

**PRELIMINARY/FINAL DRAINAGE REPORT FOR
TEMPLTON GAP TOWNHOMES
7065 TEMPLETON GAP ROAD
COLORADO SPRINGS, COLORADO**

JANUARY 2020

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Job No. 1893.00

**PRELIMINARY/FINAL DRAINAGE REPORT FOR
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7065 TEMPLETON GAP ROAD
COLORADO SPRINGS, COLORADO**

ENGINEER'S STATEMENT:

This report and plan for the drainage design of "GALANT TOWNHOMES" was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Dane Frank, P.E. 50207

Seal

DEVELOPER'S STATEMENT:

GALANT HOMES hereby certifies that the drainage facilities for TEMPLETON GAP TOWNHOMES shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of TEMPLETON GAP TOWNHOMES guarantee that final drainage design review will absolve GALANT HOMES and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

GALANT HOMES

Authorized Signature

Date

Printed Name

Title

Address

City of Colorado Springs Statement:

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

For City Engineer
Conditions:

Date

**PRELIMINARY/FINAL DRAINAGE REPORT FOR
TEMPLTON GAP TOWNHOMES
7065 TEMPLETON GAP ROAD
COLORADO SPRINGS, COLORADO**

PURPOSE AND JUSTIFICATION

The purpose of this Final Drainage Report is to identify and analyze the existing drainage patterns, determine existing runoff quantities, and analyze the proposed development of this site as a residential site (townhome complex). This lot has not been previously platted and has been previously studied in the following report:

“Dublin North Kwan Parcel Filing No. 8 Preliminary/Final Drainage Report, Colorado Springs, Colorado” by Terra Nova Engineering, dated November 2015.

The proposed use is different than what was in the previously approved reports.

GENERAL DESCRIPTION

This Final Drainage Report for “TEMPLETON GAP APARTMENTS”, located at 7065 Templeton Gap Road, is an analysis of an approximately 497,455 sf (11.42 ac) site, which includes two existing lots. The site is currently unplatted and a vacant lot. The proposed development is a townhome complex, utility services, storm water facilities, and the associated modifications to the site.

The site is in the northeast quarter of Section 7, Township 13 South, Range 65 West of the 6th Principal Meridian within the City of Colorado Springs. The east and part of the north sides of the site are at the City limits. The parcel is bounded to the west by Templeton Gap Road, to the north by two unplatted lots (one a storage yard and one a residence), to the east by an unplatted lot (vacant), and to the south by Wolf Ridge Road. (see vicinity map in appendix).

The site lies partially within the Cottonwood Creek Drainage Basin, with storm runoff draining to the southwest, and partially within the Sand Creek Drainage Basin, with storm runoff draining to the southeast and south. Roughly one quarter of the site lies within the Cottonwood Creek Drainage Basin.

The site consists of 100% Blakeland loamy sand per the USDA, NRCS web soil survey. The hydrologic group “A” was used to represent the soil types and determine the onsite basin overland flow. (see map in appendix)

The study area consists of undeveloped land, which is currently a vacant lot, with mostly grass and dirt surfaces. The study area appears to have been used for construction materials staging/storage for the previous few years. None of the study area is currently paved or otherwise impervious. The site currently drains toward the southwest, south, and southeast, with slopes ranging from 3% to 11%.

EXISTING DRAINAGE CONDITIONS

With the existing Templeton Gap Road to the west, Wolf Ridge Road to the south, and the adjacent parcel to the east being lower than the site, the only offsite flow is along the northern boundary. Overall the site drains from the north to south, with the western quarter of the site draining to the southwest corner and the eastern three quarters draining to the southeast corner. There is an existing storm inlet near the southwest corner of the site, and an existing curb inlet along the edge of Wolf Ridge Road. The following is a description of the existing Basins, Design Points and the overall existing drainage characteristics for the development of the site. (see Existing Drainage Map at the end of report).

Offsite Basin OS-Z's 22.0 acres consists of developed rural residential land and a storage facility with a gravel surface. Runoff ($Q_5 = 17.4$ cfs, $Q_{100} = 50.2$ cfs) sheet flows south onto Basin EX-A and EX-B and then continues south overland. There is also a 24" HDPE storm pipe coming from the storage facility adjacent to the site to the north that discharges onto the site. It should be noted, while the calculations per the DCM results in these flow rates, it is very unlikely these values represent reality due to the topography, structures, and landscaping upgradient of the site (an example is the cinder block wall surrounding the adjacent storage facility).

Offsite Basin OS-Y's 2.49 acres consists of developed rural residential land. Runoff ($Q_5 = 2.3$ cfs, $Q_{100} = 6.9$ cfs) sheet flows south onto Basin EX-B and EX-C and then continues south overland.

Basin EX-A's 1.88 acres consists of undeveloped land. Runoff ($Q_5 = 0.5$ cfs, $Q_{100} = 2.8$ cfs) sheet flows southwest to a storm inlet at the corner of the basin.

Basin EX-B's 6.86 acres consists of undeveloped land. Runoff ($Q_5 = 2.2$ cfs, $Q_{100} = 13.0$ cfs) sheet flows south to Wolf Ridge Road, and to a curb inlet in the road.

Basin EX-C's 2.02 acres consists of undeveloped land. Runoff ($Q_5 = 0.6$ cfs, $Q_{100} = 3.6$ cfs) sheet flows southeast to Wolf Ridge Road.

PROPOSED DRAINAGE CONDITIONS

In the proposed condition the overall drainage pattern for the site changes quite a bit, with runoff being collected and channeled along streets and swales. Drainage will generally be to the east and south, with the site draining to the detention basin, before runoff leaves the site via storm sewer. The changes to the site include constructing numerous townhouses and a clubhouse, utility connections, parking facilities, storm water facilities, grading, paving, and the associated modifications to the site.

Offsite basins OS-Z and OS-Y continue to existing in the proposed conditions the same as they did in the existing condition. In the proposed condition, runoff from these offsite basins will be captured by a cutoff trench along the north property line of the site and diverted east and west to the edges of the site. The runoff that flows west will be discharged onto Templeton Gap Road and the runoff that flows east will be channeled along a onsite street and through the site's detention basin.

Basin PR-1 (10.4 acres) includes almost the entire site and includes roof area, paved surfaces, and dirt/grass surfaces, and the detention basin than sheet and channel flow to storm inlets and then to Design Point 1. Basin PR-1 flow is 14.6 cfs for the 5 year event and 29.6 cfs for the 100 year event. Design Point 1 flow (including flow from Basin OS-Y) is 16.9 cfs for the 5 year event and 36.5 cfs for the 100 year event. Design Point 1 is at the proposed detention basin.

Flows within Basin PR-1 will include both surface routing and pipe routing. Surface routing includes sheet flow into a curb and gutter and valley gutter systems that channel flow to the south and east. Pipe routing includes flow into various storm inlets to direct runoff to the detention basin.

Basin PR-2 (0.03 acres) is the southwest corner of the site where there is a small green area between a drainage swale and the street corner that sheet flows to an existing storm inlet that is proposed to be relocated to the edge of the proposed sidewalk at Design Point 2. Basin PR-2 flow is 0.0 cfs for the 5 year event and 0.1 cfs for the 100 year event.

Basin PR-3 (0.24 acres) is the southeast corner of the site between the detention basin embankment and the property line that sheet flows off the site to the southeast and onto Wolf Ridge Road at Design Point 3. Basin PR-2 flow is 0.1 cfs for the 5 year event and 0.7 cfs for the 100 year event.

A number of proposed sub-basins have been included to show flows for specific inlets, pipes, and swales. The areas and flows of these sub-basins (SB-#) are independent of the proposed basin (PR-#) values.

Sub-basin SB-1 (3.19 acres) includes roof, street, and landscaping areas that channel flow to a storm inlet at Design Point 11. Design Point 11 flow is 4.5 cfs for the 5 year event and 9.1 cfs for the 100 year event.

Sub-basin SB-2 (2.38 acres) includes roof and landscaping areas that channel flow in a swale to a storm inlet that leads to the detention pond, and the detention pond itself at Design Point 12. Design Point 12 flow is 3.4 cfs for the 5 year event and 6.9 cfs for the 100 year event.

Sub-basin SB-3 (0.58 acres) includes landscaping areas that channel flow to a storm inlet at Design Point 13. Design Point 13 flow is 0.9 cfs for the 5 year event and 1.8 cfs for the 100 year event.

Sub-basin SB-4 (3.95 acres) includes roof, street, and landscaping areas that channel flow to a storm inlet at Design Point 14. Sub-basin SB-4 flow is 5.7 cfs for the 5 year event and 11.5 cfs

for the 100 year event. Design Point 14 flow (including Basin OS-Y) is 8.0 cfs for the 5 year event and 18.4 cfs for the 100 year event.

Sub-basin SB-5 (0.23 acres) includes landscaping areas that channel flow to a storm inlet at Design Point 15. Design Point 15 flow is 0.4 cfs for the 5 year event and 0.8 cfs for the 100 year event.

The EDB was calculated using version 3.07 UD-Detention a spreadsheet supplied by Urban Drainage Control Flood District (see appendix). Based upon the 11.42 acres of area tributary from our site (Basin PR-1) and consisting of 70% impervious area. The bottom of the pond is 6876.00 and the top of pond is set at 6884.00. The pond design has a WQCV storage requirement of 0.262ac-ft. The corresponding water surface elevation is 6877.56. The required EURV storage volume of 0.751 ac-ft on top of the WQCV gives an elevation of 6880.33. The required 100-year storage volume of 0.472 ac-ft for a total of 1.485 ac-ft gives a 100-year elevation of 6881.59. There are two proposed forebays which are both 60 cu-ft in volume and meet the required 2% of the WQCV (half of the total WQCV each - see appendix for calculations). A metal plate over the outlet with one column containing three rows of 2" diameter holes spaced 17.3" apart will act as a water quality and EURV outlet. The release of the EURV is 0.5 cfs and will take 63 hours. A 2.0' x 2.0' inlet riser acts as the outlet structure, it is set at a grate elevation of 6880.33 and will route allowable runoff for the 100 year event. The proposed 18" outlet has a restrictor plate 7.20" above the invert giving a release of $Q_{100} = 4.3$ cfs. This is in conformance within 90% of the allowable release rate of 4.7 cfs. A 10' emergency weir set at 6882.00 will also be installed per the city standards with $d_{50} = 12$ " rip rap and will safely pass the 100-year developed flow downstream. Flow in the emergency overflow situation will flow into the ROW of Wolf Ridge Road with a 100 year runoff spillway flow depth of 0.82'.

In an effort to protect receiving water and as part of the "four step process to minimize adverse impacts of urbanization" this site was analyzed in the following manner:

1. Reduce Runoff- The new improvements and impervious area to the site will be routed to a proposed private detention pond. In addition to this, runoff will be trapped behind curbs, channeled through grass swales, and primarily leaves the site through storm sewers. These above-mentioned items will reduce the volume of runoff using ponding and infiltration.

2. Treat Slowly Release WQCV- The proposed detention basin will provide the required WQCV and slowly release it, thereby allowing solids and contaminants to settle out.
3. Stabilize Stream Channel- Drainage fees will be paid when this site was platted, which can be used to stabilize the Cottonwood Creek and Sand Creek channels. Also, there is no channel adjacent to this property and flows are conveyed offsite via storm pipes.
4. Source Controls- As no materials storage or industrial operations are proposed for the site, no source controls have been proposed.

