FINAL DRAINAGE REPORT

for

WINDERMERE FILING NO. 1

Colorado Springs, CO

March 8, 2022

SF-21-026

Prepared for:

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TABLE OF CONTENTS

1.0 CERTIFICATION STATEMENTS 1
2.0 PURPOSE 2
3.0 GENERAL SITE DESCRIPTION 2
4.0 EXISTING HYDROLOGY 3
5.0 PROPOSED HYDROLOGY (RATIONAL METHOD) & HYDRAULIC SUMMARY 3
6.0 PROPOSED DETENTION/WATER QUALITY FACILITIES 10
7.0 EXISTING N. MARKSHEFFEL CULVERT 13
8.0 FOUR-STEP PROCESS 13
9.0 GEOTECHNICAL HAZARDS 14
10.0 FACILITY MAINTENANCE 15
11.0 CONSTRUCTION COST ESTIMATE 15
12.0 DRAINAGE/BRIDGE FEES 16
13.0 CONCLUSIONS 16
14.0 REFERENCES 17

APPENDICES

DRAINAGE REPORT BY CLASSIC
VICINITY MAP
SOILS MAP
FLOODPLAIN MAP
DRAINAGE CALCULATIONS
DRAINAGE MAP

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1.0 CERTIFICATION STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports, and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparing this report.

COLORADO REGISTERED TIM D. McCONNELL 33797 PROFESSIONAL ENGINEER

2/7/22

Tim D. McConnell, P.E. Date
Colorado P.E. License No. 33797
For and on Behalf of Drexel, Barrell & Co.

DEVELOPER'S STATEMENT

I, the developer have read and will comply with all the requirements specified in this drainage report and plan.

Business Name: Eagle Development Company

By: 2/7/22

Jeff Mark Date

Title: President

Address: 212 N. Wahsatch Ave. #301
Colorado Springs, CO 80903

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

APPROVED
Engineering Department
04/04/2022 3:24:15 PM
dsdnijkamp
EPC Planning & Community Development Department

Jennifer Irvine, P.E. County Engineer/ECM Administrator

CONDITIONS

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Windermere Filing No. 1 subdivision. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location

The site is located at the northwest corner of N. Carefree Cir. and Marksheffel Rd. - the E 1/2 of Section 29, Township 13 S, Range 65 W of the 6th P.M., El Paso County, Colorado.

The site is bound on the west by Antelope Ridge Dr., on the north by the Chateau at Antelope Ridge subdivision, on the east by Marksheffel Rd., and on the south by N. Carefree Cir.

Site Conditions

The site is approximately 52.1 acres in size and is proposed as a single family home subdivision. The proposed site development includes approximately 163 single-family residences. The site is currently undeveloped and is covered with native grass and vegetation. The site is located within the Sand Creek Drainage Basin. Historically, this site drains in all directions with a large hill in the southern half of the site and an existing temporary detention facility located at the northern end. There is a large roadside ditch adjacent to Marksheffel Road (M.D.D.P. DP-1x) that routes off-site (non-tributary to site facilities) runoff to the existing 24" CMP storm culvert under Marksheffel Road. This site was studied as part of the previously approved "Master Development Drainage Plan for Hilltop Subdivision El Paso County, Colorado" by URS Greiner, Inc. last revised February 1998.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is underlain by Truckton sandy loam, a type 'A' hydrologic soil. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C0543 G (December 7, 2018) the project site is within a designated Zone X area described as "areas determined to be outside 500-year floodplain". A firmette map is included in the appendix.

4.0 EXISTING HYDROLOGY

The existing conditions have not changed. An existing detention facility located at the north end of the project has already been capturing flows from the Chateau at Antelope Ridge subdivision to the north. This temporary facility will be replaced with an expanded pond of larger capacity as part of this development. The expanded facility will meet current drainage criteria, including concrete forebays at all piped inflows, a concrete trickle channel at the bottom, an outlet structure and pipe that will reduce the release of flows, and a reinforced spillway on the east side of the facility.

Please refer to excerpts from the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014 in the appendix for existing conditions description and drainage maps.

A table has been provided in the appendix for comparison of the rational method calculations that have been revised to meet current drainage criteria.

5.0 PROPOSED HYDROLOGY (RATIONAL METHOD) & HYDRAULIC SUMMARY

For the purposes of site specific analysis, the project site has been divided into several grouped drainage basins as shown on the proposed drainage plan in the appendix. A-, B-, and C-group basins represent the flows generated onsite. A number of offsite basins were also considered as part of this analysis and are described below.

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals. Mile High Flood District design software (MHFD-Detention v.4.03) and Flowmaster were used to identify pond and storm system sizing, and inlet capacity charts from the current drainage criteria manual used for inlet sizing (see appendix for calculations). See below for a summary runoff table and description of each design point.

Rational Method Runoff Summary

Onsite A-group basins and offsite Basins D-13, D-14, D-15, CT and WS represent flows that are captured by the full spectrum detention facility at the north end of the site.

Existing Design Point 7 (DP7) (Q_5=15.9 cfs and Q_{100}=34.2 cfs) represents flows generated by offsite basins D-13 and D-14 of Pronghorn Meadows Subdivision and Antelope Ridge Drive, on the west side of this project development. These flows were established by the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014. An existing 25' Type R curb inlet intercepts these flows and

discharges to the east across Antelope Ridge Dr. This inlet and piping is to remain and will connect to the proposed inlet at Design Point A.

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
WS	41.47	11.4	76.3
CT	42.07	90.6	174.3
D13	6.79	10.3	22.6
D14	3.88	6.3	13.2
D15	1.36	4.6	9.1
A1	1.56	3.2	7.1
A2	4.61	8.8	19.4
A3	2.18	5.2	11.2
A4	1.01	1.7	3.8
A5	1.98	4.3	9.5
A6	3.73	7.0	15.4
A7	1.56	3.0	6.6
A8	2.96	6.1	13.4
A9	1.86	4.0	8.7
A10	4.00	7.5	16.5
A11	2.67	5.3	11.8
A12	9.46	9.2	37.6
B1	3.33	7.2	16.0
B2	0.49	1.0	2.3
B3	5.86	11.5	25.3
B4	0.16	0.4	0.8
B5	1.05	0.8	4.4
C1	0.59	1.3	2.9
C2	3.58	2.4	13.5
C3	0.63	0.5	2.5
C4	1.79	2.1	6.9
C5	0.11	0.1	0.5
EXR	0.53	2.4	4.4
D16	2.73	4.9	10.7
NC1	0.43	1.9	3.4
NC2	1.61	5.1	9.8

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
7	10.67	15.9	34.2
A	13.59	21.0	44.9
B	4.61	8.8	19.4
C	2.18	5.2	11.2
C1	20.38	29.5	63.5
D	1.01	1.7	3.8
D1	21.39	30.6	66.1
E	1.98	4.3	9.5
F	3.73	7.0	15.4
F1	27.10	38.2	82.8
G	1.56	3.0	6.6
H	2.96	6.1	13.4
H1	4.52	8.6	19.0
I	1.86	4.0	8.7
J	6.38	11.8	25.9
K	33.48	46.3	100.7
L	4.00	7.5	16.5
L1	37.48	51.4	111.8
M	2.67	5.3	11.8
M1	40.15	54.8	119.4
24	83.54	90.7	229.0
N	133.15	145.4	357.5
North Pond Release		1.8	66.0
0	437.97	190.5	682.4
O	3.82	8.1	17.9
R	10.89	19.9	46.2
South Pond Release		0.2	9.2
4	2.73	4.9	10.7
S	16.57	10.0	33.7
19	1.61	5.1	9.8
J1	18.18	15.1	43.5
20	18.61	17.0	46.9
V	0.11	0.1	0.5

Design Point A replaces existing Design Point 8 (DP-8) that was established by the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014. This Design Point A is located at a low point on Antelope Ridge Dr. at an existing 10' sump inlet and represents combined flows from Basins D-15, offsite DP-7 (described above) and onsite basin A1. The existing inlet is proposed to be replaced in kind by an 10' Type R sump Inlet (A) due to a turn lane that will be installed on Antelope Ridge Dr. for access into the Windermere Subdivision. The flows generated by Basin A1 and Basin D15 will be captured in their entirety by the new inlet, combine with the piped flows from existing DP7 (DPA Q_5=21.0 cfs and Q_{100}=44.9 cfs) and flow to the northeast via 36" RCP storm sewer along Antelope Ridge Drive. An emergency overflow swale through Tract D will allow for flows to be directed to the north and east in the event of inlet blockage.

DP-B is located at a proposed 10' Type R at-grade Inlet (B) in Basin A2. The flows leave this inlet via a 24" storm pipe to the south towards DP-C. This design point represents the flows from Basin A2. The flows from Basin A2 are Q_5=8.8 cfs and Q_{100}=19.4 cfs. The proposed 10' Type R inlet (B) will capture Q_5=9.5 cfs and Q_{100}=13.5 cfs, with Q_5=0.0 cfs and Q_{100}=6.4 cfs bypass continuing along Borrowdale Lane to towards DP-E (See inlet summary in the appendix).

DP-C is located at a proposed 10' Type R at-grade inlet (C) in Basin A3. The flows leave this inlet via a 24" storm pipe to the northwest towards a proposed Type 2 storm manhole at DP-C1. The flows from Basin A3 are Q_5=5.2 cfs and Q_{100}=11.2 cfs. The proposed 10' Type R inlet (C) will capture all flows with no bypass.

DP-C1 is located at a proposed Type 2 storm manhole along Borrowdale Lane. This design point consists of all the flows from DPA-DPC, and discharges to the northeast via 36" RCP. The combined flows at DP-C1 are Q_5=29.5 cfs and Q_{100}=63.5 cfs.

