner is in control of when the conversion of sidewalk easement to right-of-way will occur.

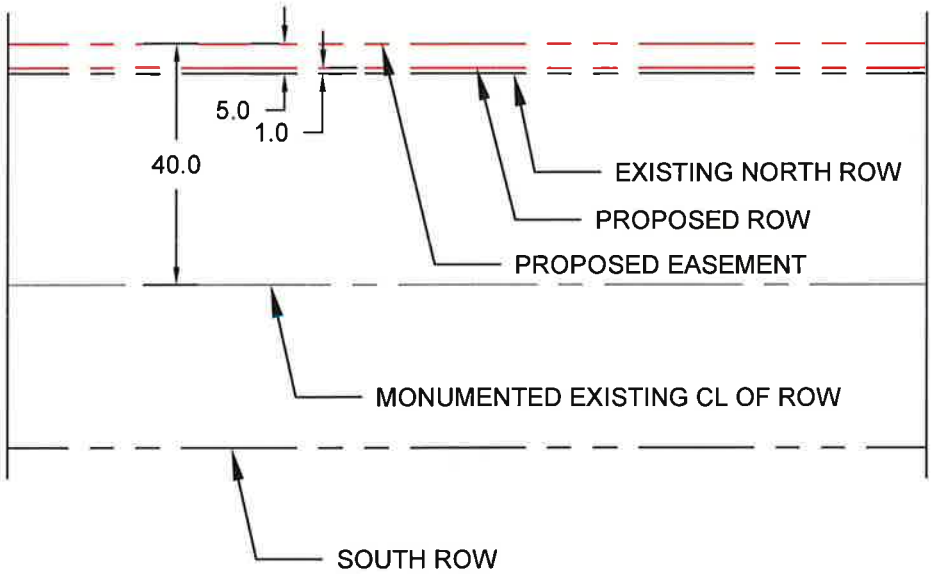
Please let me know if these requirements are acceptable to you, or if you have a different interpretation of the meeting results.

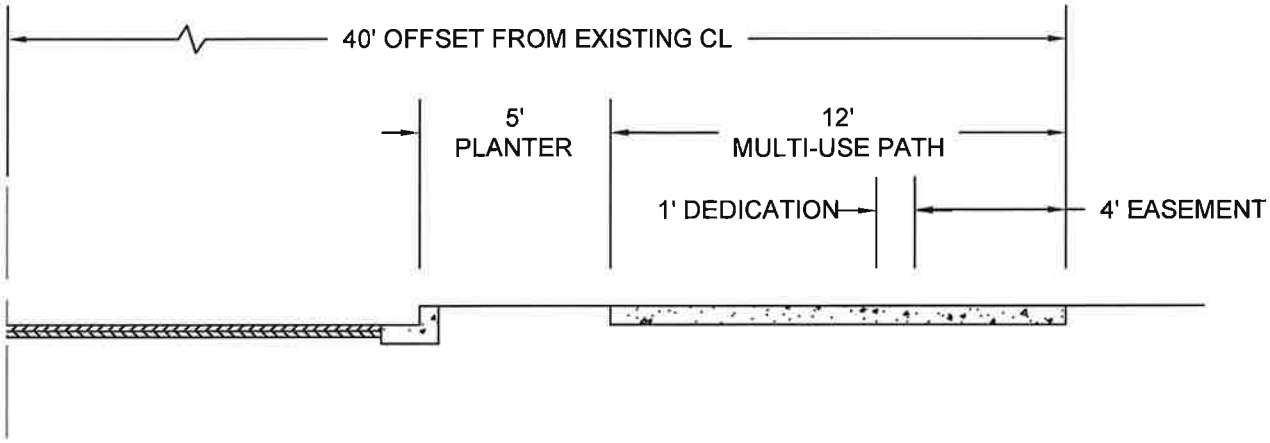
Sincerely,

Bob Galati, P.E.
City Engineer
Ph: 503-702-7565
Email: GalatiB@SherwoodOregon.gov

CC: Brad Kilby, Planning Manager
Evan Eykelbosch P.E, Froelich Engineering

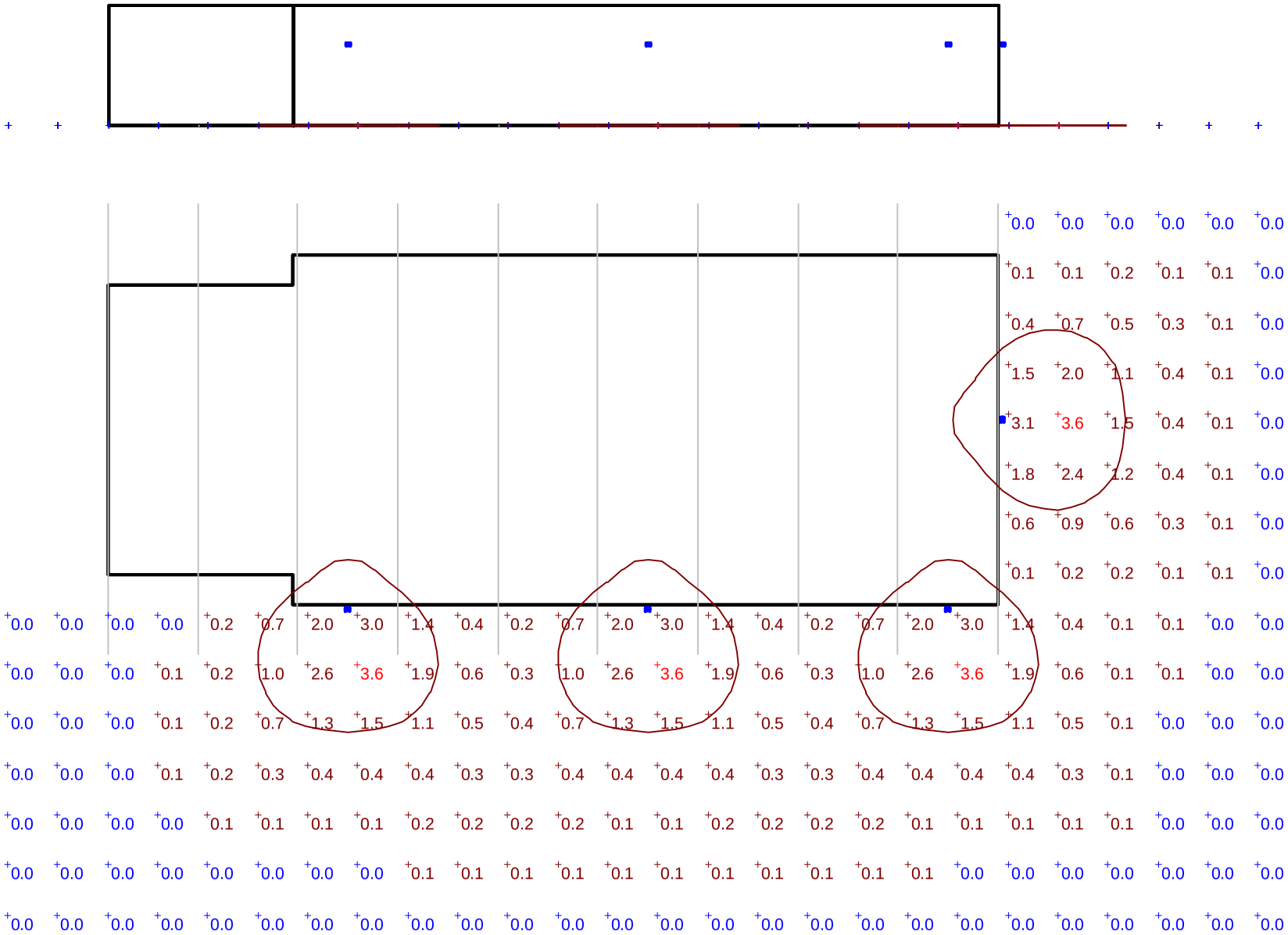
ZENPORT PROPERTY





		DRAWING NUMBER
	PROPOSED OREGON STREET ROW SECTION	
	SCALE	DATE
	N.T.S.	

APPENDIX E: PHOTOMETRIC PLAN



LUMINAIRE SCHEDULE

Symbol	Label	Qty	Catalog Number	Description	Lamp
	WP	4	WLMFC43LED	LED WALL PACK @ 16'	43W LED

STATISTICS

Description	Avg
Calc Plane @ Ground Level	0.5 fc

PLATT Design Build Sales

ZENPORT INDUSTRIAL PARK

BLDG 1

SITE LIGHTING PLAN

Designer
Brent Guthrie

Date
Dec 2 2015

Scale
1" = 30'

Drawing No.

1 of 1

APPENDIX F: GEOTECHNICAL ENGINEERING REPORT

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

January 14, 2016
Project No. 15-4080

AJ Shepard
Shepard Bros. Mgmt.
2830 NW 29th Avenue
Portland, Oregon 97227
Phone: 360-772-6355
Email: aj@uptownpm.com

Via email with hard copies mailed upon request

SUBJECT: GEOTECHNICAL ENGINEERING REPORT
ZENPORT INDUSTRIAL PARK BUILDING 1
15104 SW OREGON STREET
SHERWOOD, OREGON

This report presents the results of a geotechnical engineering study conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our investigation was to evaluate subsurface conditions at the site and to provide geotechnical recommendations for site development. This geotechnical study was performed in accordance with GeoPacific Proposal No. P-5465, dated November 10, 2015 and your subsequent authorization of our proposal and *General Conditions for Geotechnical Services*.

SITE AND PROJECT DESCRIPTION

The subject site is located at 15104 SW Oregon Street, in Sherwood, Oregon, and Building 1 is located at the western corner of this triangular shaped lot. The site is bordered by a railroad to the northwest, undeveloped land to the east, and SW Oregon Street to the south. The site has been vacant for some time. Vegetation at the site primarily consists of mostly weeds. Topography on the site is relatively flat, at an elevation of approximately 195 feet above mean sea level (amsl).

We understand that the site will be developed in stages and that the first stage of development will include the construction of a two-story steel-framed, office and warehouse building, parking areas, new underground utilities, and stormwater management systems. We understand that additional buildings, parking areas, underground utilities, and stormwater management systems may be constructed in other areas of the site at a later date.

A grading plan has not been provided for our review; however, we anticipate cuts and fills will be on the order of 5 feet or less.

REGIONAL AND LOCAL GEOLOGIC SETTING

Regionally, the subject site lies within the Willamette Valley/Puget Sound lowland, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. A series of discontinuous faults subdivide the Willamette Valley into a mosaic of fault-bounded, structural blocks (Yeats et al., 1996). Uplifted structural blocks form bedrock highlands, while down-warped structural blocks form sedimentary basins.

The subject site is underlain by Quaternary age (last 1.6 million years) Willamette Formation, a catastrophic flood deposit associated with repeated glacial outburst flooding of the Willamette Valley river system (Madin, 1990). In the Willamette River Valley, these deposits consist of horizontally layered, micaceous, fine silt to coarse sand forming poorly-defined to distinct beds less than 3 feet thick. Underlying the Willamette Formation is Miocene (about 14.5 to 16.5 million years ago) Columbia River Basalt, a thick sequence of lava flows which forms the basement of the basin.

REGIONAL SEISMIC SETTING

At least three major fault zones capable of generating damaging earthquakes are thought to exist in the vicinity of the subject site. These include the Portland Hills Fault Zone, the Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that include the central Portland Hills Fault, the western Oatfield Fault, and the eastern East Bank Fault. These faults occur in a northwest-trending zone that varies in width between 3.5 and 5.0 miles. The combined three faults vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years) sediment (Madin, 1990). The Portland Hills Fault occurs along the Willamette River at the base of the Portland Hills, and is about 11.5 miles northeast of the site. The Oatfield Fault occurs along the western side of the Portland Hills, and is about 8.9 miles northeast of the site. The accuracy of the fault mapping is stated to be within 500 meters (Wong, et al., 2000). No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW-trending faults that lies about 8.9 miles southwest of the subject site. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment (Yeats et al., 1996; Werner et al., 1992). A geologic reconnaissance and photogeologic analysis study conducted for the Scoggins Dam site in the Tualatin Basin revealed no evidence of deformed geomorphic surfaces along the structural zone (Unruh et al., 1994). No seismicity has been recorded on the Gales Creek Fault (the fault closest to the subject site); however, these faults are considered to be potentially active because they may connect with the seismically active Mount Angel Fault and the rupture plane of the 1993 M5.6 Scotts Mills earthquake (Werner et al. 1992; Geomatrix Consultants, 1995).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year (Goldfinger et al., 1996). A growing body of geologic evidence suggests that prehistoric subduction zone earthquakes have occurred (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). This evidence includes: (1) buried tidal marshes recording episodic, sudden subsidence along the coast of northern California, Oregon, and Washington, (2) burial of subsided tidal marshes by tsunami wave deposits, (3) paleoliquefaction features, and (4) geodetic uplift patterns on the Oregon coast. Radiocarbon dates on buried tidal marshes indicate a recurrence interval for major subduction zone earthquakes of 250 to 650 years with the last event occurring 300 years ago (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). The inferred seismogenic portion of the plate interface lies approximately along the Oregon Coast at depths of between 20 and 40 kilometers below the surface.

SUBSURFACE CONDITIONS

Our site-specific exploration for this report was conducted on December 22, 2015. A total of six test pits (designated TP-1 through TP-6) were excavated. The test pits were excavated to depths of 3.5 to 11.5 feet, at the approximate locations shown on Figure 2. Exploration locations were located in the field by pacing or taping distances from apparent property corners and other site features shown on the plans provided. As such, the locations of the explorations should be considered approximate.

Explorations were conducted under the full-time observation of GeoPacific personnel. Soil samples obtained from the test pits were classified in the field and representative portions were placed in relatively air-tight plastic bags. These soil samples were then returned to the laboratory for further examination. Pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence was recorded. Soils were classified in general accordance with the Unified Soil Classification System.

Summary exploration logs are attached. The soil and groundwater conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times.

The following discussion is a summary of subsurface conditions encountered in our explorations. For more detailed information regarding subsurface conditions at specific exploration locations, refer to the attached test pit logs. Also, please note that subsurface conditions can vary between exploration locations, as discussed in the *Uncertainty and Limitations* section below.

Asphalt and Base Rock: 2 inches of asphalt concrete pavement and 8 inches base rock were encountered directly underlying the ground surface in test pit TP-1. The base rock consisted of ¾"-0 crushed aggregate and had a dense consistency.

Undocumented Fill: In test pit TP-1, undocumented fill material was encountered directly underlying the base rock. The fill material ranged from very stiff gravelly SILT (ML) to dense silty GRAVEL (GM) and was wet.

We also encountered undocumented fill material underlying the ground surface in test pits TP-2 through TP-6. The undocumented fill material encountered in test pits TP-2 through TP-4 generally consisted of silty GRAVEL and COBBLES with a loose consistency. The fill material encountered in test pit TP-5 consisted of loose silty SAND (SM).

In test pits TP-1 through TP-5 the fill material extended to depths of 1.5 to 3 feet, with an average depth of 2 feet. However, in test pit TP-6 we encountered a brick-lined cistern that was full of buried brick debris and organic material. The cistern extended to a depth of 8 feet. Outside of the cistern, we observed native soils. The depths of undocumented fill material are summarized on Table 1 below. Other areas of undocumented fill may be present outside our exploration locations.

Buried Topsoil: Underlying the undocumented fill material in test pits TP-2 through TP-4 we observed a layer of buried topsoil. In test pits TP-2 and TP-3 this layer was 6 inches thick and consisted of dark gray, moderately organic silt with fine roots throughout. In test pit TP-4 the buried topsoil layer was 10 inches thick and consisted of dark gray silt with a lower organic content. The layer of buried topsoil observed in test pits TP-2 through TP-4 was generally very soft to soft. The total depths of undocumented fill and buried topsoil are presented on Table 1 below.

Table 1 – Depths of Undocumented Fill and Buried Topsoil

Exploration Designation	Depth of Undocumented Fill (ft)	Total Depth of Undocumented Fill and Buried Topsoil (ft)
TP-1	2	N/A
TP-2	2	2.5
TP-3	3	3.5
TP-4	1.5	2.25
TP-5	2	N/A
TP-6	8 (cistern)	N/A

Willamette Formation – Underlying the undocumented fill material in test pits TP-1 and TP-5, the layers of buried topsoil in test pits TP-2 through TP-4, and the cistern in TP-6, we observed native soils belonging to the Willamette Formation. Native soils were also observed on the sides of the cistern in test pit TP-6. Native Willamette Formation soils generally consisted of brown SILT to clayey SILT (ML). In test pit TP-4, a layer of silty SAND (SM) was observed from 7 to 10 feet. Below 10 feet in test pit TP-4 the soil graded back to clayey SILT (ML). We also observed a layer of silty SAND (SM) below a depth of 7 feet in test pit TP-3.

The Willamette Formation soils generally had a medium stiff to very stiff consistency in the upper four feet. Stiffness increased with depth, grading to hard in some test pits. The silty SAND (SM), where encountered, generally had a dense consistency. Willamette Formation soils extended beyond the maximum depths of our explorations in all test pits.

Soil Moisture and Groundwater

On December 22, 2015, groundwater seepage was encountered in all of the test pits at relatively shallow depths. Typically, rates of groundwater seepage increased with depth. When we returned to the site on January 7, 2016 to perform infiltration testing, we observed groundwater at a depth of 1 foot in test pit TP-1 and a depth of 4 feet in test pit TP-3.

Experience has shown that temporary storm related perched groundwater within surface soils often occur over native deposits such as those beneath the site, particularly during the wet season. It is anticipated that groundwater conditions will vary depending on the season, local subsurface conditions, changes in site utilization, and other factors.

INFILTRATION TESTING

We attempted infiltration testing at a depth of 2 feet in test pit TP-1 and a depth of 7.5 feet in test pit TP-3. On December 22, 2015 we pushed pipes into the soil at the bottom of the test pits at these depths. However, when we returned to the site on January 7, 2016 to perform the infiltration testing, we observe groundwater at a depth of 1 foot in test pit TP-1 and at a depth of 4 feet in test pit TP-3. We were unable to perform infiltration testing due to shallow groundwater conditions.

CONCLUSIONS AND RECOMMENDATIONS

Our investigation indicates that the proposed development is geotechnically feasible, provided that the recommendations of this report are incorporated into the design and construction phases of the project. In our opinion, there are two main geotechnical issues for project completion. The first main issue is the site preparation, due to the presence of undocumented fill materials and the possibility of shallow groundwater conditions. The second main issue is that subsurface infiltration is not feasible at relatively shallow depths. The following report sections provide recommendations for site development and construction in accordance with the current applicable codes and local standards of practice.

Site Preparation

Areas of proposed buildings, streets, and areas to receive fill should be cleared of vegetation and any organic and inorganic debris. Existing structures should be demolished and any cavities structurally backfilled. Inorganic debris should be removed from the site. Organic-rich topsoil should then be stripped from construction areas of the site or where engineered fill is to be placed. The estimated average necessary depth of removal in undisturbed areas for moderately to highly organic soils is about 5 inches. Deeper stripping may be necessary in localized areas. The final depth of soil removal will be determined on the basis of a site inspection after the stripping/ excavation has been performed. Stripped topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative. Organic materials from clearing should either be removed from the site or placed as landscape fill in areas not planned for structures.

In building areas, remaining undocumented fills, buried topsoil, and subsurface structures (tile drains, basements, driveway and landscaping fill, old utility lines, septic leach fields, etc.) should be removed and the excavations backfilled with engineered fill. Undocumented fill material was encountered in all test pit locations and buried topsoil was encountered in test pits TP-2 through

TP-4. A brick-lined cistern was encountered in test pit TP-6 to a depth of 8 feet. Depths of undocumented fill and buried topsoil is summarized on Table 1. We anticipate that undocumented fill material is present across the majority of the site an average depth of 2 feet.

In parking areas, the undocumented fill material may be evaluated by proofrolling. The undocumented fill materials are likely suitable for reuse as engineered fill provided they are free of highly organic material and debris. We recommend full-time monitoring by GeoPacific during the removal period to assist in identifying materials suitable for re-use as engineered fill, and to verify that these soils are not mixed with organics or debris.

Once stripping of a particular area is approved, the area must be ripped or tilled to a depth of 12 inches, moisture conditioned, root-picked, and compacted in-place prior to the placement of engineered fill or crushed aggregate base for pavement. Exposed subgrade soils should be evaluated by the geotechnical engineer. For large areas, this evaluation is normally performed by proof-rolling the exposed subgrade with a fully loaded scraper or dump truck. For smaller areas where access is restricted, the subgrade should be evaluated by probing the soil with a steel probe. Soft/loose soils identified during subgrade preparation should be compacted to a firm and unyielding condition, over-excavated and replaced with engineered fill (as described below), or stabilized with rock prior to placement of engineered fill. The depth of overexcavation, if required, should be evaluated by the geotechnical engineer at the time of construction.

Engineered Fill

All grading for the proposed development should be performed as engineered grading in accordance with the applicable building code at time of construction with the exceptions and additions noted herein. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill. In general, we anticipate that soils from planned cuts and utility trench excavations will be suitable for use as engineered fill provided they are adequately moisture conditioned prior to compacting.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 95% of the maximum dry density determined by ASTM D698 (Standard Proctor) or equivalent. Field density testing should conform to ASTM D2922 and D3017, or D1556. All engineered fill should be observed and tested by the project geotechnical engineer or his representative. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more testing. Because testing is performed on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency.

Site earthwork will be impacted by soil moisture. Earthwork in wet weather would likely require extensive use of cement or lime treatment, or other special measures, at considerable additional cost compared to earthwork performed under dry-weather conditions.

Excavating Conditions and Utility Trenches

We anticipate that on-site soils can be excavated using conventional heavy equipment such as scrapers and trackhoes. All temporary cuts in excess of 4 feet in height should be sloped in accordance with U.S. Occupational Safety and Heath Administration (OSHA) regulations (29 CFR Part 1926), or be shored. The existing native soils classify as Type B Soil and temporary excavation side slope inclinations as steep as 1H:1V may be assumed for planning purposes. This cut slope inclination is applicable to excavations above the water table only. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions.

Saturated soils and groundwater may be encountered in utility trenches, particularly during the wet season. Groundwater was encountered at relatively shallow depths in our test pit explorations. We anticipate that dewatering systems consisting of ditches, sumps and pumps would be adequate for control of perched groundwater, above the water table. Regardless of the dewatering system used, it should be installed and operated such that in-place soils are prevented from being removed along with the groundwater.

Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321. We recommend that trench backfill be compacted to at least 95% of the maximum dry density obtained by Standard Proctor ASTM D698 or equivalent. Initial backfill lift thickness for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

Adequate density testing should be performed during construction to verify that the recommended relative compaction is achieved. Typically, one density test is taken for every 4 vertical feet of backfill on each 200-lineal-foot section of trench.

Structural Foundations

At the time of this report, the specific structural loadings have not been developed. The proposed structures up to two stories in height may be supported on shallow foundations bearing on competent undisturbed, native soils and/or engineered fill, appropriately designed and constructed as recommended in this report. Based on our understanding of the proposed project and the results of our exploration program, native deposits are anticipated to be encountered within 24 to 36 inches of the ground surface. The native soils near the surface are generally medium stiff to very stiff, grading to very stiff to hard, and should provide adequate support of the structural loads.

Shallow, isolated or continuous spread footings may be used to support the proposed structures, provided they are founded on competent native soils and/or engineered fill placed and compacted over competent native soils. For footing subgrade soils prepared as recommended above, we recommend maximum allowable bearing pressures of 1,500 pounds per square foot (psf) in design of the below-grade portions of the structure. The recommended maximum allowable bearing pressures may be increased by 1/3 the above-recommended value, for short term transient conditions such as wind and seismic loading. All exterior and interior footings should be founded at least 18 inches below the lowest adjacent finished grade or below top of slab. Minimum footing widths should be determined by the project engineer/architect in accordance with applicable design codes.

Assuming construction is accomplished as recommended herein, and for the foundation loads anticipated, we estimate total static settlement of spread foundations of less than about 1 inch and differential settlement between two adjacent load-bearing components supported on competent soil of less than about ¾ inch. We anticipate that the majority of the estimated settlement will occur during construction, as loads are applied.

Wind, earthquakes, and unbalanced earth loads will subject the proposed structure to lateral forces. Lateral forces on a structure will be resisted by a combination of sliding resistance of its base or footing on the underlying soil and passive earth pressure against the buried portions of the structure. For use in design, a coefficient of friction of 0.45 may be assumed along the interface between the base of the footing and subgrade soils. Passive earth pressure for buried portions of structures may be calculated using an equivalent fluid weight of 330 pounds per cubic foot (pcf), assuming footings are cast against native soils or engineered fill. The recommended coefficient of friction and passive earth pressure values do not include a safety factor. The upper 12 inches of soil should be neglected in passive pressure computations unless it is protected by pavement or slabs on grade.

Footing excavations should be trimmed neat and the bottom of the excavation should be carefully prepared. Loose, wet or otherwise softened soil should be removed from the footing excavation prior to placing reinforcing steel bars. GeoPacific should observe foundation excavations prior to placement of reinforcing steel and formwork, to verify that an appropriate bearing stratum has been reached and that the actual exposed soils are suitable to support the planned foundation loads.

The above foundation recommendations are for dry weather conditions. Due to the high moisture sensitivity of engineered fill and native soils, construction during wet weather is likely to require overexcavation of footings and backfill with compacted, crushed aggregate. As a result of this condition, we recommend foundation excavations be observed to verify subgrade strength.

Erosion Control Considerations

During our field exploration program, we did not observe soil types that would be considered highly susceptible to erosion. In our opinion, the primary concern regarding erosion potential will occur during construction, in areas that have been stripped of vegetation. Erosion at the site during construction can be minimized by implementing the project erosion control plan, which should include judicious use of straw bales and silt fences. If used, these erosion control devices should be in place and remain in place throughout site preparation and construction.

Erosion and sedimentation of exposed soils can also be minimized by quickly re-vegetating exposed areas of soil, and by staging construction such that large areas of the project site are not denuded and exposed at the same time. Areas of exposed soil requiring immediate and/or temporary protection against exposure should be covered with either mulch or erosion control netting/blankets. Areas of exposed soil requiring permanent stabilization should be seeded with an approved grass seed mixture, or hydroseeded with an approved seed-mulch-fertilizer mixture.

Wet Weather Earthwork

Soils underlying the site are likely to be moisture sensitive and may be difficult to handle or traverse with construction equipment during periods of wet weather. Earthwork is typically most economical when performed under dry weather conditions. Earthwork performed during the wet-weather season will probably require expensive measures such as cement treatment or imported granular material to compact fill to the recommended engineering specifications. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions when soil moisture content is difficult to control, the following recommendations should be incorporated into the contract specifications.

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean engineered fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic;
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water;
- Material used as engineered fill should consist of clean, granular soil containing less than 5 percent fines. The fines should be non-plastic. Alternatively, cement treatment of on-site soils may be performed to facilitate wet weather placement;
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials;
- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed and suitable compaction and site drainage is achieved; and
- Straw waddles and/or geotextile silt fences should be strategically located to control erosion.

If cement or lime treatment is used to facilitate wet weather construction, GeoPacific should be contacted to provide additional recommendations and field monitoring.

Concrete Slabs-on-Grade

Preparation of areas beneath concrete slab-on-grade floors should be performed as recommended in the *Site Preparation* section. Care should be taken during excavation for foundations and floor slabs, to avoid disturbing subgrade soils. If subgrade soils have been adversely impacted by wet weather or otherwise disturbed, the surficial soils should be scarified

to a minimum depth of 8 inches, moisture conditioned to within about 3 percent of optimum moisture content, and compacted to engineered fill specifications. Alternatively, disturbed soils may be removed and the removal zone backfilled with additional crushed rock.