Please see detailed calculations in the appendix.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 & 2 May 2014. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. The Rational Method was used because it is the simplest method, that is applicable to the site, and allowed by the Drainage Criteria Manual.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 and 2 May 2014 and the Urban Drainage and Flood Control District (UDFCD) Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3. The hydraulic calculations include open channel flow (for gutter capacities, street capacities, and swale capacities), inlet sizing calculations, storm sewer sizing calculations, and hydraulic grade line calculations. The pertinent data sheets are included in the appendix of this report. It is requested that the HGL calculations and plots be provided in an addendum at the time of storm sewer plan submittal. The HGL calculations will be performed using the software UD-SEWER (or similar).

WATER QUALITY

Water quality for this development is being address by the proposed detention basin. Calculations can be found in the appendix.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0537 G dated December 7, 2018 (see appendix).

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. At this time, Terra Nova Engineering, Inc. respectfully requests that the erosion control plan be submitted in conjunction with the final grading plan. Rock socks, sediment control logs, silt fence, and inlet protection are currently proposed as erosion control measures.

CONSTRUCTION COST OPINION

Private Drainage Facilities Improvements (non Reimbursable)

	<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
1.	6" PVC Storm	664 LF	\$ 25	\$ 16,600
2.	8" PVC Storm	110 LF	\$ 25	\$ 2,750
3.	12" HDPE Storm	257 LF	\$ 30	\$ 7,710
4.	15" HDPE Storm	138LF	\$ 35	\$ 4,830
5.	18" HDPE Storm	76 LF	\$ 45	\$ 3,420
6.	21" HDPE Storm	43 LF	\$ 50	\$ 2,150
7.	Storm Inlet, Type C	2 EA	\$ 2,500	\$ 5,000
8.	Storm Inlet, 4' D-10-R	1 EA	\$ 4,000	\$ 4,000
9.	Storm Inlet, 12' D-10-R	1 EA	\$ 8,000	\$ 8,000
10.	Storm Inlet, 16' D-10-R	1 EA	\$ 10,000	\$ 10,000
11.	4' Dia. Manhole	5 EA	\$ 3,500	<u>\$ 17,500</u>
Total				\$ 81,960

Public Drainage Facilities Improvements (non Reimbursable)

	<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
1.	18" RCP Storm	383 LF	\$ 65	<u>\$ 24,895</u>
Total				\$ 24,895

Private Permanent BMPs (non-Reimbursable)

<u>Description</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Cost</u>
1. Extended Detention Basin			
- Earthwork	2,400 CY	\$ 12	\$ 28,800
- Forebays	2 EA	\$ 1,500	\$ 3,000
- Trickle Channel	250 LF	\$ 32	\$ 8,000
- Outlet Structures (2'x2')	1 EA	\$ 3,300	\$ 3,300
- Emergency Spillways	1 EA	\$ 1,500	\$ 1,500
- Access Roads	1 EA	\$ 500	\$ 500
- Stabilization	1 EA	\$ 5,000	\$ 5,000
		Subtotal	\$ 50,100
		10% Contingency	\$ 5,010
		Total	\$ 55,110

DRAINAGE FEES

This site is not currently platted, is being platted as part of this development, and is located in both the Cottonwood Creek Drainage Fee Basin and Sand Creek Drainage Fee Basin. Fees for this site will be calculated as follows:

Cottonwood Creek Drainage Fee Basin 2020

Drainage	\$14,356/acre	x	0.39 acres	=	\$ 5,599
Bridge	\$1,175/acre	x	0.39 acres	=	\$ 458
Surcharge	\$752/acre	x	0.39 acres	=	\$ 293
				Total	\$ 6,350

Sand Creek Drainage Fee Basin 2020

Drainage	\$13,309/acre	x	10.25 acres	=	\$ 136,417
Bridge	\$791/acre	x	10.25 acres	=	\$ 8,108
Pond Land	\$1,070/acre	x	10.25 acres	=	\$ 10,968
Pond Facility	\$3,823/acre	x	10.25 acres	=	\$ 39,186
Surcharge	\$1,386/acre	x	10.25 acres	=	\$ 14,207

Total \$ 208,886

*Fees are due prior to plat recordation

MAINTENANCE

The proposed detention basin will be privately maintained. The proposed storm sewers include both private and public lines. The private lines will be privately maintained and the public lines will be maintained by the City.

SUMMARY

Development of this site will not adversely affect the downstream and surrounding developments. Proposed onsite collection and piping will drain into the proposed detention pond, before flowing offsite via storm sewer. Water quality will be addressed by the proposed detention basin. This Final Drainage Report is in general conformance with the previously approved reports/studies for this site.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Dane Frank, P.E.
Project Engineer
Jobs//1893.00/Drainage/189300 Final Drainage Report.docx

BIBLIOGRAPHY

“City of Colorado Springs Drainage Criteria Manual Volumes 1 & 2”, May 2014

“NRCS Soil Map for El Paso County Area, Colorado”

“FEMA Floodplain Map”

“Dublin North Kwan Parcel Filing No. 8 Preliminary/Final Drainage Report, Colorado Springs, Colorado” by Terra Nova Engineering, dated November 2015.

“Cottonwood Creek Drainage Basin Planning Study” by Ayres Associates, dated June 2000.

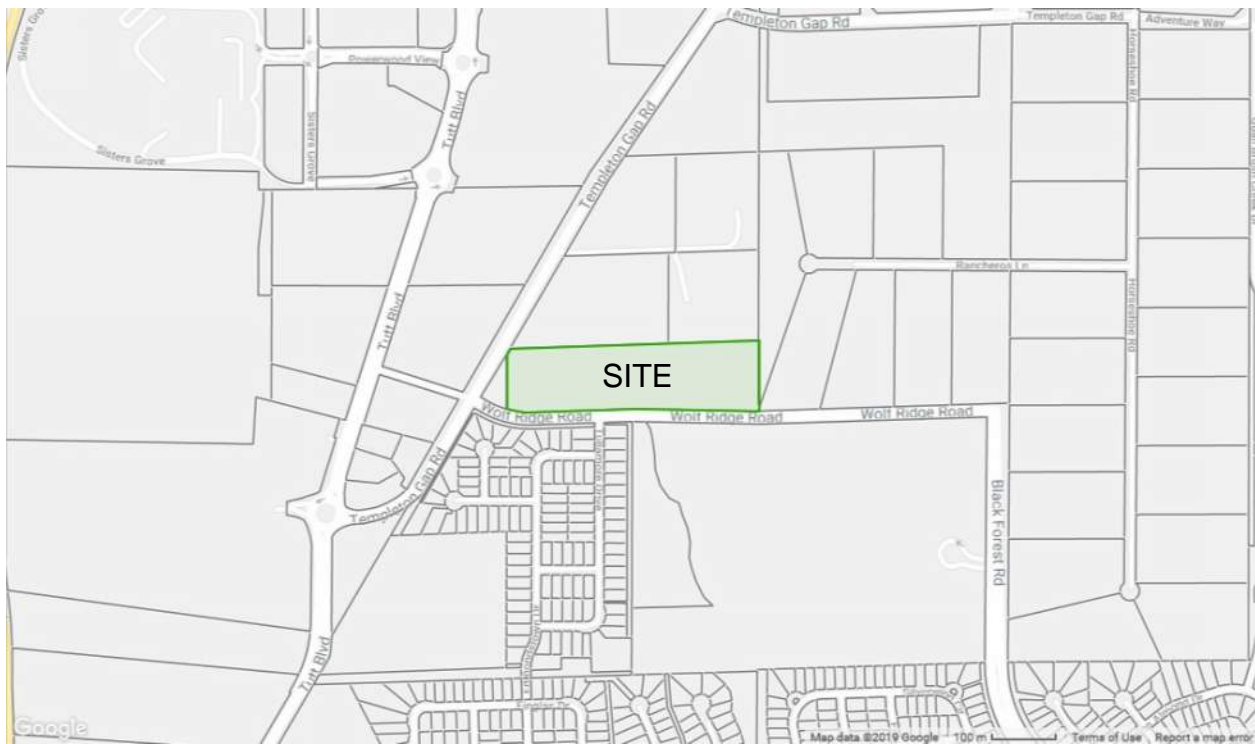
“Sand Creek Drainage Basin Planning Study, Preliminary Design Report, City of Colorado Springs, El Paso County, Colorado” by Kiowa Engineering Corporation, dated January 1993 and revised March 1996,