DP-D is located at a proposed 5' Type R at grade inlet (D) in Basin A4. The flows leave this inlet via a 18" storm pipe and are conveyed to the northeast towards a proposed Type 2 manhole at DP-D1. The flows from Basin A4 are Q_5=1.7 cfs and Q_{100}=3.8 cfs. The proposed 5' Type R inlet (D) will capture all flows with no bypass.

DP-D1 is located at a proposed Type 2 storm manhole along Borrowdale Lane. This design point consists of all the flows from DPA-DPD, and discharges to the northeast via 36" RCP. The combined flows at DP-D1 are Q_5=30.6 cfs and Q_{100}=66.1 cfs.

DP-E is located at a proposed at-grade 15' Type R inlet (E) in Basin A5. The flows leave this inlet via an 24" storm pipe and are conveyed towards DP-F1 to the south. This design point represents the flows from Basin A5. The flows from Basin A5 are Q_5=4.3 cfs and Q_{100}=9.5 cfs. The proposed 15' Type R inlet (E) will capture all basin flows reaching this point from Basin A5 along with bypass flows from Inlet (B) (Q_5=0.0 cfs and Q_{100}=6.4 cfs.) with no further bypass downstream.

DP-F is located at a proposed at-grade 15' Type R inlet (F) in Basin A6. The flows leave this inlet via a 24" storm pipe and are conveyed towards the type 2 storm manhole at DP-F1 to the southwest. The flows from Basin A6 are Q_5=7.0 cfs and Q_{100}=15.4 cfs. The proposed 15' Type R inlet (F) will capture all flows reaching this point with no further bypass

downstream.

DP-F1 is located at a proposed Type 2 storm manhole along Borrowdale Lane. This design point consists of all the flows from DPA-DPF, and discharges to the northeast via 36" RCP. The combined flows at DP-F1 are Q_5=38.2 cfs and Q_{100}=82.8 cfs.

DP-G is located at a proposed at-grade 5' Type R inlet (L) in Basin A7. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-H1 to the west. This design point represents the flows from Basin A7. The flows from Basin A7 are Q_5=3.0 cfs and Q_{100}=6.6 cfs. The proposed 5' Type R inlet (L) will capture Q_5=3.8 cfs and Q_{100}=6.0 cfs, with Q_5=0.0 cfs and Q_{100}=0.6 cfs bypass continuing to the north along Wyedale Way towards Inlet (N).

DP-H is located at a proposed at-grade 10' Type R inlet (J) in Basin A8. The flows leave this inlet via a 30" storm pipe and are conveyed towards DP-H1 to the east. The flows from Basin A8 are Q_5=6.1 cfs and Q_{100}=13.4 cfs. The proposed 10' Type R inlet will capture Q_5=7.0 cfs and Q_{100}=12.5 cfs, with Q_5=0.0 cfs and Q_{100}=0.9 cfs bypass continuing along Borrowdale Lane to towards inlet (I).

DP-H1 is located at a proposed Type 2 storm manhole along Wyedale Way. This design point represents the flows from DPG-DPH, and discharges to the northwest via 30" RCP. The combined flows at DP-H1 are Q_5=8.6 cfs and Q_{100}=19.0 cfs.

DP-I is located at a proposed at-grade 10' Type R inlet (I) in Basin A9. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-J to the northeast. This design point represents the flows from Basin A9. The flows from Basin A9 are Q_5=4.0 cfs and Q_{100}=8.7 cfs. The proposed 10' Type R inlet will capture all basin flows reaching this point in addition to Inlet (J) bypass (Q_5=0.0 cfs and Q_{100}=0.9 cfs.) with no further bypass downstream.

DP-J is located at a proposed 24"x30" wye along Wyedale Way. The flows leave this wye via a 30" storm pipe which conveyed the flows towards DP-K. This design point captures all the flows from DPH1 and DP-I. The combined flows at DP-J are Q_5=11.8 cfs and Q_{100}=25.9 cfs.

DP-K is located at a proposed type 1 storm manhole, located at the intersection of Borrowdale Lane and Wyedale Way. The flows leave this manhole via a 43"X68" elliptical storm pipe and are conveyed towards DP-L1 to the northwest. This design point captures all the flows from DPF1 and DP-J. The combined flows at DP-K are Q_5=46.3 cfs and Q_{100}=100.7cfs.

DP-L is located at a proposed sump 10' Type R inlet (M) at the low point on Wyedale Way in Basin 10. The flows leave this inlet via 30" storm pipe and are conveyed towards proposed type 1 storm manhole at DP-L1 to the northeast. The flows from Basin A10 are Q_5=7.5 cfs and Q_{100}=16.5 cfs. All flows will be captured by this inlet (M). In the emergency overflow/clogged condition flows will pond at this low point, ultimately crossing the crown of the street to be captured by inlet M, or onwards to the northeast through the open space tract towards the north pond,

DP-L1 is located at a proposed Type 1 storm manhole along Wyedale Way. This design point consists of all the flows from DPK and DPL, and discharges to the northeast via 43"x68" elliptical RCP. The combined flows at DP-L1 are Q_5=51.4 cfs and Q_{100}=111.8 cfs.

DP-M is located at a proposed sump 10' Type R inlet (N) at the low point on Wyedale Way in Basin 11. The flows leave this inlet via 30" storm pipe and are conveyed towards proposed type 1 storm manhole at DP-M1 to the southeast. The flows from Basin A11 are Q_5=5.3 cfs and Q_{100}=11.8 cfs. All flows will be captured by this inlet (N), with emergency overflow through a tract between lots 48 and 49 to the northeast towards the north pond.

DP-M1 is located at a proposed Type 1 storm manhole within Tract A. This design point consists of all the flows from DPL1 and DPM, and discharges to the northeast via 43"x68" elliptical RCP. The combined flows at DP-M1 are Q_5=54.8 cfs and Q_{100}=119.4 cfs. These flows continue to the northeast to discharge into the north pond.

Existing Design Point 24 (DP24) was established by the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014, and consists of offsite area tributary to the existing detention facility along the northern project boundary. According to the aforementioned report, the runoff for basin WS was calculated at 2% (historic flow analysis) as all developed runoff is treated and released at historic rates within the Whispering Springs onsite facilities to the north. The tributary runoff for basin CT was calculated at 70%. The combined flows at DP-24 are Q_5=90.7 cfs and Q_{100}=229.0 cfs

DP-N is located at the bottom of the north proposed Full Spectrum EDB pond in Basin A12. The flows leave the pond via an outlet structure and a 36" storm pipe which conveys the flows to the roadside ditch along Marksheffel Rd. towards DP-T. This design point reflects all the flows from all "A" basins, offsite basins D-13 through D-15, and offsite flows entering the pond from offsite Basins CT and WS (DP24). The combined (undetained) flows at DP-N are Q_5=145.4 cfs and Q_{100}=357.5 cfs. The release rates for the north pond are Q_5=1.8 cfs and Q_{100}=66.0 cfs.

Onsite B-group basins represent flows that are captured by the full spectrum detention facility on the south end of the site.

DP-O is located at the proposed Type R sump inlets (10' West, 5' East) just south of the intersection of Mardale Lane and Wyedale Way. The flows leave the easterly inlet via a 24" storm pipe and are conveyed towards the proposed detention facility to the east. This design point captures all the flows from Basins B1 (Q_5=7.2 cfs and Q_{100}=16.0 cfs) and B2 (Q_5=1.0 cfs and Q_{100}=2.3 cfs). The flows at DP-O are Q_5=8.1 cfs and Q_{100}=17.9 cfs. Emergency overflow for these inlets is to the south and east towards the south detention facility.

Basin B3 covers the area of Tract B, to be developed at a future stage by replat. This basin will discharge by sheet flow overland to the east towards the south detention facility. Flows generated by Basin B3 are Q_5=11.5 cfs and Q_{100}=25.3 cfs.

Basin B4 covers the area along the back of Lots 70-73. Flows generated by this basin

(Q_5=0.4 cfs and Q_{100}=0.8 cfs) will be captured by a 2'x6" concrete swale along the lot side of the screen wall located at the bottom of the slope. These flows are collected by a proposed private Type C Inlet and directed towards the south detention facility by private 12" PVC storm sewer.

Basin B5 covers the area of the proposed south detention facility. Flows generated by this basin (Q_5=0.8 cfs and Q_{100}=4.4 cfs) are absorbed directly by the pond.

DP-R is located at the bottom of the south proposed Full Spectrum EDB pond in Basin B5. The flows leave the pond via an outlet structure and an 18" storm pipe where the flows are conveyed to DP-S (described below). Design point DP-R captures all the flows from Basins B1 through B5. The combined (undetained) flows at DP-R are Q_5=19.9 cfs and Q_{100}=46.2 cfs. The release rates for the south pond are Q_5=0.2 cfs and Q_{100}=9.2 cfs, however final release rates will be determined in the future by others, and as previously discussed, will require a replat and a final drainage report analysis.

Onsite C-group basins represent flows that leave the project site without being treated for Water Quality and are captured by the existing storm system, see further description below and appendix for proposed drainage map indicating offsite basins.

North area – tributary to existing Marksheffel Rd culvert

Basin C1 covers the area along the back of Lots 58-69. Flows generated by this basin (Q_5=1.3 cfs and Q_{100}=2.9 cfs) will be captured by a 2'x6" concrete swale along the lot side of the sound wall located at the bottom of the slope. These flows are directed to the north and will discharge into the open swale along Marksheffel Road continuing north towards the existing 24" CMP culvert.

Basin C2 is located along the easterly project boundary along N. Marksheffel Road. A portion of this basin (0.30-acres) covers the rear of lots 53-57 along Wyedale Way, the remainder of this basin will be subject to some regrading but will otherwise remain undeveloped and be landscaped or reseeded. This basin generates flows of Q_5=2.4 cfs and Q_{100}=13.5 cfs that travel to the east and north or south, ultimately reaching the existing 24" CMP culvert under N. Marksheffel Road.