For evaluation of the concrete slab-on-grade floors using the beam on elastic foundation method, a modulus of subgrade reaction of 150 kcf (87 pci) should be assumed for the medium stiff native silt soils anticipated at subgrade depth. This value assumes the concrete slab system is designed and constructed as recommended herein, with a minimum thickness of crushed rock of 8 inches beneath the slab.

Interior slab-on-grade floors should be provided with an adequate moisture break. The capillary break material should consist of ODOT open graded aggregate per ODOT Standard Specifications 02630-2. The minimum recommended thickness of capillary break materials on re-compacted soil subgrade is 8 inches. The total thickness of crushed aggregate will be dependent on the subgrade conditions at the time of construction, and should be verified visually by proof-rolling. Under-slab aggregate should be compacted to at least 90% of its maximum dry density as determined by ASTM D1557 or equivalent.

In areas where moisture will be detrimental to floor coverings or equipment inside the proposed structure, appropriate vapor barrier and damp-proofing measures should be implemented. A commonly applied vapor barrier system consists of a 10-mil polyethylene vapor barrier placed directly over the capillary break material. With this type of system, an approximately 2-inch thick layer of sand is often placed over the vapor barrier to protect it from damage, to aid in curing of the concrete, and also to help prevent cement from bleeding down into the underlying capillary break materials. Other damp/vapor barrier systems may also be feasible. Appropriate design professionals should be consulted regarding vapor barrier and damp proofing systems, ventilation, building material selection and mold prevention issues, which are outside GeoPacific's area of expertise.

Footing and Roof Drains

Experience has shown that temporary perched groundwater conditions often occur over fine-grained native deposits such as those beneath the site, particularly during the wet season. To minimize the fluctuation of soil moisture content near structural foundations, we recommend that the structures be constructed with perimeter footing drains. The outside edge of perimeter footings should be provided with a drainage system consisting of 3-inch minimum diameter perforated plastic pipe embedded in a minimum of 1 ft^3 per lineal foot of clean, free-draining sand and gravel or 1¼"- ¼" drain rock. The drain pipe and surrounding drain rock should be wrapped in non-woven geotextile (Mirafi 140N, or approved equivalent) to minimize the potential for clogging and/or ground loss due to piping. Water collected from the footing drains should be directed into the local storm drain system or other suitable outlet. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. The footing drains should include clean-outs to allow periodic maintenance and inspection.

Down spouts and roof drains should collect roof water in a system separate from the footing drains in order to reduce the potential for clogging. Roof drain water should be directed to an appropriate discharge point well away from structural foundations. Grades should be sloped downward and away from buildings to reduce the potential for ponded water near structures.

Stormwater Management Facilities

We understand that plans for project development may include stormwater management facilities, such as detention ponds. We also understand that it is desired to incorporate subsurface disposal of stormwater through infiltration. However, our observations indicate that subsurface disposal of stormwater at relatively shallow depths is not a feasible option for the site, due to shallow groundwater conditions.

It is critical for the performance of stormwater management facilities relying on subsurface disposal of stormwater through infiltration to maintain adequate separation from groundwater levels. Additional testing could be performed to investigate whether the observed groundwater is only perched and if subsurface infiltration of stormwater is possible at depths greater than eight feet below the ground surface. An investigation of this type would involve infiltration testing in soil borings as well as installation and monitoring of piezometers. Piezometers would need to be monitored over the course of one year to observed groundwater level fluctuations.

Stormwater management systems should be constructed as specified by the designer. Stormwater exceeding storage capacities will need to be directed to a suitable discharge location. Stormwater management systems may need to include overflow outlets, surface water control measures and/or be connected to the street stormdrain system, if available.

Pavement Design - On Site Private Driveways and Parking Areas

We understand that the proposed new on site automobile driveways and parking areas will be surfaced with asphalt concrete pavement. We assume the proposed new automobile driveways will be subjected to an initial two-way ADT (average daily traffic count) of 200 vehicles per day, and that the automobile parking areas will be subjected to an initial ADT of 100 vehicles per day. Further, we assumed 3 percent of the vehicles will be heavy trucks (FHWA Class 5 or greater). For design purposes, we assume that the native soils on the site exhibit a resilient modulus of at least 9,000 pci.

Table 2 presents the recommended section thicknesses for the proposed on site automobile driveways and parking areas that are to be completed as part of the project, under dry weather construction conditions. In our opinion, this pavement section is suitable to support the anticipated light levels of traffic.

The pavement sections recommended in Table 2 are for typical volumes of automobile traffic. Heavy truck traffic will reduce the design life of the pavements and may lead to inadequate pavement performance. If heavy truck traffic is anticipated, GeoPacific should be contacted for additional pavement design recommendations based on the traffic volumes expected.

Table 2 - Recommended Minimum Dry-Weather Pavement Section

Material Layer	Layer Thickness (inches)	Compaction Standard
Asphaltic Concrete (AC)	3	91% of Rice Density AASHTO T-209
Crushed Aggregate Base ¾"-0 (leveling course)	2	95% of Modified Proctor ASTM D1557
Crushed Aggregate Base 1½"-0	8	95% of Modified Proctor ASTM D1557
Recommended Subgrade	12	95% of Standard Proctor or approved native

Any pockets of organic debris or loose fill encountered during subgrade preparation should be removed and replaced with engineered fill (see *Site Preparation* Section). In order to verify subgrade strength, we recommend proof-rolling directly on subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas that pump, rut, or weave should be stabilized prior to paving. If pavement areas are to be constructed during wet weather, the subgrade and construction plan should be reviewed by the project geotechnical engineer at the time of construction so that condition specific recommendations can be provided. The moisture sensitive subgrade soils make the site a difficult wet weather construction project. General recommendations for wet weather pavement construction are presented below.

During placement of pavement section materials, density testing should be performed to verify compliance with project specifications. Generally, one subgrade, one base course, and one asphalt compaction test is performed for every 100 to 200 linear feet of paving.

Wet Weather Construction Pavement Section

This section presents our recommendations for wet weather pavement sections, which are for construction of on-site driving lanes and parking areas. These wet weather pavement section recommendations are intended for use in situations where it is not feasible to compact the subgrade soils to Clackamas County requirements, due to wet subgrade soil conditions, and/or construction during wet weather.

Based on our site review, we recommend a wet weather section with a minimum subgrade deepening of 6 inches to accommodate a working subbase of additional 1½"-0 crushed rock. Geotextile fabric, Mirafi 500x or equivalent, should be placed on subgrade soils prior to placement of base rock.

In some instances it may be preferable to use Special Treated Base (STB) in combination with overexcavation and increasing the thickness of the rock section. GeoPacific should be consulted for additional recommendations regarding use of STB in wet weather pavement sections if it is desired to pursue this alternative. Cement treatment of the subgrade may also be considered instead of overexcavation. For planning purposes, we anticipate that treatment of the on-site soils would involve mixing cement powder to approximately 6 percent cement content and a mixing depth on the order of 12 inches.

With implementation of the above recommendations, it is our opinion that the resulting pavement sections will provide equivalent or greater structural strength than the dry weather pavement section currently planned. However, it should be noted that construction in wet weather is challenging, and the performance of pavement subgrade depend on a number of factors including the weather conditions, the contractor's methods, and the amount of traffic the areas are subjected to. There is a potential that soft spots may develop even with implementation of the wet weather provisions recommended in this letter. If soft spots in the subgrade are identified during roadway excavation, or develop prior to paving, the soft spots should be over-excavated and backfilled with additional crushed rock.

During subgrade excavation, care should be taken to avoid disturbing the subgrade soils. Removals should be performed using an excavator with a smooth-bladed bucket. Truck traffic should be limited until an adequate working surface has been established. We suggest that the crushed rock be spread using bulldozer equipment rather than dump trucks, to reduce the amount of traffic and potential disturbance of subgrade soils.

Care should be taken to avoid over-compaction of the base course materials, which could create pumping, unstable subgrade soil conditions. Heavy and/or vibratory compaction efforts should be applied with caution. Following placement and compaction of the crushed rock to project specifications (95% of AASHTO T-180), a finish proof-roll should be performed before paving.

The above recommendations are subject to field verification. GeoPacific should be on-site during construction to verify subgrade strength and to take density tests on the engineered fill, base rock and asphaltic pavement materials.

Seismic Design

Structures should be designed to resist earthquake loading in accordance with the methodology described in the 2012 International Residential Code (IRC) for One- and Two-Family Dwellings, with applicable Oregon Structural Specialty Code (OSSC) revisions (*current 2014*). We recommend Site Class D be used for design per the OSSC, Table 1613.5.2 and as defined in ASCE 7, Chapter 20, Table 20.3-1. Design values determined for the site using the USGS (United States Geological Survey) *2014 Seismic Design Maps Summary Report* are summarized in Table 3.

Table 3 - Recommended Earthquake Ground Motion Parameters (2015 USGS)

Parameter	Value
Location (Lat, Long), decimal	45.361, -122.831
Probabilistic Ground Motion Values, 2% Probability of Exceedance in 50 yrs	
Short Period, S_s	0.940 g
1.0 Sec Period, S_1	0.418 g
Soil Factors for Site Class D:	
F_a	1.124
F_v	1.582
Residential Site Value = 2/3 x F_a x S_s	0.704 g
Residential Seismic Design Category	D

Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a liquid in response to earthquake shaking. Soil liquefaction is generally limited to loose, granular soils located below the water table. The on-site soils consist predominantly of stiff to hard fine-grained soils and dense fine to coarse-grained soils, which are not considered susceptible to liquefaction. Oregon DAGAMI Hazvu mapping indicates that the subject site has a low risk of seismic liquefaction.

UNCERTAINTIES AND LIMITATIONS

We have prepared this report for the owner and their consultants for use in design of this project only. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

Within the limitations of scope, schedule and budget, GeoPacific attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, expressed or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

January 14, 2016
Project No. 15-4080

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER 90013PE OREGON MAY 22, 2015 BENJAMIN G. ANDERSON

Expires: 12/31/17

Benjamin G. Anderson, P.E.
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER 14743PE OREGON JAN. 23, 1990 JAMES D. IMBRIE

EXPIRES: 06/30/2017

James D. Imbrie, G.E., C.E.G.
Principal Geotechnical Engineer

Attachments: References
Figure 1 – Vicinity Map
Figure 2 – Site Plan and Exploration Locations
Figure 3 – Aerial Site Plan and Exploration Locations
Test Pit Logs (TP-1 - TP-6)

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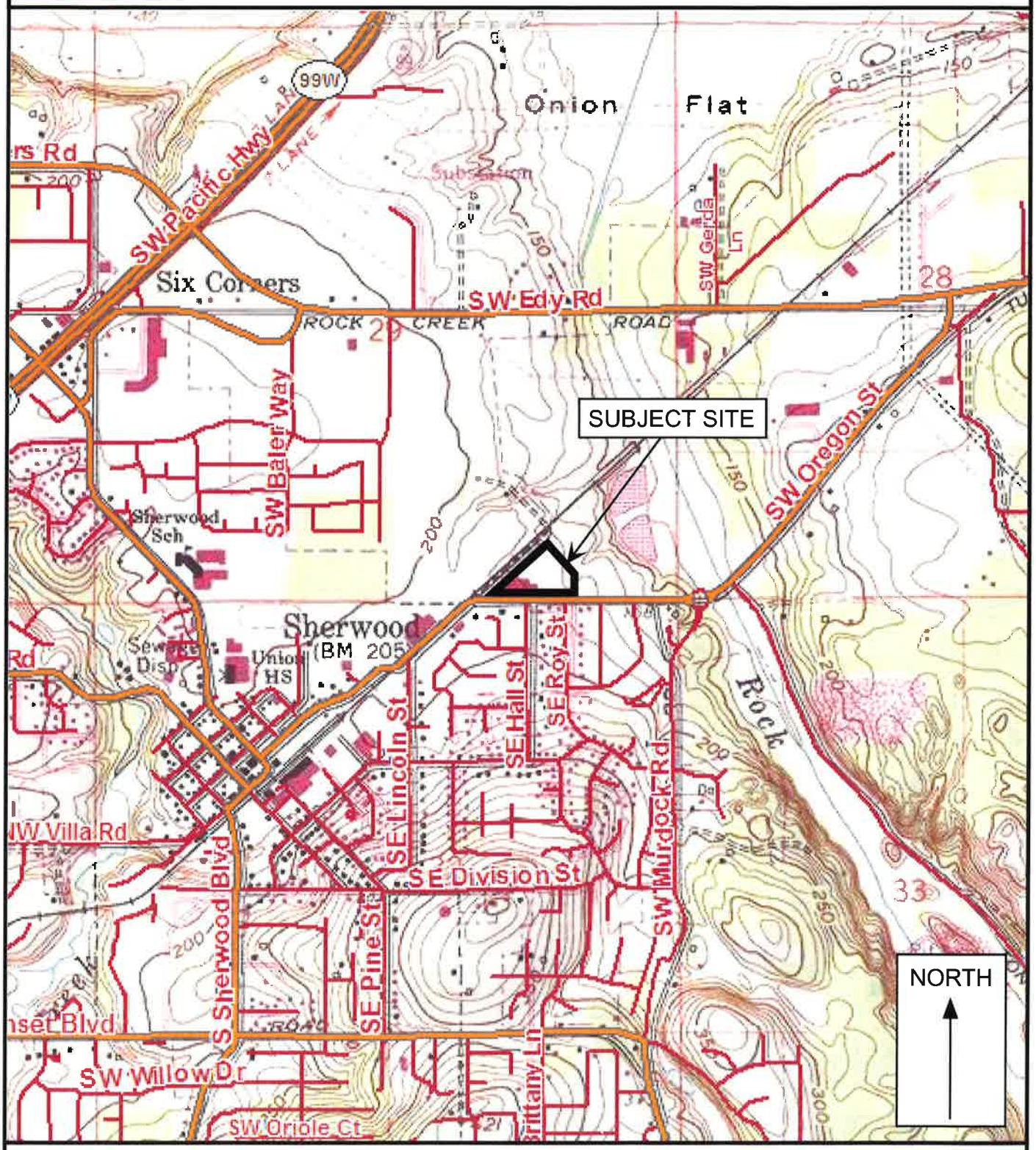
GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

VICINITY MAP



Legend

Approximate Scale 1 in = 1,400 ft

Date: 01/14/16
Drawn by: BGA

Base maps: National Geographic TOPO!, Tele Atlas, Oregon, 1990.

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	FIGURE 1

GeoPacific Engineering, Inc.
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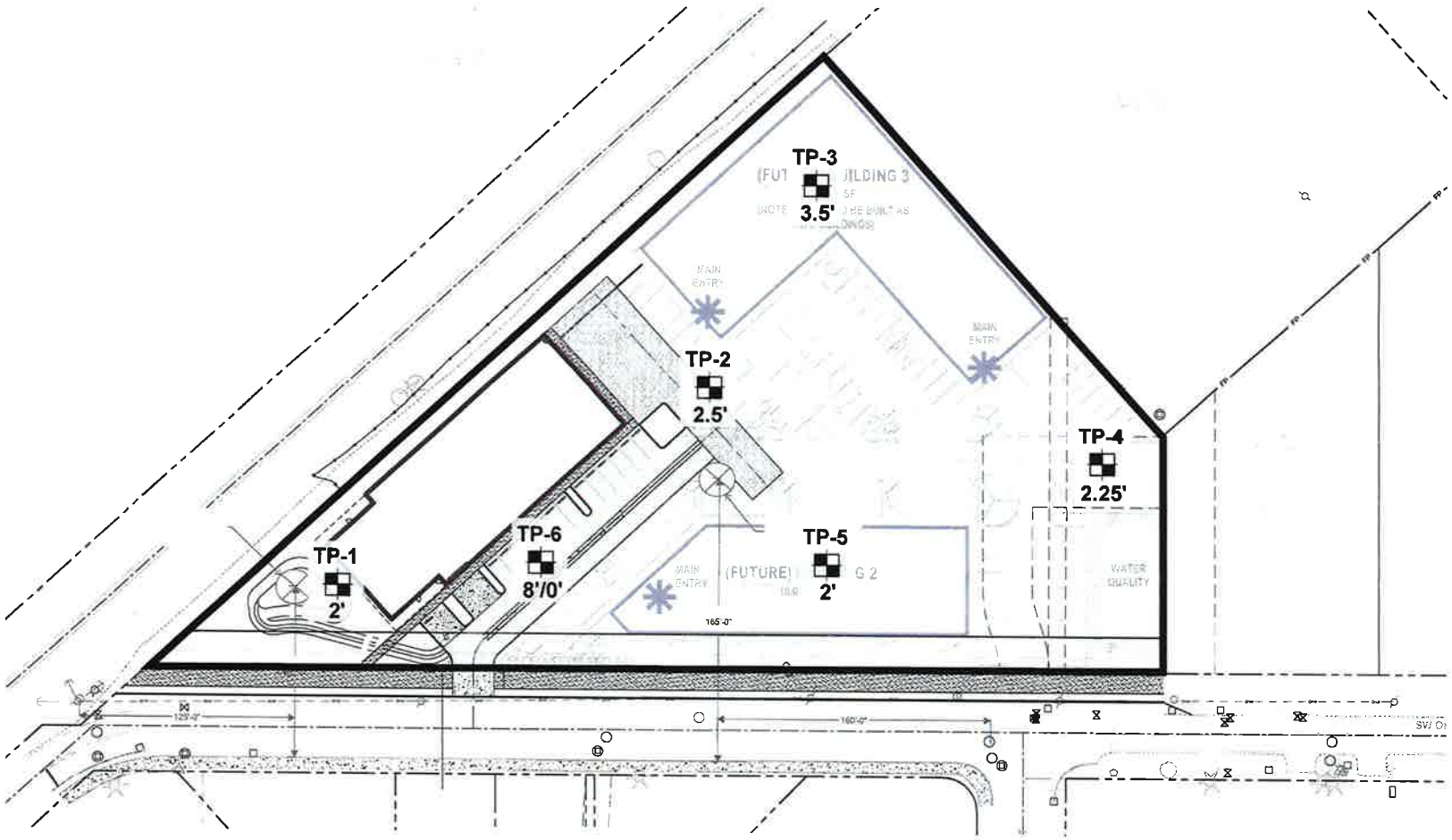
Tel: (503) 598-8445 Fax: (503) 941-9281

SITE PLAN AND EXPLORATION LOCATIONS



North

Legend

TP-1
2'
Test Pit Designation, Approximate Location, and Depth of Undocumented Fill and Buried Topsoil

0 100'
APPROXIMATE SCALE 1"=100'

Date: 01/13/16
Drawn by: BGA

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	FIGURE 2

GeoPacific Engineering, Inc.
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Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

AERIAL SITE PLAN AND EXPLORATION LOCATIONS

Legend

TP-1
2'
Test Pit Designation, Approximate Location, and Depth of Undocumented Fill and Buried Topsoil

0 100'
APPROXIMATE SCALE 1"=100'

Date: 01/13/16
Drawn by: BGA

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	FIGURE 3

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park
Sherwood, Oregon

Project No. 15-4080

Test Pit No. **TP- 1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						2" asphalt pavement over 8 inches of dense base rock
1						Gravelly SILT (ML) to silty GRAVEL(GM), very stiff to dense, gray, moist to wet (Undocumented Fill)
2	4.0					Stiff, clayey SILT (ML), gray, micaceous, with some fine roots throughout upper 12 inches, wet (Willamette Formation)
	2.0					
3	3.0					
4						[Very fast groundwater seepage below 4 feet]
5						
6						
7						Grades to brown, very stiff, and with some sand
8						
9						Test pit terminated at 8.5 feet
10						
11						Notes: Fast groundwater seepage encountered below 4 feet Discharge visually estimated at about 10 gallons per minute
12						Infiltration test attempted at 2 feet bgs, but groundwater measured at 1 feet bgs at time of testing
13						
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park
Sherwood, Oregon

Project No. 15-4080

Test Pit No. **TP-2**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Silty GRAVEL and COBBLES (GM) with brick debris and chunks of concrete, dense, moist (Undocumented Fill)
2						6" layer of moderately organic, dark gray silt with fine roots throughout (Buried Topsoil)
3	1.5 2.0					Medium stiff to stiff, clayey SILT (ML), with dark gray and orange mottling, very moist to wet (Willamette Formation) [Very fast groundwater seepage below 3.5 feet]
4						
5						Grades to brown, very stiff, and with some sand
6						Test pit terminated at 6 feet
7						
8						Notes: Slow groundwater seepage encountered below 2 feet Discharge visually estimated at less than 2 gallons per minute
9						Fast groundwater seepage encountered below 3.5 feet Discharge visually estimated at about 5 gallons per minute
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	Test Pit No. **TP-3**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1, 2						Silty GRAVEL and COBBLES (GM) with brick debris, chunks of concrete, and some organic debris, loose to medium dense, moist (Undocumented Fill)
3						6" layer of dark gray, moderately organic, dark gray SILT (ML) with partially decomposed organic material (Buried Topsoil)
4						Very stiff SILT (ML), brown and gray, wet (Willamette Formation)
5, 6						[Very fast groundwater seepage below 5 feet]
7						Dense, silty SAND (SM), fine to coarse-grained, very moist to wet
8, 9, 10, 11, 12, 13, 14, 15, 16, 17						Test pit terminated at 7.5 feet Notes: Fast groundwater seepage encountered below 3.5 feet Discharge visually estimated at about 5 gallons per minute Infiltration test attempted at 7.5 feet bgs, but groundwater measured at 4 feet bgs at time of testing

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
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Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park
Sherwood, Oregon

Project No. 15-4080

Test Pit No. **TP-4**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Silty GRAVEL and COBBLES (GM) with brick debris, chunks of concrete, and some organic debris, loose, very moist (Undocumented Fill)
1						
2						18-28" dark gray, low organic, clayey SILT (ML), dark gray, moist (Buried Topsoil)
3	1.5 2.0					Medium stiff, SILT (ML), brown, wet (Willamette Formation)
4						
5						
6						Grades to hard and sandy below 6 feet
7						
8						Dense, silty SAND (SM), fine to coarse-grained, gray, very moist to wet (Willamette Formation)
9						
10						Very stiff to hard, clayey SILT (ML), brown, with some sand, wet (Willamette Formation)
11						Test pit terminated at 11 feet
12						
13						Notes: Groundwater encountered below 1 foot
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	Test Pit No. **TP-5**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Loose, silty SAND (SM), fine to coarse-grained, with fine roots throughout upper 4 inches, moist to wet (Undocumented Fill)
2	2.5 2.5					Stiff, clayey SILT (ML), gray, wet (Willamette Formation)
3						
4						Grades to brown and with gray and orange mottling
5						
6						Grades to hard and sandy
7						Test pit terminated at 6 feet
8						Notes: Groundwater encountered near ground surface
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	Test Pit No. **TP-6**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1, 2						56-inch diameter brick-lined cistern filled with brick debris and organic material (Undocumented Fill) [Outside of the cistern - stiff, native, clayey SILT (ML), brown, wet]
3, 4, 5, 6, 7					▨	
8						Stiff, sandy SILT (ML), blue gray, wet (Willamette Formation)
9, 10, 11, 12, 13, 14, 15, 16, 17						Test pit terminated at 9 feet Notes: Groundwater encountered below 2.5 feet

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

Preliminary Stormwater Drainage Report

Zenport Industrial Park
Building No. 1

15104 SW Oregon Street, Sherwood OR 97140

Regular maintenance and inspection are required on all components of the stormwater system. This plan provides instruction on how to maintain and inspect the system.

Prepared by: Evan Eykelbosch, PE
Froelich Engineers
6969 SW Hampton St.
Portland, OR 97223
Froelich Project Number: 15-C012
Date: March 28, 2016

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I. Project Overview and Description

The proposed project site is the future home for the Zenport Industrial Park and is located at 15104 SW Oregon Street, in Sherwood, Washington County, Oregon (See Vicinity Map, Appendix A). This site is currently undeveloped, aside from an old parking lot, but was historically part of the Frontier Leather Company. The site is currently overgrown with vegetation. The proposed project will develop the southwest corner of the site with a new office/warehouse building and accompanying site features (ie. parking lot, curbs, sidewalk...). Roadway improvements are required along the entire length of the adjacent Oregon Street frontage.

The existing and propose surface area can be seen below in Table 1.1. See Appendix B for the basin map and basin area breakdown.

Table 1.1

Surface	Existing (square feet)	Proposed (square feet)
Impervious	19,126	21,435
Pervious	37,480	31,859
Total	56,606	56,606

A Service Provider Letter from the City of Hillsboro can be found in Appendix C.

General Soil Condition

The NRCS, Natural Resources Conservation Service, identifies the project area as having Aloha silt loam. These soils are poor draining and have a low permeability. They are classified into hydrologic soil group C/D (see Appendix D). For the proposed pervious area, we have used a curve number of 89. This is consistent with fair conditioned open space. All impervious surfaces will use a curve number of 98.
The geotechnical investigation indicated that ground water is 1 to 4 feet below grade and that stormwater inflation was not an option (See Appendix D).

II. Stormwater

a. Existing Conditions

There is no existing stormwater system located on site. The topography of the site naturally slopes from the southwest corner to the northeast corner of the site. An existing swale runs to the north along the western property line between the site and the railroad property.

The existing roadway, Oregon Street, is crowned and sheds runoff into a series of catch basins. These catch basins connect into the existing 30” Stormwater Main located along

the south side of Oregon Street. The main runs to the east and outfalls into Rock Creek just before reaching the Oregon Street/ Murdock Road roundabout.

b. Proposed Conditions

The proposed site is required to meet the stormwater requirements set by Clean Water Services. Both the proposed onsite and offsite stormwater systems drain into the public stormwater main located in Oregon Street.

Onsite: Due to a high ground water table, the availability of LIDA facilities is greatly reduced. Aside from the gravel lot flowing through a vegetated filter strip, no other LIDA treatment is proposed. A series of catch basins and roof downspouts will collect a majority of the proposed site runoff and convey it into Contech StormFilter Catch Basin for treatment prior to discharging into a downstream manhole. The undeveloped areas of the property will continue to drain as is.

Offsite: Stormwater runoff from the half street improvements will be collected within a series of catch basins located along the curb. These catch basins connect into the public storm main located within Oregon Street.

c. Water Quality:

Per Clean Water Services requirements all new impervious surfaces must meet stormwater treatment requirements. Stormwater treatment is provided to the maximum extent possible through utilization of a Contech StormFilter located at the east end of the site. This facility will treat stormwater runoff from Basins A, B, C, D, E, and H. Each StormFilter Cartridge has the capacity to treat 0.033cfs.

- Water Quality Volume = 643 cf
- Water Quality Flow = 0.045 cfs

Therefore, the treatment system will require 2 cartridges.

Stormwater treatment for Basin E, is provided by a Vegetative Filter Strip. Filter strips are required to be a minimum of 5’ wide, include 18” of growing medium and have a treatment area ratio of 6%.

Per the direction of the City of Sherwood, no water quality treatment is to be provided for stormwater runoff along Oregon Street. The city plans to construct a downstream treatment facility to handle treatment of the public stormwater runoff.

d. Conveyance:

Per Clean Water Services requirements all stormwater pipes must be designed to convey the 25-year stormwater event. The proposed conveyance system was analyzed using the Santa Barbara Urban Hydrograph method with NRCS Type 1A precipitation distribution. The storm event was the 24-hour 25-year storm event with 3.9-inches of precipitation. Using Manning's, equation the pipes were sized to convey the 25-year storm event without surcharging. The pipe calculation and pipe map are attached in Appendix F.