VICINITY MAP

El Paso County - Community: Property Search

Templeton Gap Apartments
Vicinity Map

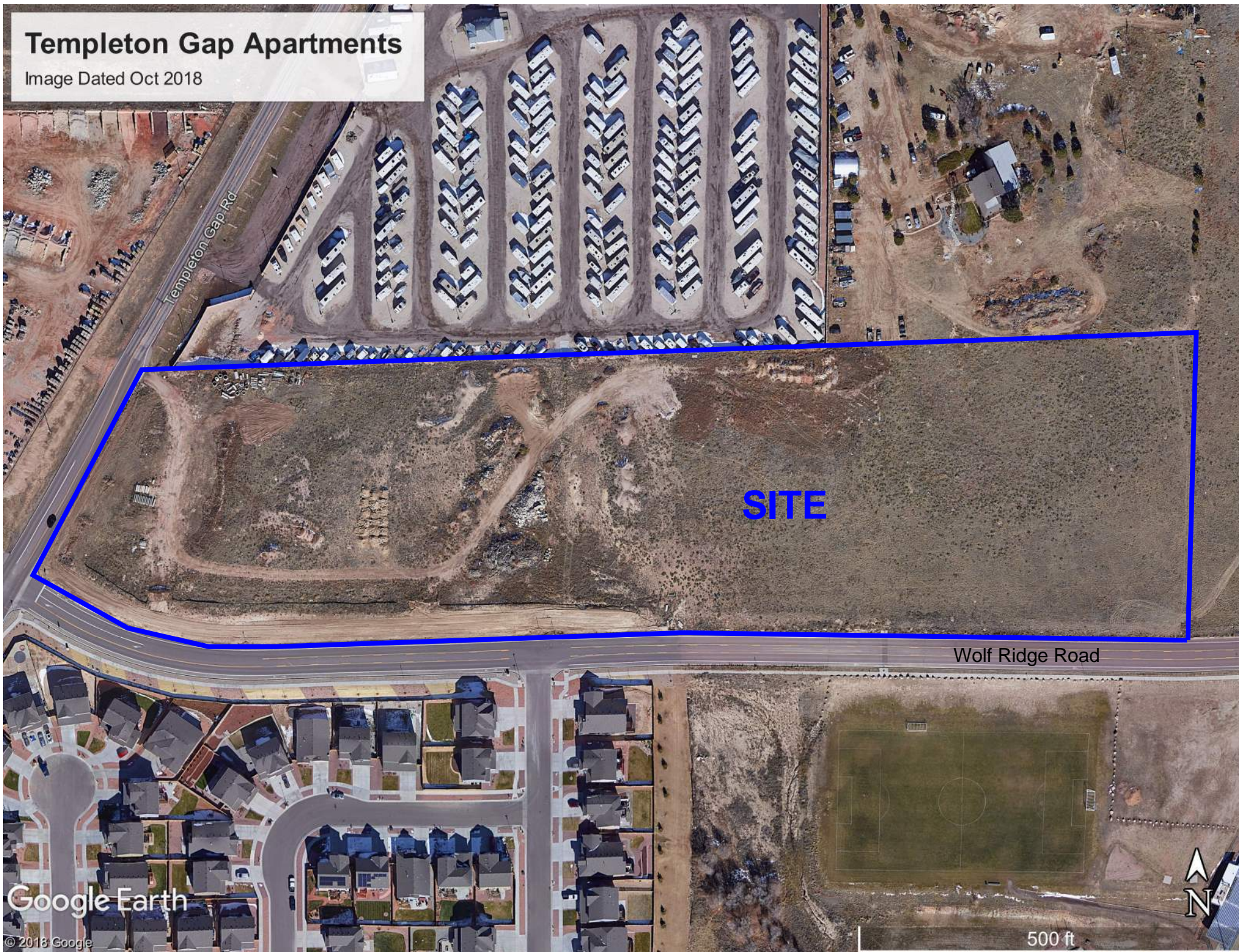
Schedule Number: 5307000011



GENERAL LOCATION MAP

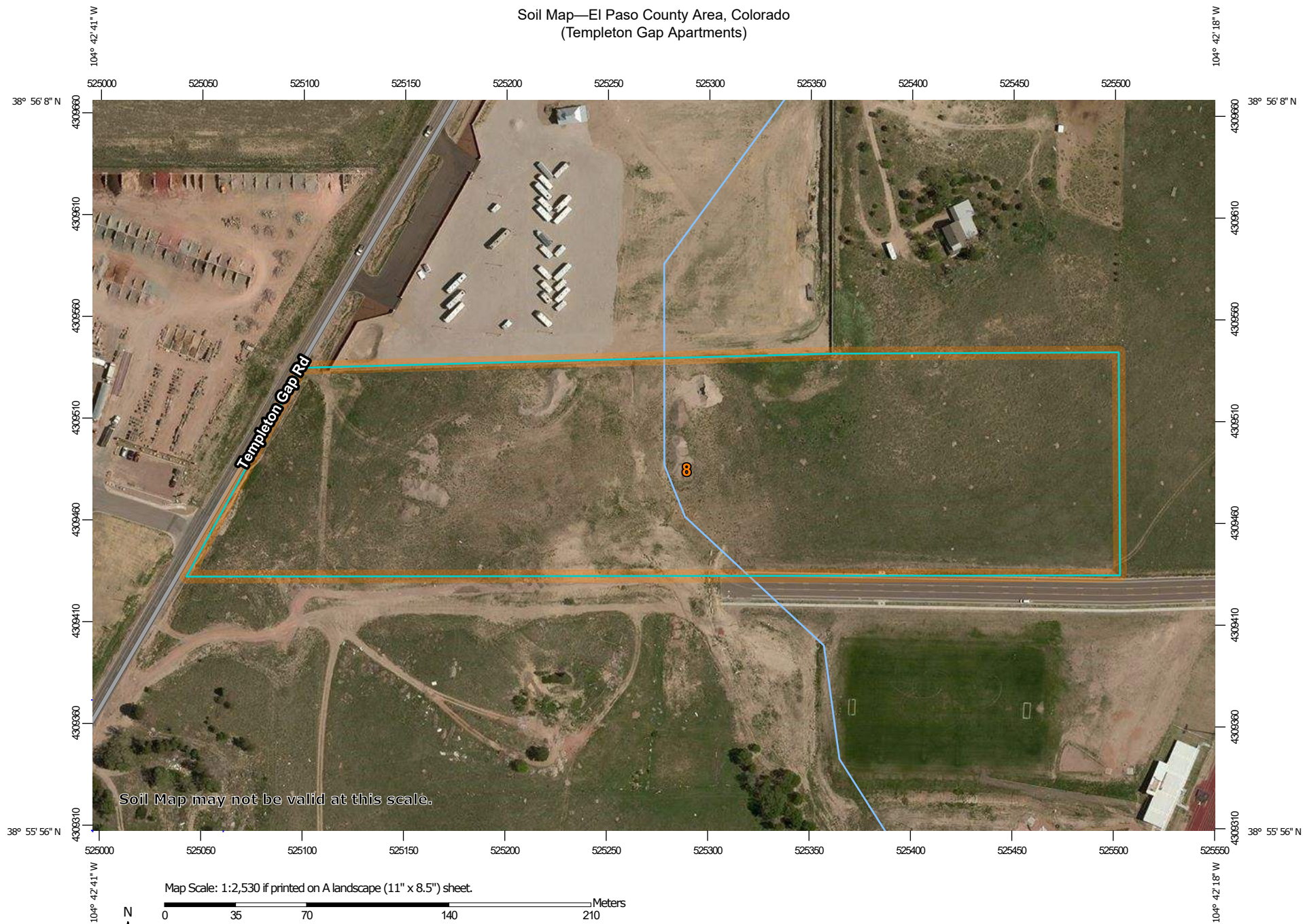
Templeton Gap Apartments

Image Dated Oct 2018

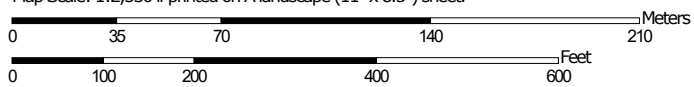


NRCS SOIL MAP

Soil Map—El Paso County Area, Colorado
(Templeton Gap Apartments)



Map Scale: 1:2,530 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

5/3/2019
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Soil Map—El Paso County Area, Colorado
(Templeton Gap Apartments)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils



Soil Map Unit Polygons



Soil Map Unit Lines



Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	11.4	100.0%
Totals for Area of Interest		11.4	100.0%

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v

Elevation: 4,600 to 5,800 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 125 to 145 days

Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats

Landform position (three-dimensional): Side slope, talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from sedimentary rock and/or
eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand

AC - 11 to 27 inches: loamy sand

C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to
very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 5 percent

Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: Sandy Foothill (R049BY210CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 16, Sep 10, 2018

FEMA FIRM MAP

HYDROLOGIC CALCULATIONS

GALANT TOWNHOMES
AREA RUNOFF COEFFICIENT (C) SUMMARY

EXISTING

		<i>DEVELOPED</i>			<i>UNDEVELOPED</i>			<i>WEIGHTED</i>		<i>WEIGHTED CA</i>	
BASIN	TOTAL AREA	AREA	C5	C100	AREA	C5	C100	C5	C100	CA5	CA100
	(Acres)	(Acres)			(Acres)						
<i>OS-Z</i>	22.00	22.00	0.25	0.43	0.00	0.09	0.31	0.25	0.43	5.50	9.46
<i>OS-Y</i>	2.49	2.49	0.25	0.43	0.00	0.09	0.31	0.25	0.43	0.62	1.07
<i>EX-A</i>	1.88	0.00	0.49	0.60	1.88	0.09	0.31	0.09	0.31	0.17	0.58
<i>EX-B</i>	6.86	0.00	0.49	0.60	6.86	0.09	0.31	0.09	0.31	0.62	2.13
<i>EX-C</i>	2.02	0.00	0.49	0.60	2.02	0.09	0.31	0.09	0.31	0.18	0.63

DEVELOPED

		<i>DEVELOPED</i>			<i>UNDEVELOPED</i>			<i>WEIGHTED</i>		<i>WEIGHTED CA</i>	
BASIN	TOTAL AREA	AREA	C5	C100	AREA	C5	C100	C5	C100	CA5	CA100
	(Acres)	(Acres)			(Acres)						
<i>OS-Z</i>	22.00	22.00	0.25	0.43	0.00	0.09	0.31	0.25	0.43	5.50	9.46
<i>OS-Y</i>	2.49	2.49	0.25	0.43	0.00	0.09	0.31	0.25	0.43	0.62	1.07
<i>PR-1</i>	10.40	10.40	0.49	0.60	0.00	0.09	0.31	0.49	0.60	5.10	6.24
<i>PR-2</i>	0.03	0.03	0.09	0.31	0.00	0.09	0.31	0.09	0.31	0.00	0.01
<i>PR-3</i>	0.24	0.24	0.09	0.31	0.00	0.09	0.31	0.09	0.31	0.02	0.07
<i>SB-1</i>	3.19	3.19	0.49	0.60	0.00	0.09	0.31	0.49	0.60	1.56	1.91
<i>SB-2</i>	2.38	2.38	0.49	0.60	0.00	0.09	0.31	0.49	0.60	1.17	1.43
<i>SB-3</i>	0.58	0.58	0.49	0.60	0.00	0.09	0.31	0.49	0.60	0.28	0.35
<i>SB-4</i>	3.95	3.95	0.49	0.60	0.00	0.09	0.31	0.49	0.60	1.94	2.37
<i>SB-5</i>	0.23	0.23	0.49	0.60	0.00	0.09	0.31	0.49	0.60	0.11	0.14

Calculated by: DLF

Date: 12/23/2019

Checked by: _____

GALANT TOWNHOMES RUNOFF SUMMARY

EXISTING

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				T _c	INTENSITY		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Slope (ft/ft)	T _i (min)	Length (ft)	Slope (%)	Velocity (fps)	T _i (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		* For Calcs See Runoff Summary														
OS-Z	22.00	0.25	0.43	0.25	300	0.03	18.5	0	3.0%	1.2	0.0	18.5	3.2	5.3	17.4	50.2
OS-Y	2.49	0.25	0.43	0.25	300	0.10	12.4	0	10%	2.2	0.0	12.4	3.7	6.4	2.3	6.9
EX-A	1.88	0.09	0.31	0.09	300	0.03	22.0	0	3.0%	1.2	0.0	22.0	2.9	4.8	0.5	2.8
EX-B	6.86	0.09	0.31	0.09	300	0.12	13.9	0	12%	2.4	0.0	13.9	3.6	6.1	2.2	13.0
EX-C	2.02	0.09	0.31	0.09	300	0.08	15.9	0	8.0%	2.0	0.0	15.9	3.4	5.7	0.6	3.6

DEVELOPED

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				T _c	INTENSITY		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Slope (ft/ft)	T _t (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		* For Calcs See Runoff Summary														
OS-Z	22.00	0.25	0.43	0.25	300	0.03	18.5	0	3.0%	1.2	0.0	18.5	3.2	5.3	17.4	50.2
OS-Y	2.49	0.25	0.43	0.25	300	0.10	12.4	0	10%	2.2	0.0	12.4	3.7	6.4	2.3	6.9
PR-1	10.40	0.49	0.60	0.49	300	0.02	15.2	1300	2.0%	2.8	7.7	22.8	2.9	4.7	14.6	29.6
PR-2	0.03	0.09	0.31	0.09	25	0.10	4.3	0	10%	2.2	0.0	4.3	5.2	9.5	0.0	0.1
PR-3	0.24	0.09	0.31	0.09	25	0.15	3.7	0	15%	2.7	0.0	3.7	5.3	9.8	0.1	0.7
SB-1	3.19	0.49	0.60	0.49	300	0.02	15.2	1300	2.0%	2.8	7.7	22.8	2.9	4.7	4.5	9.1
SB-2	2.38	0.49	0.60	0.49	300	0.02	15.2	1200	2.0%	2.8	7.1	22.2	2.9	4.8	3.4	6.9
SB-3	0.58	0.49	0.60	0.49	300	0.02	15.2	650	2.0%	2.8	3.8	19.0	3.1	5.2	0.9	1.8
SB-4	3.95	0.49	0.60	0.49	300	0.02	15.2	1120	2.0%	2.8	6.6	21.8	2.9	4.9	5.7	11.5
SB-5	0.23	0.49	0.60	0.49	300	0.02	15.2	270	2.0%	2.8	1.6	16.8	3.3	5.6	0.4	0.8

Calculated by: DLF

Date: 12/23/2019

Checked by: _____

GALIAN TOWNHOMES

SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (ac)	Flow (cfs)	
			Q_5	Q_{100}
1	PR-1, OS-Y	12.90	16.9	36.5
2	PR-2	0.03	0.0	0.1
3	PR-3	0.24	0.1	0.7
11	SB-1	3.19	4.5	9.1
12	SB-2	2.38	3.4	6.9
13	SB-3	0.58	0.9	1.8
14	SB-4, OS-7	6.44	8.0	18.4
15	SB-5	0.23	0.4	0.8