Basin C1 (0.59-acres) and a portion of basin C2 (0.30-acres) cover developed area that is not treated for Water Quality. As per El Paso County ECM App I.7.1.C.1, this area is less than 20% of site area or 1-acre, and is due to grading restrictions (an exclusion listed in ECM App I.7.1.B), the discharge of these flows offsite to the northern drainageway is permitted under County MS4 criteria.

DP-T is located at the existing 24" CMP culvert crossing at Marksheffel Road, and represents flows generated by Basins C1 & C2, detained flows released by the northern detention facility (DP-N) and the offsite flows from MDDP DP-1X. The combined flows at DP-T are Q_5=190.5 cfs and Q_{100}=682.4 cfs, which is less than the flows listed for this location in the MDDP (Q_5=250 cfs and Q_{100}=852 cfs). More information on the MDDP flows can be found in the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014, in the appendix, in addition to further discussion below.

South area – tributary to existing N. Carefree/Marksheffel storm system

Basin C3 covers an area of 0.63-acres of pond embankment and is located along the southeasterly project boundary along N. Marksheffel Road. This basin generates flows of Q_5=0.5 cfs and Q_{100}=2.5 cfs that travel offsite to the east and ultimately south along N. Marksheffel Road towards the existing storm inlet at DP-S. As this basin is to remain undeveloped, the discharge of flows offsite is acceptable under MS4 criteria.

Existing Design Point 4 covers runoff from Basin D-16 of the Pronghorn Meadows Subdivision to the west of this project development. An existing 8' sump curb inlet intercepts the runoff (Q_5=4.9 cfs and Q_{100}=10.7 cfs) and directs it via existing 24" RCP across Antelope Ridge Drive, where it currently discharges into a roadside swale along N. Carefree Circle. Design and extension of this storm system to the east and connection to the existing storm sewer system at DP-S will be completed at the time of development of Tract B, and will be analyzed at that time by a final drainage report for Tract B.

Basin C4 is located along the southerly project boundary of Tract B along N. Carefree Circle and generates flows of Q_5=2.1 cfs and Q_{100}=6.9 cfs that travel to the south and ultimately combine with flows from Design Point 4 in a roadside swale traveling east along N. Carefree Circle towards DP-S.

A portion of basin C4 (0.72-acres) is conservatively assumed to cover future development of Tract B that will drain offsite and will not be treated for Water Quality. As per El Paso County ECM App I.7.1.C.1, this area is less than 20% of site area or 1-acre, and is due to grading restrictions (an exclusion listed in ECM App I.7.1.B), the discharge of these flows offsite to the southern drainageway is permitted under County MS4 criteria. This assumption of grading and future use will be required to be reviewed at the time of replat for future development of Tract B. To meet this criteria, this area will be required to remain impervious, or be redirected to drain to the detention pond.

DP-S is located at the existing area inlet in Basin C3. The flows leave this inlet via an existing 24" storm pipe that connects to the existing storm system in N. Carefree Cir., which then carries the flows to the south. This design point reflects the flows from Basins C3 & C4, detained flows released by the south detention facility, offsite Basin EXR, and offsite Basin D-16. The combined flows at DP-S are Q_5=10.0 cfs and Q_{100}=33.7 cfs, which is less than the existing condition at Ex. DP-6 of Q_5=18.4 cfs and Q_{100}=42.6cfs.

Existing Design Point 19 represents the flows generated by offsite Basin NC2 (Q_5=5.1 cfs and Q_{100}=9.8 cfs), these flows are picked up by the existing 15' triple at-grade inlet just west of the intersection with N. Marksheffel Road. The flows then leave this inlet via an existing 18" storm pipe to the east, ultimately converging with the flows from DP-S at an existing manhole at existing design point J1.

Flows of Q_5=15.1 cfs and Q_{100}=43.5 cfs leave DP-J1 via an existing 24" storm pipe and are carried to the existing 10' sump inlet at Existing DP-20 in offsite Basin NC1. The flows leave this existing inlet via an existing 30" storm pipe ultimately traveling to the south via the Marksheffel Road storm system. Developed runoff rates at DP-20 (Q_5=17.0 cfs and Q_{100}=46.9 cfs) are less than those in the existing condition (Q_5=24.2 cfs and Q_{100}=53.3 cfs, thereby reducing impact to the existing storm sewer system.

Northwest area – along Antelope Ridge Drive

DP-V is located at the north end of the site on Antelope Ridge Dr. and exclusively covers right-of-way. This design point reflects all the flows from Basin C5 that exit the site and flow to the north along the curb and gutter in Antelope Ridge Dr. before being captured by the existing storm system. The flows from Basin C5 are Q_5=0.1 cfs and Q_{100}=0.5 cfs.

6.0 PROPOSED DETENTION/WATER QUALITY FACILITIES

North Detention Facility

The north detention facility has been designed to capture flows from the "A" basins, offsite basins D-13, D-14, D-15, CT and WS, and has been designed to meet full-spectrum detention criteria. During the overlot grading of the project, the pond was excavated to full volume in its entirety and a temporary outlet structure installed. Now that full build out of the project is underway, the outlet structure will be installed per the final design. See below for description of detention volume and pond characteristics, and the appendix for design calculations.

Tributary to North Pond		
Basin	**Area**	**Impervious**
Offsite		
D-13	6.79	20.2%
D-14	3.88	42.8%
D-15	1.36	100.0%
WS	41.47	2.0%
CT	42.07	70.0%
Onsite		
A1	1.56	65%
A2	4.61	65%
A3	2.18	65%
A4	1.01	65%
A5	1.98	65%
A6	3.73	65%
A7	1.56	65%
A8	2.96	65%
A9	1.86	65%
A10	4.00	65%
A11	2.67	65%
A12	9.46	13%
Total	**133.15**	**40.7%**

As noted above, a total of 133.15 acres is tributary to this north facility, with a composite imperviousness of 40.7% for the final fully developed condition. Required volumes are listed below.

		Required Volume		
	Imperviousness	**WQCV**	**EURV**	**100-YR**
FINAL	40.7%	2.02	5.90	9.94

The actual design pond volume at the proposed spillway stage is 12.6 acre-feet. Concrete forebays with energy dissipaters will be placed where the flows enter the pond on the south and the north sides of the pond. The flows will exit the forebays through a notch, discharging into the concrete trickle channel at the bottom of the pond. The trickle channel conveys the flows to the micropool. The outlet structure then releases the flows at a reduced flow rate with the use of a plate with orifice holes, into a 36" storm pipe. The pipe releases into a ditch that conveys the flows to an existing 24" CMP culvert under Marksheffel Rd. after which the flows continue in historic patterns to the east. See further discussion of the existing Marksheffel culvert below.

In accordance with El Paso County criteria, the modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period with release rates of Q_5=1.8 cfs and Q_{100}=66.0 cfs, less than the anticipated release of Q_5=3.2 cfs and Q_{100}=80.7 cfs established by the preliminary drainage report.

A 70-ft wide riprap emergency spillway will be located on the east side of the pond. In the event that water overtops the spillway, flow will discharge into the ditch along Marksheffel Rd.

Forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillway design calculations are provided in the appendix.

The pond will have a 15' wide maintenance access that will provide access to the pond bottoms, forebays and outlet structures per ECM 3.3.3.K. Private maintenance agreements and O&M manuals will be established for these ponds as required by the County.

The existing channel along Marksheffel Rd. in the northeast portion of the project site will be aesthetically maintained by Windermere Metropolitan District and will be structurally maintained by the City of Colorado Springs/El Paso County. The slopes of the channel are such that it can be accessed for maintenance along Marksheffel Rd.

South Detention Facility

The south detention pond has been designed as a full-spectrum detention facility to capture flows from the "B" basins. With this Windermere Filing No. 1 development, Tract B is to remain undeveloped. Future development of Tract B will require a replat and final drainage report to confirm the pond capacity/discharge rates presented in this report.

Tributary to Sound Pond			
Basin	**Area**	**Interim Imp %**	**Final Imp %**
Onsite			
B1	3.33	65%	65%
B2	0.49	65%	65%
B3	5.86	0%	82%
B4	0.16	65%	65%
B5	1.05	0%	0%
Total	**10.89**	**23.8%**	**68.0%**

In order to minimize future grading within the detention facility area, the volume was based on an assumed final build-out watershed imperviousness of 68.0%, which considers Tract B (Basin B3) as potentially higher density than single-family residential. As part of the Windermere Filing 1 overlot grading, the pond has been excavated to full volume and the outlet structure and associated piping installed. Until full build-out occurs, an orifice plate (assuming full developed condition within the street right-of-way, but no further development) has been installed to allow for appropriate WQCV drain time.

A final orifice plate has been designed for the watershed imperviousness described above, however before installation can occur, the design will need to be confirmed based on the final development.

A total of 10.9 acres is tributary to this south facility, with a composite imperviousness of 23.8% for the interim condition and 68.0% for the final fully developed condition. Required volumes are listed below.

		Approximate Req Volume		
	Imperviousness	**WQCV**	**EURV**	**100-YR**
INTERIM	23.0%	0.12	0.24	0.50
FINAL	68.0%	0.24	0.93	1.37

The actual design pond volume at the proposed spillway stage is 1.15 acre-feet. A concrete forebay with an energy dissipater will be installed where the flows enter the pond. The volume of the forebay will be 3% of the WQCV volume for the pond. The flow will exit the forebay through a notch, discharging into the concrete trickle channel at the bottom of the pond. The trickle channel conveys the flows to the micropool. The outlet structure then releases the flows at a reduced flow rate with the use of a plate with orifice holes, into a proposed 18" pipe with restrictor plate, discharging into an existing storm inlet at the corner of N. Carefree Circle and Marksheffel Rd, after which the flows continue to the south via the existing storm sewer system.

In accordance with El Paso County criteria, the modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period. Switching out of the orifice plate will ensure that the WQCV release rate remains within criteria for the interim and fully developed conditions. The outlet structure will remain in place for the final condition and will result in release rates of Q_5=0.2 cfs and Q_{100}=9.2 cfs. For comparison, the existing basin EX-A released flow rates of Q_5=11.3 cfs and Q_{100}=28.2 cfs.