No stormwater conveyance system is proposed for collecting the runoff from Basin E. After treatment through the Vegetative Filter Strip, runoff will be shed into the adjoining landscaping and will naturally drain across the site and into the soil.

Basin F and Basin I will continue to drain into the existing swale and convey runoff to the north along the property line

Basin G will convey pervious runoff onto the existing undeveloped pervious area where it will naturally drain across the site and into the soil.

e. Downstream Analysis

A downstream analysis of the public stormwater system was required to ensure there were no downstream deficiencies. Based on the analysis provided in Appendix G, there are no downstream deficiencies within the downstream stormwater main. The analysis looks at the contributing basin areas serving the public stormwater main located adjacent to our site and downstream to the outfall. The contributing basin areas and existing condition of the pipe were based on the basin map and as-built drawings provided by the City of Sherwood. Analysis assumptions are found in the Appendix E.

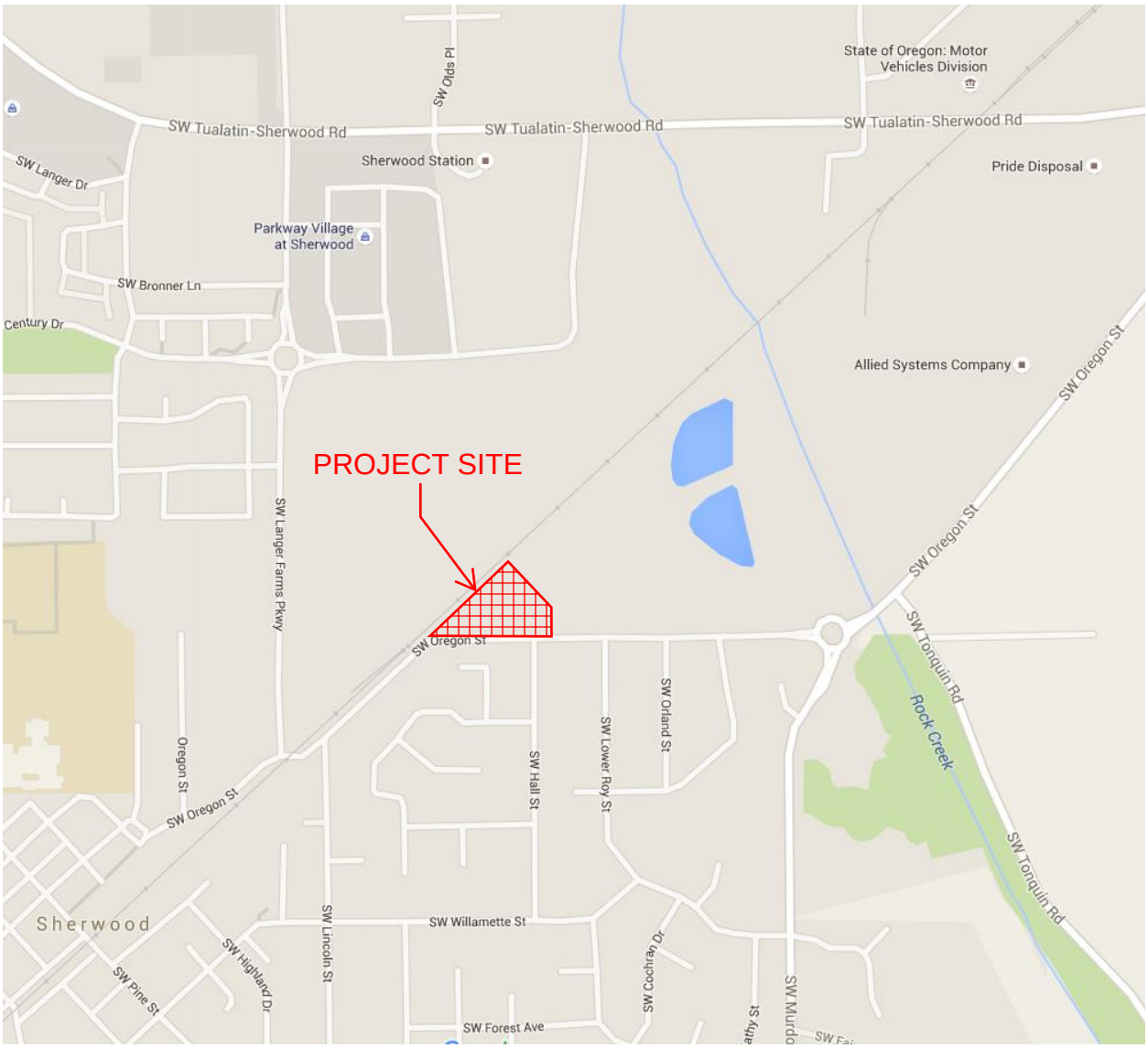
The analysis accounted for the full future building out of the site property and determined that there are no known deficiencies located in the downstream system.

III. Engineering Conclusion

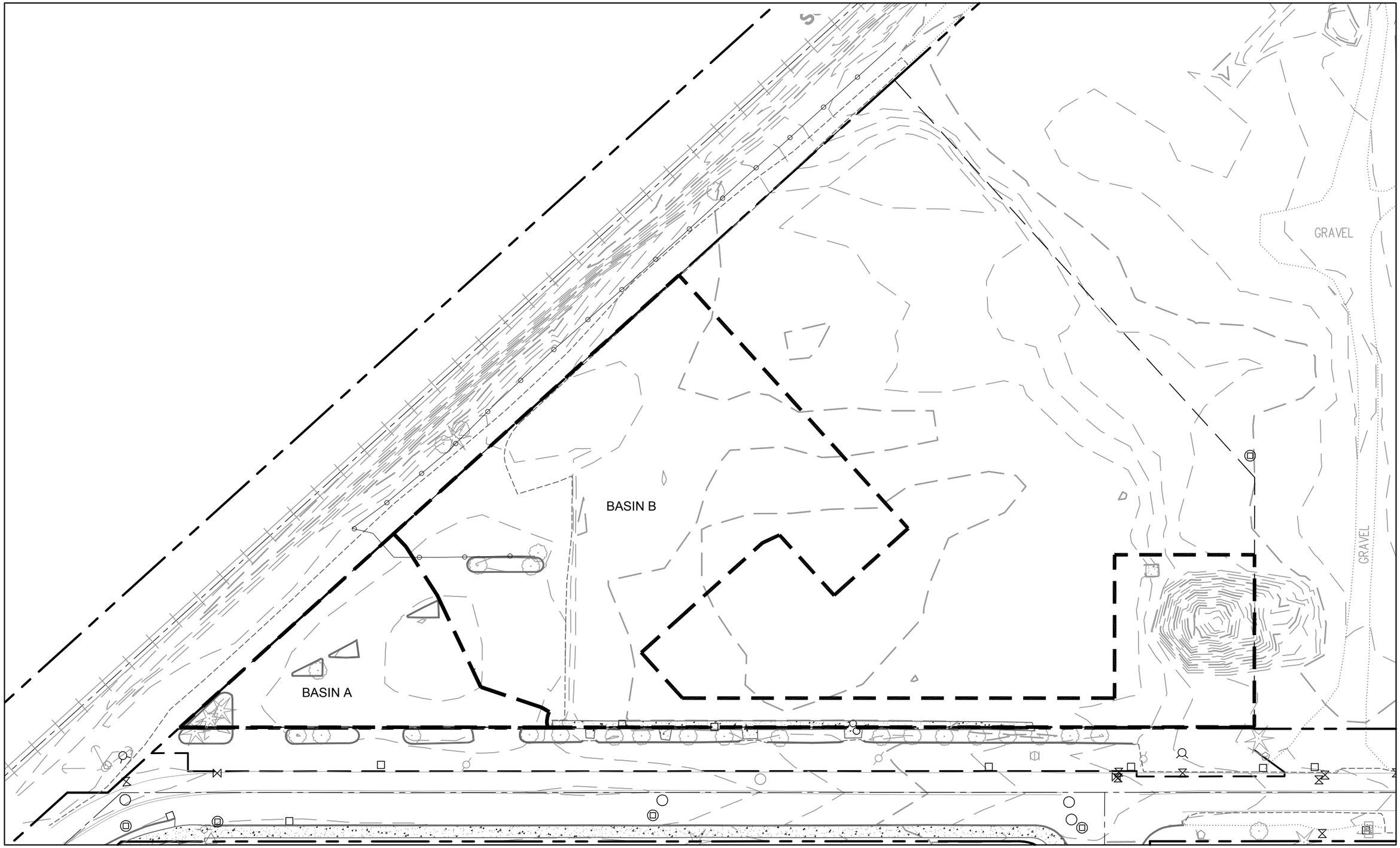
Stormwater treatment has been provided to the maximum extent practicable per the standards set forth by Clean Water Services and the City of Sherwood.

IV. Appendices

Appendix A: Vicinity Map



Appendix B: Figures and Areas



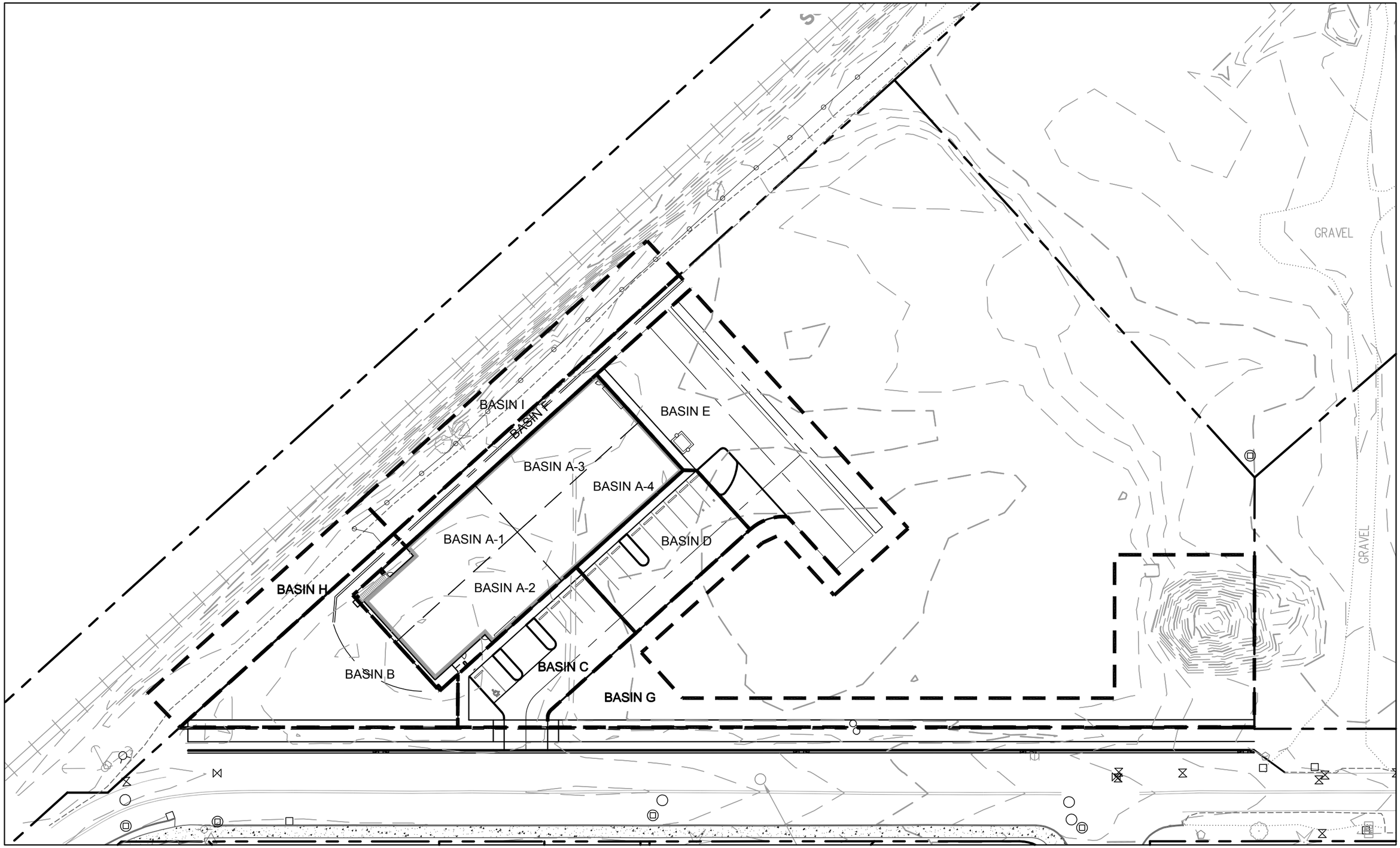
EXISTING BASIN MAP

SCALE:1"=40'

0 40' 80'

SHEET NO.

EXISTING



PROPOSED BASIN MAP

SCALE:1"=40'

0 40' 80'

SHEET NO.

PROPOSED

Basin Areas

Existing

BASIN	AREA					
	pervious		impervious		total	
	sf	ac	sf	ac	sf	ac
BASIN A	630	0.01	9,578	0.22	10,208	0.23
BASIN B	36,867	0.85	9,548	0.22	46,415	1.07

Proposed

BASIN	AREA						
	pervious		impervious		total		Flow
	sf	ac	sf	ac	sf	ac	Q (cfs)
BASIN A (ROOF)	0	0.00	12,934	0.30	12,934	0.30	0.91
A-1	0	0.00	3,185	0.07	3,185	0.07	0.22
A-2	0	0.00	3,276	0.08	3,276	0.08	0.23
A-3	0	0.00	3,191	0.07	3,191	0.07	0.22
A-4	0	0.00	3,285	0.08	3,285	0.08	0.23
BASIN B	6,935	0.16	3	0.00	6,938	0.16	0.12
BASIN C	438	0.01	4,246	0.10	4,684	0.11	0.31
BASIN D	92	0.00	4,059	0.09	4,151	0.10	0.29
BASIN E	3,621	0.08	7,253	0.17	10,874	0.25	0.57
BASIN F	2,122	0.05	0	0.00	2,122	0.05	0.04
BASIN G	13,341	0.31	1,559	0.04	14,900	0.34	0.34
BASIN H (OFFSITE)	2,389	0.05	1,732	0.04	4,121	0.09	0.16
BASIN I (OFFSITE)	2,921	0.07	2,583	0.06	5,504	0.13	0.23
BASIN I (FUTURE BLDG)	2,922	0.07	2,035	0.05	4,957	0.11	0.19
BASIN I (FUTURE PARKING)	0	0.00	1,604	0.04	1,604	0.04	0.11

Appendix C: Service Provider Letter

Clean Water Services File Number 14-002802

CleanWater Services

Sensitive Area Pre-Screening Site Assessment

1. Jurisdiction: City of Sherwood Active tax lot: 2S129DC00800

2. Property Information *(example 1S234AB01400)*
Tax lot ID(s): #2S129D00 1100 historic tax lot.
Legal Description: Parcel 3, PARTITION PLAT No. 2003-030, Sherwood, Washington Co.
Site Address: 15104 SW Oregon Street
City, State, Zip: Sherwood, Oregon, 97140
Nearest Cross Street: SW Hall Street

3. Owner Information
Name: Randy Killion + Jui-mei Killion
Company:
Address: 11825 SW Katherine St.
City, State, Zip: Tigard, OR 97223
Phone/Fax: 503 704 6208 / (F) 503 524 6876
E-Mail: randykzone hotmail.com

4. Development Activity *(check all that apply)*
- ☐ Addition to Single Family Residence (rooms, deck, garage)
- ☐ Lot Line Adjustment
- ☐ Minor Land Partition
- ☐ Residential Condominium
- ☐ Commercial Condominium
- ☐ Residential Subdivision
- ☐ Commercial Subdivision
- ☒ Single Lot Commercial
- ☐ Multi Lot Commercial

Other

5. Applicant Information
Name: Brian Yee
Company: KH2A Engineering
Address: 5515 SE Milwaukie Avenue
City, State, Zip: Portland, Oregon, 97202
Phone/Fax: 503-230-9348 / 503-233-2051
E-Mail: byee@kh2aengineering.com

6. Will the project involve any off-site work? ☐ Yes ☒ No ☐ Unknown
Location and description of off-site work

7. Additional comments or information that may be needed to understand your project This is a mitigated brownfield parcel suitable for industrial manufacturing use. Groundwater use is not allowed.

This application does NOT replace Grading and Erosion Control Permits, Connection Permits, Building Permits, Site Development Permits, DEQ 1200-C Permit or other permits as issued by the Department of Environmental Quality, Department of State Lands and/or Department of the Army COE. All required permits and approvals must be obtained and completed under applicable local, state, and federal law.

By signing this form, the Owner or Owner's authorized agent or representative, acknowledges and agrees that employees of Clean Water Services have authority to enter the project site at all reasonable times for the purpose of inspecting project site conditions and gathering information related to the project site. I certify that I am familiar with the information contained in this document, and to the best of my knowledge and belief, this information is true, complete, and accurate.

Print/Type Name Randy Killion + Jui-mei Killion Print/Type Title Jui-mei H. Killion
Signature Date 10/2/14

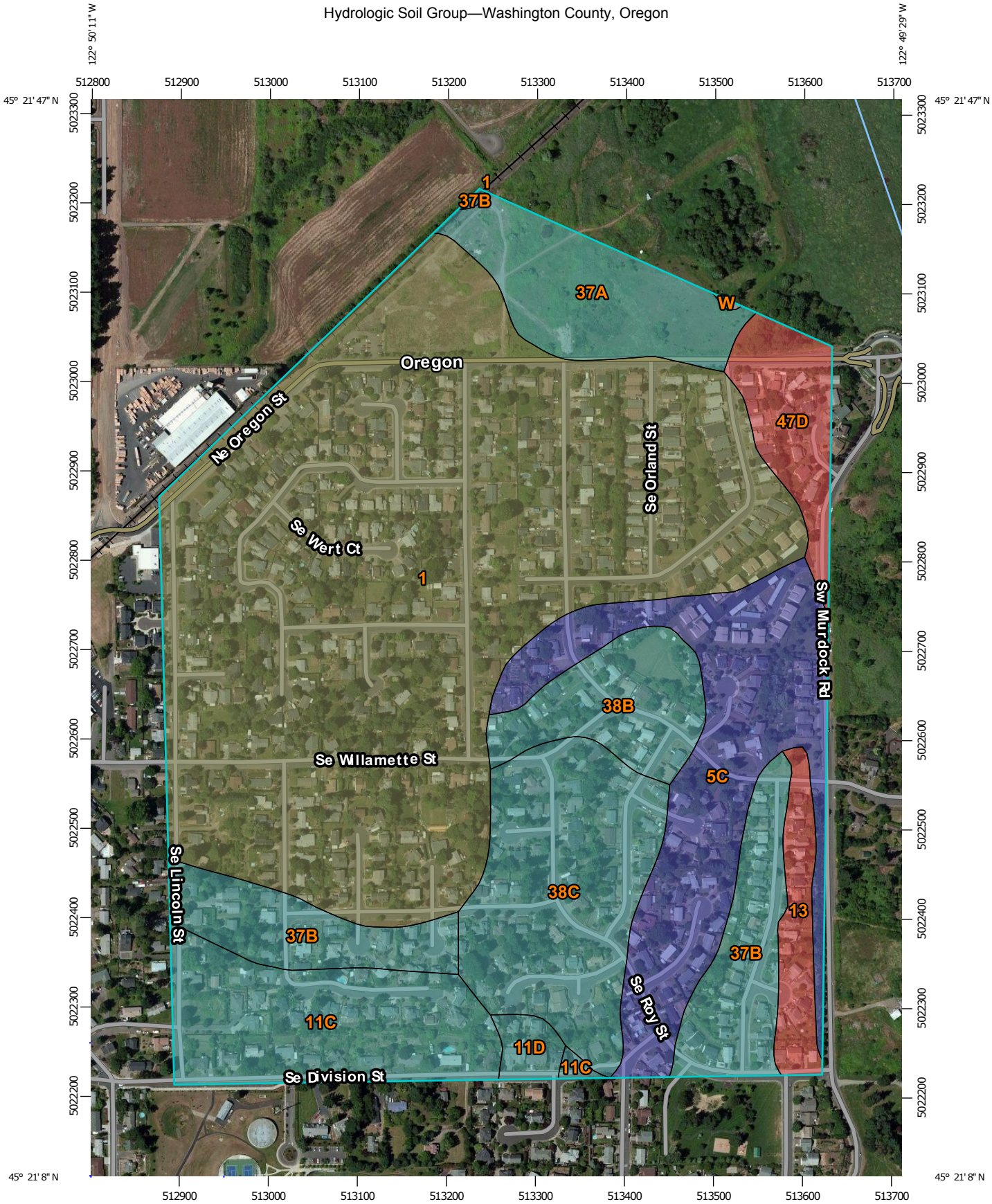
FOR DISTRICT USE ONLY

- ☐ Sensitive areas potentially exist on site or within 200' of the site. THE APPLICANT MUST PERFORM A SITE ASSESSMENT PRIOR TO ISSUANCE OF A SERVICE PROVIDER LETTER. If Sensitive Areas exist on the site or within 200 feet on adjacent properties, a Natural Resources Assessment Report may also be required.
- ☒ Based on review of the submitted materials and best available information Sensitive areas do not appear to exist on site or within 200' of the site. This Sensitive Area Pre-Screening Site Assessment does NOT eliminate the need to evaluate and protect water quality sensitive areas if they are subsequently discovered. This document will serve as your Service Provider letter as required by Resolution and Order 07-20, Section 3.02.1. All required permits and approvals must be obtained and completed under applicable local, State, and federal law.
- ☐ Based on review of the submitted materials and best available information the above referenced project will not significantly impact the existing or potentially sensitive area(s) found near the site. This Sensitive Area Pre-Screening Site Assessment does NOT eliminate the need to evaluate and protect additional water quality sensitive areas if they are subsequently discovered. This document will serve as your Service Provider letter as required by Resolution and Order 07-20, Section 3.02.1. All required permits and approvals must be obtained and completed under applicable local, state and federal law.
- ☐ This Service Provider Letter is not valid unless _____ CWS approved site plan(s) are attached.
- ☐ The proposed activity does not meet the definition of development or the lot was platted after 9/9/95 ORS 92.040(2). NO SITE ASSESSMENT OR SERVICE PROVIDER LETTER IS REQUIRED.

Reviewed by Laurie Harris Date 10/13/14

Appendix D: Geotechnical Information

Hydrologic Soil Group—Washington County, Oregon



Map Scale: 1:5,870 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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: 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	79.0	49.2%
5C	Briedwell stony silt loam, 7 to 12 percent slopes	B	18.5	11.5%
11C	Cornelius and Kinton silt loams, 7 to 12 percent slopes	C	12.0	7.5%
11D	Cornelius and Kinton silt loams, 12 to 20 percent slopes	C	1.2	0.7%
13	Cove silty clay loam	D	3.3	2.0%
37A	Quatama loam, 0 to 3 percent slopes	C	8.6	5.4%
37B	Quatama loam, 3 to 7 percent slopes	C	11.7	7.3%
38B	Saum silt loam, 2 to 7 percent slopes	C	6.3	3.9%
38C	Saum silt loam, 7 to 12 percent slopes	C	14.7	9.2%
47D	Xerochrepts-Rock outcrop complex	D	5.0	3.1%
W	Water		0.1	0.0%
Totals for Area of Interest			**160.4**	**100.0%**

Description

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 soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

January 14, 2016
Project No. 15-4080

AJ Shepard
Shepard Bros. Mgmt.
2830 NW 29th Avenue
Portland, Oregon 97227
Phone: 360-772-6355
Email: aj@uptownpm.com

Via email with hard copies mailed upon request

SUBJECT: GEOTECHNICAL ENGINEERING REPORT
ZENPORT INDUSTRIAL PARK BUILDING 1
15104 SW OREGON STREET
SHERWOOD, OREGON

This report presents the results of a geotechnical engineering study conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our investigation was to evaluate subsurface conditions at the site and to provide geotechnical recommendations for site development. This geotechnical study was performed in accordance with GeoPacific Proposal No. P-5465, dated November 10, 2015 and your subsequent authorization of our proposal and *General Conditions for Geotechnical Services*.

SITE AND PROJECT DESCRIPTION

The subject site is located at 15104 SW Oregon Street, in Sherwood, Oregon, and Building 1 is located at the western corner of this triangular shaped lot. The site is bordered by a railroad to the northwest, undeveloped land to the east, and SW Oregon Street to the south. The site has been vacant for some time. Vegetation at the site primarily consists of mostly weeds. Topography on the site is relatively flat, at an elevation of approximately 195 feet above mean sea level (amsl).

We understand that the site will be developed in stages and that the first stage of development will include the construction of a two-story steel-framed, office and warehouse building, parking areas, new underground utilities, and stormwater management systems. We understand that additional buildings, parking areas, underground utilities, and stormwater management systems may be constructed in other areas of the site at a later date.

A grading plan has not been provided for our review; however, we anticipate cuts and fills will be on the order of 5 feet or less.

Soil Moisture and Groundwater

On December 22, 2015, groundwater seepage was encountered in all of the test pits at relatively shallow depths. Typically, rates of groundwater seepage increased with depth. When we returned to the site on January 7, 2016 to perform infiltration testing, we observed groundwater at a depth of 1 foot in test pit TP-1 and a depth of 4 feet in test pit TP-3.

Experience has shown that temporary storm related perched groundwater within surface soils often occur over native deposits such as those beneath the site, particularly during the wet season. It is anticipated that groundwater conditions will vary depending on the season, local subsurface conditions, changes in site utilization, and other factors.

INFILTRATION TESTING

We attempted infiltration testing at a depth of 2 feet in test pit TP-1 and a depth of 7.5 feet in test pit TP-3. On December 22, 2015 we pushed pipes into the soil at the bottom of the test pits at these depths. However, when we returned to the site on January 7, 2016 to perform the infiltration testing, we observe groundwater at a depth of 1 foot in test pit TP-1 and at a depth of 4 feet in test pit TP-3. We were unable to perform infiltration testing due to shallow groundwater conditions.

CONCLUSIONS AND RECOMMENDATIONS

Our investigation indicates that the proposed development is geotechnically feasible, provided that the recommendations of this report are incorporated into the design and construction phases of the project. In our opinion, there are two main geotechnical issues for project completion. The first main issue is the site preparation, due to the presence of undocumented fill materials and the possibility of shallow groundwater conditions. The second main issue is that subsurface infiltration is not feasible at relatively shallow depths. The following report sections provide recommendations for site development and construction in accordance with the current applicable codes and local standards of practice.

Site Preparation

Areas of proposed buildings, streets, and areas to receive fill should be cleared of vegetation and any organic and inorganic debris. Existing structures should be demolished and any cavities structurally backfilled. Inorganic debris should be removed from the site. Organic-rich topsoil should then be stripped from construction areas of the site or where engineered fill is to be placed. The estimated average necessary depth of removal in undisturbed areas for moderately to highly organic soils is about 5 inches. Deeper stripping may be necessary in localized areas. The final depth of soil removal will be determined on the basis of a site inspection after the stripping/ excavation has been performed. Stripped topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative. Organic materials from clearing should either be removed from the site or placed as landscape fill in areas not planned for structures.