Calculated by: DLF

Date: 12/23/2019

Checked by: _____

GALANT TOWNHOMES PIPE ROUTING SUMMARY

5 Year Event

<i>Pipe Run #</i>	<i>Inlet #</i>	<i>Contributing Flow Sources</i>	<i>Contributing Pipe Flow(s) (cfs)</i>	<i>Contributing Inlet Flow (cfs)</i>	<i>Pipe Run Flow (cfs)</i>
<i>1-9</i>	<i>-</i>	North cutoff trench	none	none	<i>n/a</i>
<i>10</i>	<i>-</i>	North cutoff trench (Basin OS-Y)	none	none	<i>2.3</i>
<i>11</i>	<i>1</i>	Inlet #1 (Basin SB-3)	none	0.9	<i>0.9</i>
<i>12</i>	<i>2</i>	PR#11, Inlet #2	0.9	0.1	<i>1.0</i>
<i>13</i>	<i>3</i>	PR#12, Inlet #3	1.0	4.5	<i>5.5</i>
<i>14</i>	<i>4</i>	Inlet #4 (Basin SB-2)	none	3.0	<i>3.0</i>
<i>15</i>	<i>5</i>	PR#14, Inlet #5	3.0	0.1	<i>3.1</i>
<i>16</i>	<i>6</i>	Inlet #6 (Basin SB-5)	none	0.4	<i>0.4</i>
<i>17</i>	<i>7</i>	PR#16, Inlet #17, Basin OS-Y	0.4	7.9	<i>8.3</i>
<i>18</i>	<i>-</i>	Pond Outlet	none	0.5	<i>0.5</i>

100 Year Event

<i>Pipe Run #</i>	<i>Inlet #</i>	<i>Contributing Flow Sources</i>	<i>Contributing Pipe Flow(s) (cfs)</i>	<i>Contributing Inlet Flow (cfs)</i>	<i>Pipe Run Flow (cfs)</i>
<i>1-9</i>	<i>-</i>	North cutoff trench	none	none	<i>n/a</i>
<i>10</i>	<i>-</i>	North cutoff trench (Basin OS-Y)	none	none	<i>6.9</i>
<i>11</i>	<i>1</i>	Inlet #1 (Basin SB-3)	none	1.8	<i>1.8</i>
<i>12</i>	<i>2</i>	PR#11, Inlet #2	1.8	0.5	<i>2.3</i>
<i>13</i>	<i>3</i>	PR#12, Inlet #3	2.3	9.1	<i>11.4</i>
<i>14</i>	<i>4</i>	Inlet #4 (Basin SB-2)	none	6.9	<i>6.9</i>
<i>15</i>	<i>5</i>	PR#14, Inlet #5	6.9	0.2	<i>7.1</i>
<i>16</i>	<i>6</i>	Inlet #6 (Basin SB-5)	none	0.8	<i>0.8</i>
<i>17</i>	<i>7</i>	PR#16, Inlet #17, Basin OS-Y	0.8	18.3	<i>19.1</i>
<i>18</i>	<i>-</i>	Pond Outlet	none	4.3	<i>4.3</i>

Note: Inlet flow values are based on tributary area as a percentage of total drainage basin

Calculated by: DLF

Date: 12/23/2019

Checked by: _____

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

UD-BMP (Version 3.06, November 2016)

		User Input	
		Calculated cells	
***Design Storm: 1-Hour Rain Depth	2-Year Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer:	Dane Frank
Company:	Terra Nova Engineering
Date:	January 7, 2020
Project:	Templeton Gap Townhomes
Location:	7065 Templeton Gap Road, Colorado Springs

SITE INFORMATION (USER-INPUT)

[illegible]

CALCULATED RESULTS (OUTPUT)

[illegible]

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

[illegible]

Total Site Imperviousness:	64.9%
Total Site Effective Imperviousness for 2-Year Event:	64.9%
Total Site Effective Imperviousness for 5-Year Event:	64.9%
Total Site Effective Imperviousness for 100-Year Event:	64.9%
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposes

HYDRAULIC CALCULATIONS

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Galiant Townhomes**

Location: **Drive Lanes at 2% Grade - Capacity**

By: **Dane Frank**

Date: **9/12/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

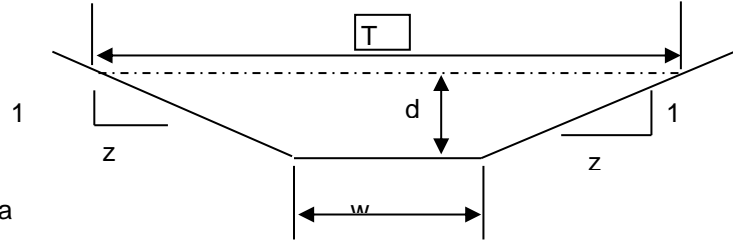
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 25
z (sideslope)= 25
b (btm width, ft)= 0
d (depth, ft)= 0.48
S (slope, ft/ft) 0.02
n low = 0.016
n high = 0.016

Clear Data
Entry Cells

		Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs
0.48	5.76	24.02	0.24	5.06954765	29.2006	5.069548	29.2006
				T =		24	
				Dm =		0.240	
				Sc low =		0.0060	
				Sc high =		0.0060	
				.7 Sc		1.3 Sc	
				0.0042		0.0078	

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Galiant Townhomes**

Location: **Drive Lanes at 11% Grade - Capacity**

By: **Dane Frank**

Date: **9/12/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

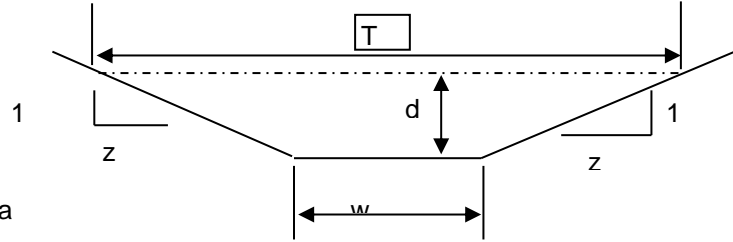
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 50
z (sideslope)= 50
b (btm width, ft)= 0
d (depth, ft)= 0.74
S (slope, ft/ft) 0.11
n low = 0.016
n high = 0.016

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		T =	Dm =
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.74	27.38	74.01	0.37	15.8729395	434.601	15.87294	434.601	74	0.370

Sc low = 0.0052 Sc high = 0.0052

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

.7 Sc	1.3 Sc	.7 Sc	1.3 Sc
0.0036	0.0068	0.0036	0.0068

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Galiant Townhomes**

Location: **South Swale - 2% Section - Capacity (Need Q=2.0 cfs)**

By: **Dane Frank**

Date: **9/12/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

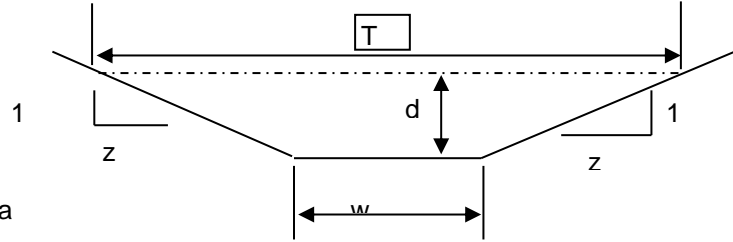
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 3
z (sideslope)= 3
b (btm width, ft)= 0
d (depth, ft)= 0.75
S (slope, ft/ft) 0.02
n low = 0.035
n high = 0.035

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs	
0.75	1.69	4.74	0.36	3.0145268	5.08701	3.014527	5.08701	T = 4.5
				Sc low = 0.0265		Sc high = 0.0265		Dm = 0.375
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc	
				0.0186	0.0345	0.0186	0.0345	

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: Galiant Townhomes **Location:** South Swale - 5% Section - Capacity (Need Q=6.0 cfs)
By: Dane Frank **Date:** 9/12/2019
Chk By: **Date:** version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

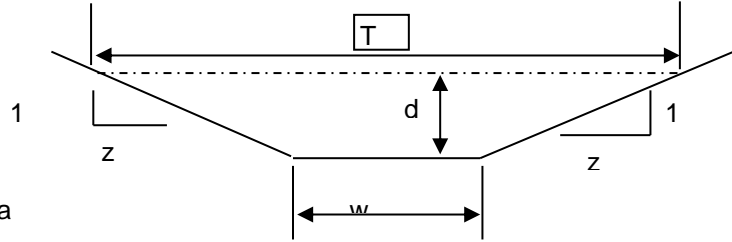
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 3
 z (sideslope)= 3
 b (btm width, ft)= 0
 d (depth, ft)= 1
 S (slope, ft/ft) 0.05
 n low = 0.035
 n high = 0.035

Clear Data
 Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		T =	Dm =
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
1	3.00	6.32	0.47	5.77412006	17.3224	5.77412	17.3224	6	0.500
Sc low =				0.0241	Sc high =		0.0241		
s _c = critical slope				ft / ft					
T = top width of the stream				.7 Sc		1.3 Sc			
d _m = a/T = mean depth of flow				0.0169		0.0313			

s_c = critical slope ft / ft

T = top width of the stream

$d_m = a/T$ = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Galiant Townhomes**

By: **Dane Frank**

Chk By:

Location: **N Conc Channel - West Side - Capacity (Need Q=50.2 cfs)**

Date: **9/12/2019**

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

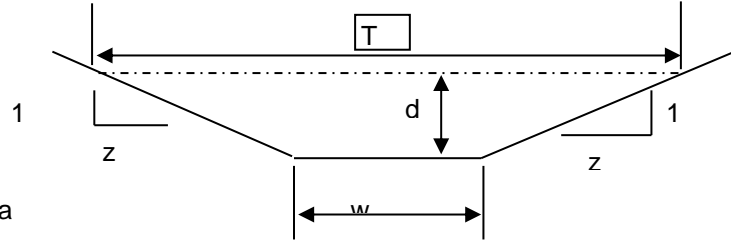
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 0
z (sideslope)= 0
b (btm width, ft)= 2
d (depth, ft)= 2.8
S (slope, ft/ft) 0.01
n low = 0.013
n high = 0.013

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		T =	Dm =
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
2.8	5.60	7.60	0.74	9.32511063	52.2206	9.325111	52.2206	2	2.800
Sc low =				0.0104	Sc high =		0.0104		
s _c = critical slope				ft / ft					
T = top width of the stream				.7 Sc		1.3 Sc			
d _m = a/T = mean depth of flow				0.0072		0.0135			

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: Galiant Townhomes **Location:** N Conc Channel - West Side - Capacity (Need Q=6.9 cfs)
By: Dane Frank **Date:** 9/12/2019
Chk By: **Date:** **version** 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

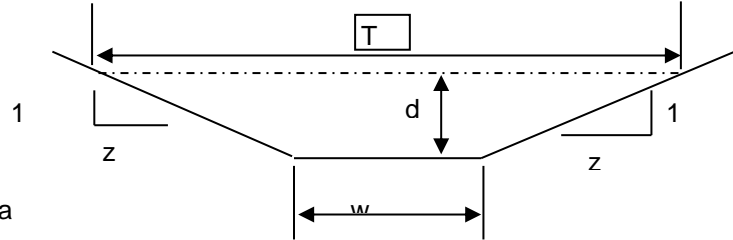
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 0
z (sideslope)= 0
b (btm width, ft)= 2
d (depth, ft)= 0.5
S (slope, ft/ft) 0.03
n low = 0.013
n high = 0.013