A 27-ft wide riprap emergency spillway will be located on the south side of the pond. In the event that water overtops the spillway, flow will discharge into existing Type C area inlet at the intersection of N. Carefree Cir and Marksheffel Rd, where it is then picked up by the existing storm system.

Interim and final calculations, including forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillway design are provided in the appendix.

The pond will have a 15' wide maintenance access that will provide access to the pond bottoms, forebays and outlet structures per ECM 3.3.3.K. Private maintenance

agreements and O&M manuals will be established for these ponds as required by the County.

7.0 EXISTING N. MARKSHEFFEL CULVERT

The flows reaching the existing 24" CMP culvert under N. Marksheffel Road are discussed at length in the appendix report by Classic Consulting. To summarize:

	Runoff Rates	
Condition (Design Point)	*Q_5 (cfs)*	*Q_{100} (cfs)*
MDDP (DP-1X)	250.0	852.0
EXISTING (DP-26 + Hilltop)	323.3	866.9
PROPOSED (DP-T)	**190.5**	**682.4**

The table above indicates that by detaining and releasing historic flow rates from both the proposed Windermere Filing No.1, and existing Hilltop subdivision to the north, the situation at the undersized culvert under Marksheffel is improved from the existing condition, and still within the rates established by the MDDP. No additional flows are being added to the ditch. The existing 24" CMP culvert however, is still grossly undersized resulting in road overtopping and localized flooding during major storm events. Improvements to the area are included in Master Planning for both El Paso County and the City of Colorado Springs.

The receiving ditch along the west side of Marksheffel has not been analyzed as part of this report. The ditch has been previously stabilized with riprap to handle the MDDP flows.

8.0 FOUR-STEP PROCESS

This project conforms to the City of Colorado Springs/El Paso County Four Step Process. The process focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

1. ***Employ Runoff Reduction Practices:*** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.

2. ***Implement BMP's that provide a Water Quality Capture Volume with slow release:*** Runoff from this project will be treated through capture and slow release of the WQCV in two permanent Extended Detention Basin facilities designed per current City of Colorado Springs/El Paso County drainage criteria.

3. ***Stabilize Drainage Ways:*** Flows from the north pond are released into the ditch alongside Marksheffel Rd. This ditch has previously been stabilized with rip-rap to handle the MDDP flows of 852 cfs. Flows from the south pond are released directly into the existing storm sewer system and no stabilization will be necessary.

4. ***Implement Site Specific and Other Source Control BMP's:*** The site is proposed as a

residential development, and as such standard household source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: garages for storage of household chemicals, trash receptacles for individual households and in common areas for pet waste. The need for Industrial and Commercial BMP's was considered, however per ECM I.7.2.A the need for industrial and commercial BMPs are not applicable for this project.

9.0 GEOTECHNICAL HAZARDS

In accordance with geotechnical recommendations, the project design is intended to direct runoff away from structures, and into the receiving storm sewer system and water quality/detention basins. This will be accomplished by a variety of means, i.e. curb and gutter and storm sewer. Per "Soils and Geology Study, Windermere Subdivision" by RMG, October 26, 2020 (Revised January 18, 2021):

10.1 Soil and Rock Design Parameters

TB-6 (Job No. 142206, dated May 28, 2015) and TB-107 (Job No. 162062, last dated February 5, 2019) were located in the general vicinity of the proposed Full Spectrum Detention Basin, Tract A. TB-160 (Job No. 162062, last dated February 5, 2019) was located in the general vicinity of the proposed Private Full Spectrum Extended Detention Basin, Tract A. RMG has performed laboratory tests of soil from across the proposed development. Based upon Field and laboratory testing, the following soil and rock parameters are typical for the soils likely to be encountered, and are recommended for use in detention pond embankment design.

Soil Description	Unit Weight ($lb/ft^{3)}$	Friction Angle (degree)	Active Earth Pressure, Ka	Passive Earth Pressure, Kp	At Rest Earth Pressure, Ko
Silty to Clayey Sand (SC/SM)	105	30	0.33	3.0	0.50
Silty Sandstone	110	30	0.33	3.0	0.50
Sandy Claystone/ Siltstone	100	20	0.49	2.0	0.66

10.2 Embankment Recommendations

The proposed detention pond in Tract A is to be excavated approximately 40 plus feet below the surrounding ground surface on the western portion and approximately 11 feet above the surrounding ground surface on the eastern portion. Above grade embankments are to be constructed with 4:1 slopes. Embankments should be constructed in accordance with applicable sections of the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, the El Paso County Land Development Code, and the geotechnical report recommendations.

10.0 FACILITY MAINTENANCE

Ownership and maintenance of all public facilities, generally located within the public right-of-way will be by El Paso County. Ownership and maintenance of all tracts and private facilities will be by the Sands Metropolitan District #4.

11.0 CONSTRUCTION COST ESTIMATE

NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
	PUBLIC STORM SEWER SYSTEM (NON-REIMBURSABLE)				
1	18" RCP	LF	44	$ 67.00	$ 2,948.00
2	24" RCP	LF	132	$ 81.00	$ 10,692.00
3	30" RCP	LF	350	$ 100.00	$ 35,000.00
4	36" RCP	LF	1,017	$ 124.00	$ 126,108.00
5	43"X68" ELLIPTICAL RCP	LF	155	$ 254.00	$ 39,370.00
6	24"X30" PREFAB RCP WYE	EA	1	$ 750.00	$ 750.00
7	5' TYPE R INLET	EA	3	$ 5,736.00	$ 17,208.00
8	10' TYPE R INLET	EA	8	$ 8,136.00	$ 65,088.00
9	15' TYPE R INLET	EA	2	$ 11,005.00	$ 22,010.00
10	TYPE 1 MANHOLE	EA	2	$ 12,034.00	$ 24,068.00
11	TYPE 2 MANHOLE	EA	5	$ 6,619.00	$ 33,095.00
			PUBLIC STORM SEWER SUBTOTAL		**$ 376,337.00**
	PRIVATE NORTH POND				
12	43"X68" ELLIPTICAL RCP	LF	168	$ 254.00	$ 42,672.00
13	TYPE 1 MANHOLE	EA	1	$ 12,034.00	$ 12,034.00
14	36" RCP OUTFALL	LF	137	$ 124.00	$ 16,988.00
15	OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16	MICROPOOL	EA	1	$ 2,800.00	$ 2,800.00
17	FOREBAY	EA	2	$ 3,500.00	$ 7,000.00
18	TRICKLE CHANNEL	LF	700	$ 30.00	$ 21,000.00
19	RIPRAP SPILLWAY	CY	420	$ 40.00	$ 16,800.00
20	MAINTENANCE ACCESS	LF	600	$ 20.00	$ 12,000.00
			PRIVATE NORTH POND SUBTOTAL		**$ 146,294.00**
	PRIVATE SOUTH POND				
21	12" PVC	LF	82	$ 81.00	$ 6,642.00
22	TYPE C INLET	EA	107	$ 4,802.00	$ 4,802.00
23	24" RCP	LF	72	$ 81.00	$ 5,832.00
24	18" RCP OUTFALL	LF	107	$ 67.00	$ 7,169.00
25	OUTLET STRUCTURE	EA	1	$ 10,000.00	$ 10,000.00
26	MICROPOOL	EA	1	$ 2,800.00	$ 2,800.00
27	FOREBAY	EA	1	$ 3,500.00	$ 3,500.00
28	TRICKLE CHANNEL	LF	270	$ 30.00	$ 8,100.00
29	RIPRAP SPILLWAY	CY	135	$ 40.00	$ 5,400.00
30	MAINTENANCE ACCESS	LF	720	$ 20.00	$ 14,400.00
			PRIVATE SOUTH POND SUBTOTAL		**$ 68,645.00**
				IMPROVEMENTS SUBTOTAL	**$ 591,276.00**
				10% CONTINGENCY	**$ 59,127.60**
				TOTAL	**$ 650,403.60**

12.0 DRAINAGE/BRIDGE FEES

The project lies within the Sand Creek Drainage Basin and is previously unplatted, as such payment of drainage/bridge fees are required prior to recording of the Final Plat.

The 2021 Sand Creek Drainage Basin Fees are as follows:
Drainage fee $20,387/impervious acre
Bridge Fee $8,339/impervious acre

The percent imperviousness for this subdivision is calculated as follows:

35.74 acres residential subdivision	53% impervious
16.33 acres open space	0% impervious
52.07 acres	36.4% impervious

52.07 acres at 36.4% impervious = 18.94 impervious acres

Therefore, the following fees are due:

18.94 acres x $20,387.00 = **$386,129.78 drainage fee**
18.94 acres x $8,339.00 = **$157,940.66 bridge fee**

Tract B is considered as an open space tract for the purposes of this calculation. Future development of Tract B will require a replat and payment of drainage fees associated with the proposed impervious acreage.

13.0 CONCLUSIONS

The Windermere project has been designed in accordance with El Paso County criteria. The EDB/water quality ponds have been designed to limit the release of storm runoff. This development will not negatively impact the downstream facilities.

14.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs "Drainage Criteria Manual", 2016.

2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised October 2019.

3. Soil Survey for Colorado Springs and El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

4. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 2018.

5. "Soils and Geology Study, Windermere Subdivision", prepared by RMG, October 26, 2020, Revised January 18, 2021.

6. "Final Drainage Report for Pronghorn Meadows, Filing 2," prepared by URS, July 2004.

7. "Final Drainage Report and Erosion Control Amendment for Chateau at Antelope Ridge," prepared by URS, September 9, 2002.

8. "Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1," prepared by Classic Consulting Engineers & Surveyors, October 2014.

9. "MDDP for Hilltop Subdivision," prepared by URS Greiner, Inc., November 1, 1996.