In building areas, remaining undocumented fills, buried topsoil, and subsurface structures (tile drains, basements, driveway and landscaping fill, old utility lines, septic leach fields, etc.) should be removed and the excavations backfilled with engineered fill. Undocumented fill material was encountered in all test pit locations and buried topsoil was encountered in test pits TP-2 through

January 14, 2016
Project No. 15-4080

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER 90013PE OREGON MAY 22, 2015 BENJAMIN G. ANDERSON

Expires: 12/31/17

Benjamin G. Anderson, P.E.
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER 14743PE OREGON JAN. 23, 1990 JAMES D. IMBRIE

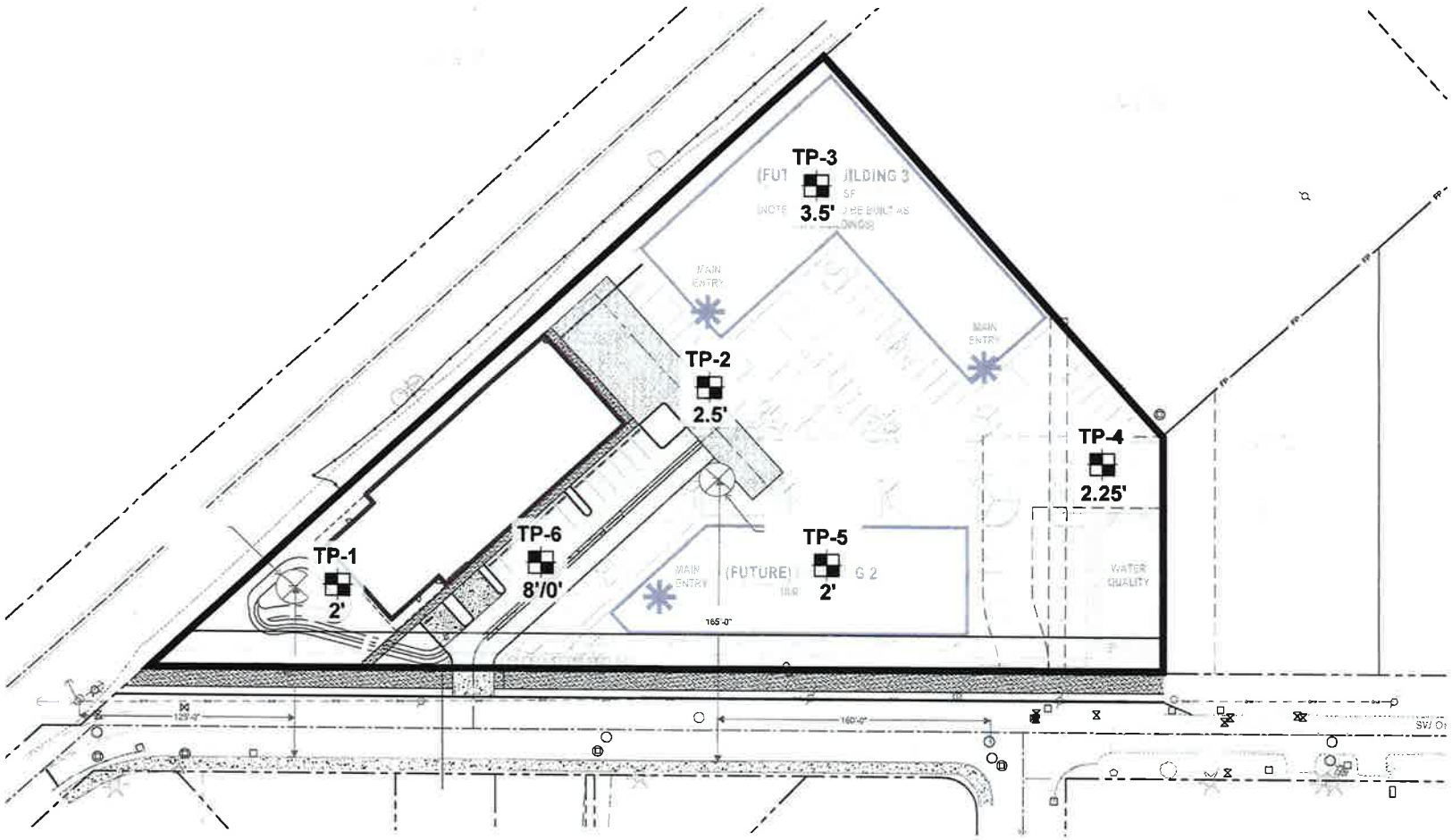
EXPIRES: 06/30/2017

James D. Imbrie, G.E., C.E.G.
Principal Geotechnical Engineer

Attachments: References
Figure 1 – Vicinity Map
Figure 2 – Site Plan and Exploration Locations
Figure 3 – Aerial Site Plan and Exploration Locations
Test Pit Logs (TP-1 - TP-6)

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

SITE PLAN AND EXPLORATION LOCATIONS



North

Legend

TP-1
2'
Test Pit Designation, Approximate Location, and Depth of Undocumented Fill and Buried Topsoil

0 100'
APPROXIMATE SCALE 1"=100'

Date: 01/13/16
Drawn by: BGA

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	FIGURE 2

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

AERIAL SITE PLAN AND EXPLORATION LOCATIONS

Legend

TP-1
2'
Test Pit Designation, Approximate Location, and Depth of Undocumented Fill and Buried Topsoil

0 100'
APPROXIMATE SCALE 1"=100'

Date: 01/13/16
Drawn by: BGA

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	FIGURE 3

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park
Sherwood, Oregon

Project No. 15-4080

Test Pit No. **TP- 1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						2" asphalt pavement over 8 inches of dense base rock
1						Gravelly SILT (ML) to silty GRAVEL(GM), very stiff to dense, gray, moist to wet (Undocumented Fill)
2	4.0					Stiff, clayey SILT (ML), gray, micaceous, with some fine roots throughout upper 12 inches, wet (Willamette Formation)
	2.0					
3	3.0					
4						[Very fast groundwater seepage below 4 feet]
5						
6						
7						Grades to brown, very stiff, and with some sand
8						
9						Test pit terminated at 8.5 feet
10						
11						Notes: Fast groundwater seepage encountered below 4 feet Discharge visually estimated at about 10 gallons per minute
12						Infiltration test attempted at 2 feet bgs, but groundwater measured at 1 feet bgs at time of testing
13						
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Zenport Industrial Park Sherwood, Oregon	Project No. 15-4080	Test Pit No. **TP-3**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1, 2						Silty GRAVEL and COBBLES (GM) with brick debris, chunks of concrete, and some organic debris, loose to medium dense, moist (Undocumented Fill)
3						6" layer of dark gray, moderately organic, dark gray SILT (ML) with partially decomposed organic material (Buried Topsoil)
4						Very stiff SILT (ML), brown and gray, wet (Willamette Formation)
5, 6						[Very fast groundwater seepage below 5 feet]
7						Dense, silty SAND (SM), fine to coarse-grained, very moist to wet
8, 9, 10, 11, 12, 13, 14, 15, 16, 17						Test pit terminated at 7.5 feet Notes: Fast groundwater seepage encountered below 3.5 feet Discharge visually estimated at about 5 gallons per minute Infiltration test attempted at 7.5 feet bgs, but groundwater measured at 4 feet bgs at time of testing

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 12/22/15
Logged By: BGA
Surface Elevation:

Appendix E: Assumptions

Assumptions

Santa Barbara Unit Hydrogragh (SBUH) Assumptions:
(used for Downstream Analysis Pipe Sizing)

2-year Storm Event=	**2.5**	in/24-hours	Per CWS Manual
5-year Storm Event=	**3.1**	in/24-hours	Per CWS Manual
10-year Storm Event=	**3.45**	in/24-hours	Per CWS Manual
25-year Storm Event =	**3.9**	in/24-hours	Per CWS Manual
Roughness Coefficient	**0.013**		

Curve Number Assumptions:

Impervious Area =	**98**	Per NRCS Runoff Curve
Pervious Area =	**74**	Per NRCS Runoff Curve
Average =	**83**	Per NRCS Runoff Curve Number for 1/4 acre residential lot development

Clean Water Services Water Quality:

Water Quality (WQ) Storm Event =	**0.36**	Per CWS Manual

Rational Method Assumptions:
(used for Pipe sizing)

25-year Storm Event=	**3.4**	in/hour	Per CWS Manual

Runoff Coefficients (C)

C value for roof/pavement=	**0.9**	ODOT Hydraulcs Manual
C value for landscape=	**0.22**	ODOT Hydraulcs Manual

Appendix F: Conveyance Calculations

FROELICH ENGINEERS

CONVEYANCE CALCULATIONS

DESIGN SECTION		DESIGN CALCULATIONS		Detail						
		RUNOFF	TOTAL	SLOPE	DIA	CAPACITY	VEL.	RUNOFF	VEL.	CAPACITY
PIPE	CONTRIBUTING BASIN/PIPE	Q CFS	Q CFS	%	IN.	Qf CFS	Vf FT/S	RATIO Q/Qf	AT Q/QF	Q VS. Qf
1	Basin A-1	0.22	0.22	0.5	6	0.40	2.02	0.56	2.08	OK
2	Basin B + Basin H	0.28	0.28	0.5	6	0.40	2.02	0.71	2.18	OK
3	Pipe 1 + Pipe 2	0.00	0.51	0.5	8	0.85	2.45	0.59	2.55	OK
4	Basin A-2 + Pipe 3	0.23	0.74	0.5	8	0.85	2.45	0.86	2.75	OK
5	Basin A-3	0.22	0.22	0.5	6	0.40	2.02	0.56	2.08	OK
6	Basin A-4 + Pipe 5	0.23	0.45	0.5	8	0.85	2.45	0.53	2.47	OK
7	Pipe 4 + Pipe 6	0.00	1.19	0.5	10	1.55	2.84	0.77	2.98	OK
8	Basin C	0.31	0.31	0.5	8	0.85	2.45	0.36	2.23	OK
9	Basin D	0.29	0.29	0.5	8	0.85	2.45	0.34	2.19	OK
10	Pipe 7 + 8 + 9	0.00	1.78	0.79	12	3.17	4.03	0.56	4.15	OK

1	COTG-1 N=10148.91 E=9597.37 IE=189.71	11	NODE-3 N=10085.06 E=9697.18
2	COTG-2 N=10208.51 E=9663.13 IE=189.27	12	NODE-4 N=10082.23 E=9697.04
3	NODE-1 N=10153.42 E=9713.05	13	CB-2 N=10,042.96 E=9,646.25 RIM=191.19 IE 8" OUT=187.13 (SE)
4	COTG-3 N=10140.71 E=9712.43 IE=188.83	14	NODE-5 N=10040.74 E=9648.27
5	COTG-4 N=10135.48 E=9582.55 IE=189.71	15	NODE-6 N=10040.60 E=9651.09
6	COTG-5 N=10078.39 E=9519.54 IE=189.28	16	AD-1 N=10,064.06 E=9,513.72 RIM=190.95 IE 6" OUT=189.52 (NE)
7	NODE-2 N=10020.96 E=9571.57	17	MH-1 N=10,020.33 E=9,705.80 RIM=190.35 IE 10" IN=187.72 (NW) IE 12" OUT=187.62 (E)
8	COTG-6 N=10020.56 E=9579.83 IE=188.86	18	WQMH-1 (2 CARTRIDGE) N=10,020.39 E=9,915.99 RIM=189.10 IE 12" IN=185.52 (W) IE 12" OUT=184.06 (E)
9	COTG-7 N=10083.13 E=9648.88 IE=188.39 IE=188.39	19	COTG-8 N=10020.39 E=9926.99 IE=183.84
10	CB-1 N=10,087.28 E=9,695.16 RIM=191.28 IE 8" OUT=187.30 (SE)	20	STUB-1 N=10010.39 E=9926.99 IE=183.64

STORMWATER DESIGN

ALL STORMWATER SYSTEMS ARE DESIGNED PER THE CLEAN WATER SERVICES DESIGN STANDARDS (CWS).

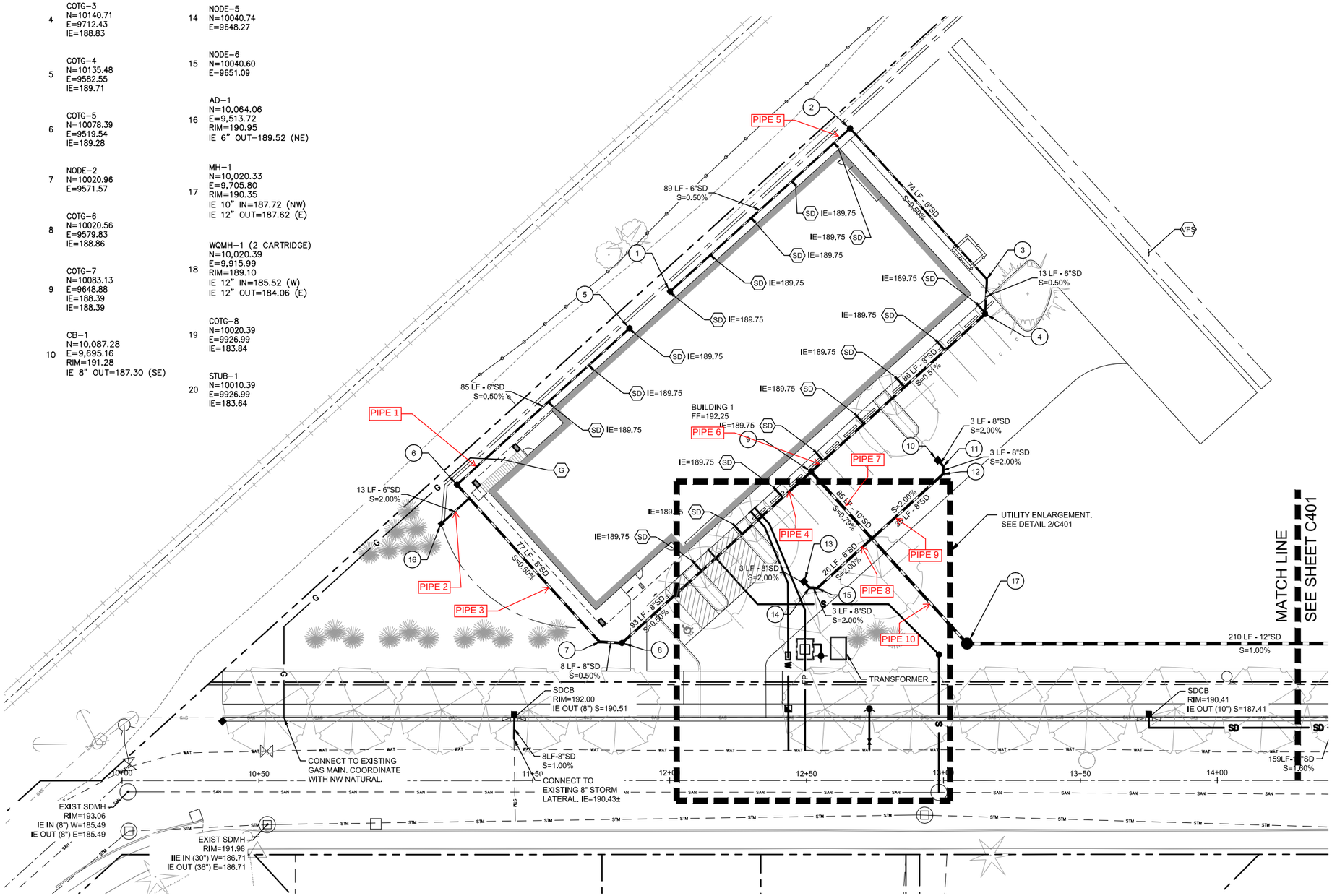
PER CWS 5.04.2 FLOW DETERMINATIONS WERE BASED ON THE RATIONAL METHOD FOR A 25-YEAR STORM EVENT OF 3.4 IN/HR.

PER CWS 4.05.6 WATER QUALITY VOLUMES AND FLOWS WERE DETERMINED:

$$\text{WQ VOLUME} = \frac{0.36(\text{in}) \times \text{AREA(sf)}}{12(\text{in/ft})} = 643 \text{ (cf)}$$

$$\text{WQ FLOW} = \frac{\text{WQ VOLUME}}{14{,}400(\text{sec})} = 0.045 \text{ (cfs)}$$

WQ TREATMENT IS PROVIDED VIA A 2-CARTRIDGE CONTECH STORMWATER QUALITY MANHOLE. TREATMENT CAPACITY = 0.033 (cfs/CARTRIDGE)



SHEET NOTES

1. PIPE BEDDING AND BACKFILL FOR ALL UTILITIES SHALL BE DONE PER DETAIL X/C5.X.
2. STRUCTURES LOCATIONS ARE BASED ON CENTER OF STRUCTURE.
3. INSTALL TRUST BLOCK ON FIRE AND WATER LINES PER DETAIL X & X/CX.X.

(X) KEY NOTES

1 COORDINATE WATER SERVICE POINT OF CONNECTION TO EXISTING X" MAIN WITH CITY OF XXX.

2 FIELD VERIFY LOCATION AND IE OF EXISTING XX" XXXXX LATERAL PRIOR TO CONSTRUCTION.

3 IRRIGATION BACKFLOW ASSEMBLY VAULT, SEE LANDSCAPE PLANS.

UTILITY LABEL LEGEND

STRUCTURE LABEL

UTILITY TYPE (SD=STORM DRAINAGE, S=SANITARY SEWER, W=WATER, FP=FIRE PROTECTION)
STRUCTURE TYPE CALLOUT
ID NUMBER (WHERE APPLICABLE)

XX XX-XX
N=XX.XX
E=XX.XX
RIM=
IE IN = XX.X
IE OUT = XX.X

LOCATION (WHERE APPLICABLE)
STRUCTURE INFO (WHERE APPLICABLE)

PIPE LABEL

UTILITY LENGTH
UTILITY SIZE
UTILITY TYPE

XXLF - XX" XX

S=X.XX%

SLOPE (WHERE APPLICABLE)

SHEET LEGEND

- (G) CONNECT TO GAS METER. CONTRACTOR TO COORDINATE WITH GAS COMPANY. SEE PLUMBING FOR CONTINUATION.
- (S) CONNECT TO WASTE LINE. SEE PLUMBING PLANS FOR CONTINUATION. SIZE AS NOTED.
- (SD) CONNECT TO STORM DRAIN/ROOF DRAIN. SEE PLUMBING PLANS FOR CONTINUATION. SIZE AND IE AS NOTED.
- (VFS) VEGETATED FILTER STRIP.
- (!!) UTILITY CROSSING. PROVIDE 12" MIN. CLEARANCE, U.N.O.

FROELICH ENGINEERS LLC
MAIN OFFICE:
6969 SW HAMPTON ST
PORTLAND, OREGON 97223
(503) 624-7005

BEND OFFICE:
745 NW MT WASHINGTON DR
SUITE #205
BEND, OREGON 97701

froelich-engineers.com

REGISTERED PROFESSIONAL ENGINEER 83603PE OREGON JUNE 2, 2000 EVAN M. EYKELBOSCH
RENEWS: 12/31/

SHEPARD BROTHERS MANAGEMENT

2830 NW 29TH AVE
PORTLAND, OR 97210

ZENPORT INDUSTRIAL PARK
BUILDING NO. 1

15104 SW OREGON STREET
SHERWOOD, OR 97140

SITE PLAN REVIEW SET

REV	DATE	ISSUE TITLE

PROJECT MANAGER:	EME
DESIGNER:	EME
DRAWN BY:	FCE-CIV-1
PROJECT NO:	---
DATE:	02/15/16
SCALE:	AS SHOWN

SHEET TITLE:
UTILITY PLAN

SHEET NUMBER:
C400

File: P:\2015\15-0312 (Zenport Phase 1)\Drafting-Civil\CAD\PLOT\15-0312_C400_UTIL.dwg TAB:C400

Plotted: 2/15/16 at 9:22am By: FCE-CIV-1

Appendix G: Downstream Analysis

BASIN MAP

SCALE:1"=400'

0 400' 800'

SHEET NO.

MAP

Project Description

File Name ..... SAS Zenport.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... Santa Barbara UH
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Dec 11, 2015 00:00:00
End Analysis On ..... Dec 12, 2015 00:00:00
Start Reporting On ..... Dec 11, 2015 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	8
Nodes	22
Junctions	21
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	21
Channels	0
Pipes	21
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-02	Time Series	25YR-24HR	Cumulative	inches	Oregon	Washington	25	3.90	SCS Type IA 24-hr

25-YEAR EVENT

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Basin-A	60.63	38.00	98.00	74.00	3.89	2.32	140.60	28.56	0 00:14:31
2	Basin-B	4.42	38.00	98.00	74.00	3.89	2.32	10.25	2.08	0 00:14:31
3	Basin-C	6.77	38.00	98.00	74.00	3.89	2.32	15.70	3.19	0 00:14:31
4	Basin-D	8.12	38.00	98.00	74.00	3.89	2.32	18.83	3.83	0 00:14:31
5	Basin-E	7.16	38.00	98.00	74.00	3.89	2.32	16.60	3.37	0 00:14:31
6	Basin-F	6.27	38.00	98.00	74.00	3.89	2.32	14.54	2.95	0 00:14:31
7	Basin-G	0.50	38.00	98.00	74.00	3.89	2.32	1.16	0.24	0 00:14:31
8	Basin-H	3.05	38.00	98.00	74.00	3.89	2.32	7.08	1.54	0 00:10:16

AVERAGE CN = 83
FOR 1/4 ACRE
RESIDENTIAL LOT

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Bend-1	Junction	178.30	185.80	178.30	0.00	0.00	35.28	180.41	0.00	5.39	0 00:00	0.00	0.00
2	Bend-2	Junction	177.38	183.90	177.38	0.00	0.00	35.27	179.49	0.00	4.41	0 00:00	0.00	0.00
3	Bend-3	Junction	168.50	178.50	168.50	0.00	0.00	39.07	169.88	0.00	8.62	0 00:00	0.00	0.00
4	Bend-4	Junction	165.69	170.73	165.69	0.00	0.00	42.43	167.33	0.00	3.40	0 00:00	0.00	0.00
5	Bend-5	Junction	158.80	163.87	158.80	0.00	0.00	42.42	160.12	0.00	3.75	0 00:00	0.00	0.00
6	Bend-6	Junction	157.05	161.20	157.05	0.00	0.00	42.43	158.37	0.00	2.83	0 00:00	0.00	0.00
7	Inlet-1	Junction	186.35	189.31	186.35	0.00	0.00	2.08	186.95	0.00	2.36	0 00:00	0.00	0.00
8	Inlet-2	Junction	187.64	192.02	187.64	0.00	0.00	3.19	188.32	0.00	3.70	0 00:00	0.00	0.00
9	Inlet-3	Junction	174.88	180.57	174.88	0.00	0.00	3.83	176.29	0.00	4.28	0 00:00	0.00	0.00
10	Inlet-4	Junction	176.45	180.00	176.45	0.00	0.00	3.37	177.11	0.00	2.89	0 00:00	0.00	0.00
11	Inlet-5	Junction	170.00	172.00	170.00	0.00	0.00	3.36	170.66	0.00	1.34	0 00:00	0.00	0.00
12	Inlet-6	Junction	157.60	159.12	157.60	0.00	0.00	2.95	157.98	0.00	1.15	0 00:00	0.00	0.00
13	Inlet-7	Junction	155.06	158.06	155.06	0.00	0.00	0.24	155.23	0.00	2.83	0 00:00	0.00	0.00
14	MH-1	Junction	187.20	192.62	187.20	0.00	0.00	28.56	188.75	0.00	3.87	0 00:00	0.00	0.00
15	MH-2	Junction	186.71	192.65	186.71	0.00	0.00	28.56	188.42	0.00	4.23	0 00:00	0.00	0.00
16	MH-3	Junction	185.58	192.38	185.58	0.00	0.00	30.59	187.29	0.00	5.09	0 00:00	0.00	0.00
17	MH-4	Junction	182.06	188.89	182.06	0.00	0.00	35.28	185.46	0.00	3.43	0 00:00	0.00	0.00
18	MH-5	Junction	174.60	180.51	174.60	0.00	0.00	39.07	175.78	0.00	4.73	0 00:00	0.00	0.00
19	MH-6	Junction	166.00	173.91	166.00	0.00	0.00	42.43	168.53	0.00	5.38	0 00:00	0.00	0.00
20	MH-7	Junction	154.16	160.98	154.16	0.00	0.00	45.36	156.38	0.00	4.60	0 00:00	0.00	0.00
21	MH-8	Junction	153.11	159.27	153.11	0.00	0.00	45.59	154.82	0.00	4.45	0 00:00	0.00	0.00
22	Outlet-1	Outfall	150.20					45.59	151.39					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	Pipe 1	Pipe	MH-1	MH-2	50.48	187.20	186.71	0.9700	30.000	0.0130	28.56	40.41	0.71	8.92	1.55	0.62	0.00	Calculated
2	Pipe 10	Pipe	Bend-4	Bend-5	153.21	165.69	158.80	4.5000	36.000	0.0130	42.42	141.44	0.30	17.48	1.13	0.38	0.00	Calculated
3	Pipe 11	Pipe	Bend-5	Bend-6	69.48	158.80	157.05	2.5200	36.000	0.0130	42.43	105.85	0.40	14.15	1.32	0.44	0.00	Calculated
4	Pipe 12	Pipe	Bend-6	MH-7	37.00	157.05	154.46	7.0000	36.000	0.0130	42.43	176.47	0.24	20.52	1.00	0.33	0.00	Calculated
5	Pipe 13	Pipe	MH-7	MH-8	76.75	154.16	153.11	1.3700	36.000	0.0130	45.35	78.01	0.58	11.45	1.64	0.55	0.00	Calculated
6	Pipe 14	Pipe	MH-8	Outlet-1	68.00	153.11	150.20	4.2800	36.000	0.0130	45.59	137.98	0.33	17.51	1.19	0.40	0.00	Calculated
7	Pipe 15	Pipe	Inlet-7	MH-8	36.92	155.06	154.65	1.1100	12.000	0.0130	0.24	3.75	0.06	2.66	0.17	0.17	0.00	Calculated
8	Pipe 16	Pipe	Inlet-1	MH-3	102.15	186.35	185.58	0.7500	12.000	0.0130	2.08	3.09	0.67	4.22	0.60	0.60	0.00	Calculated
9	Pipe 17	Pipe	Inlet-2	MH-4	388.23	187.64	184.78	0.7400	15.000	0.0130	3.18	5.54	0.57	4.67	0.68	0.54	0.00	Calculated
10	Pipe 18	Pipe	Inlet-3	MH-5	100.00	175.60	174.60	1.0000	15.000	0.0130	3.82	6.46	0.59	5.48	0.69	0.55	0.00	Calculated
11	Pipe 19	Pipe	Inlet-4	Inlet-5	433.00	176.45	170.00	1.4900	12.000	0.0130	3.36	4.35	0.77	6.12	0.66	0.66	0.00	Calculated
12	Pipe 2	Pipe	MH-2	MH-3	238.41	186.71	185.58	0.4700	36.000	0.0130	28.51	45.92	0.62	6.84	1.71	0.57	0.00	Calculated
13	Pipe 20	Pipe	Inlet-5	MH-6	67.00	170.00	168.00	2.9900	12.000	0.0130	3.36	6.16	0.55	8.01	0.53	0.53	0.00	Calculated
14	Pipe 21	Pipe	Inlet-6	MH-7	21.31	157.60	156.00	7.5100	12.000	0.0130	2.95	9.76	0.30	10.89	0.38	0.38	0.00	Calculated
15	Pipe 3	Pipe	MH-3	MH-4	238.47	185.58	182.06	1.4800	36.000	0.0130	30.58	81.03	0.38	10.65	1.28	0.43	0.00	Calculated
16	Pipe 4	Pipe	MH-4	Bend-1	132.43	182.06	178.30	2.8400	36.000	0.0130	35.28	112.39	0.31	14.06	1.16	0.39	0.00	Calculated
17	Pipe 5	Pipe	Bend-1	Bend-2	231.88	178.30	177.38	0.4000	36.000	0.0130	35.27	42.01	0.84	6.67	2.11	0.70	0.00	Calculated
18	Pipe 6	Pipe	Bend-2	MH-5	15.33	177.38	174.60	18.1300	36.000	0.0130	35.27	284.02	0.12	27.38	0.71	0.24	0.00	Calculated
19	Pipe 7	Pipe	MH-5	Bend-3	191.76	174.60	168.50	3.1800	36.000	0.0130	39.07	118.96	0.33	15.07	1.18	0.39	0.00	Calculated
20	Pipe 8	Pipe	Bend-3	MH-6	137.18	168.50	166.00	1.8200	36.000	0.0130	39.07	90.04	0.43	12.29	1.38	0.46	0.00	Calculated
21	Pipe 9	Pipe	MH-6	Bend-4	25.50	166.00	165.69	1.2200	36.000	0.0130	42.43	73.54	0.58	10.77	1.64	0.55	0.00	Calculated