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		T =	Dm =
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	1.00	3.00	0.33	9.51786069	9.51786	9.517861	9.51786	2	0.500
Sc low =				0.0053	Sc high =		0.0053		
s _c = critical slope				ft / ft					
T = top width of the stream				.7 Sc		1.3 Sc			
d _m = a/T = mean depth of flow				0.0037		0.0069			

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Galiant Townhomes**

Location: **Center Swale - Capacity (Need Q=1.8 cfs)**

By: **Dane Frank**

Date: **12/23/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

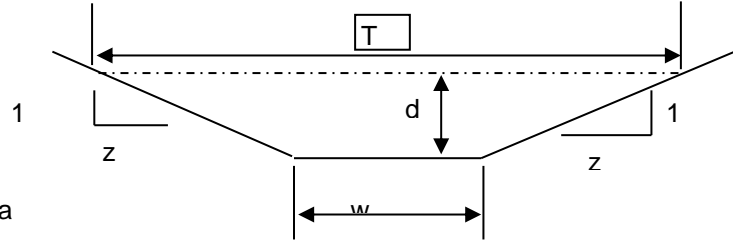
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 7
z (sideslope)= 7
b (btm width, ft)= 3
d (depth, ft)= 0.5
S (slope, ft/ft) 0.02
n low = 0.035
n high = 0.035

Clear Data
Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity,		Velocity,		T =	
				fps	Flow, cfs	fps	Flow, cfs		
0.5	3.25	10.07	0.32	2.8248016	9.18061	2.824802	9.18061		10
								Dm =	0.325
				Sc low =	0.0262	Sc high =	0.0262		
s _c = critical slope				ft / ft					
T = top width of the stream				.7 Sc		1.3 Sc			
d _m = a/T = mean depth of flow				0.0183		0.0340			
				.7 Sc		1.3 Sc			
				0.0183		0.0340			

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#1-PR#9 (cutoff trench drains) - Capacity

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 6 inches
d= 6 inches
n= 0.01 mannings coeff
θ= 0.0 degrees
S= 0.1 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

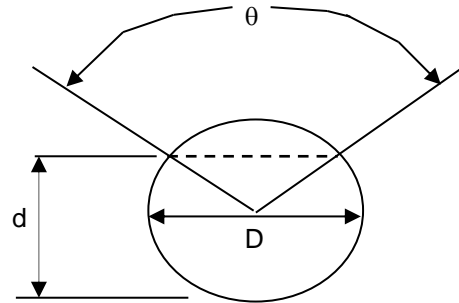
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
0.20	1.57	0.13	11.75	2.31	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#10 (Need Q=6.9cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 18 inches
d= 18 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.1 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

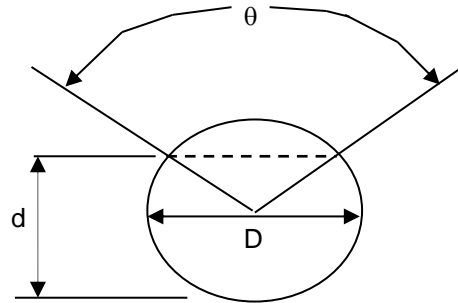
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
1.77	4.71	0.38	20.36	35.98	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#11 (Need Q=1.8cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 12 inches
d= 12 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

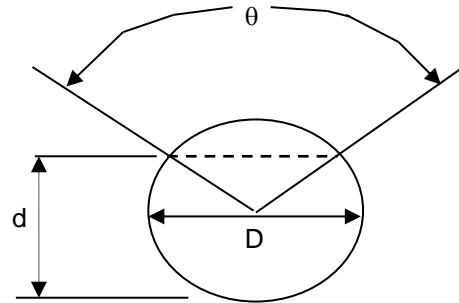
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
0.79	3.14	0.25	6.95	5.46	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#12 (Need Q=2.3cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 12 inches
d= 12 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

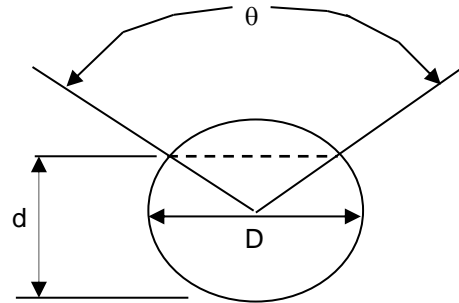
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
0.79	3.14	0.25	6.95	5.46	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#13 (Need Q=11.4cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 18 inches
d= 18 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q = (1.486/n) A R_h^{2/3} S^{1/2}$$

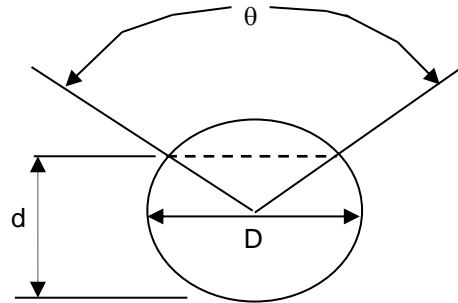
$$R = A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V = (1.49/n) R_h^{2/3} S^{1/2}$$

$$Q = V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
1.77	4.71	0.38	9.11	16.09	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#14 (Need Q=6.9cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 15 inches
d= 15 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

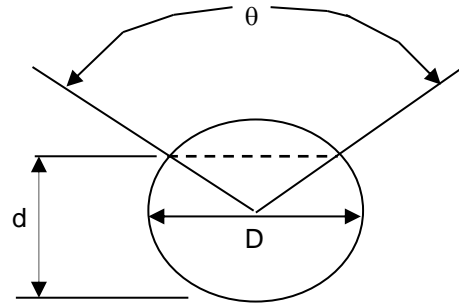
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
1.23	3.93	0.31	8.06	9.90	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#15 (Need Q=7.1cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 15 inches
d= 15 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

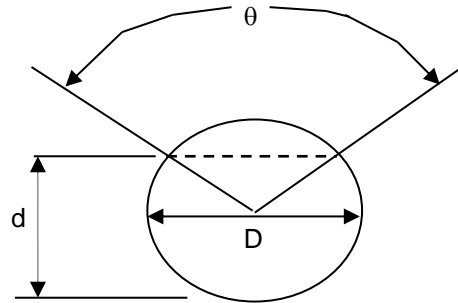
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
1.23	3.93	0.31	8.06	9.90	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#16 (Need Q=0.8cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 8 inches
d= 8 inches
n= 0.01 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

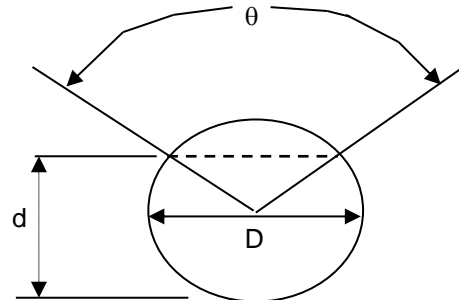
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
0.35	2.09	0.17	6.36	2.22	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#17 (Need Q=19.1cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 21 inches
d= 21 inches
n= 0.012 mannings coeff
θ= 0.0 degrees
S= 0.02 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

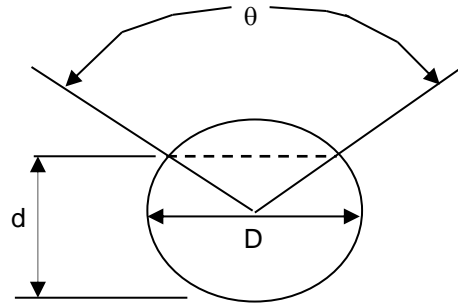
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
2.41	5.50	0.44	10.09	24.27	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project: Templeton Gap Townhomes Location: PR#18 (Need Q=4.3cfs)

By: Dane Frank

Date: #####

Chk. By:

Date:

mdo version 12.8.00

Clear Data
Entry Cells

INPUT

D= 18 inches
d= 18 inches
n= 0.013 mannings coeff
θ= 0.0 degrees
S= 0.005 slope in/in

Mannings Formula

$$Q=(1.486/n)AR_h^{2/3}S^{1/2}$$

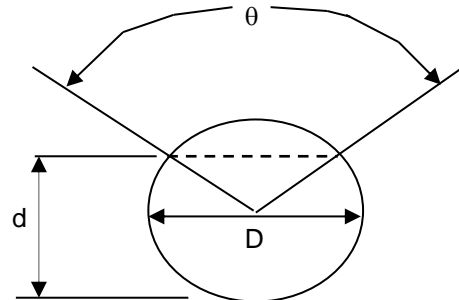
$$R=A/P$$

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient



$$V=(1.49/n)R_h^{2/3}S^{1/2}$$

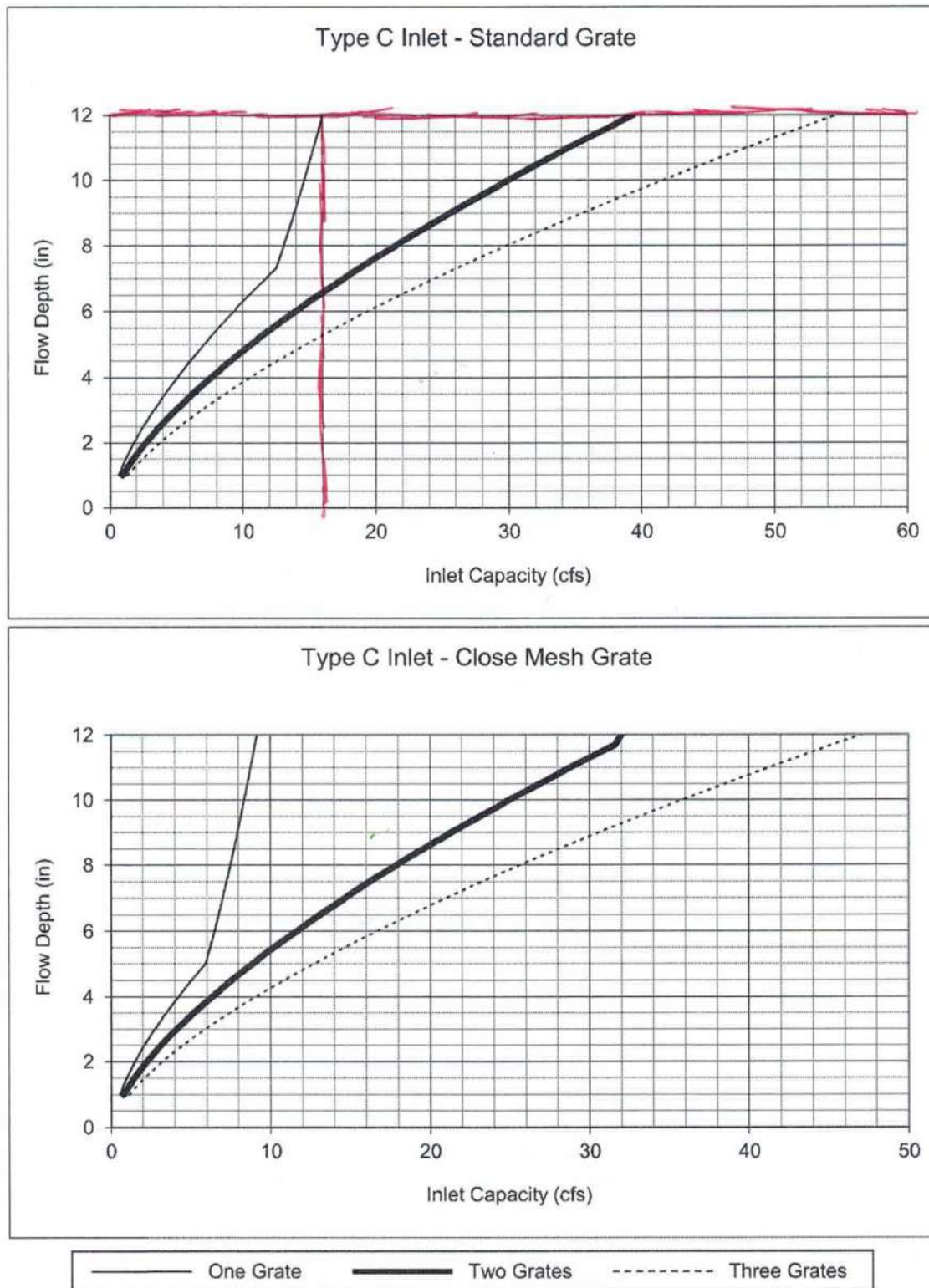
$$Q=V \times A$$

			Solution to Mannings Equation		Manning's n-values	
Area,ft ²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		
1.77	4.71	0.38	4.20	7.43	PVC	0.01
					PE (<9"dia)	0.015
					PE (>12"dia)	0.02
					PE(9-12"dia)	0.017
					CMP	0.025
					ADS N12	0.012
					HCMP	0.023
					Conc	0.013