10. "Final Drainage Report Marksheffel Road from Constitution Ave. to Dublin Rd.," by CH2M Hill, dated May 2008 and Marksheffel Road Construction Drawings by Wilson & Company.

APPENDIX

PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

October 2014

Prepared for:
JAMES TODD STEPHENS
c/o WINDSOR RIDGE HOMES
4164 AUSTIN BLUFFS PKWY #361
COLORADO SPRINGS CO 80918

Prepared by:
CLASSIC CONSULTING ENGINEERS & SURVEYORS
6385 CORPORATE DRIVE SUITE 101
COLORADO SPRINGS CO 80919
(719) 785-0790

Job no. 2441.00

RECEIVED
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BY:

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PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Kyle R Campbell, Colorado P.E. #29794 — Date: 6-18-15

DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: Windsor Ridge Homes

By:

Title: Manager

Address: 4164 Austin Bluffs Parkway #361

Colorado Springs, CO 80918

EL PASO COUNTY ONLY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Andre P. Brackin, P.E. — Date: 6-22-15
County Engineer / ECM Administrator

Conditions:

CLASSIC CONSULTING ENGINEERS & SURVEYORS

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PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

TABLE OF CONTENTS:

PURPOSE	Page 1
GENERAL DESCRIPTION	Page 1
EXISTING DRAINAGE CONDITIONS	Page 2
PROPOSED DRAINAGE CHARACTERISTICS	Page 6
EROSION CONTROL PLAN	Page 16
DRAINAGE CRITERIA	Page 16
FLOODPLAIN STATEMENT	Page 16
DRAINAGE AND BRIDGE FEES	Page 16
CONSTRUCTION COST OPINION	Page 17
SUMMARY	Page 18
REFERENCES	Page 19

APPENDICES

VICINITY MAP

SOILS MAP (S.C.S. SURVEY)

F.E.M.A. MAP

REFERENCE MATERIAL FROM ADJACENT STUDIES

EXISTING DRAINAGE CONDITIONS CALCULATIONS

DEVELOPED DRAINAGE CONDITIONS CALCULATIONS

FILING NO. 1 – FULL SPECTRUM EDB FINAL DESIGN

FILING NO. 2 – FULL SPECTRUM EDB PRELIMINARY DESIGN

COORESPONDANCE FROM YES! COMMUNITIES

DRAINAGE MAP

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PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

PURPOSE

This document is the Preliminary Drainage Report for the entire Windermere (Filings 1-3) development and the Final Drainage Report for Windermere Filing No. 1. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate detention and water quality facilities while releasing storm water at or below historic rates and in accordance with all applicable master drainage plans. This report will discuss the proposed storm system to be built with Filing 1 and the future system to be built with Filings 2 & 3. A Final Drainage Report will be needed for Filings 2 & 3 that will discuss the final construction details, and more specifically, the final design details of the proposed sub-regional public detention/water quality facility located at the north end of the site. Preliminary design of the sub-regional public facility is included in this report, along with the final design information for the Filing No. 1 detention/water quality facility located at the south-east corner of the site.

GENERAL DESCRIPTION

Windermere is a 52.07 acre single family home subdivision within the east half of Section 29, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located on the east side of Antelope Ridge Drive just north of North Carefree Circle. The existing Chateau at Antelope Ridge subdivision sits directly north of the site, with Marksheffel Road bordering the east side of the site. The proposed development includes a total of 201 single-family residences and will be developed in three filings. Filing 1 includes 59 residential lots on approximately 15 acres. Filing 2 will include 70 lots on approximately 22 acres, and Filing 3 is 72 lots on approximately 15 acres.

The average soil condition of the entire site and tributary area to the proposed ponds reflects Hydrologic Group "B" (Truckton sandy loam) as determined by the "Soil Survey of El Paso County Area," prepared by the National Cooperative Soil Survey (see map in Appendix).

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EXISTING DRAINAGE CONDITIONS

The site is located within the Sand Creek Drainage Basin. Historically, this site drains in all directions with a large hill in the southern half of the site and an existing temporary detention facility located at the northern end. There is a large roadside ditch adjacent to Marksheffel Road (M.D.D.P. DP-1X) that routes off-site (non-tributary to site facilities) runoff to the existing 24" CMP storm culvert under Marksheffel Road (Design Point 26). This site has been previously studied as part of the previously approved "Master Development Drainage Plan for Hilltop Subdivision El Paso County, Colorado" by URS Greiner, Inc. last revised February 1998. See below for detailed descriptions of the existing drainage conditions and see appendix for the Existing Conditions Drainage Map.

Design Point 4 - Existing (Q_5 = 7.2 cfs, Q_{100}= 14.6 cfs) consists of runoff from off-site Basin D-16, 2.73 acres of existing Pronghorn Meadows Subdivision, Antelope Ridge Drive, and North Carefree Circle. An existing 8' curb sump inlet intercepts the runoff with an existing 24" RCP conveying it directly onto the proposed site where a roadside ditch along N. Carefree Circle drains to the area drain at DP-6 (North West corner of Marksheffel Rd. and N. Carefree Cir.). The Basin D-16 characteristics and size was derived from the previously approved "Final Drainage Report for Pronghorn Meadows Filing 2," by URS, dated July 2004; "Preliminary Drainage Report for Pronghorn Meadows and Final Drainage Report for Pronghorn Meadows Filing No. 1," by URS, dated September 4, 2002; and also using observed field conditions and satellite imagery.

Design Point 6 - Existing (Q_5 = 18.4 cfs, Q_{100}= 42.6 cfs) consists of runoff from DP-4-EX, Basin EX-R, and Basin EX-A. Basin EX-R is 0.53 acres of existing Marksheffel Rd. and roadside ditch that drain to the existing grated area drain at DP-6. Basin EX-A is 13.20 acres of undeveloped Windermere property with historic runoff of Q_5 = 11.3 cfs and Q_{100}= 28.2 cfs. This historic runoff rate from Basin EX-A is used as the allowable release rate for the proposed Filing 1 detention/water quality facility located at this corner of the site. This cumulative historic and existing storm water runoff (Q_5 = 18.4 cfs, Q_{100}= 42.6 cfs) at this grated sump area drain inlet does not appear to have been quantified correctly in the design of the downstream Marksheffel Road storm sewer system as the outfall pipe from the existing grated inlet (24" RCP) only has a capacity of 16 cfs at 0.50% grade. The "Final Drainage Report Marksheffel Road from Constitution Ave. to Dublin Rd.," by CH2M Hill dated May 2008 was approved by El Paso County for the storm sewer improvement design associated with the expansion of Marksheffel Road. Construction plans

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for the Marksheffel Rd. improvements were completed by Wilson & Company Engineers & Architects in accordance with the Final Drainage Report. On these construction plans (PPRTA Project #75174, Sheets 12 & 13) a 24" RCP (Pipe 6b, Q_5 = 18.4 cfs and Q_{100}= 42.6 cfs) was constructed to this existing area drain with a capacity listed as 16 cfs. It appears that the historic runoff from the proposed Windermere site (Basin EX-A) was not included in the downstream pipe sizing and construction. The Marksheffel Road Final Drainage Report by CH2M Hill states on page 13 that "Storm pipes are designed to convey the 10-year flow, except at sump locations where they are designed to convey the 100-year flow." A sump condition exists at this Design Point and at the adjacent N. Carefree Circle median inlet at DP-20. Therefore, it is our belief and understanding that the storm system should convey the entire 100 year historic and existing runoff at this location.

Design Point 7 - Existing (Q_5 = 20.0 cfs, Q_{100}= 41.6 cfs) consists of runoff from off-site Basins D-13 & D-14, 6.79 acres & 3.88 acres respectively of existing Pronghorn Meadows Subdivision and existing Antelope Ridge Drive. The previous approved reports for Pronghorn Meadows and existing field conditions were used to determine the tributary basin sizes and the results are in conformance to the previously approved reports. An existing 25' (field verified) Type R curb inlet intercepts all of this runoff and an existing storm pipe routes flows to the existing inlet at DP-8 prior to day lighting onto the proposed site. This developed runoff does not appear to be detained or treated for storm water quality before being released onto the Windermere site.

Design Point 8 - Existing (Q_5 = 5.6 cfs, Q_{100}= 11.2 cfs) consists of runoff from off-site Basin D-15, 1.36 acres of existing Antelope Ridge Drive, and from Basin EX-E, 1.10 acres of on-site undeveloped land that drains onto Antelope Ridge Drive. An existing 10' (field verified) Type R curb inlet intercepts all of this runoff and an existing 36" storm (Pipe 8) routes the combined runoff (Q_5 = 24.7 cfs and Q_{100}= 50.9 cfs) directly onto the proposed Windermere site. This runoff drains across the site to Design Point 26. This developed runoff also does not appear to have been detained or treated for water quality prior to releasing onto the proposed site.

Design Point 19 - Existing (Q_5 = 6.7 cfs, Q_{100}= 12.5 cfs) consists of runoff from off-site Basin NC-2, 1.49 acres of existing Antelope Ridge Drive and N. Carefree Circle. An existing 15' Type R at-grade curb inlet just west of Marksheffel Road intercepts a portion of this runoff (Q_5 = 4.8 cfs and Q_{100}= 8.1 cfs) and an

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existing 18" storm (Pipe 6a) connects with Pipe 6B at an existing storm manhole. Pipe 6C is the 24" outfall pipe from this connection manhole and contains a combined runoff of Q_5 = 21.6 cfs and Q_{100}= 47.9 cfs. From the Marksheffel Rd. Construction Drawings, the capacity of the system at Pipe 6C is 16 cfs. Pipe 6C connects into the face of the median sump inlet at DP-20.