NO PIPE OVERFLOW

Subbasin Hydrology

Subbasin : Basin-A

Input Data

Area (ac) 60.63
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	60.63		83.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

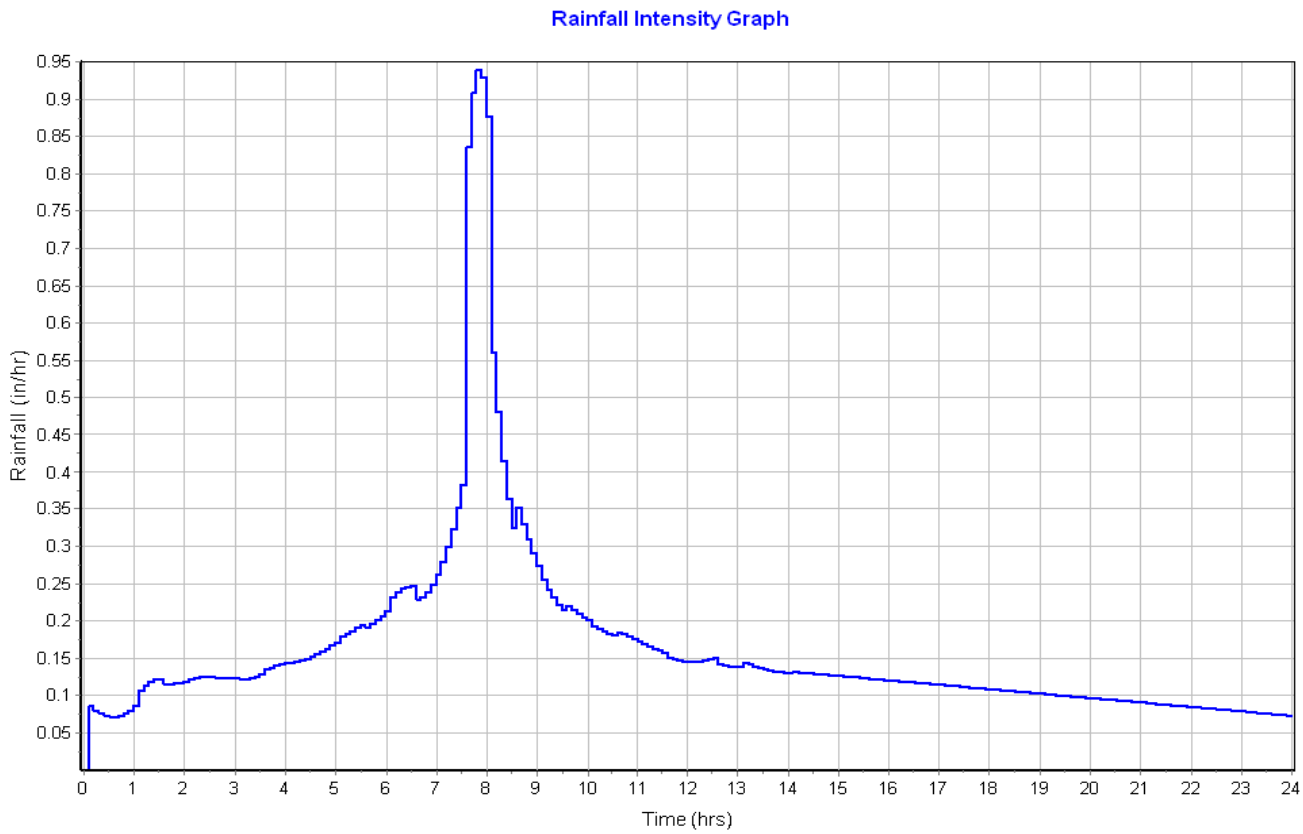
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

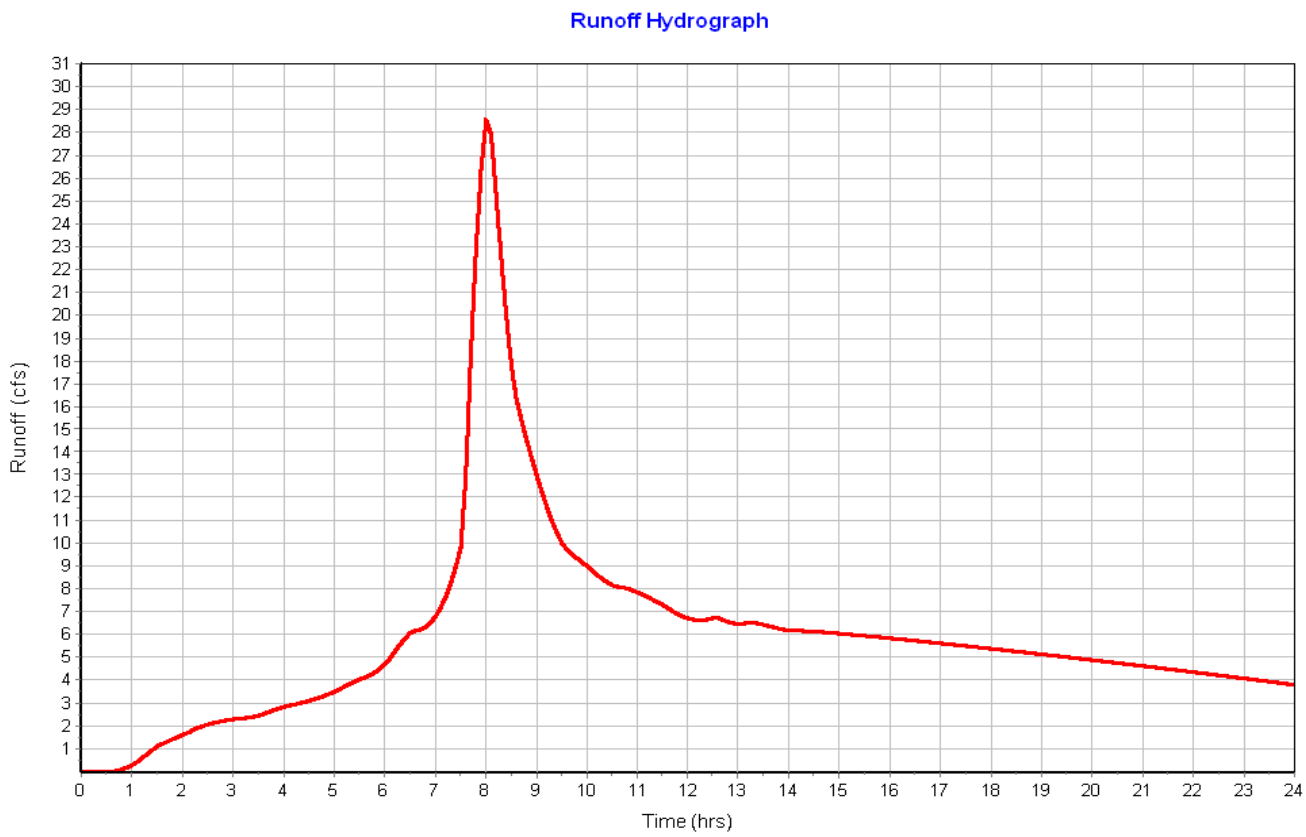
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 28.56
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-A





Subbasin : Basin-B

Input Data

Area (ac) 4.42
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	4.42		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

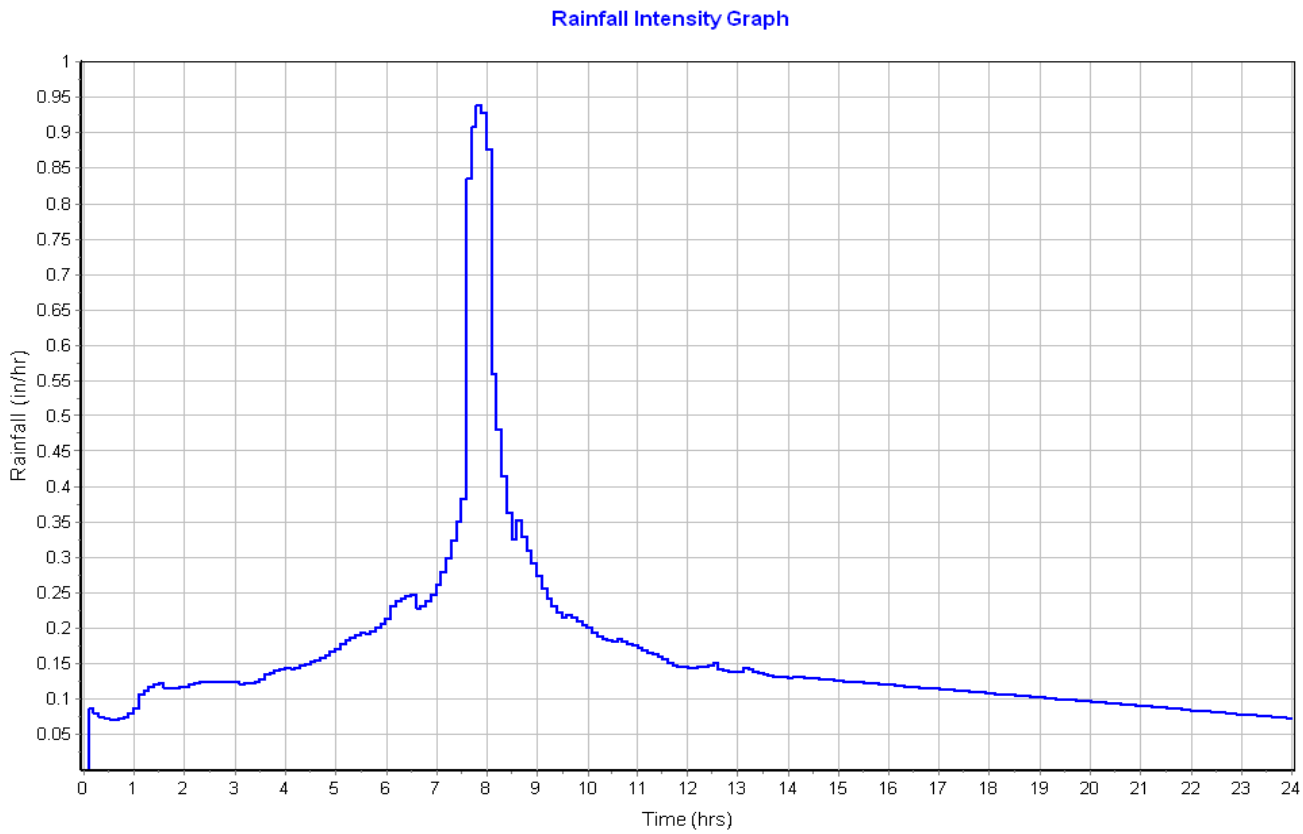
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

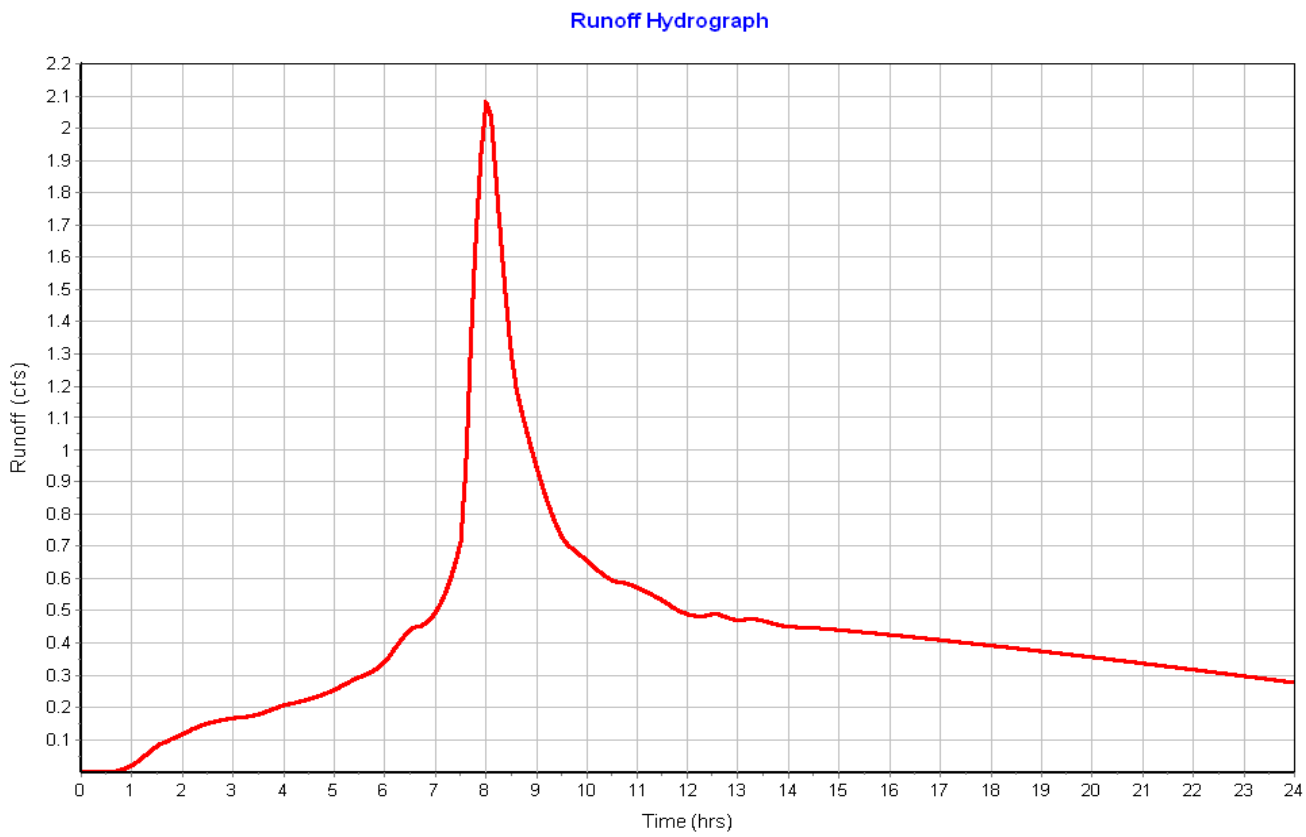
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 2.08
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-B





Subbasin : Basin-C

Input Data

Area (ac) 6.77
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	6.77		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

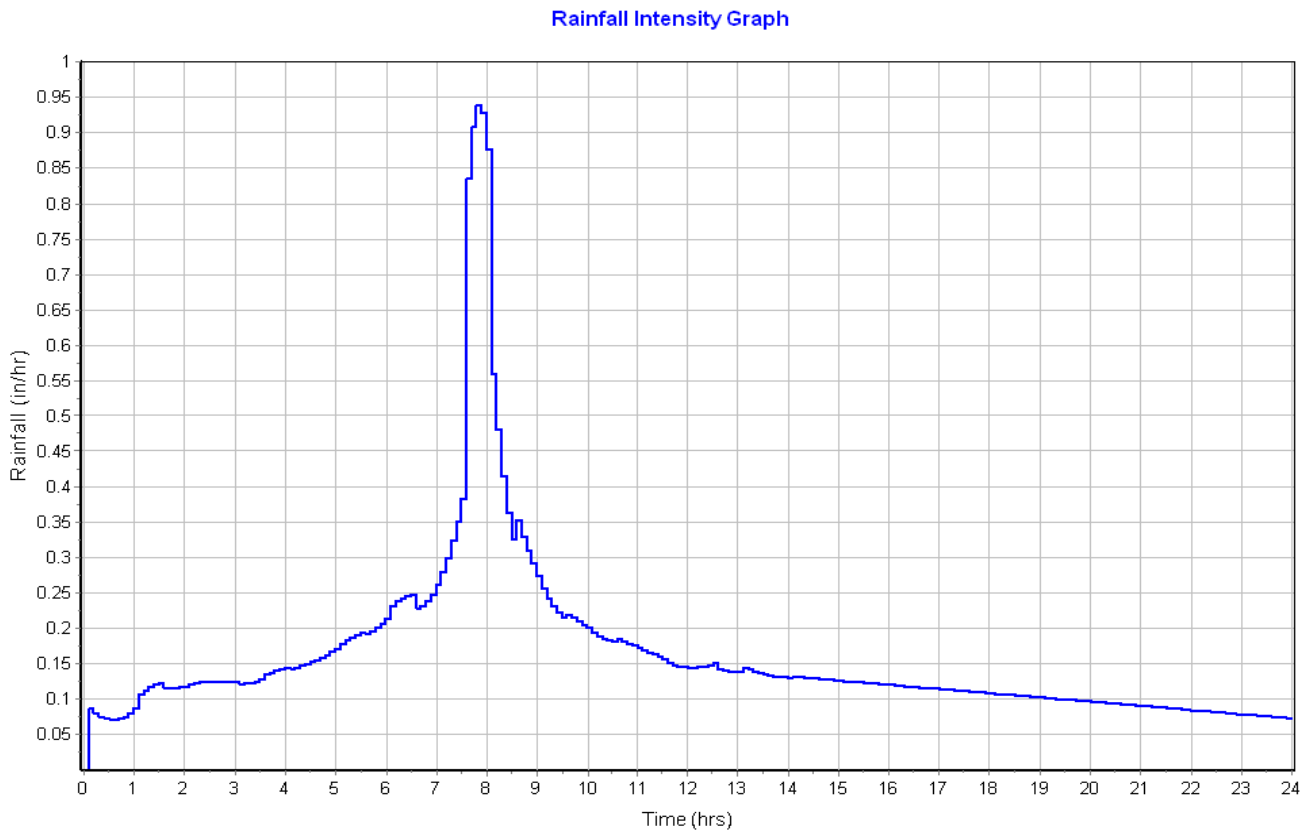
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

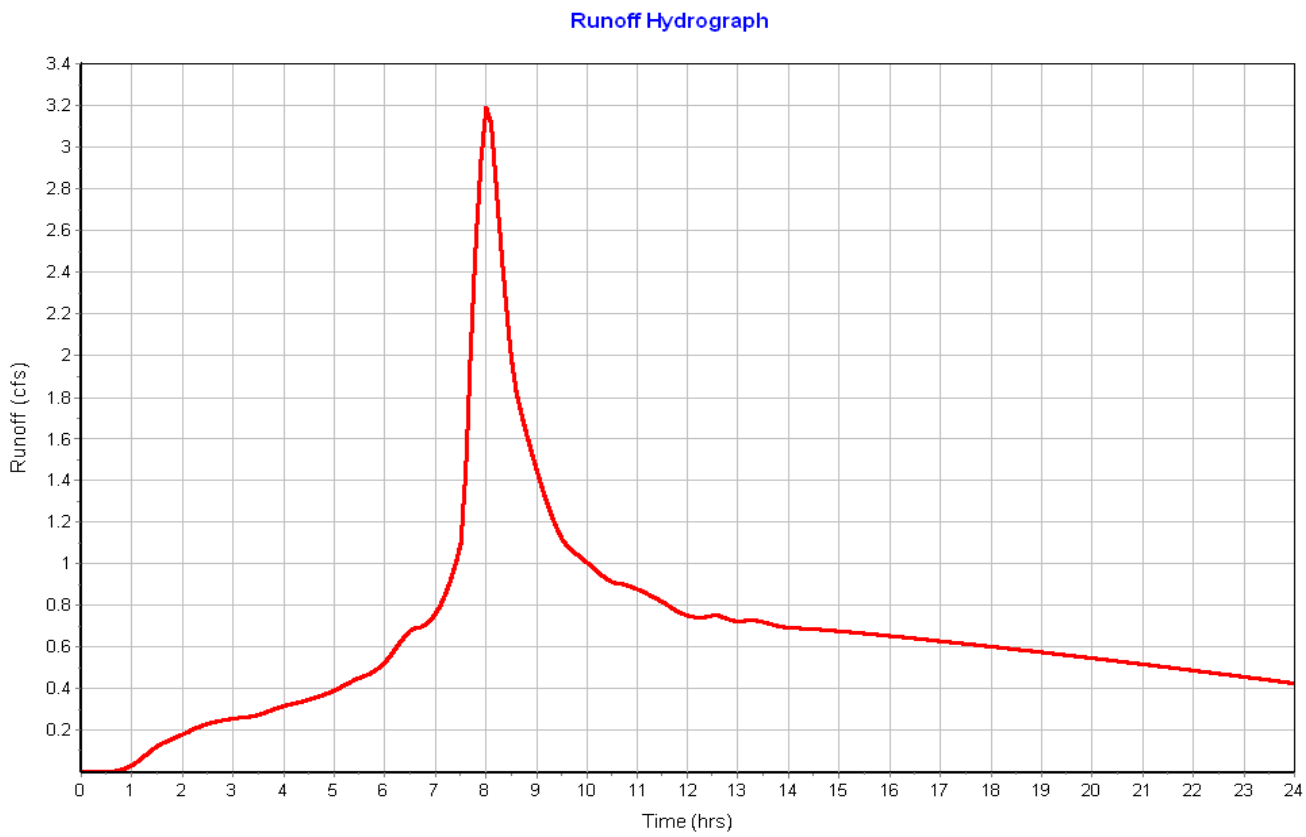
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 3.19
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-C





Subbasin : Basin-D

Input Data

Area (ac) 8.12
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	8.12		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

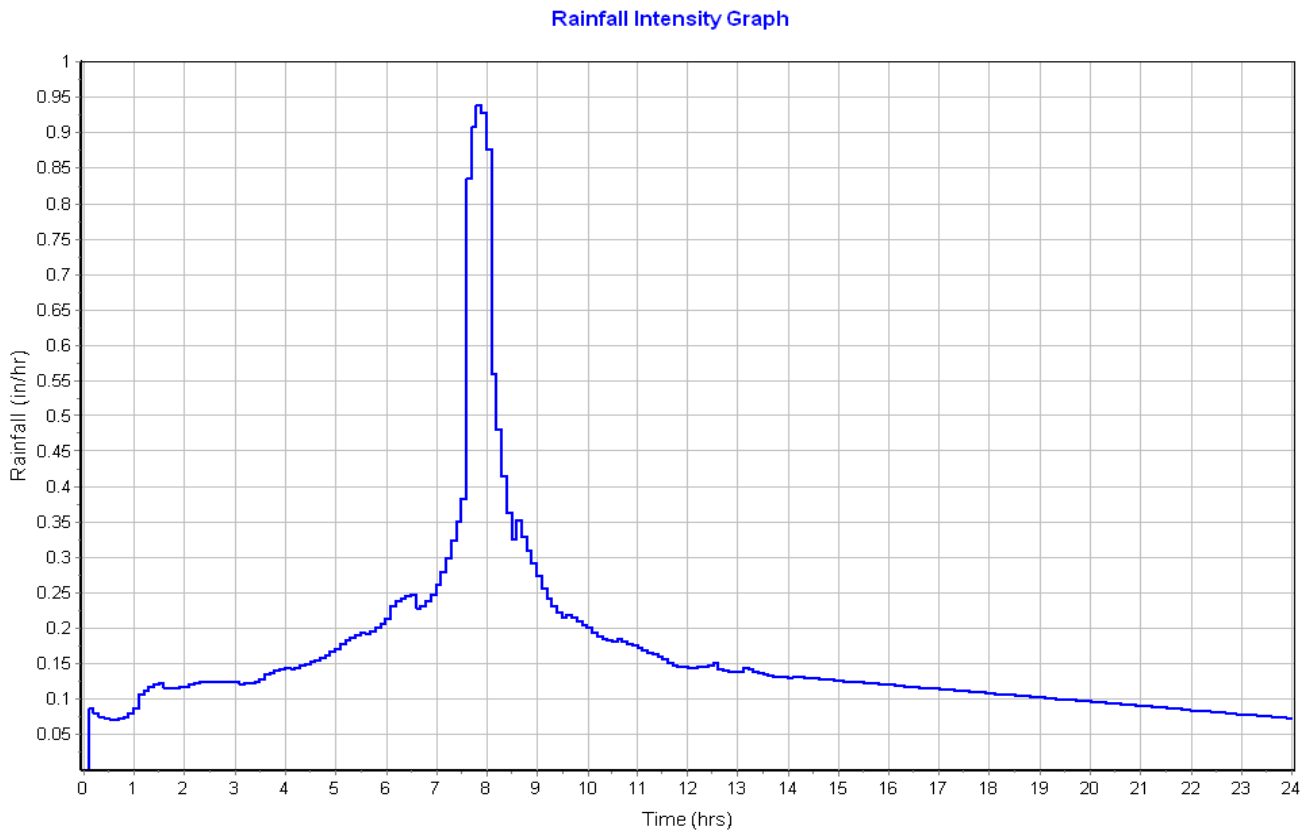
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

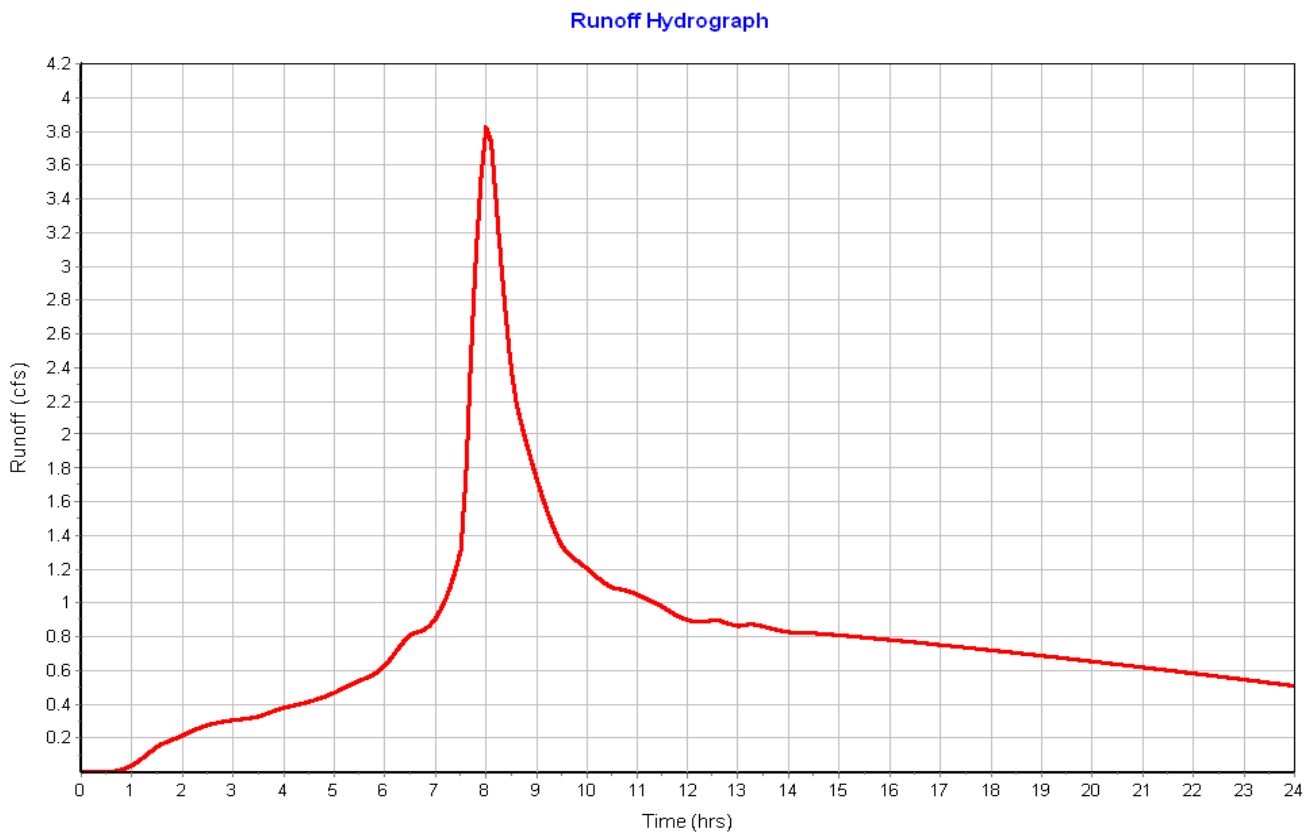
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 3.83
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-D