Created by: Mike O'Shea

Inlet at south drive access
Need 7 cfs

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet

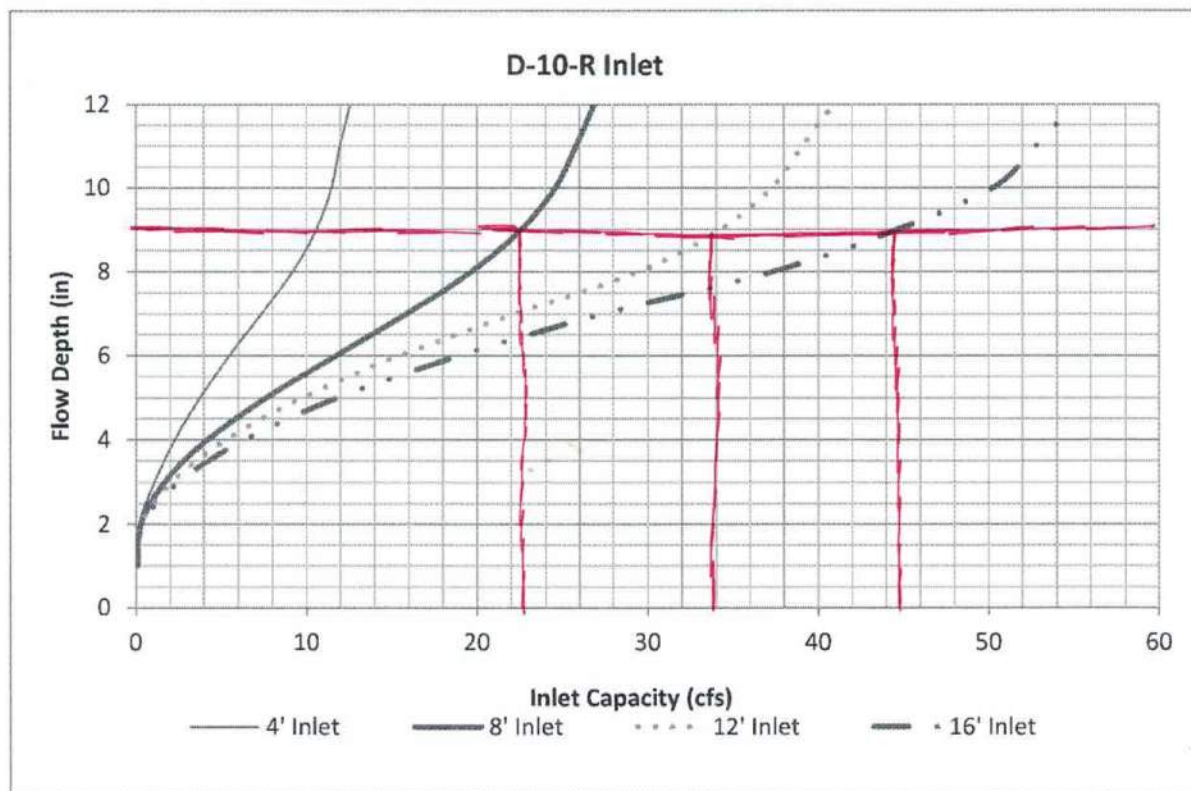


Notes:

1. The standard inlet parameters must apply to use these charts.

Inlet at DP14 - Need 18 cfs

Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet



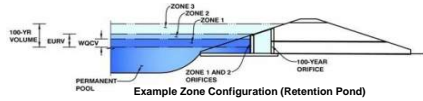
EDB DESIGN CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Templeton Gap Townhomes

Basin ID: **EDB**



Required Volume Calculation

Selected BMP Type	EDB	
Watershed Area	11.42	acres
Watershed Length	1.400	ft
Watershed Slope	0.077	ft/ft
Watershed Imperviousness	70.00%	percent
Percentage Hydrologic Soil Group A	100.0%	percent
Percentage Hydrologic Soil Group B	0.0%	percent
Percentage Hydrologic Soil Groups C/D	0.0%	percent
Desired WQCV Drain Time	40.0	hours
Location for 1-hr Rainfall Depth	Denver - Capitol Building	
Water Quality Capture Volume (WQCV)	0.262	acre-feet
Excess Urban Runoff Volume (EURV)	1.013	acre-feet
2-yr Runoff Volume ($P_1 = 1.19$ in.)	0.698	acre-feet
5-yr Runoff Volume ($P_1 = 1.5$ in.)	0.910	acre-feet
10-yr Runoff Volume ($P_1 = 1.75$ in.)	1.104	acre-feet
25-yr Runoff Volume ($P_1 = 2$ in.)	1.327	acre-feet
50-yr Runoff Volume ($P_1 = 2.2$ in.)	1.562	acre-feet
100-yr Runoff Volume ($P_1 = 2.52$ in.)	1.839	acre-feet
500-yr Runoff Volume ($P_1 = 3.14$ in.)	2.467	acre-feet
Approximate 2-yr Detention Volume	0.661	acre-feet
Approximate 5-yr Detention Volume	0.863	acre-feet
Approximate 10-yr Detention Volume	1.036	acre-feet
Approximate 25-yr Detention Volume	1.241	acre-feet
Approximate 50-yr Detention Volume	1.363	acre-feet
Approximate 100-yr Detention Volume	1.485	acre-feet

Optional User Override

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (V_{WC1})	0.262	acre-feet
Zone 2 Volume ($EURV - Zone 1$)	0.751	acre-feet
Zone 3 Volume (100-Year - Zones 1 & 2)	0.472	acre-feet
Total Detention Basin Volume =	1.485	acre-feet
Initial Surcharge Volume (ISV)	user	ft ³
Initial Surcharge Depth (ISD)	user	ft
Total Available Detention Depth (H_{DAV})	user	ft
Depth of Trickle Channel (H_{TC})	user	ft
Slope of Trickle Channel (S_{TC})	user	ft/ft
Slopes of Main Basin Sides (S_{MAIN})	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$)	user	
Initial Surcharge Area (A_{IS1})	user	ft ²
Surcharge Volume Length (L_{IS1})	user	ft
Surcharge Volume Width (W_{IS1})	user	ft
Depth of Basin Floor ($H_{1,FOA}$)	user	ft
Length of Basin Floor ($H_{1,FOA}$)	user	ft
Width of Basin Floor ($W_{1,FOA}$)	user	ft
Area of Basin Floor ($A_{1,FOA}$)	user	ft ²
Volume of Basin Floor ($V_{1,FOA}$)	user	ft ³
Depth of Main Basin (H_{MAIN})	user	ft
Length of Main Basin (L_{MAIN})	user	ft
Width of Main Basin (W_{MAIN})	user	ft
Area of Main Basin (A_{MAIN})	user	ft ²
Volume of Main Basin (V_{MAIN})	user	ft ³
Calculated Total Basin Volume (V_{DAV})	user	acre-feet

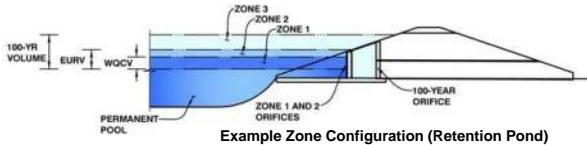
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Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: **Templeton Gap Townhomes**

Basin ID: **EDB**



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.56	0.262	Orifice Plate
Zone 2 (EURV)	4.33	0.751	Orifice Plate
Zone 3 (100-year)	5.59	0.472	Weir&Pipe (Rect.)
		1.485	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft ²
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.33	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	17.30	inches
Orifice Plate: Orifice Area per Row =	3.25	sq. inches (diameter = 2 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.257E-02	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.44	2.89					
Orifice Area (sq. inches)	3.25	3.25	3.25					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft ²
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	4.33	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _u =	4.33	N/A	feet
Over Flow Weir Slope Length =	2.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.57	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	2.80	N/A	ft ²
Overflow Grate Open Area w/ Debris =	1.40	N/A	ft ²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Rectangular Orifice Width =	7.40	N/A	inches
Rectangular Orifice Height =	7.20	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Rectangular	Not Selected	
Outlet Orifice Area =	0.37	N/A	ft ²
Outlet Orifice Centroid =	0.30	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