Design Point 20 - Existing (Q_5 = 3.7 cfs, Q_{100}= 8.0 cfs) consists of runoff from off-site Basin NC-1, 0.42 acres of existing N. Carefree Circle and Marksheffel Rd, and the flow-by from the at-grade inlet at Design Point 19. An existing 10' Type R sump median curb inlet intercepts all of this runoff and combines it with that from the incoming Pipe 6C. Pipe 7 represents the existing 30" outfall pipe from this inlet and contains a historic and existing runoff rate of Q_5 = 24.2 cfs and Q_{100}= 53.3 cfs. From the Marksheffel Rd. Construction Drawings, the capacity of the 30" Pipe 7 is 29 cfs. This runoff continues within the existing Marksheffel Rd. storm system to the south to downstream facilities.

Design Point 24 - Existing (Q_5 = 111.3 cfs, Q_{100}= 199.7 cfs) consists of off-site tributary area to the existing temporary detention facility located along the northern site boundary. The temporary detention facility was constructed in conjunction with the Chateau at Antelope Ridge subdivision located directly north of the proposed site. The tributary runoff at DP-24 is a combination of developed runoff from the Chateau at Antelope Ridge subdivision and detained release from the Whispering Springs Development, located west of Antelope Ridge Drive and the Chateau at Antelope Ridge subdivision. The "Preliminary Drainage Report for Whispering Springs Development and Final Drainage Report for Whispering Springs Filing No. 1," by Rockwell Consulting, Inc., dated August 2013 details the overall detained and water quality treated runoff that drains directly into the storm sewer system of the Chateau at Antelope Ridge. This runoff is described in this report as Basin WS, 41.47 acres with a release rate of Q_5 = 47.3 cfs and Q_{100}= 66.4 cfs (Design Point 10 from Whispering Springs Drainage Report).

DP-24 also contains the developed runoff from Basin CT, 42.07 acres of the existing Chateau at Antelope Ridge subdivision. The Basin CT characteristics and size was derived from the previously approved "Final Drainage Report and Erosion Control for Chateau at Antelope Ridge," by URS, approved January 21, 1999 as well as observed field conditions and satellite imagery. Basin CT produces a developed runoff rate of Q_5 = 90.8 cfs and Q_{100}= 184.7 cfs that drains to DP-24 and into the existing and proposed detention/water quality facility.

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Design Point 25 - Existing (Q_5 = 117.5 cfs, Q_{100}= 215.1 cfs) consists of the total existing runoff into the existing temporary detention facility located along the northern site boundary. This runoff consists of DP-24, Basins EX-D (6.19 acres of on-site undeveloped land) and EX-F (3.15 acres of temporary detention pond area). Per the Hilltop Subdivision M.D.D.P., detention of developed runoff is required in order to maintain historic release rates under Marksheffel Road and to the east to the main Sand Creek channel. An existing 48" CMP serves as the temporary facility's outfall along with a riprap lined emergency overall spillway. The discharge pipe and portions of the embankment are located outside of the Tract A Temporary Detention Facility.

Design Point 26 - Existing (Q_5 = 138.3 cfs, Q_{100}= 266.9 cfs) consists of the total existing runoff to the existing 24" CMP Marksheffel Road culvert crossing from the north-west. This runoff is comprised of the DP-25 storm water and that from Basins EX-B and EX-C, 7.30 acres and 24.28 acres respectively of on-site undeveloped land that drains directly east to the Marksheffel Road ditch. This runoff quantity does not include that from the upstream Marksheffel Road ditch, described in the Hilltop MDDP as Design Point 1X. Per the Hilltop MDDP the existing runoff within the Marksheffel Rd. ditch is Q_5 = 144 cfs and Q_{100}= 481 cfs. However, with the "Final Drainage Report and Erosion Control Plans for Chateau at Antelope Ridge El Paso County, Colorado," by URS, dated December 18, 1998 discusses the Marksheffel Road ditch design and assumptions used; varying the flow within the ditch from 420 to 714.5 cfs. As stated in this previous report "these flows were added as each design point without considering routing to give a worst case scenario." This large range of flow rates was used as a very conservative channel design and does not reflect the actual (routed) flow within the Marksheffel ditch. The same December 1998 report included a HEC model to more accurately define the ditch runoff and determine the allowable release rate for the temporary pond. The flow of 521 cfs was used as the routed flow in the Marksheffel ditch.

However, the "Final Drainage Report and Erosion Control Amendment for Chateau at Antelope Ridge El Paso County, Colorado," by URS, dated September 9, 2002 was approved by El Paso County and discusses an increase in tributary runoff to this Marksheffel Rd. ditch (north of Barnes Road). This increase of 79 cfs directly transposed to the M.D.D.P. DP-1X results in a 100-yr historic runoff within the Marksheffel Ditch of 600 cfs (estimated 5 year increased flow to 185 cfs).

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Design Point 26 directly correlates with M.D.D.P. DP-1C, which states a maximum flow rate in existing and developed conditions of Q_5 = 250 cfs and Q_{100}= 852 cfs that crosses under Marksheffel Road. Using a conservative approach by directly adding the M.D.D.P. DP-1X runoff (increased as previously stated) with the quantified DP-26 runoff from the proposed site analysis, a total runoff value can be compared with the M.D.D.P. allowable runoff rate at this culvert crossing of Marksheffel Road. In the current undeveloped conditions, the total runoff is Q_5 = 323.3 cfs and Q_{100}= 866.9 cfs. The 5 year & 100 year storm event runoffs are slightly higher than that quantified in the Chateau at Antelope Ridge Drainage Report due to conservatively assuming runoff drains directly into and out of the temporary facility at DP-25 since an outlet structure restricting runoff does not exist. The proposed developed conditions will ensure the runoff at DP-26 is less than the allowable rates per the M.D.D.P. (Q_5 = 250 cfs, Q_{100}= 852 cfs).

PROPOSED DRAINAGE CONDITIONS

Developed runoff from Windermere Development will be conveyed into the proposed storm sewer systems as shown on the Developed Conditions Drainage Map, and will outfall into two separate Public Full Spectrum Extended Detention Basin (EDB) Water Quality Facilities. All curb inlets are CDOT Type R, storm pipes are reinforced concrete pipe (RCP), and curbs are El Paso County Type A (6" vertical curb) and El Paso County Type C (ramp curb).

Per current El Paso County Drainage Criteria for stormwater capacity within street sections, the following applies:

Street Type	***Allowable – Initial Storm (5 yr)***	***Allowable–Major Storm (100 yr)***
Residential w/Ramp Curb	Flow spread to crown. Maximum of 20 cfs per side.	12" maximum depth at flowline with no adjacent flooding.
Residential w/Vertical Curb	6" allowable depth at flowline. Maximum of 34 cfs per side.	12" maximum depth at flowline with no adjacent flooding.
Collector Street	6" allowable depth at flowline, maximum of 34 cfs per side, no overtopping of crown.	12" maximum depth at flowline with no adjacent flooding.

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For more exact allowable curb capacities for each curb and roadway type at varying street slopes the Curb Capacity Equations were used as shown on the charts located in the front of the Drainage Criteria Manual. At no times is curb capacity an issue due to the placement of at-grade inlets when needed.

Drainage from individual lots is assumed to travel in side-lot swales to the street. A detailed description of the developed runoff for Windermere, including the final design of Filing No. 1 is as follows:

Design Point 1 (Q_5 = 13.1 cfs, Q_{100}= 26.2 cfs) consists of runoff from Basin C, 4.20 acres of Filing No. 1 single family home lots, and the two Pronghorn Meadows Circle roadways. A proposed 15' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to Design Point 2. Pipe 1 (24" RCP, Q_5 = 8.9 cfs and Q_{100}= 15.6 cfs) conveys the intercepted runoff south toward the detention/water quality facility at Design Point 5. As is typical throughout the proposed Windermere subdivision, all developed flows are within allowable street capacities for both 5 yr and 100 year events. For the minor event storm, the curb capacity of ramp curb at 1.5% is 13.8 cfs.

Design Point 2 (Q_5 = 12.4 cfs, Q_{100}= 27.3 cfs) consists of runoff from Basin B, 2.72 acres of Filing No. 1 single family home lots and adjacent residential roadways, and the flow-by from the at-grade inlet at DP-1. A proposed 15' sump inlet will intercept this runoff and combine with that from Pipe 1. Pipe 2 (30" RCP, Q_5 = 20.9 cfs and Q_{100}= 41.9 cfs) conveys the combined runoff south toward the detention/water quality facility at Design Point 5.

Design Point 3 (Q_5 = 9.1 cfs, Q_{100}= 18.2 cfs) consists of runoff from Basin A, 3.35 acres of Filing No. 1 single family home lots and adjacent residential roadways. A proposed 10' sump inlet will intercept this runoff and a 24" RCP (Pipe 3a) will connect to the storm main from DP-2. Pipe 3b (36" RCP, Q_5 = 27.6 cfs and Q_{100}= 55.5 cfs) conveys the combined runoff from the Filing No. 1 development into the proposed Full Spectrum Extended Detention Basin at Design Point 5.

Design Point 4 (Q_5 = 7.2 cfs, Q_{100}= 14.6 cfs) is exactly as described within the Existing Conditions portion of this report. The existing 24" RCP will be extended with a proposed 24" RCP (Pipe 4) and connected directly into the downstream Marksheffel Road storm sewer system.

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Design Point 5 (Q_5 = 28.1 cfs, Q_{100}= 56.8 cfs) is the Filing No. 1 developed runoff into the proposed Private Full Spectrum Extended Detention Basin. This storm water consists of that from Pipe 3b and Basin P, 0.60 acres of the detention facility itself. The facility was designed using the sizing spreadsheet (See Appendix) and criteria from the Urban Drainage and Flood Control District (UDFCD). A total of 10.87 acres of Windermere Filing No. 1 is tributary to this facility, with a composite impervious value of 73.3%. A required Excess Urban Runoff Volume (EURV) of 0.893 acre-feet is required. This volume is provided under the top of outlet box opening (elevation 6570.00, within the orifice plate of the outlet box).