Subbasin : Basin-E

Input Data

Area (ac) 7.16
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	7.16		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

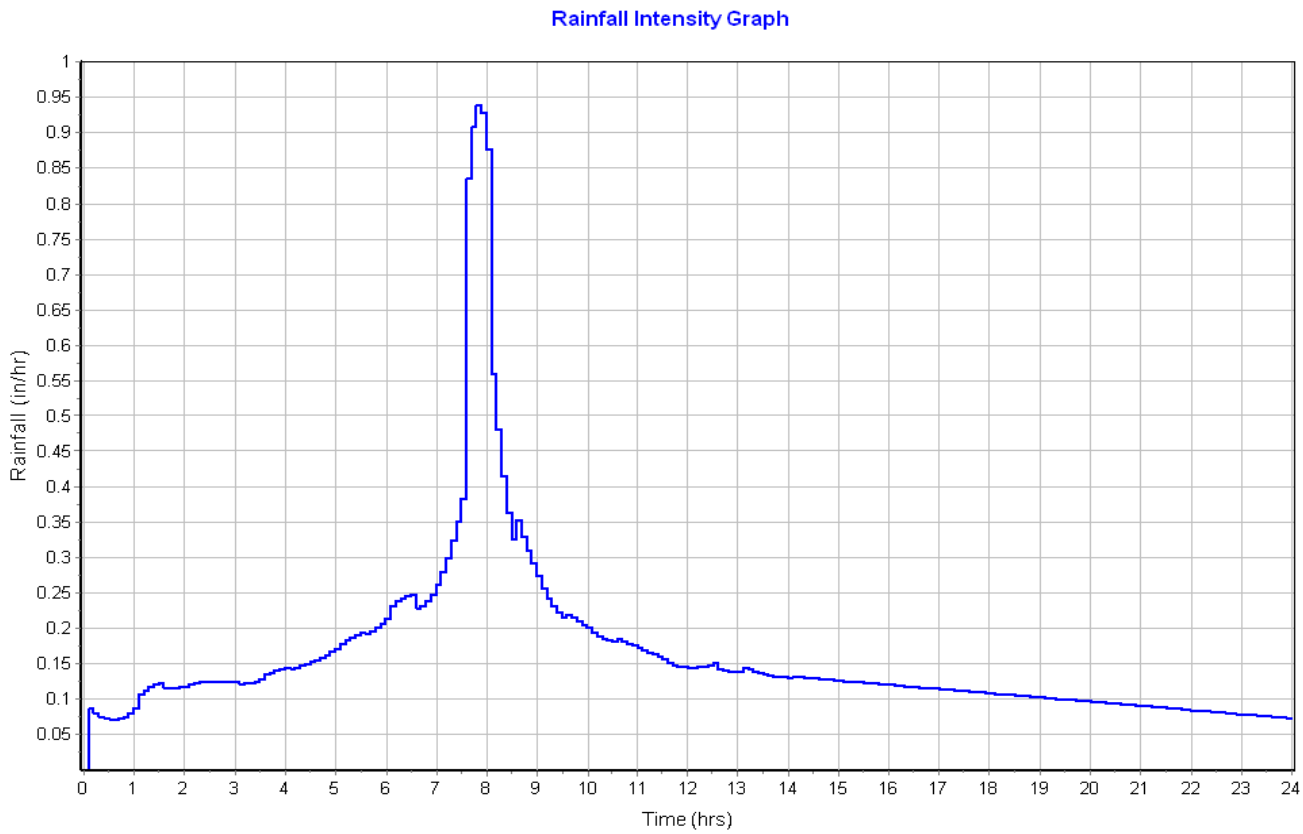
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

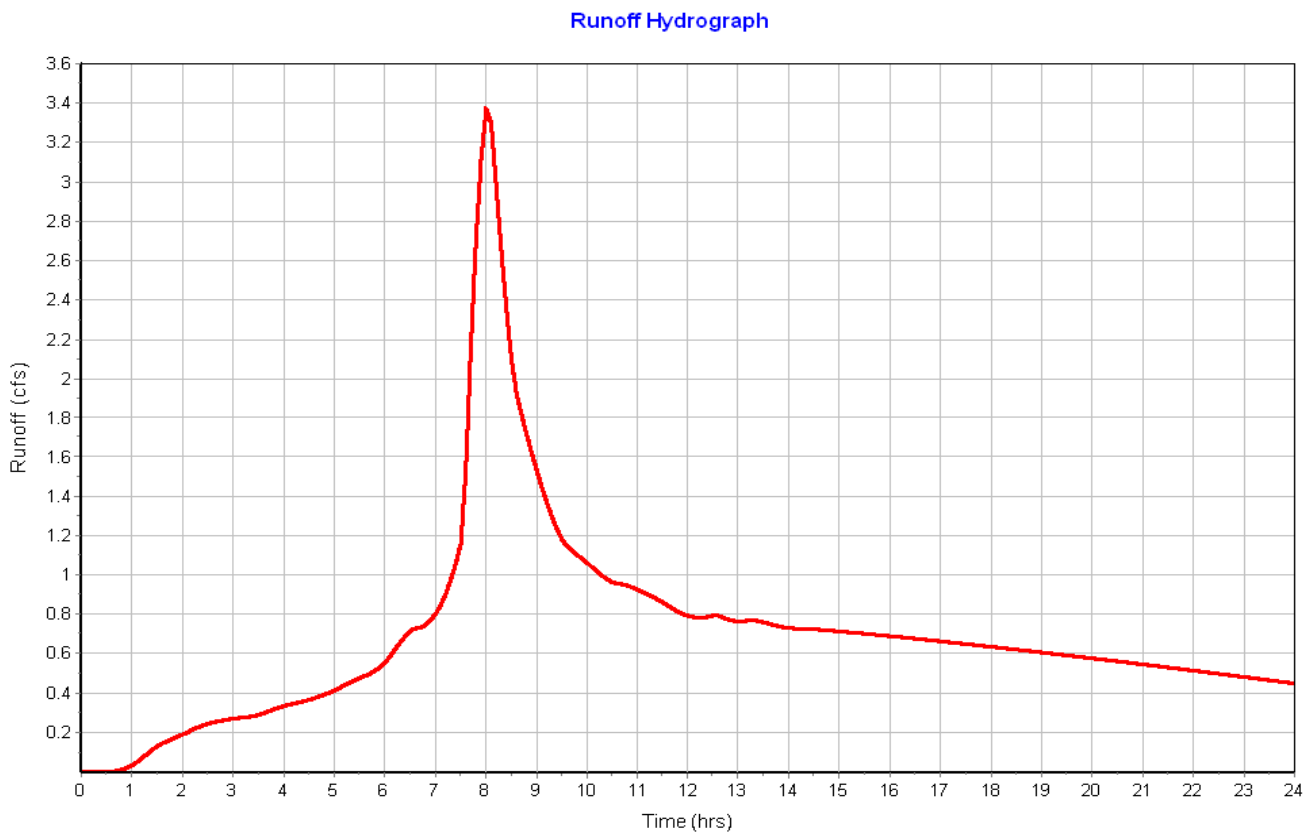
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 3.37
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-E





Subbasin : Basin-F

Input Data

Area (ac) 6.27
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	6.27		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

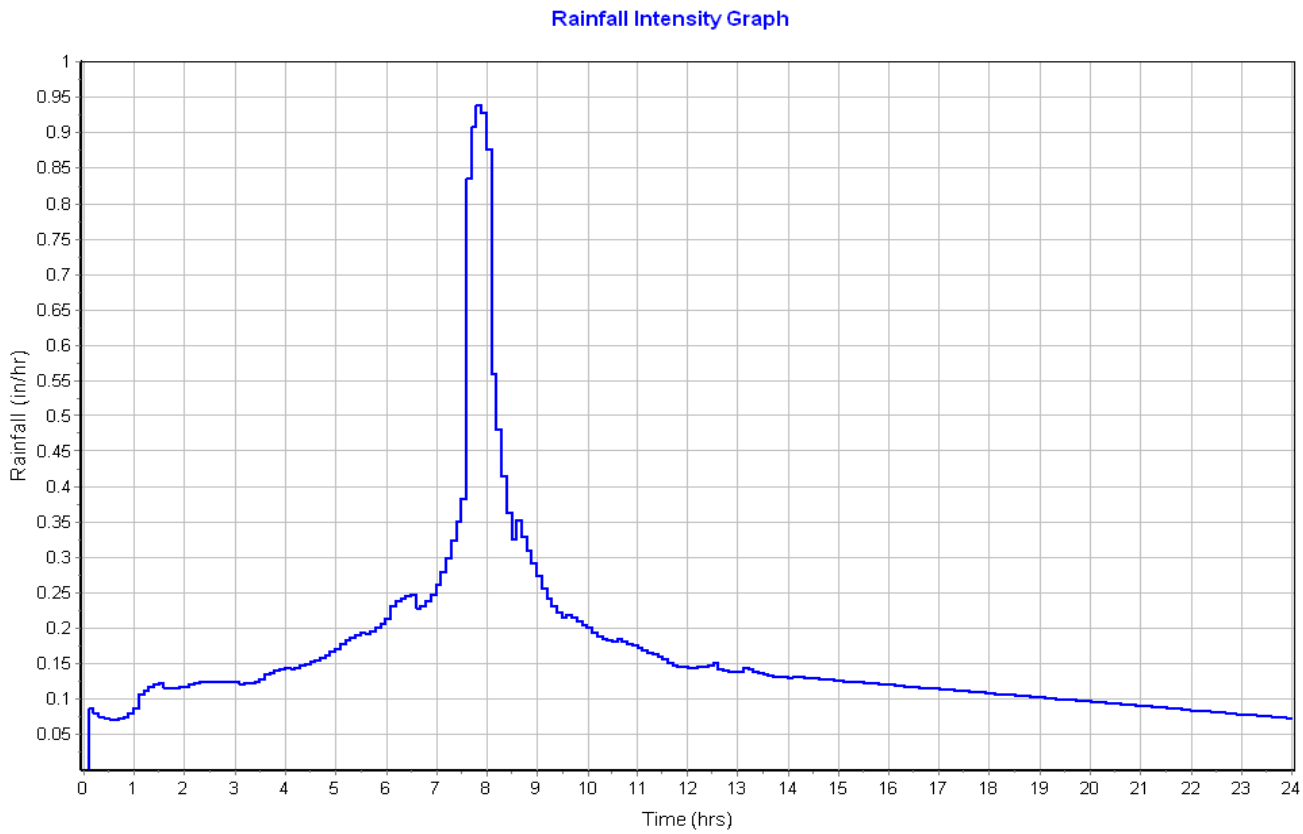
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

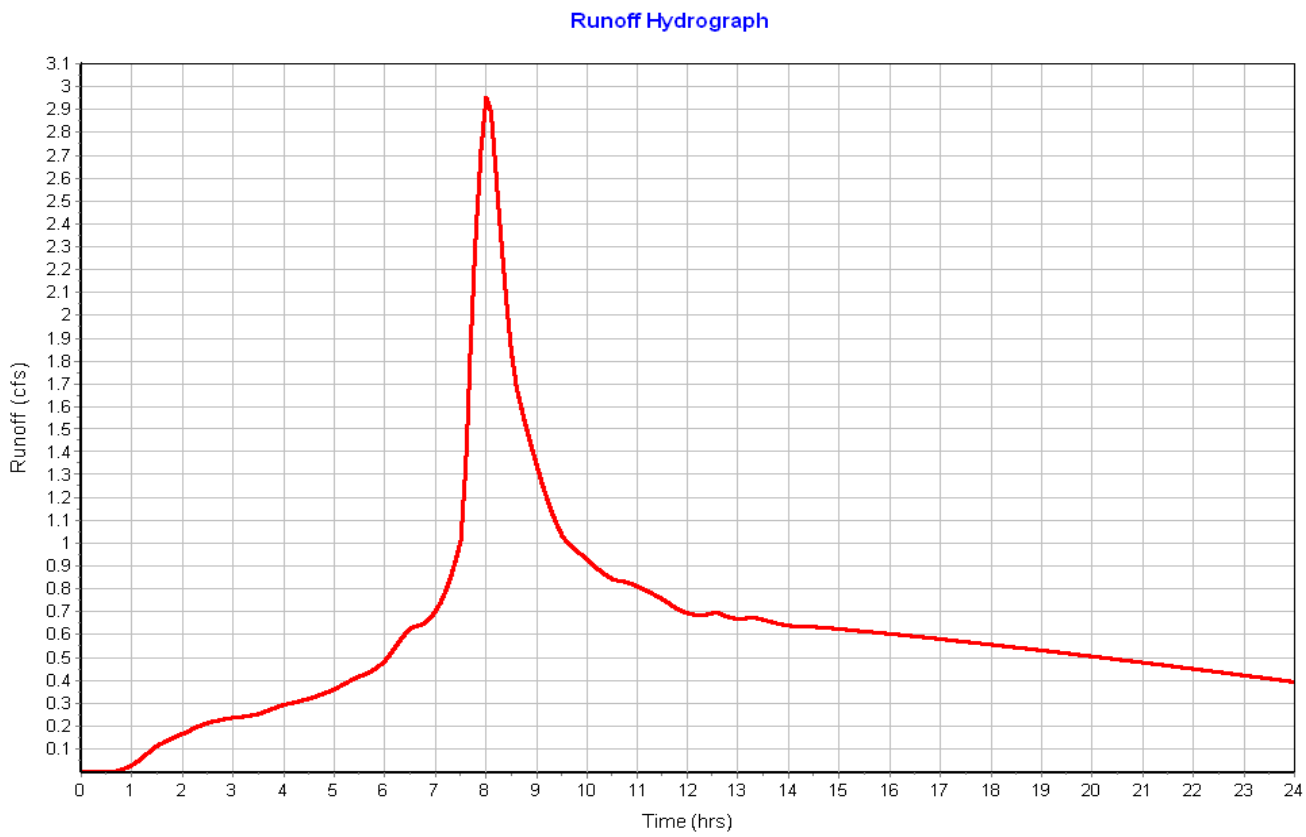
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 2.95
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-F





Subbasin : Basin-G

Input Data

Area (ac) 0.50
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.50		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.95	0.00	0.00

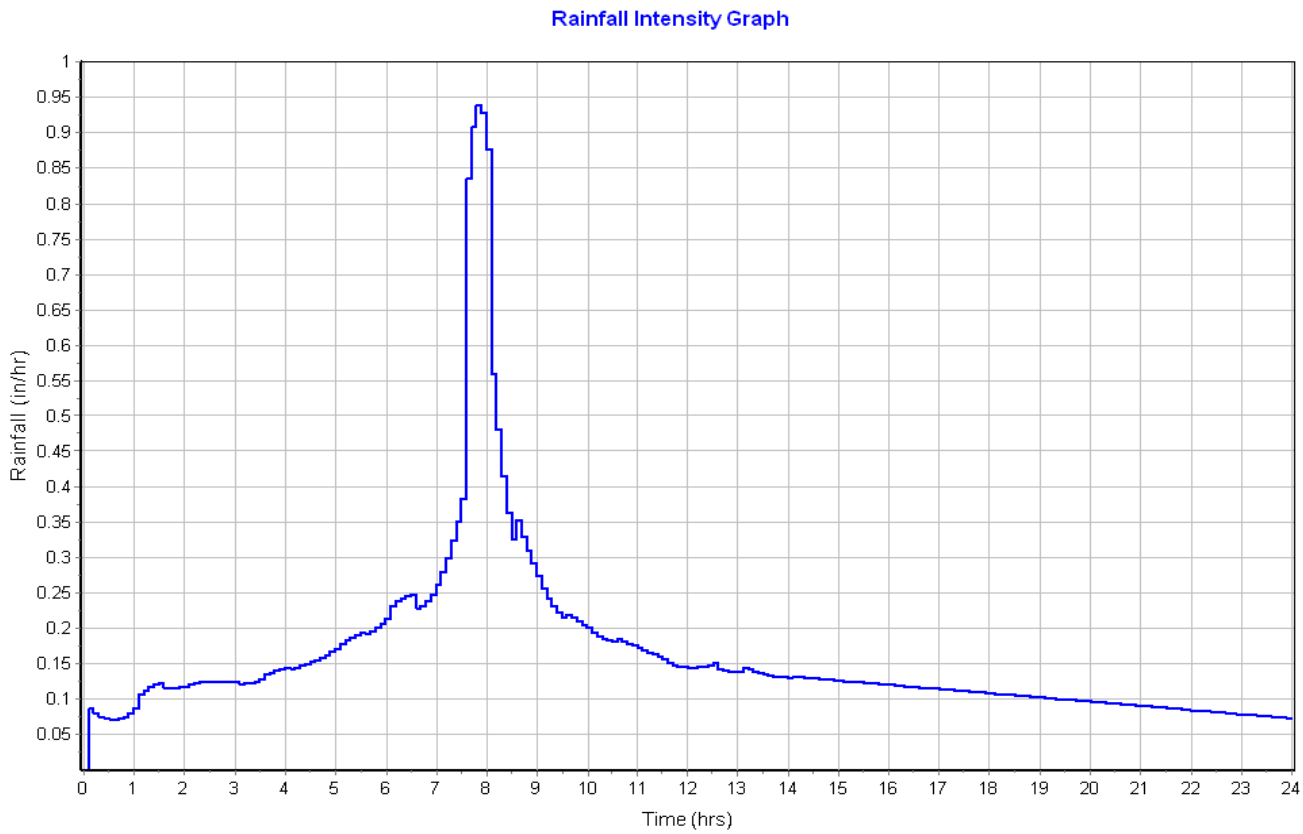
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

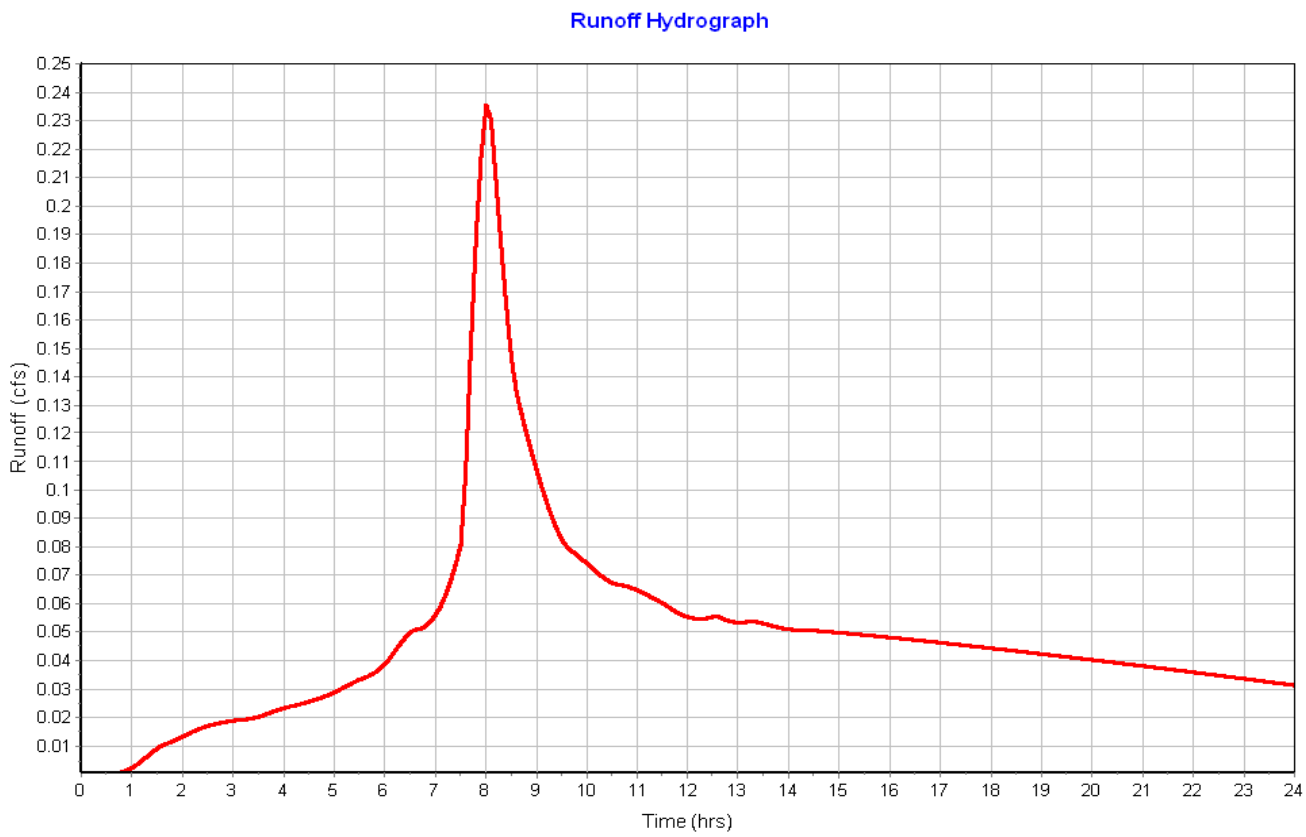
Total TOC (min) 14.53

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 0.24
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:14:32

Subbasin : Basin-G





Subbasin : Basin-H

Input Data

Area (ac) 3.05
Impervious Area (%) 38.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 74.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	3.05		83.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.11	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.5	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	9.70	0.00	0.00

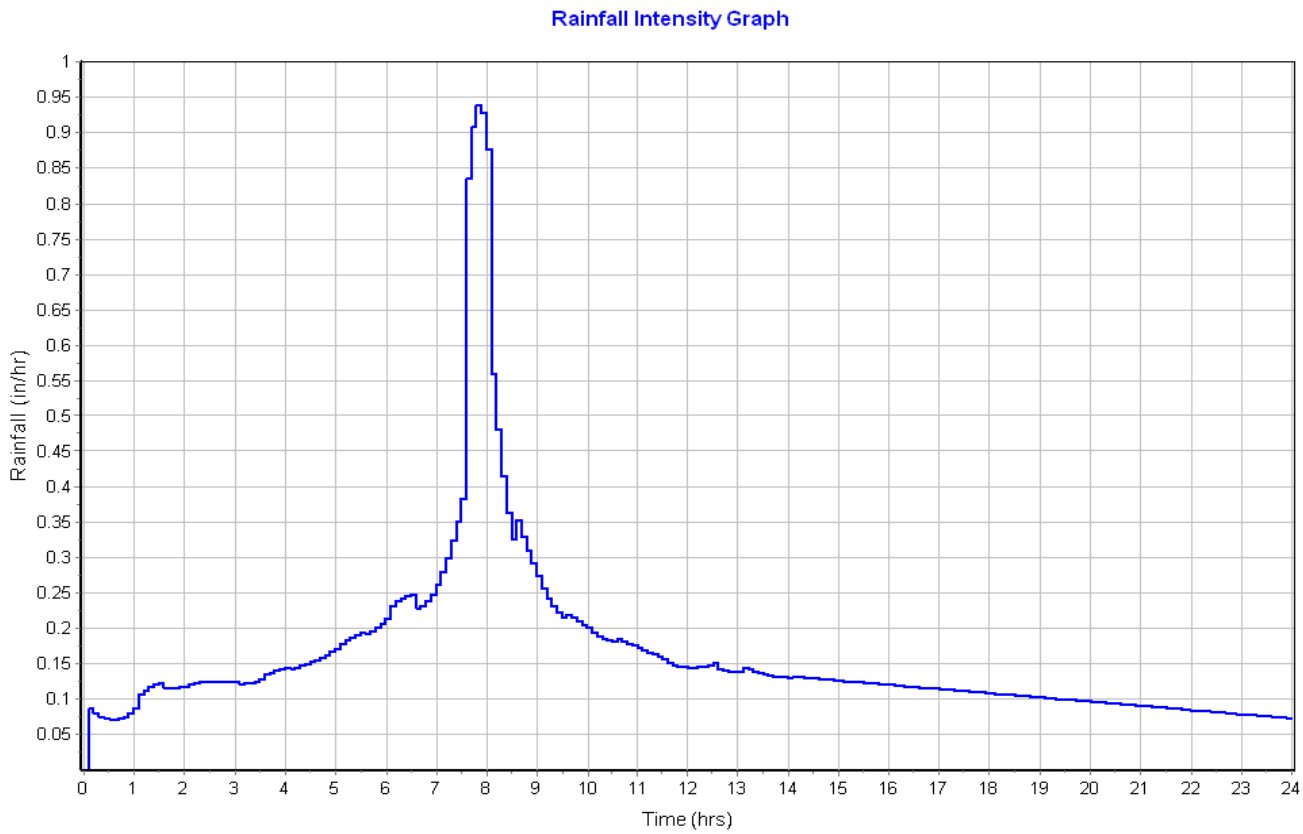
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	0.58	0.00	0.00