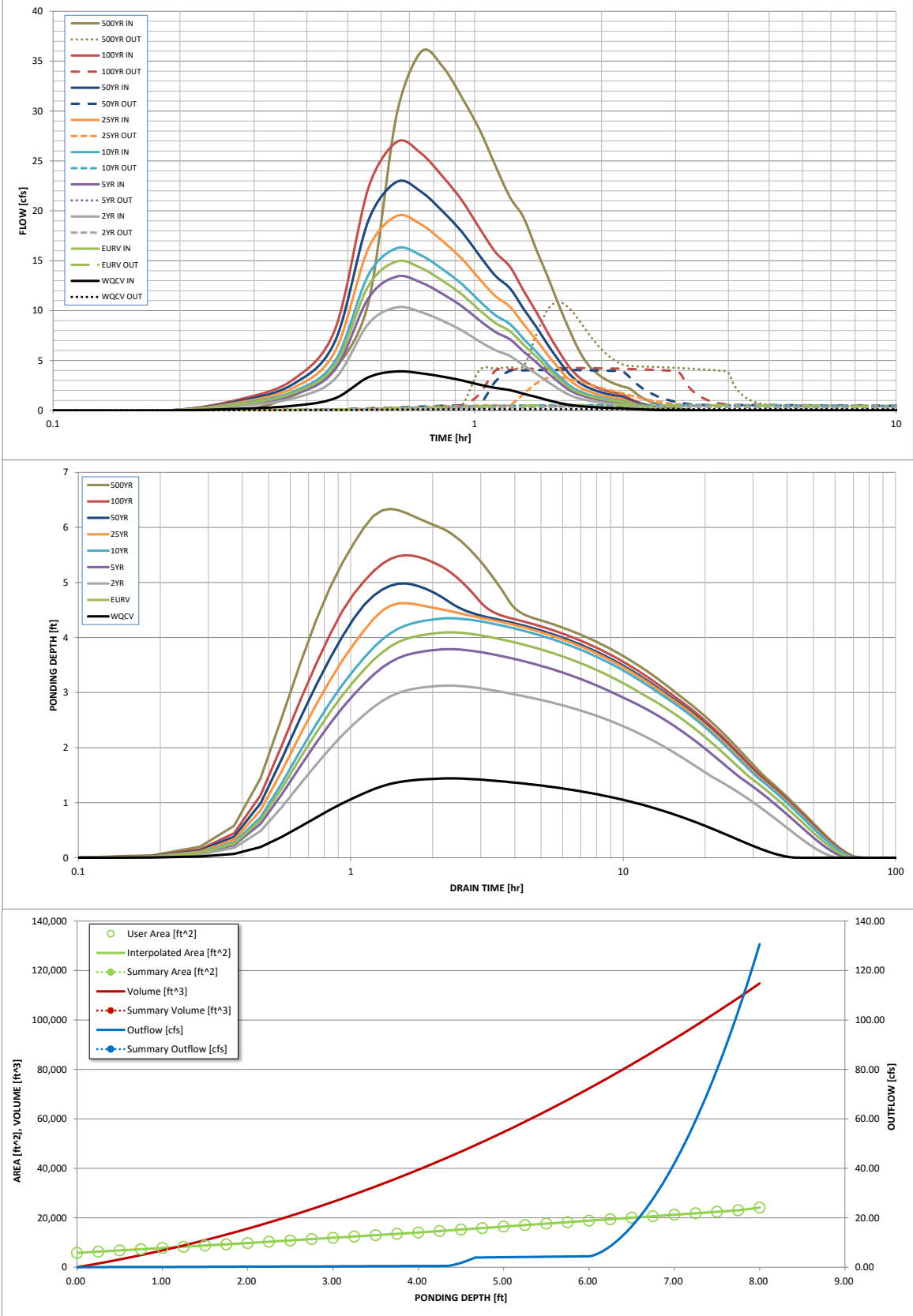
Spillway Design Flow Depth=	0.82	feet
Stage at Top of Freeboard =	7.82	feet
Basin Area at Top of Freeboard =	0.54	acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.14
Calculated Runoff Volume (acre-ft) =	0.262	1.013	0.698	0.910	1.104	1.327	1.562	1.839	2.467
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.261	1.012	0.697	0.908	1.103	1.325	1.561	1.837	2.465
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.17	0.41	0.94
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.3	1.9	4.7	10.7
Peak Inflow Q (cfs) =	3.9	14.9	10.3	13.4	16.3	19.5	22.9	26.9	35.9
Peak Outflow Q (cfs) =	0.1	0.5	0.4	0.5	0.6	3.4	4.1	4.3	10.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	9.6	5.1	12.5	2.1	0.9	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	1.0	1.2	1.3	1.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	57	51	55	58	57	56	55	53
Time to Drain 99% of Inflow Volume (hours) =	40	63	57	61	65	64	64	63	62
Maximum Ponding Depth (ft) =	1.44	4.09	3.13	3.79	4.35	4.63	4.98	5.50	6.34
Area at Maximum Ponding Depth (acres) =	0.20	0.33	0.28	0.31	0.34	0.36	0.38	0.40	0.45
Maximum Volume Stored (acre-ft) =	0.239	0.934	0.640	0.835	1.018	1.116	1.247	1.446	1.805

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

FORBAY VOLUMES

EDB FORBAY VOLUME

<i>ELEV</i>	<i>AREA</i>	<i>AREA AVG.</i>	<i>DELTA ELEV.</i>	<i>VOLUME</i>	<i>VOLUME TOTAL</i>
94.00	160	160	1.5	240	240
95.50	160				

End Area Method: 240 C.F.
 0.006 A.F.

Total East Forebay Volume= 240 C.F.
 0.006 A.F.

Required Forbay Volume = 3% of WQCV

WQCV = 0.18 ac-ft

WQCV = 7,623 cu-ft

3% of WQCV = 228.69 cu-ft

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Templeton Gap Townhomes**

Location: **West EDB Forebay Notch - Q=17.9 cfs * 2% = 0.36 cfs**

By: **Dane Frank**

Date: **11/12/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

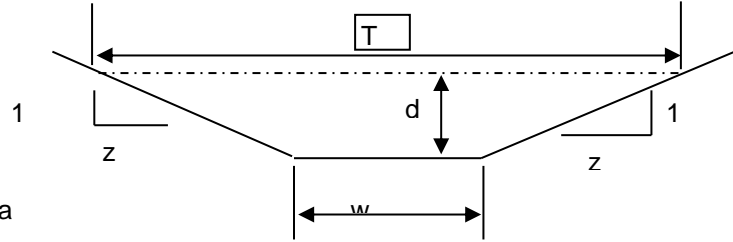
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 0
z (sideslope)= 0
b (btm width, ft)= 0.17
d (depth, ft)= 1.5
S (slope, ft/ft) 0.005
n low = 0.013
n high = 0.013

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs	
1.5	0.26	3.17	0.08	1.50606802	0.38405	1.506068	0.38405	T = 0.17
				Sc low = 0.1063		Sc high = 0.1063		Dm = 1.500
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc	
				0.0744	0.1382	0.0744	0.1382	

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Templeton Gap Townhomes**

Location: **West EDB Forebay Notch - Q=19.1 cfs * 2% = 0.38 cfs**

By: **Dane Frank**

Date: **11/12/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

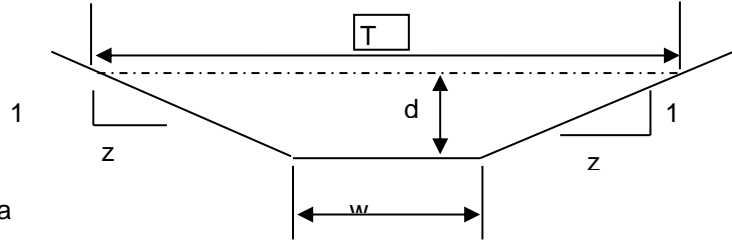
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 0
z (sideslope)= 0
b (btm width, ft)= 0.17
d (depth, ft)= 1.5
S (slope, ft/ft) 0.005
n low = 0.013
n high = 0.013

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs	
1.5	0.26	3.17	0.08	1.50606802	0.38405	1.506068	0.38405	T = 0.17
								Dm = 1.500
				Sc low = 0.1063	Sc high = 0.1063			
				.7 Sc 0.0744	1.3 Sc 0.1382	.7 Sc 0.0744	1.3 Sc 0.1382	

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Templeton Gap Townhomes**

Location: **EDB Trickle Channels (need Q= 0.38 cfs)**

By: **Dane Frank**

Date: **11/12/2019**

Chk By:

Date:

version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_h^{2/3}S^{1/2}$$

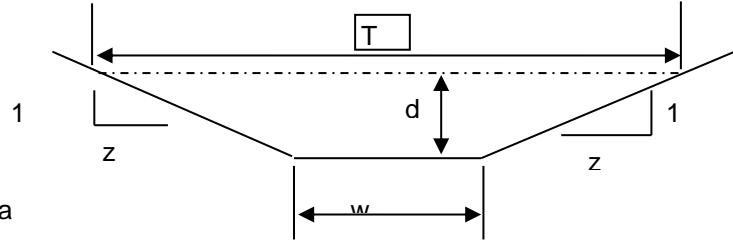
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_h^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 0
z (sideslope)= 0
b (btm width, ft)= 0.37
d (depth, ft)= 0.5
S (slope, ft/ft) 0.005
n low = 0.013
n high = 0.013

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs	
0.5	0.19	1.37	0.14	2.12731719	0.39355	2.127317	0.39355	T = 0.37
				Sc low = 0.0178		Sc high = 0.0178		Dm = 0.500
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc	
				0.0124	0.0231	0.0124	0.0231	

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

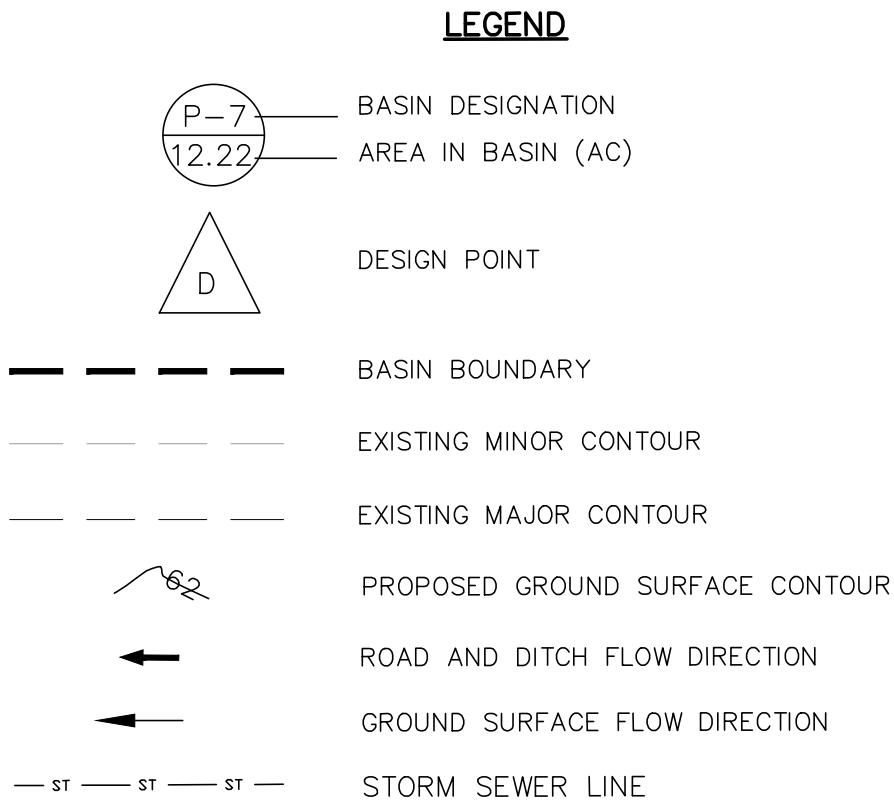
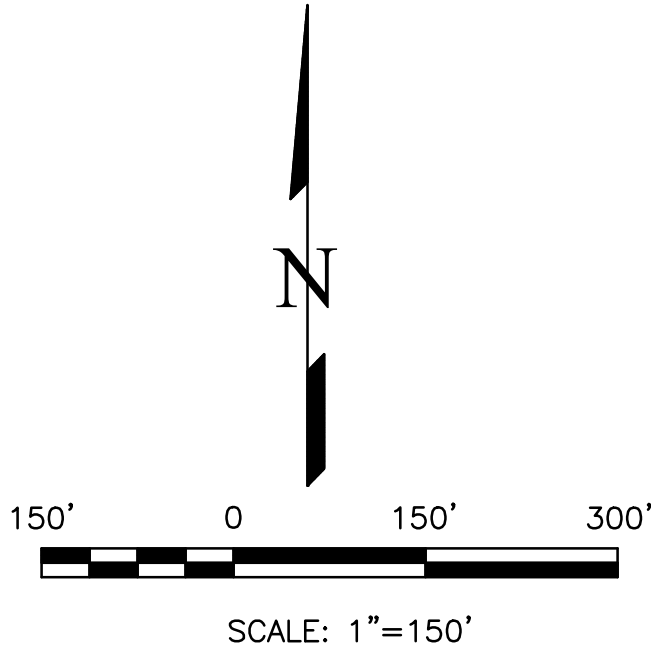
DRAINAGE MAP