A concrete box forebay will be placed at the Pipe 3b entry point into the facility. Per the UDFCD sizing spreadsheet a 6" notch in the vertical wall of the forebay box is required. All pond structure details are included in the Filing No. 1 construction drawings. A 6' wide concrete trickle channel at 1.0% grade will be installed down the center of the basin to convey the low flows to the outlet box and limit erosion within the bottom of the facility. A 3.0% minimum basin bottom slope into the trickle channel is provided as per the UDFCD requirements.

The bottom of the detention basin is at an elevation of 6562.50 with the EURV provided at the elevation 6570.00. A 6' wide outlet box (4' deep opening) is proposed with a top of box at this 6570.00 elevation. For a Full Spectrum facility, the outlet box orifice holes within the front plate are to drain the EURV in 72 hours, resulting in the necessary orifice hole sizing of 1 column of 3/4" diameter circular holes. A 2.5' deep concrete bottom micropool is to be installed within the outlet structure, with a surface area of 107 square feet. A removable trash screen of 12" in width will be placed in front of the orifice plate to help prevent the orifice holes from clogging. A 24" RCP outlet, Pipe 5, will convey the facility's restricted release (Q_5 = 0.63 cfs, Q_{100}= 9.77 cfs) (historic from site is Q_5 = 11.3 cfs, Q_{100}= 28.2 cfs) to the existing 24" storm sewer pipe of the Marksheffel Road storm sewer system. See Design Point 6 for continued discussion of downstream system.

A 20' length emergency spillway located at elevation 6571.00 will pass the entire incoming 100-year storm event (56.8 cfs) at a flood depth less than 1.0' (0.84' using equation Q = CLH^0.5 from the DCM). Per the El Paso County Drainage Criteria Manual (DCM), the top of the pond berm shall be 2.0' higher than the flood depth water surface elevation, in this case at 6574.00. This emergency spillway will only be utilized in the case of a complete outlet box failure and will be constructed of riprap rock buried under top soil and re-

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vegetated. Also, a 15' wide maintenance access road at 15% grade will be installed to the bottom of the facility from the interior roadway, Grizedale Terrace. By utilizing the Full Spectrum Outlet box design, the minor storm event release rates are significantly below historic levels, and the 100-year event is less than a third of the historic (allowable) runoff rate of the proposed site (Basin EX-A Q_5 = 11.3 cfs, Q_{100}= 28.2 cfs).

Maintenance of the Private detention/water quality structures and aesthetic maintenance of the facility will be by either the home owner's association or Windermere Metropolitan District 1 as is to be determined.

Initially, as a part of the early grading permit, a temporary sediment pond will be constructed in the same location as the ultimate detention and stormwater quality facility. The temporary sediment basin outlet pipe will ultimately be replaced with a formal outlet structure at the time of Filing No. 1 public street and storm construction. The storm outfalls into the ultimate pond will also be constructed along with the proposed perimeter retaining walls.

Design Point 6 (Q_5 = 3.4 cfs, Q_{100}= 7.1 cfs) consists of runoff from Basin R, 1.18 acres of existing Marksheffel Road, adjacent roadside swale, and proposed home lots that drain in the same pattern as existing Basin EX-R. The existing type D grated area drain must remain due to existing electric vaults being installed lower than the roadway intersection. However, this inlet must be relocated to the east in order to construct the N. Carefree sidewalk. The new Type D inlet intercepts all of this runoff and an 18" RCP conveys it to the storm outfall from the proposed detention/water quality facility at DP-5. Pipe 6b (24" RCP, Q_5 = 10.3 cfs, Q_{100}= 29.4 cfs) is the combined runoff rate from the Pond Outfall (Pipe 5), DP-6, and off-site DP-14 (Pipe 4). This 24" RCP connects to the existing 24" RCP of the Marksheffel Rd. storm system. Per the Existing Conditions analysis of this report, the allowable historic runoff rate to the existing 24" RCP is Q_5 = 18.4 cfs and Q_{100}= 42.6 cfs. As stated in the Existing Conditions section, the existing storm sewer system constructed with the Marksheffel Road improvements does not have the capacity (listed as 16 cfs) to convey even the reduced detained runoff. See Design Point 19 for continued discussion of the existing Marksheffel Road storm system.

Design Point 7 (Q_5 = 20.0 cfs, Q_{100}= 41.6 cfs) is the same as described in the Existing Conditions section of this report.

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Design Point 8 (Q_5 = 7.7 cfs, Q_{100}= 15.1 cfs) consists of runoff from off-site Basin D-15, 1.36 acres of existing Antelope Ridge Drive, and from Basin E, 1.47 acres of the back yards of proposed single family home lots that drains onto Antelope Ridge Drive. The runoff at this location in the developed conditions is slightly higher than in the existing conditions; however the existing inlet and storm pipe have adequate capacity. The existing 10' Type R curb inlet intercepts all of this runoff and an existing 36" storm (Pipe 8) the previously daylighted onto the proposed site will be extended east within Borrowdale Lane and eventually to the detention/water quality facility at DP-25. This 36" Pipe 8 conveys runoff of Q_5 = 26.4 cfs and Q_{100}= 54.1 cfs.

Design Point 9 (Q_5 = 12.9 cfs, Q_{100}= 26.0 cfs) consists of runoff from Basin I, 4.44 acres of Filing No. 3 single family home lots and Ryedale Way. A proposed 20' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to Design Point 10. Pipe 9 (24" RCP, Q_5 = 9.0 cfs and Q_{100}= 16.0 cfs) conveys the intercepted runoff to the 36" main from DP-8 (Pipe 10 36" RCP, Q_5 = 32.4 cfs and Q_{100}= 64.7 cfs). At no times within the proposed site is curb capacity an issue due to the placement of these at-grade storm inlets. For the minor event storm, the curb capacity of ramp curb at 4.0% is above the maximum of 20.0 cfs.

Design Point 10 (Q_5 = 5.6 cfs, Q_{100}= 13.5 cfs) consists of runoff from Basin N, 0.58 acres of Filing No. 3 single family home lots and Borrowdale Lane, and the flow-by from DP-9. A proposed 15' at-grade inlet will intercept the majority of this runoff while the remaining continues within the curb and gutter to Design Point 11. Pipe 11 (18" RCP, Q_5 = 4.3 cfs and Q_{100}= 8.5 cfs) conveys the intercepted runoff to the at-grade inlet at DP-11.

Design Point 11 (Q_5 = 11.2 cfs, Q_{100}= 24.8 cfs) consists of runoff from Basin J, 3.30 acres of single family home lots and Patterdale Place, and the flow-by from DP-10. A proposed 10' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 15. Pipe 12 (24" RCP, Q_5 = 9.8 cfs and Q_{100}= 16.4 cfs) conveys the intercepted runoff from this at-grade inlet and that from the at-grade at DP-10 (Pipe 11) to the storm main. The outfall main (Pipe 13, 42" RCP, Q_5 = 38.9 cfs and Q_{100}= 75.5 cfs) continues east within Borrowdale Lane and ultimately to the proposed detention/water quality facility at DP-25.

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Design Point 12 (Q_5 = 11.0 cfs, Q_{100}= 22.4 cfs) consists of runoff from Basin K, 3.74 acres of single family home lots and Pronghorn Meadows Circle. A proposed 20' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 15. Pipe 16 (24" RCP, Q_5 = 8.7 cfs and Q_{100}= 15.4 cfs) conveys the intercepted runoff and connects to the 60" RCP storm main that drains into the detention/water quality facility at Design Point 25. For the minor event storm, the curb capacity of ramp curb at 1.5% is 13.8 cfs.

Design Point 14 (Q_5 = 12.3 cfs, Q_{100}= 24.5 cfs) consists of runoff from Basins F & Q, 2.85 acres and 1.70 acres respectively of single family home lots and adjacent residential roadways. A proposed 20' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 15. Pipe 14 (24" RCP, Q_5 = 8.8 cfs and Q_{100}= 15.1 cfs) conveys the intercepted runoff from this at-grade inlet and connects to the 42" storm main (Pipe 15, Q_5 = 45.9 cfs and Q_{100}= 87.4 cfs).

Design Point 15 (Q_5 = 20.5 cfs, Q_{100}= 50.7 cfs) consists of runoff from Basin G, 3.97 acres of single family home lots and adjacent residential roadways, and the flow-by runoff from the at-grade inlets at Design Points 11, 12, & 14. A proposed 20' sump inlet will intercept all of this runoff with a 42" RCP lateral connecting with the 42" main within Borrowdale Lane at a proposed storm manhole.

Design Point 16 (Q_5 = 10.4 cfs, Q_{100}= 20.8 cfs) consists of runoff from Basin L, 3.86 acres of single family home lots, the Ryedale Way cul-de-sac, and Pronghorn Meadows Circle. A proposed 10' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 17. Pipe 17 (18" RCP, Q_5 = 6.5 cfs and Q_{100}= 9.3 cfs) conveys the intercepted runoff and connects to the 60" RCP storm main (Pipe 22, Q_5 = 78.1 cfs and Q_{100}= 158.1 cfs) that drains into the detention/water quality facility at Design Point 23/25. For the minor event storm, the curb capacity of ramp curb at 1.5% is 13.8 cfs.

Design Point 17 (Q_5 = 7.8 cfs, Q_{100}= 19.1 cfs) consists of runoff from Basin H, 1.42 acres of single family home lots and adjacent residential roadways, and the flow-by runoff from the at-grade inlet at Design Point 16. A proposed 10' sump inlet will intercept all of this runoff with a 24" RCP (Pipe 20) connecting with the 42" lateral to DP-15. The 42" lateral combines with the 42" Borrowdale Lane main at a storm manhole at

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the roadway intersection. Pipe 18 (60" RCP, Q_5 = 67.7 cfs and Q_{100}= 141.5 cfs) conveys the combined runoff to the north to DP-23.