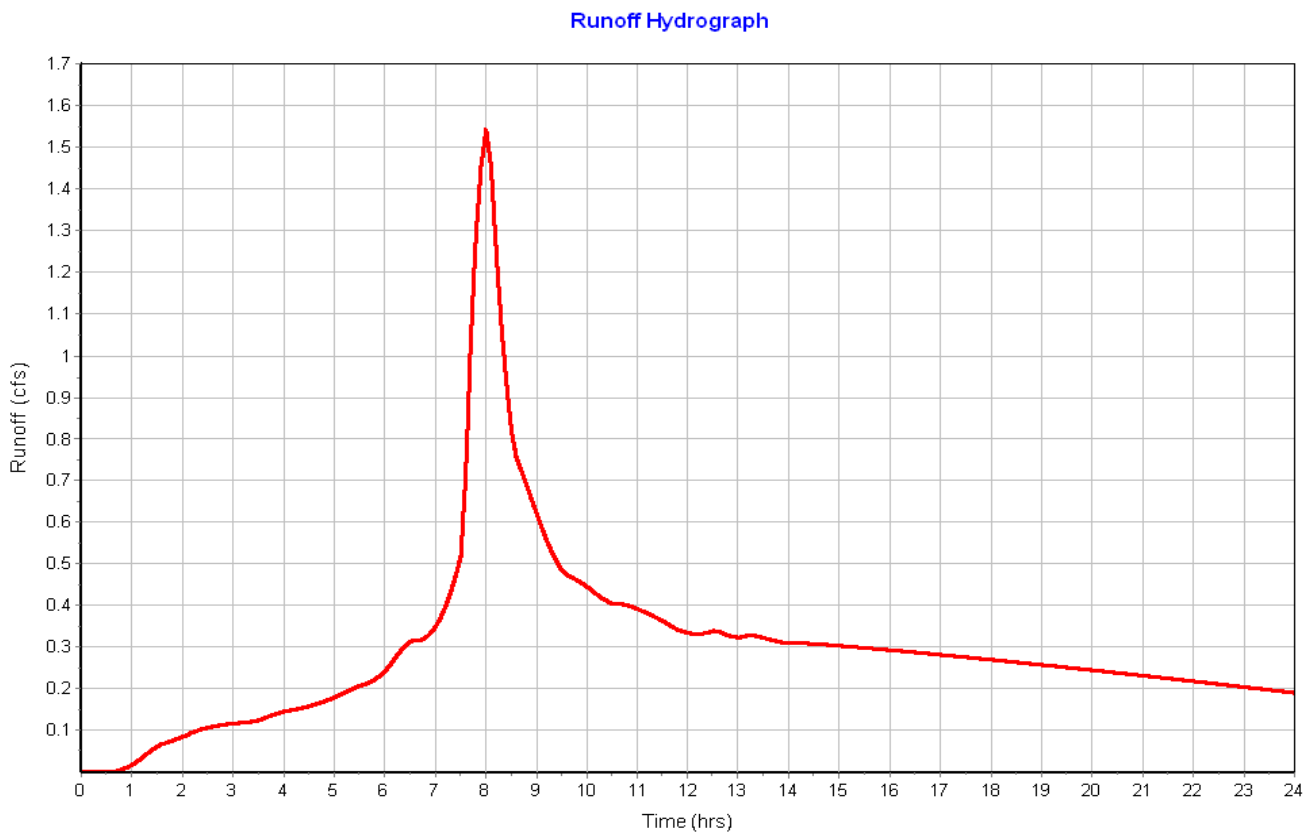
Total TOC (min) 10.28

Subbasin Runoff Results

Total Rainfall (in) 3.89
Total Runoff (in) 2.32
Peak Runoff (cfs) 1.54
Weighted Curve Number 83.12
Time of Concentration (days hh:mm:ss) 0 00:10:17

Subbasin : Basin-H





Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Bend-1	178.30	185.80	7.50	178.30	0.00	0.00	-185.80	0.00	0.00
2	Bend-2	177.38	183.90	6.52	177.38	0.00	0.00	-183.90	0.00	0.00
3	Bend-3	168.50	178.50	10.00	168.50	0.00	0.00	-178.50	0.00	0.00
4	Bend-4	165.69	170.73	5.04	165.69	0.00	0.00	-170.73	0.00	0.00
5	Bend-5	158.80	163.87	5.07	158.80	0.00	0.00	-163.87	0.00	0.00
6	Bend-6	157.05	161.20	4.15	157.05	0.00	0.00	-161.20	0.00	0.00
7	Inlet-1	186.35	189.31	2.96	186.35	0.00	0.00	-189.31	0.00	0.00
8	Inlet-2	187.64	192.02	4.38	187.64	0.00	0.00	-192.02	0.00	0.00
9	Inlet-3	174.88	180.57	5.69	174.88	0.00	0.00	-180.57	0.00	0.00
10	Inlet-4	176.45	180.00	3.55	176.45	0.00	0.00	-180.00	0.00	0.00
11	Inlet-5	170.00	172.00	2.00	170.00	0.00	0.00	-172.00	0.00	0.00
12	Inlet-6	157.60	159.12	1.52	157.60	0.00	0.00	-159.12	0.00	0.00
13	Inlet-7	155.06	158.06	3.00	155.06	0.00	0.00	-158.06	0.00	0.00
14	MH-1	187.20	192.62	5.42	187.20	0.00	0.00	-192.62	0.00	0.00
15	MH-2	186.71	192.65	5.94	186.71	0.00	0.00	-192.65	0.00	0.00
16	MH-3	185.58	192.38	6.80	185.58	0.00	0.00	-192.38	0.00	0.00
17	MH-4	182.06	188.89	6.83	182.06	0.00	0.00	-188.89	0.00	0.00
18	MH-5	174.60	180.51	5.91	174.60	0.00	0.00	-180.51	0.00	0.00
19	MH-6	166.00	173.91	7.91	166.00	0.00	0.00	-173.91	0.00	0.00
20	MH-7	154.16	160.98	6.82	154.16	0.00	0.00	-160.98	0.00	0.00
21	MH-8	153.11	159.27	6.16	153.11	0.00	0.00	-159.27	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Bend-1	35.28	0.00	180.41	2.11	0.00	5.39	179.10	0.80	0 08:01	0 00:00	0.00	0.00
2	Bend-2	35.27	0.00	179.49	2.11	0.00	4.41	178.18	0.80	0 08:01	0 00:00	0.00	0.00
3	Bend-3	39.07	0.00	169.88	1.38	0.00	8.62	169.07	0.57	0 08:02	0 00:00	0.00	0.00
4	Bend-4	42.43	0.00	167.33	1.64	0.00	3.40	166.35	0.66	0 08:02	0 00:00	0.00	0.00
5	Bend-5	42.42	0.00	160.12	1.32	0.00	3.75	159.35	0.55	0 08:02	0 00:00	0.00	0.00
6	Bend-6	42.43	0.00	158.37	1.32	0.00	2.83	157.60	0.55	0 08:02	0 00:00	0.00	0.00
7	Inlet-1	2.08	2.08	186.95	0.60	0.00	2.36	186.59	0.24	0 08:00	0 00:00	0.00	0.00
8	Inlet-2	3.19	3.19	188.32	0.68	0.00	3.70	187.91	0.27	0 08:00	0 00:00	0.00	0.00
9	Inlet-3	3.83	3.83	176.29	1.41	0.00	4.28	175.88	1.00	0 08:00	0 00:00	0.00	0.00
10	Inlet-4	3.37	3.37	177.11	0.66	0.00	2.89	176.71	0.26	0 08:00	0 00:00	0.00	0.00
11	Inlet-5	3.36	0.00	170.66	0.66	0.00	1.34	170.26	0.26	0 08:01	0 00:00	0.00	0.00
12	Inlet-6	2.95	2.95	157.98	0.38	0.00	1.15	157.76	0.16	0 08:00	0 00:00	0.00	0.00
13	Inlet-7	0.24	0.24	155.23	0.17	0.00	2.83	155.14	0.08	0 08:00	0 00:00	0.00	0.00
14	MH-1	28.56	28.56	188.75	1.55	0.00	3.87	187.81	0.61	0 08:00	0 00:00	0.00	0.00
15	MH-2	28.56	0.00	188.42	1.71	0.00	4.23	187.40	0.69	0 08:00	0 00:00	0.00	0.00
16	MH-3	30.59	0.00	187.29	1.71	0.00	5.09	186.26	0.68	0 08:01	0 00:00	0.00	0.00
17	MH-4	35.28	1.54	185.46	3.40	0.00	3.43	185.05	2.99	0 08:01	0 00:00	0.00	0.00
18	MH-5	39.07	0.00	175.78	1.18	0.00	4.73	175.10	0.50	0 08:01	0 00:00	0.00	0.00
19	MH-6	42.43	0.00	168.53	2.53	0.00	5.38	168.21	2.21	0 08:01	0 00:00	0.00	0.00
20	MH-7	45.36	0.00	156.38	2.22	0.00	4.60	156.16	2.00	0 08:00	0 00:00	0.00	0.00
21	MH-8	45.59	0.00	154.82	1.71	0.00	4.45	154.72	1.61	0 08:00	0 00:00	0.00	0.00

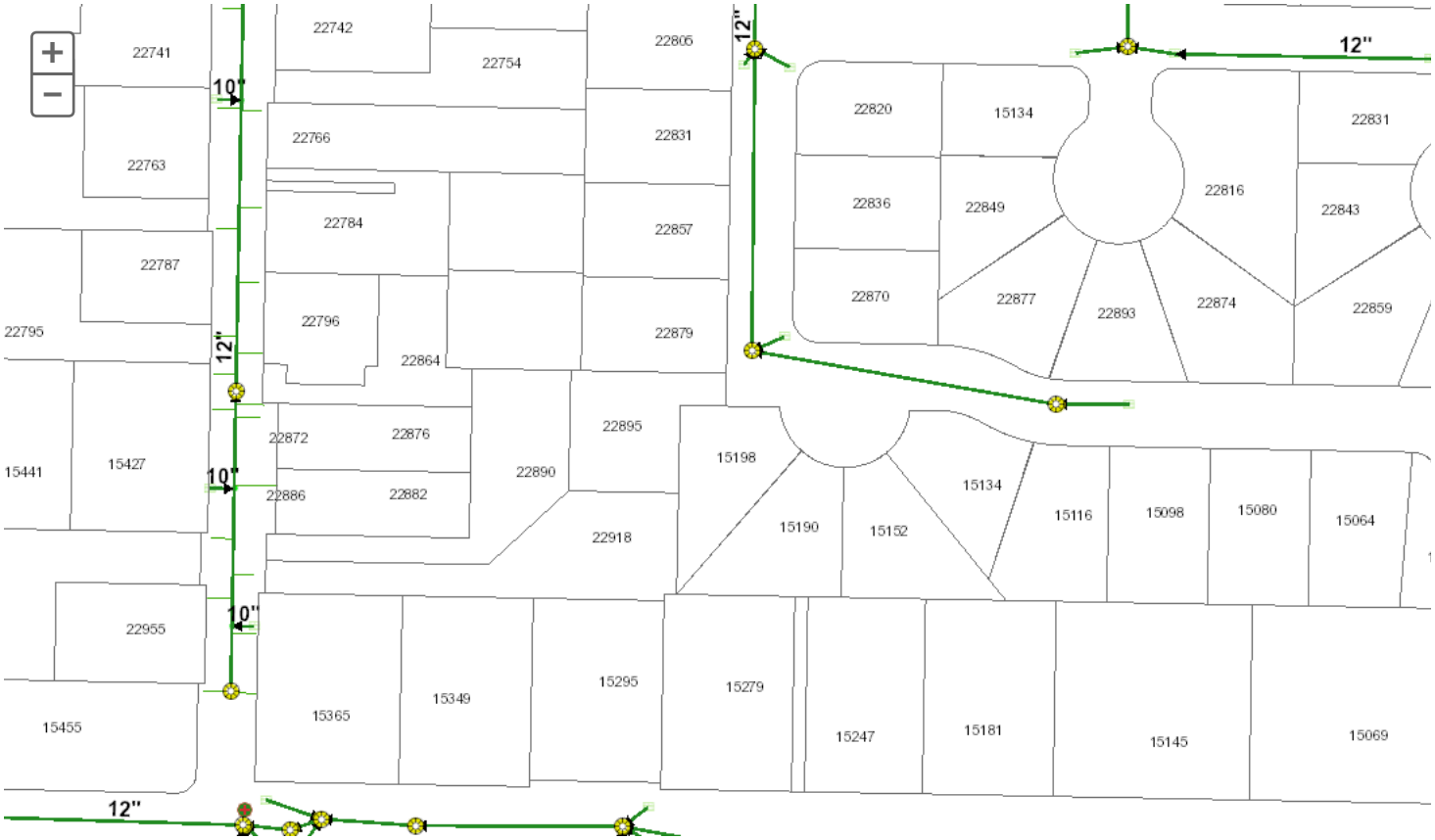
Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Pipe 1	50.48	187.20	0.00	186.71	0.00	0.49	0.9700	CIRCULAR	30.000	30.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	Pipe 10	153.21	165.69	0.00	158.80	0.00	6.89	4.5000	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	Pipe 11	69.48	158.80	0.00	157.05	0.00	1.75	2.5200	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
4	Pipe 12	37.00	157.05	0.00	154.46	0.30	2.59	7.0000	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	Pipe 13	76.75	154.16	0.00	153.11	0.00	1.05	1.3700	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	Pipe 14	68.00	153.11	0.00	150.20	0.00	2.91	4.2800	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	Pipe 15	36.92	155.06	0.00	154.65	1.54	0.41	1.1100	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	Pipe 16	102.15	186.35	0.00	185.58	0.00	0.77	0.7500	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	Pipe 17	388.23	187.64	0.00	184.78	2.72	2.86	0.7400	CIRCULAR	15.000	15.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	Pipe 18	100.00	175.60	0.72	174.60	0.00	1.00	1.0000	CIRCULAR	15.000	15.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
11	Pipe 19	433.00	176.45	0.00	170.00	0.00	6.45	1.4900	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	Pipe 2	238.41	186.71	0.00	185.58	0.00	1.13	0.4700	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	Pipe 20	67.00	170.00	0.00	168.00	2.00	2.00	2.9900	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	Pipe 21	21.31	157.60	0.00	156.00	1.84	1.60	7.5100	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	Pipe 3	238.47	185.58	0.00	182.06	0.00	3.52	1.4800	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	Pipe 4	132.43	182.06	0.00	178.30	0.00	3.76	2.8400	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
17	Pipe 5	231.88	178.30	0.00	177.38	0.00	0.92	0.4000	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
18	Pipe 6	15.33	177.38	0.00	174.60	0.00	2.78	18.1300	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
19	Pipe 7	191.76	174.60	0.00	168.50	0.00	6.10	3.1800	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
20	Pipe 8	137.18	168.50	0.00	166.00	0.00	2.50	1.8200	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
21	Pipe 9	25.50	166.00	0.00	165.69	0.00	0.31	1.2200	CIRCULAR	36.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Pipe 1	28.56	0 08:00	40.41	0.71	8.92	0.09	1.55	0.62	0.00		Calculated
2	Pipe 10	42.42	0 08:02	141.44	0.30	17.48	0.15	1.13	0.38	0.00		Calculated
3	Pipe 11	42.43	0 08:02	105.85	0.40	14.15	0.08	1.32	0.44	0.00		Calculated
4	Pipe 12	42.43	0 08:02	176.47	0.24	20.52	0.03	1.00	0.33	0.00		Calculated
5	Pipe 13	45.35	0 08:02	78.01	0.58	11.45	0.11	1.64	0.55	0.00		Calculated
6	Pipe 14	45.59	0 08:02	137.98	0.33	17.51	0.06	1.19	0.40	0.00		Calculated
7	Pipe 15	0.24	0 08:00	3.75	0.06	2.66	0.23	0.17	0.17	0.00		Calculated
8	Pipe 16	2.08	0 08:00	3.09	0.67	4.22	0.40	0.60	0.60	0.00		Calculated
9	Pipe 17	3.18	0 08:01	5.54	0.57	4.67	1.39	0.68	0.54	0.00		Calculated
10	Pipe 18	3.82	0 08:00	6.46	0.59	5.48	0.30	0.69	0.55	0.00		Calculated
11	Pipe 19	3.36	0 08:01	4.35	0.77	6.12	1.18	0.66	0.66	0.00		Calculated
12	Pipe 2	28.51	0 08:01	45.92	0.62	6.84	0.58	1.71	0.57	0.00		Calculated
13	Pipe 20	3.36	0 08:01	6.16	0.55	8.01	0.14	0.53	0.53	0.00		Calculated
14	Pipe 21	2.95	0 08:00	9.76	0.30	10.89	0.03	0.38	0.38	0.00		Calculated
15	Pipe 3	30.58	0 08:01	81.03	0.38	10.65	0.37	1.28	0.43	0.00		Calculated
16	Pipe 4	35.28	0 08:01	112.39	0.31	14.06	0.16	1.16	0.39	0.00		Calculated
17	Pipe 5	35.27	0 08:01	42.01	0.84	6.67	0.58	2.11	0.70	0.00		Calculated
18	Pipe 6	35.27	0 08:01	284.02	0.12	27.38	0.01	0.71	0.24	0.00		Calculated
19	Pipe 7	39.07	0 08:02	118.96	0.33	15.07	0.21	1.18	0.39	0.00		Calculated
20	Pipe 8	39.07	0 08:02	90.04	0.43	12.29	0.19	1.38	0.46	0.00		Calculated
21	Pipe 9	42.43	0 08:02	73.54	0.58	10.77	0.04	1.64	0.55	0.00		Calculated

14647 SW OREGON ST



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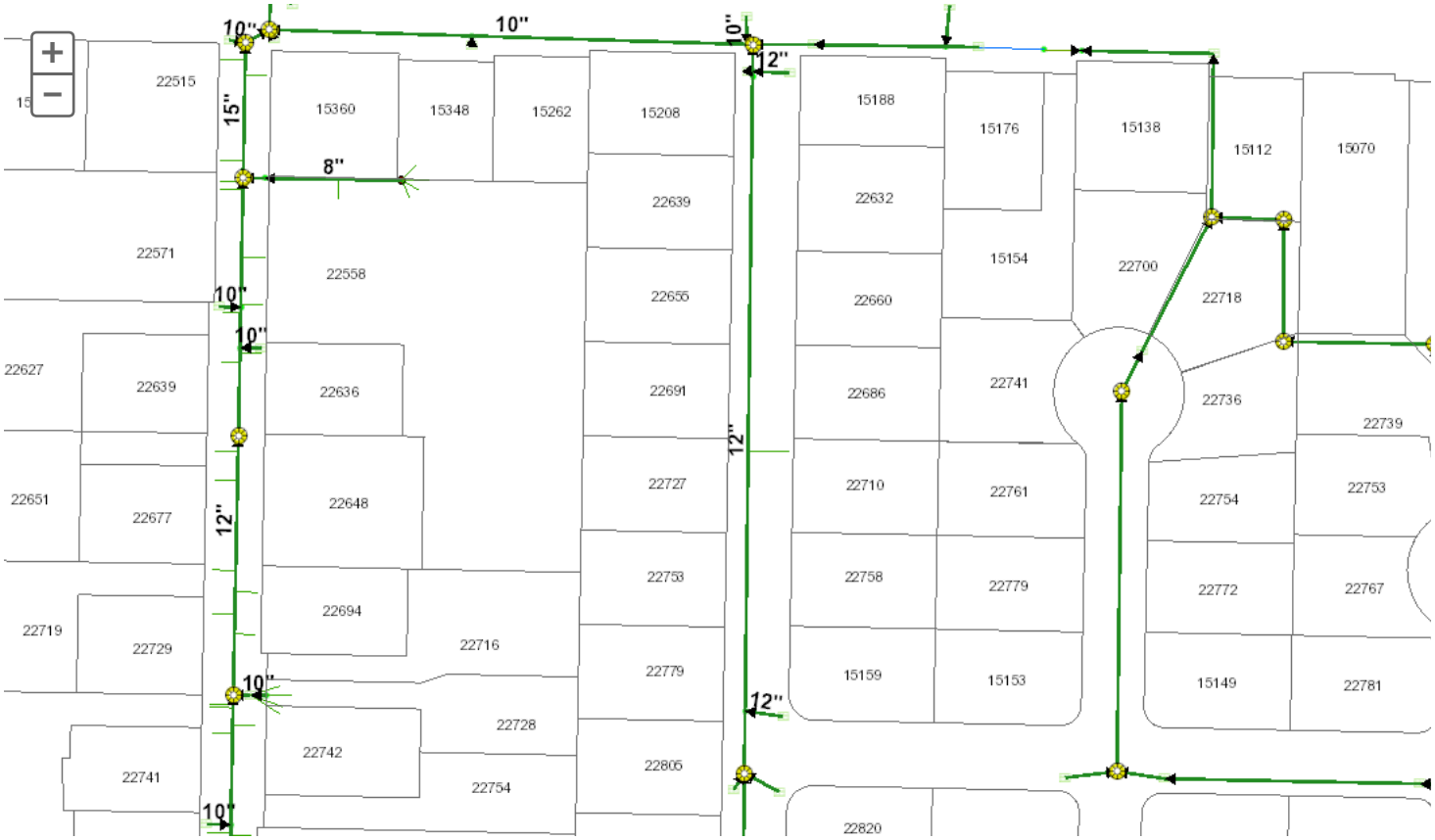

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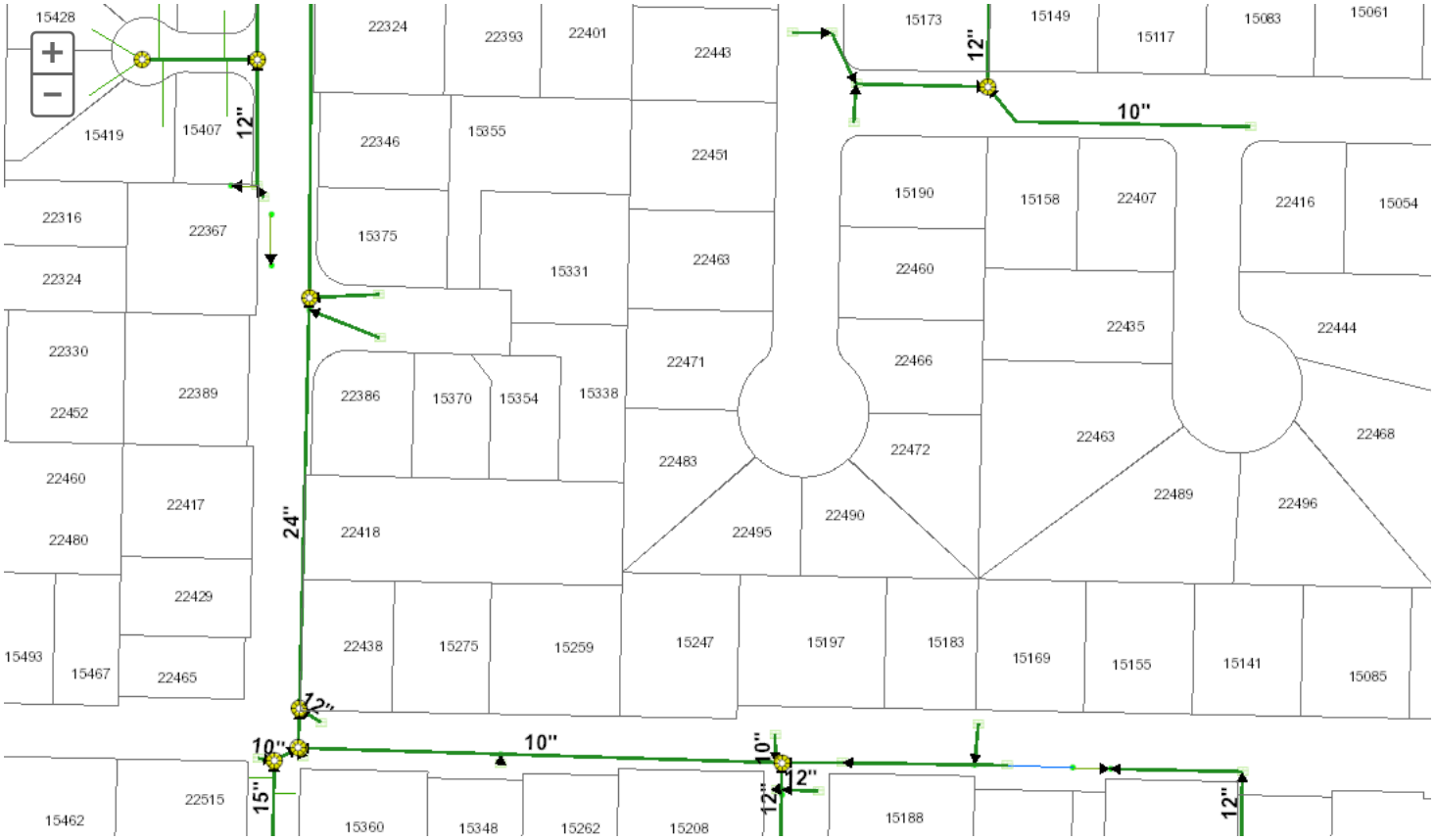

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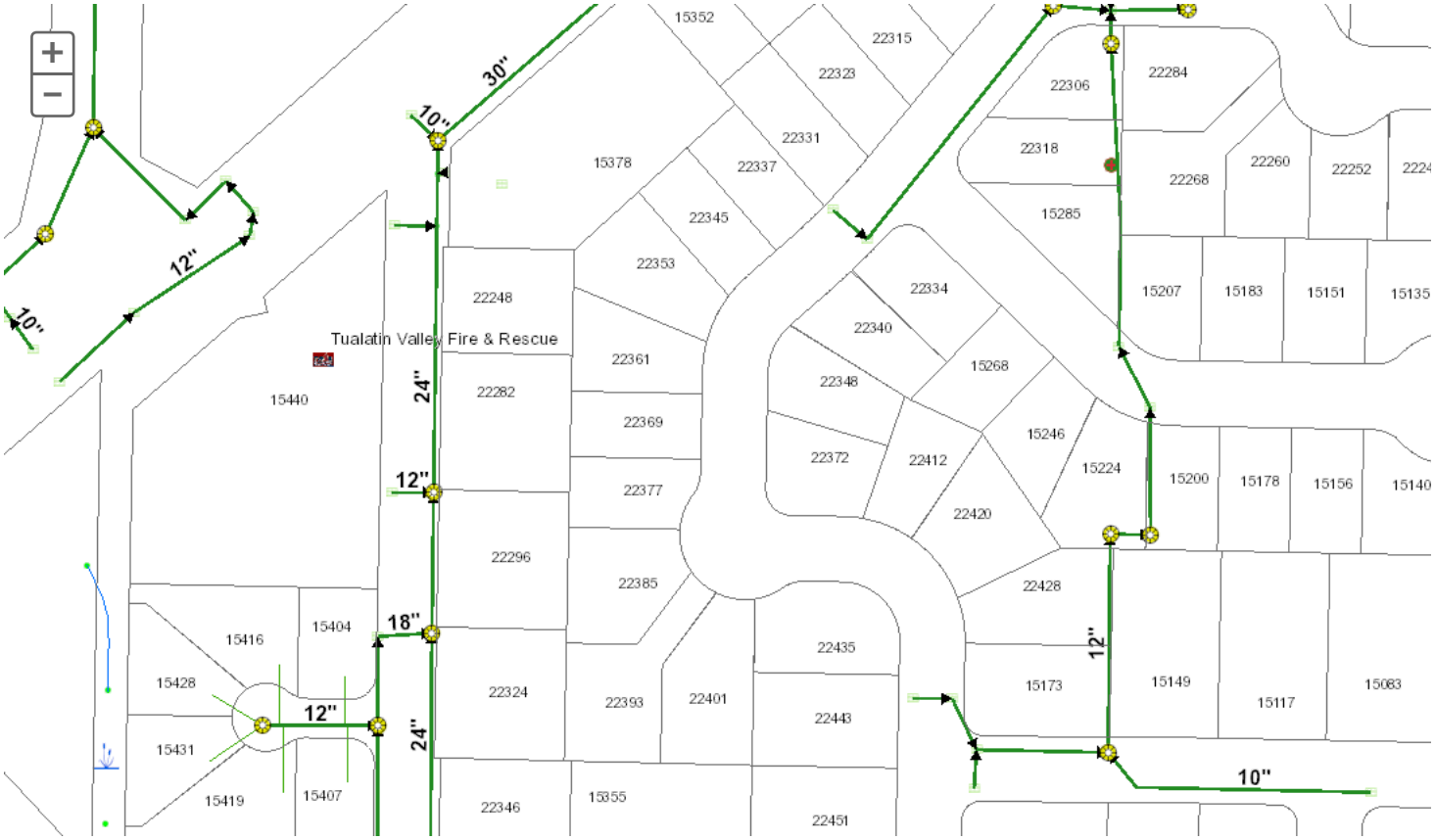