N:\jobs\1893.00\Drawings\DP\189300 DP.dwg, 12/23/2019 10:50:19 AM

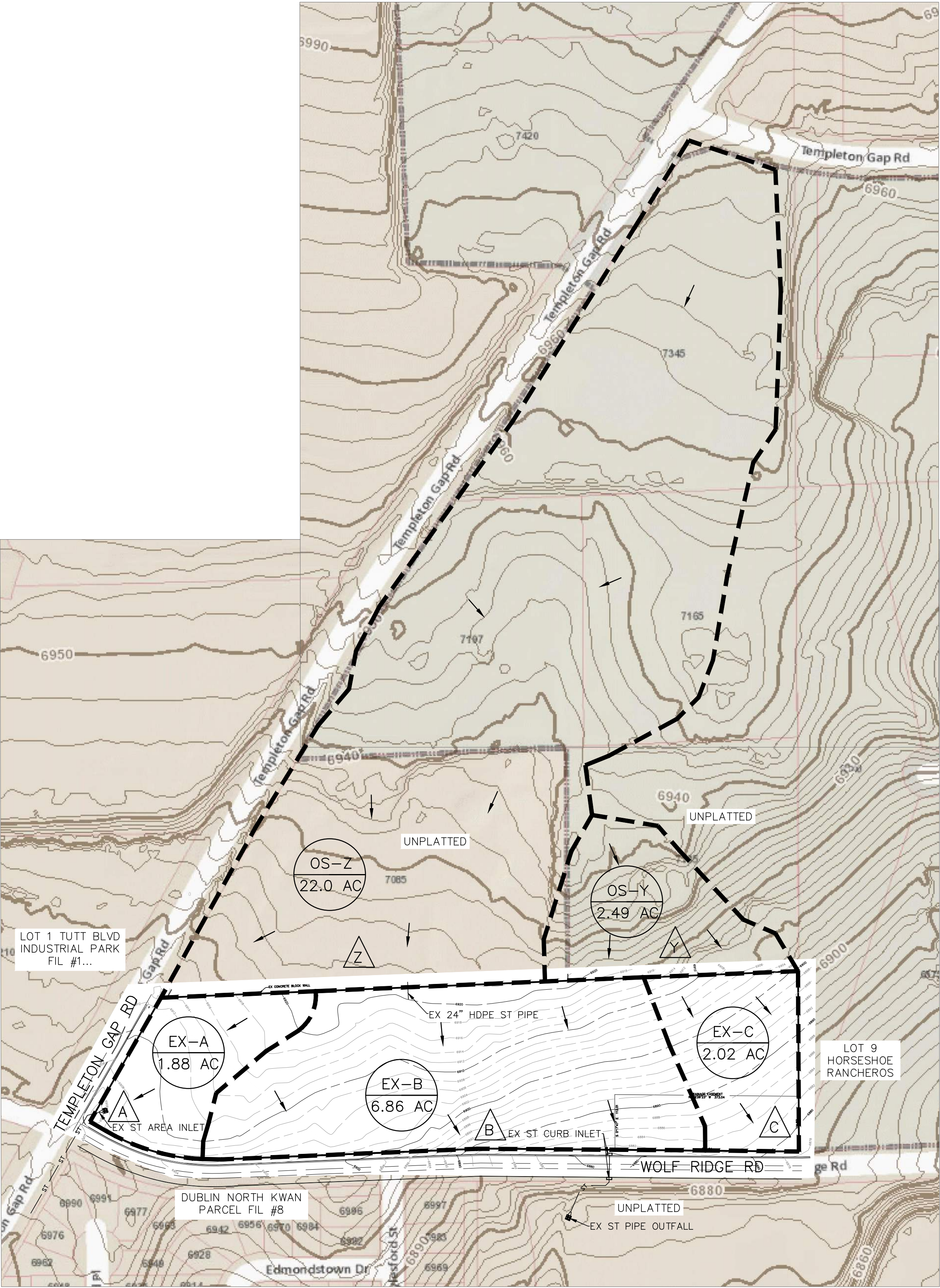
TEMPLETON GAP TOWNHOMES
COLORADO SPRINGS, CO
EXISTING DRAINAGE MAP
DECEMBER 2019

PLAT NAME
LOTS 1 TO 4 INCLUDING BLOCK B, LA VERGNE

NOTES
1. THE SITE IS NOT WITHIN A 100 YEAR FEMA FLOOD PLAIN.
2. OFFSITE GROUND SURFACE CONTOURS ARE FROM COLORADO SPRINGS SPRINGSVIEW GIS (NAD 1983).



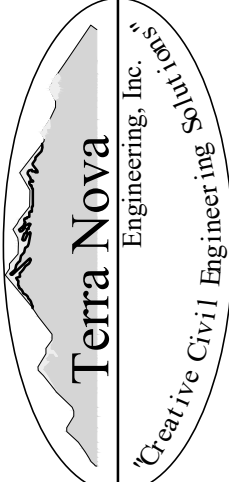
DRAINAGE SUMMARY				
DESIGN POINT	BASIN TRIBUTARY	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
Z	OS-Z	22.0	17.4	50.2
Y	OS-Y	2.49	2.3	6.9
A	EX-A	1.88	0.5	2.8
B	EX-B	6.86	2.2	13.0
C	EX-C	2.02	0.6	3.6



REVISIONS		DATE
NO.	DESCRIPTION	

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE LOCAL AGENCIES, THE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PROJECT AND SITE DESIGNATED BY THE LOCAL AGENCIES. NO WRITTEN AUTHORIZATION.

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TEMPLETON GAP TOWNHOMES	
EXISTING DRAINAGE MAP	
DESIGNED BY LD	
DRAWN BY JGF	
CHECKED BY LD	
H-SCALE AS NOTED	
V-SCALE N/A	
JOB NO. 1807.00	
DATE ISSUED 12/23/19	
SHEET NO. 1 OF 2	

TEMPLETON GAP TOWNHOMES
COLORADO SPRINGS, CO
PROPOSED DRAINAGE MAP
DECEMBER 2019

PLAT NAME
LOTS 1 TO 4 INCLUDING BLOCK B, LA VERGNE

NOTES
1. THE SITE IS NOT WITHIN A 100 YEAR FEMA FLOOD PLAIN.
2. OFFSITE GROUND SURFACE CONTOURS ARE FROM COLORADO SPRINGS SPRINGSVIEW GIS (NAD 1983).
3. BASIN LABEL IDENTIFIERS: OS=OFFSITE, PR=PROPOSED, SB=SUBBASINS. SUBBASIN AREAS & FLOWS ARE NOT PART OF SITE TOTALS.

DESIGN POINT SUMMARY				
DESIGN POINT	BASIN TRIBUTARY	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
Z	OS-Z	22.0	17.4	50.2
Y	OS-Y	2.49	2.3	6.9
1	PR-1, OS-Y	12.9	16.9	36.5
2	PR-2	0.03	0.0	0.1
3	PR-3	0.24	0.1	0.7
11	SB-1	3.19	4.5	9.1
12	SB-2	2.38	3.4	6.9
13	SB-3	0.58	0.9	1.8
14	SB-4, OS-Y	6.44	8.0	18.4
15	SB-5	0.23	0.4	0.8

DRAINAGE SUMMARY			
BASIN	AREA (ACRES)	FLOW	
		5 YR (cfs)	100 YR (cfs)
OS-Z	22.0	17.4	50.2
OS-Y	2.49	2.3	6.9
PR-1	10.4	14.6	29.6
PR-2	0.03	0.0	0.1
PR-3	0.24	0.1	0.7
SB-1	3.19	4.5	9.1
SB-2	2.38	3.4	6.9
SB-3	0.58	0.9	1.8
SB-4	3.95	5.7	11.5
SB-5	0.23	0.4	0.8

LEGEND

Basin Designation: P-7, 12.22
Area in Basin (AC): 12.22

Design Point: D

Basin Boundary: ---

Existing Minor Contour: ---

Existing Major Contour: ---

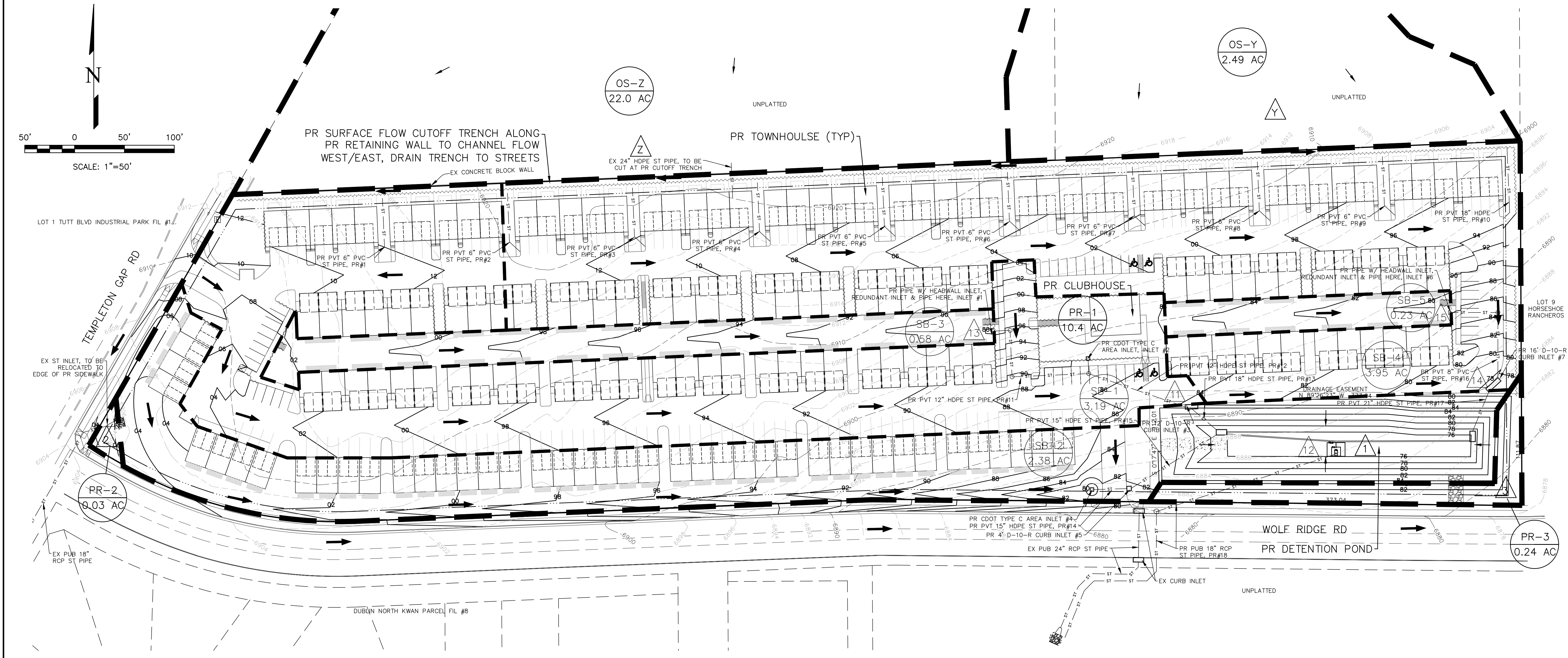
Proposed Ground Surface Contour: ---

Road and Ditch Flow Direction: ---

Ground Surface Flow Direction: ---

Proposed Retaining Wall: ---

Storm Sewer Line: ---



REVISIONS

NO.	DESCRIPTION	DATE

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TEMPLETON GAP TOWNHOMES

PROPOSED DRAINAGE MAP

DESIGNED BY LD
DRAWN BY JGF
CHECKED BY LD

H-SCALE AS NOTED
V-SCALE N/A

JOB NO. 1807.00
DATE ISSUED 12/23/19
SHEET NO. 2 OF 2