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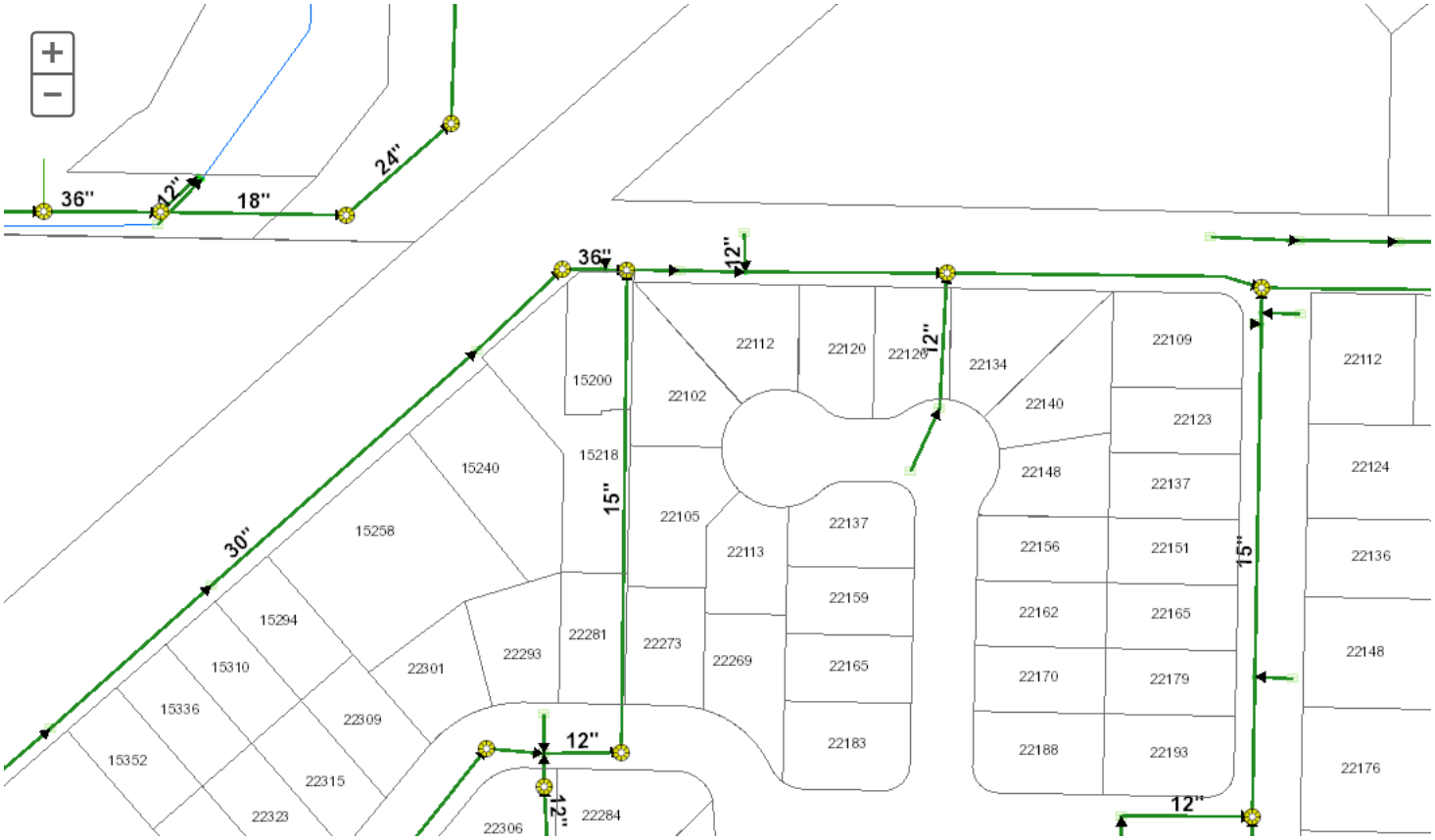

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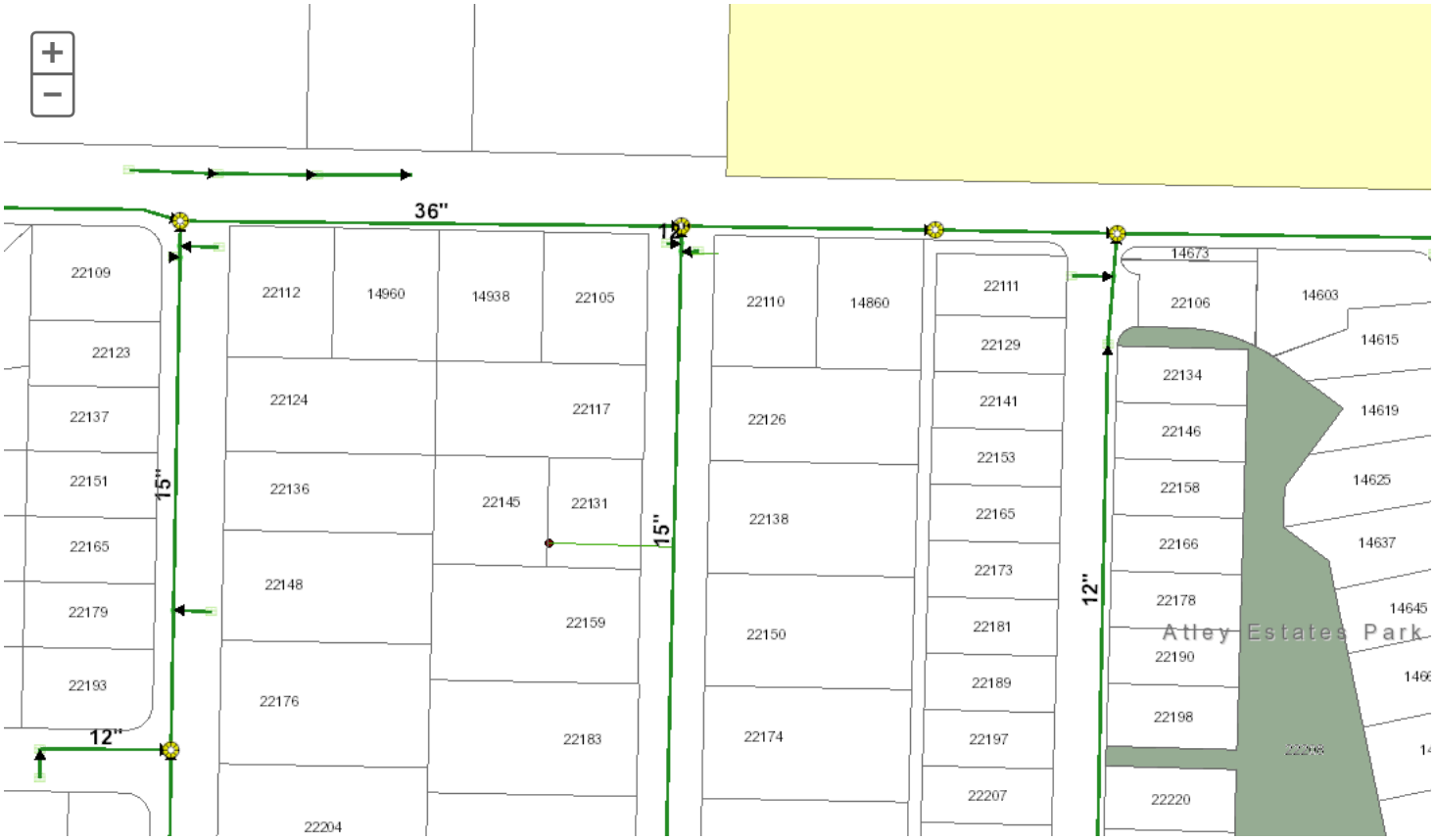

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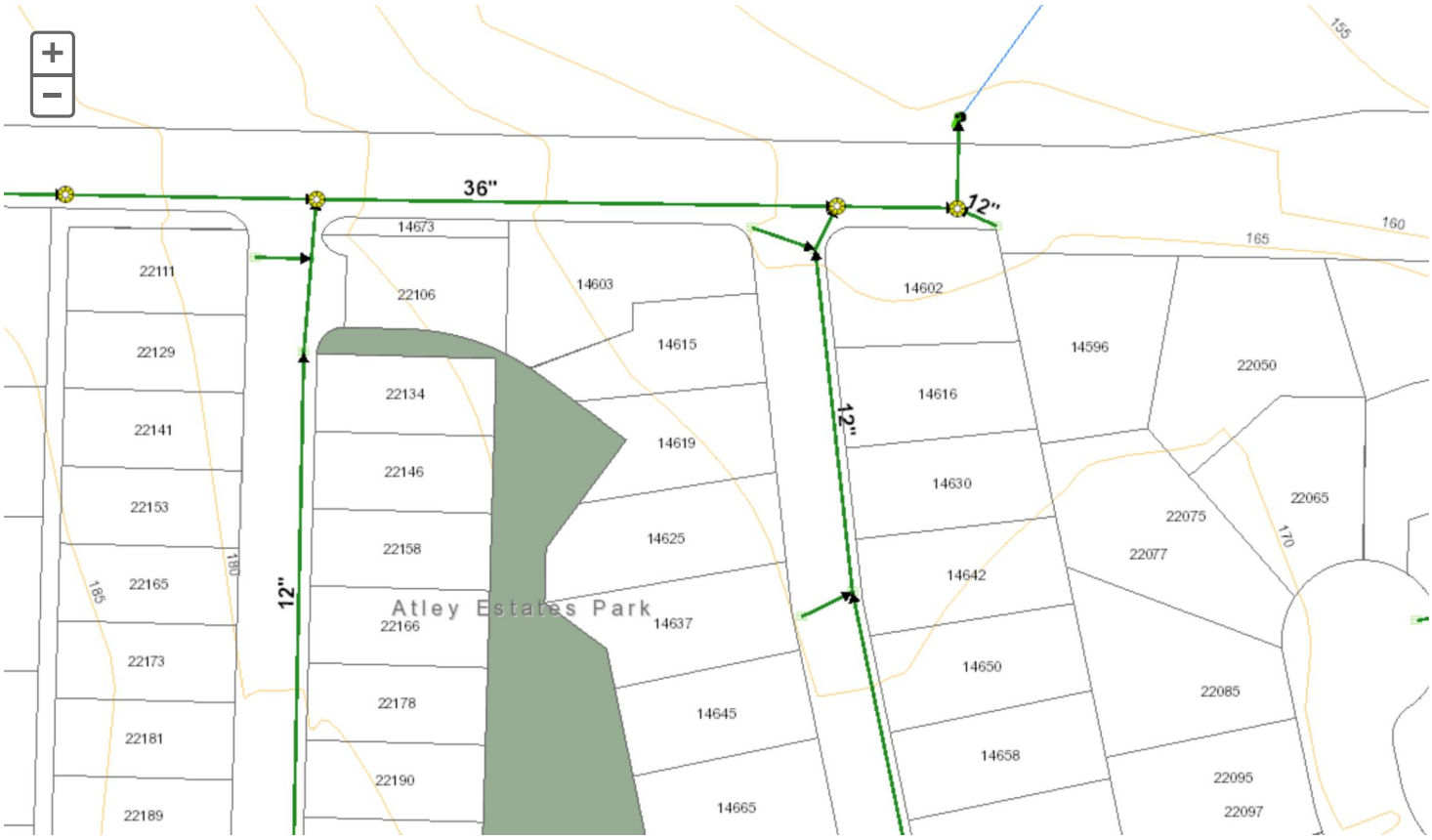

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Morgan Holen & Associates LLC
Consulting Arborists and Urban Forest Management
971.409.9354
3 Monroe Parkway, Suite P 220
Lake Oswego, Oregon 97035
morgan.holen@comcast.net

Zenport Industrial Park, Building No. 1 – Sherwood, Oregon
Tree and Woodland Inventory and Report
March 10, 2016
Revised: March 31, 2016

MHA15095

Purpose

This Tree and Woodland Inventory and Report for the Zenport Industrial Park Building No. 1 project in Sherwood, Oregon, is provided pursuant to City of Sherwood Municipal Code Chapter 16.142. This report describes the existing trees located on and adjacent to the project site, provides tree removal and protection recommendations, and explains how the required tree canopy cover requirement will be satisfied. This report is based on observations made by International Society of Arboriculture (ISA) Board Certified Master Arborist (PN-6145A) and Qualified Tree Risk Assessor Morgan Holen during a site visit conducted on March 8, 2016. No woodlands, as defined in Sherwood Municipal Code Section 16.142.070.C.3.b, are located on or adjacent to the project site.

Scope of Work and Limitations

Morgan Holen & Associates, LLC, was contracted by Uptown Properties to collect tree inventory data for individual trees measuring six inches and larger in diameter and to develop an arborist report for the project. The site is planned for industrial development; one building and street improvements are proposed at this time. Site plans were provided by Uptown Properties illustrating the location of existing trees and proposed construction impacts.

Visual Tree Assessment (VTA) was performed on individual trees measuring at least six inches in diameter located across the site and on neighboring properties located adjacent to the project site. VTA is the standard process whereby the inspector visually assesses the tree from a distance and up close, looking for defect symptoms and evaluating overall condition and vitality of individual trees. Trees were evaluated in terms of general condition and potential construction impacts. Following the tree inventory fieldwork, we coordinated with AJ Shepard of Uptown Properties, Todd Moon of WTM Architect, Evan Eykelbosch of Froelich Engineers, and Clement Walsh of Otten Landscape Architects, to discuss potential construction impacts to existing trees, finalize treatment recommendations, and develop the tree canopy cover calculation.

The client may choose to accept or disregard the recommendations contained herein, or seek additional advice. Neither this author nor Morgan Holen & Associates, LLC, have assumed any responsibility for liability associated with the trees on or adjacent to this site.

General Description

The project site is located at 15104 SW Oregon Street and is bounded by SW Oregon Street to the south, the Southern Pacific Railroad right-of-way to the northwest and industrial land to the east and northeast. The site is undeveloped except for an old parking lot in the southwest area. Only the southwestern-most portion of the site is proposed to be developed at this time. The project proposes the construction of a single industrial building and associated site improvements including parking, landscaping, circulation, loading areas, and a trash and recycling area. In addition, half-street improvements are required along the entire frontage of SW Oregon Street including re-construction of the existing asphalt paving, new curb and gutter, a landscape strip and a public sidewalk.

Tree Inventory

In all, 33 trees measuring at least six inches in diameter were inventoried, including nine different tree species and six (18%) trees located on-site and 27 (82%) trees located off-site. The 27 off-site trees include 20 trees located in the public right-of-way directly adjacent to the project site along the north side of SW Oregon Street, four trees located northwest of the project site within the Southern Pacific Railroad right-of-way, and three trees located far off-site in the public right-of-way or on adjacent private properties along the south side of SW Oregon Street. A complete description of individual trees is provided in the enclosed tree data (attachment A). Table 1 provides a summary of the number of trees by species and location.

Table 1. Number of Trees by Species and Location – Zenport Industrial Park, Sherwood.

Common Name	Species Name	On-Site	Off-Site	Total	Percent
bigleaf maple	*Acer macrophyllum*		1	1	3%
Douglas-fir	*Pseudotsuga menziesii*		1	1	3%
English hawthorn	*Crataegus monogyna*		1	1	3%
flowering pear	*Pyrus calleryana*	3		3	9%
ponderosa pine	*Pinus ponderosa*		2	2	6%
red maple	*Acer rubrum*		18	18	55%
scots pine	*Pinus sylvestris*	2	1	3	9%
white fir	*Abies concolor*		1	1	3%
willow	*Salix* spp.	1	2	3	9%
Total		**6**	**27**	**33**	**100%**
Percent of Total		**18%**	**82%**		

The trees appeared in variable condition and, as described in the enclosed tree data, individual trees were assigned a general condition rating defined as follows:

D: Dead – completely lifeless

P: Poor Condition – not sustainable

F: Fair Condition – sustainable, but with notable defects such as branch dieback, moderate or poor structure, or codominant stems with included bark, for example

G: Good Condition – no major defects

E: Excellent Condition – specimen quality

None of the inventoried trees were classified as dead or excellent.

The six on-site trees include three flowering pears (*Pyrus calleryana*) in fair condition measuring six to 12-inches in diameter each, two scots pines (*Pinus sylvestris*) in good condition measuring 15- and 18-inches in diameter each, and one multi-stemmed willow (*Salix* spp.) in fair condition. The flowering pears are located in existing parking lot islands surrounded by curb and asphalt in the southwest area and have moderate crown structure and minor defects. The scots pines are also located in an existing island surrounded by curb and asphalt in the far southwest corner of the site. A third scots pine is also located in the island, but is off-site in the public right-of-way according to the site survey. These three pines are densely planted and have grown up competing with and adapting to one another. They are most suitable for preservation as an intact group as removal of one is likely to result in impacts to the protection and aesthetics of the two adjacent trees. The willow is located directly north of the

northernmost parking lot island in the southwest area. This tree has poor structure including multiple stems, dead and broken branches and branch decay.

The 20 trees located in the public right-of-way directly adjacent to the project site along the north side of SW Oregon Street include 18 red maples (*Acer rubrum*), one white fir (*Abies concolor*), and one scots pine previously mentioned. The red maples are existing street trees and some have been pruned for powerline clearance resulting in crown asymmetry and branch decay. These trees range in size from 8- to 13-inches in diameter, including three trees in poor condition that have extensive crown decay or are otherwise in decline, nine trees in fair condition with moderate structure and minor defects, and six trees in good condition with relatively better structure and less serious defects. The white fir and scots pine were both classified in good condition with no major defects; these trees measured 18- and 14-inches each in diameter, respectively.

Complete visual assessment was inhibited for the four trees located northwest of the project site within the Southern Pacific Railroad right-of-way due to access limitations and blackberry infestation. These trees are generally in fair condition, including one bigleaf maple (*Acer macrophyllum*), one Douglas-fir (*Pseudotsuga menziesii*), and two willows.

Complete visual assessment was also inhibited for the three off-site trees located south of SW Oregon Street due to access limitations, including one invasive English hawthorn (*Crataegus monogyna*) in fair condition and two large ponderosa pines (*Pinus ponderosa*) in good condition. These three trees should not be affected by the project.

Tree Plan Recommendations

Prior to preparation of this report we coordinated with the project team in regard to the relatively best existing trees and potential construction impacts, and reviewed and considered the approval criteria identified in Sherwood Municipal Code Section 16.142.070. The three scots pines located in the southwest corner of the project are the best existing trees affected by the project. We discussed potential construction impacts to these trees with the project engineer and determined that adequate protection is not possible. The scots pine located in the right-of-way and the on-site pine directly adjacent to it will both be directly impacted by the half-street improvements. Removal of these two trees will impact the protection and aesthetics of the third pine. Therefore, all three of these trees are recommended for removal as a group.

Table 2 provides a summary of the number of trees by general condition rating and treatment recommendation.

Table 2. Inventoried Trees by Condition Rating and Treatment Recommendation.

Treatment Recommendation	Condition Rating			Total
	Poor	Fair	Good	
Remove	3	13	10	**26** (79%)
Protect Off-Site Tree	0	5	2	**7** (21%)
Total	**3** (9%)	**18** (55%)	**12** (36%)	**33** (100%)

Of the 33 inventoried trees, 26 (79%) are recommended for removal for the purposes of development, including grading, building, parking, and the half-street improvements, including the six on-site trees and 20 trees located in the public right-of-way along the north side of SW Oregon Street.

Protection fencing installed along the northwest property boundary is recommended to provide adequate protection for the four trees located within the Southern Pacific Railroad right-of-way directly adjacent to the project site.

No protection is needed for the three trees located south of SW Oregon Street which are far off-site and not affected by the project.

Required Tree Canopy

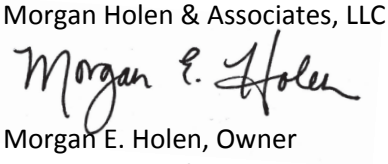
Sherwood Municipal Code Section 16.142.070.D requires that industrial development sites achieve a minimum total tree canopy cover of 30 percent based on the expected mature canopy of existing retained trees and planted new trees. The total area of the project development site is 63,870 square feet. To meet the 30 percent total tree canopy requirement, the required tree canopy cover needed is 19,161 square feet.

None of the existing on-site trees are planned for retention; therefore, the canopy requirement can only be achieved by planting new trees. The location, species, and size of trees proposed for planting is illustrated on sheet L1.0 prepared by Otten Landscape Architects. Thirty-two trees are proposed to be planted on the project site for landscaping. An additional 17 new street trees are also proposed along SW Oregon Street for the half-street improvements; however, street trees are not included in the canopy requirement for industrial development projects. The 32 landscaping trees provide a total of 21,304 square feet of expected mature tree canopy, or 33.4% of the total project development site, satisfying the City's canopy cover requirement.

The enclosed canopy credit summary provides a complete description of the trees to be planted and demonstrates how the canopy cover requirement is satisfied (attachment B).

Please contact us if you have questions or need any additional information. Thank you for choosing Morgan Holen & Associates, LLC, to provide consulting arborist services for the Zenport Industrial Park, Building No. 1 project in Sherwood.

Thank you,
Morgan Holen & Associates, LLC



Morgan E. Holen, Owner
ISA Board Certified Master Arborist, PN-6145B
ISA Tree Risk Assessment Qualified
Forest Biologist

Enclosures: Attachment A: MHA15095 Zenport Industrial – Tree Data 3-8-16
Attachment B: MHA15095 Zenport Industrial – Canopy Credit Summary

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Location	Treatment
12143	white fir	*Abies concolor*	18	12	G	no major defects, assessment limited by blackberries	ROW	remove
12801	bigleaf maple	*Acer macrophyllum*	10	10	F	assessment inhibited by blackberries	off-site	protect
13200	English hawthorn	*Crataegus monogyna*	3x10	18	F	invasive species, moderate structure, assessment inhibited by laurel shrub	off-site	protect
13334	ponderosa pine	*Pinus ponderosa*	50	26	G	old broken top, multiple leaders, assessment limited by access	off-site	protect
13362	ponderosa pine	*Pinus ponderosa*	52	28	G	forked leaders, assessment inhibited by access	off-site	protect
13466	scots pine	*Pinus sylvestris*	15	15	G	no major defects, suitable for preservation in group with 13467 & 13468	on-site	remove
13467	scots pine	*Pinus sylvestris*	18	20	G	no major defects, suitable for preservation in group with 13466 & 13468	on-site	remove
13468	scots pine	*Pinus sylvestris*	14	15	G	no major defects, suitable for preservation in group with 13466 & 13467	ROW	remove
13469	red maple	*Acer rubrum*	12	13	G	branches with included bark	ROW	remove
13470	red maple	*Acer rubrum*	9	11	F	moderate structure	ROW	remove
13471	red maple	*Acer rubrum*	12	15	G	branches with included bark	ROW	remove
13472	red maple	*Acer rubrum*	8	10	G	some included bark	ROW	remove
13473	red maple	*Acer rubrum*	8	10	G	moderate structure	ROW	remove
13474	red maple	*Acer rubrum*	8	10	G	some included bark	ROW	remove
13475	red maple	*Acer rubrum*	8	10	F	moderate structure, codominant leaders	ROW	remove
13476	red maple	*Acer rubrum*	11	15	F	poor structure, crown decay	ROW	remove
13477	red maple	*Acer rubrum*	10	12	G	codominant leaders	ROW	remove
13478	red maple	*Acer rubrum*	8	13	P	decline	ROW	remove
13479	red maple	*Acer rubrum*	9	10	F	moderate structure, included bark	ROW	remove
13480	red maple	*Acer rubrum*	10	12	F	some crown decay	ROW	remove
13481	red maple	*Acer rubrum*	2x6	9	P	crown decay, trunk wound	ROW	remove

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Location	Treatment
13482	red maple	*Acer rubrum*	11	11	P	crown decay	ROW	remove
13483	red maple	*Acer rubrum*	12	14	F	moderate structure, included bark	ROW	remove
13484	red maple	*Acer rubrum*	13	14	F	multiple attachments with included bark	ROW	remove
13485	red maple	*Acer rubrum*	10	14	F	moderate structure, some branch decay, blackberries	ROW	remove
13486	red maple	*Acer rubrum*	12	12	F	moderate structure, included bark	ROW	remove
13556	flowering pear	*Pyrus calleryana*	12	14	F	moderate structure, multiple attachments, broken branches	on-site	remove
13557	flowering pear	*Pyrus calleryana*	6	6	F	moderate structure	on-site	remove
13558	flowering pear	*Pyrus calleryana*	6	8	F	moderate structure, some trunk decay	on-site	remove
13624	willow	*Salix* spp.	4x6	12	F	poor structure, dead and broken branches, branch decay	on-site	remove
13852	willow	*Salix* spp.	2x10	12	F	poor structure, assessment inhibited by access	off-site	protect
13853	Douglas-fir	*Pseudotsuga menziesii*	8	10	F	small high live crown, assessment inhibited by access	off-site	protect
13854	willow	*Salix* spp.	14	12	F	poor structure, assessment inhibited by access	off-site	protect

[1]**DBH** is tree diameter measured at 4.5-feet above ground level in inches, except off-site tree diameter was visually estimated; trees with multiple trunks splitting below DBH were measured at the narrowest point beneath the split or are indicated as quantity x size. [2]**C-Rad** is the average crown radius measured in feet. [3]**Cond** is an arborist assigned rating to generally describe the condition of individual trees as follows- **D**ead; **P**oor Condition; **F**air Condition; **G**ood Condition; and **E**xcellent Condition.

Morgan Holen & Associates LLC

Attachment B

MHA15095 Zenport Industrial - Canopy Credit Summary

Common Name	Species Name	Mature Canopy Spread (ft)[1]	Mature Canopy (sqft)[2]
Oregon ash	*Fraxinus latifolia*	40	1,257
Oregon ash	*Fraxinus latifolia*	40	1,257
Oregon ash	*Fraxinus latifolia*	40	1,257
Austrian pine	*Pinus nigra*	25	491
river birch	*Betula nigra*	50	1,963
river birch	*Betula nigra*	50	1,963
river birch	*Betula nigra*	50	1,963
river birch	*Betula nigra*	50	1,963
river birch	*Betula nigra*	50	1,963
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
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Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
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Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Hogan cedar	*Thuja plicata* 'Fastigiata'	20	314
Total Canopy Cover Credit (sqft):			**21,304**
Total Area of Development Site (sqft):			63,870
Required Tree Canopy (%):			30%
Required Tree Canopy (sqft):			19,161
Difference of Canopy Cover Proposed - Required (sqft):			2,143
Canopy Cover Requirement Satisfied?			Yes (33%)

[1]Mature Canopy Spread is the expected mature canopy diameter provided in the *Sunset Western Garden Book*

[2]Mature Canopy is total square feet of canopy cover calculated as 3.14159 x Canopy Radius^2

Morgan Holen & Associates, LLC
Consulting Arborists and Urban Forest Management
3 Monroe Parkway, Suite P220, Lake Oswego, OR 97035
morgan.holen@comcast.net | 971.409.9354

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BETA Version

Fire Hydrant Flow Calculator

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- Use the tab key to navigate.
- Tab between each box to update the calculation.
- Be sure to tab past your final entry for a correct calculation.

Static:	78	psi before flowing
Residual:	45	psi while flowing
Pitot:	35	pitot gage reading
Diameter:	4	size of opening tested
This hydrant is flowing:	2118	GPM from the test outlet
Projected available hydrant flow:	2872	GPM **Note 1**
2nd Static:	78	secondary psi before flowing
2nd Residual:	68	secondary psi while flowing
The main can be expected to flow about:	5472	GPM

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and FireHydrant.org express no warranty for its suitability for any particular purpose.

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Flowing Hyd, 78 static, 35 pitot, 45 res
Monitoring Hydrant, 78 static, 68 residual
21980
14843
15104
22100
15561
WHY0433
WHY0386
WHY0190
WHY0196
WHY0395
WHY0189
WHY0354
WHY0156
KELSEY
HALL
LOWER ROY
NOTTINGHAM