Design Point 19 (Q_5 = 10.4 cfs, Q_{100}= 20.7 cfs) consists of runoff from off-site Basin NC-2, 1.49 acres of existing Antelope Ridge Drive and N. Carefree Circle, and from Basin D, 1.75 acres of landscaped areas and single family home lots. For arterial streets in the minor storm event, the maximum street capacity is 6" depth at flowline with 34 cfs per side while maintaining at least (1) 10' lane width free of water. For the major storm event the maximum street flow is 8" depth at flowline dependant on street grade. An existing 15' Type R at-grade curb inlet (at approx. 4% street grade) intercepts a portion of this runoff (Q_5 = 9.0 cfs and Q_{100}= 12.8 cfs) and an existing 18" storm (Pipe 6a) connects with Pipe 6B at an existing storm manhole. Pipe 6C is the 24" outfall pipe from this connection manhole and contains a combined runoff of Q_5 = 17.5 cfs and Q_{100}= 39.7 cfs. The storm water in the existing Marksheffel Road storm sewer system is less in the developed conditions than in the existing conditions due to the over-detention of the proposed development runoff at DP-5. Per the Marksheffel Rd. Construction Drawings, the capacity of the system at Pipe 6C is 16 cfs. Pipe 6C connects into the face of the median sump inlet at DP-20.

Design Point 20 (Q_5 = 4.5 cfs, Q_{100}= 11.3 cfs) consists of runoff from off-site Basin NC-1, 0.42 acres of existing N. Carefree Circle and Marksheffel Rd, and the flow-by from the at-grade inlet at Design Point 19. An existing 10' Type R sump curb inlet intercepts all of this runoff and combines it with that from the incoming Pipe 6C. Pipe 7 represents the existing 30" outfall pipe from this inlet and contains a developed runoff rate of Q_5 = 21.2 cfs and Q_{100}= 48.9 cfs (less than in the existing conditions). From the Marksheffel Rd. Construction Drawings, the capacity of the 30" Pipe 7 is 29 cfs. This runoff continues within the existing Marksheffel Rd. storm system to the south to downstream facilities.

Design Point 20-DS (Q_5 = 33.8 cfs, Q_{100}= 84.5 cfs) This design point quantifies the worst case surface storm runoff downstream of Design Point 20 if the existing Marksheffel Road storm system is at full capacity and the proposed facility overtops the emergency spillway. The quantity is a combination of the surface runoff at Design Point 20 and the theoretical difference in the listed capacity of Pipe 6C (16 cfs) and the total un-detained proposed developed runoff; which is a difference of Q_5 = 29.3 cfs and Q_{100}= 73.2 cfs. As previously mentioned, the allowable street runoff for arterial streets in the minor storm event is a max. 6" depth at flowline with 34 cfs per side while maintaining at least (1) 10' lane width free of water. For the

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major storm event the maximum street flow is 8" depth at flowline dependant on street grade. Flowmaster gutter calculations are included in the Appendix of this report. The capacity of the arterial roadway (Marksheffel Rd.) downstream of the existing Marksheffel and N. Carefree intersection maintains acceptable flow depths, spreads, and overall flow rates as defined in the current Drainage Criteria Manual in the event of an entire 100-yr storm overtopping the spillway.

Design Point 23 (Q_5 = 83.8 cfs, Q_{100}= 173.0 cfs) consists of the total runoff from the Windermere development that drains into the northern proposed Public Full Spectrum Extended Detention Basin and Water Quality Facility to be constructed with Filing 2. A Final Drainage Report will be completed with Windermere Filings 2 & 3 that further detail the detention/water quality facility and address any changes made to this Preliminary Drainage Report for Filings 2 & 3. DP-23 represents the runoff from 49.32 acres (including Pond Basin M) of proposed Windermere on-site developed land at a calculated impervious value of 60.88%. A forebay will be constructed at this 60" RCP entry point into the facility with a concrete low flow trickle channel draining to the outlet box micropool.

As the existing temporary detention facility is located on property not owned or controlled by the Windermere developer, please find in the appendix a letter from the Tract A owner (Yes! Communities) acknowledging their willingness to work with the Windermere developer in converting this existing temporary private facility into a public facility.

Design Point 24 (Q_5 = 111.3 cfs, Q_{100}= 199.7 cfs) is described in the Existing Conditions section of this report. A forebay will be constructed at this channel entry point in the facility with a concrete low flow trickle channel within the middle of the pond bottom. For the design purposes of the proposed EDB facility at DP-25, this tributary runoff was calculated at the following impervious values: Basin WS 41.47 acres @ 2% (historic flow analysis since all developed runoff is treated and released at historic rates with Whispering Springs on-site facilities) and Basin CT 42.07 acres @ 70% (interpolated from previous reports and satellite imagery).

Design Point 25 (Q_5 = 185.7 cfs, Q_{100}= 353.3 cfs) consists of the combination of the existing tributary runoff (DP-24) with the developed runoff from the proposed Windermere site (DP-23) that collect in this proposed Public Full Spectrum Extended Detention Basin (EDB) Water Quality Facility. Per the Hilltop

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Subdivision M.D.D.P., detention of developed runoff is required in order to maintain historic release rates under Marksheffel Road and to the east to the main Sand Creek channel. As mentioned in the Existing Conditions Section, there is currently a temporary detention pond located in this area constructed with the Chateau at Antelope Ridge development to the north. This facility was to be removed when the large regional Sand Creek detention facility was constructed to the south. This facility is no longer a feasible option due to multiple ownerships and lack of planned development to the east of Marksheffel Road. Therefore this permanent facility will ensure acceptable downstream runoff rates and the statement of this facility being temporary in the Chateau reports no longer applies. This Public EDB facility will be required with the development of Windermere Filing No. 2 and a Final Drainage Report will be completed at that time that will provide the final design of this facility. The following pond design/analysis has been completed with this Preliminary Drainage Report for Windermere:

The Extended Detention Basin (EDB) facility was designed using the sizing spreadsheet (See Appendix) and criteria from the Urban Drainage and Flood Control District (UDFCD). A total of 132.86 acres of land is tributary to this facility at a composite imperviousness of 45.4%. An Excess Urban Runoff Volume (EURV) of 6.548 acre-feet is required. This volume is provided under the top of outlet box opening (elevation 6576.50, within the orifice plate of the outlet box).

Forebays will be constructed at both Design Points 23 & 24 and will likely consist of riprap berms with small outlet pipes draining a concrete bottom forebay. Final details will be provided with the Windermere Filing No. 2 Final Drainage Report. An 8' wide concrete trickle channel at 0.50% grade will be installed down the center of the basin to convey the low flows to the outlet box and limit erosion within the bottom of the facility. A 3.0% minimum basin bottom slope into the trickle channel is provided as per the UDFCD requirements.

The bottom of the detention basin is at an elevation of 6571.00 with the EURV provided at the elevation 6576.50. A 20' wide outlet box (4' deep opening) is proposed with a top of box at this 6576.50 elevation. For a Full Spectrum facility, the outlet box orifice holes within the front plate are to drain the EURV in 72 hours, resulting in the necessary orifice hole sizing of 1 column of 1-7/8" diameter circular holes. A 2.5' deep concrete bottom micropool is to be installed within the outlet structure. A removable trash screen of 35" in width will be placed in front of the orifice plate to help prevent the orifice holes from clogging. A

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54" RCP outlet, Pipe 23, will convey the facility's restricted release (Q_5 = 3.22 cfs, Q_{100}= 80.70 cfs) to the adjacent Marksheffel Road ditch, which drains to the existing 24" CMP culvert under Marksheffel Road (DP-26).

A 115' length emergency spillway located at elevation 6579.00 will pass the entire incoming 100-year storm event (353.3 cfs) at a flood depth less than 1.0'. Per the El Paso County Drainage Criteria Manual (DCM), the top of the pond berm shall be 2.0' higher than the flood depth water surface elevation, in this case at 6582.00. This emergency spillway will only be utilized in the case of a complete outlet box failure and will be constructed of riprap rock buried under top soil and re-vegetated. Also, a 15' wide maintenance access road at 12% grade will be installed to the bottom of the facility as per the DCM. By utilizing the Full Spectrum Outlet box design, the release rates are significantly below historic levels. A maximum allowable release rate from this facility can be conservatively calculated as the direct difference between the release rates at M.D.D.P. Design Points 1C & 1X; Q_5 = 65 cfs and Q_{100}= 252 cfs).

Maintenance of the Public detention/water quality structures is by El Paso County. Aesthetic maintenance of the facility will be by either the home owner's association or Windermere Metropolitan District 1 as is to be determined.

Design Point 26 (Q_5 = 7.6 cfs, Q_{100}= 90.9 cfs) consists of the total developed runoff to the existing 24" CMP Marksheffel Road culvert crossing from the north-west (proposed facility release and Basin S, 4.52 acres of single family homes and Marksheffel Road ditch). This runoff quantity does not include that from the upstream Marksheffel Road ditch.

Design Point 26 directly correlates with M.D.D.P. DP-1C, which states a maximum flow rate in existing and developed conditions of Q_5 = 250 cfs and Q_{100}= 852 cfs that crosses under Marksheffel Road. Using a conservative approach by directly adding the M.D.D.P. DP-1X runoff (increased as previously stated) with the quantified DP-26 runoff from the proposed site analysis, a total runoff value can be compared with the M.D.D.P. allowable runoff rate at this culvert crossing of Marksheffel Road. In the proposed developed conditions, the total runoff is Q_5 = 192.6 cfs and Q_{100}= 690.9 cfs. The proposed development and construction of a large public regional detention/water quality facility releases runoff to downstream

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facilities below historic and allowable rates and therefore will not be detrimental to any downstream facilities.

EROSION CONTROL PLAN

Erosion control measures will be installed per the approved grading/erosion control plans and in accordance with the El Paso County Drainage Criteria Manual.

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. Stormwater quality analysis and Extended Detention Basin (EDB) design are per the Urban Drainage and Flood Control District Manual and UD-BMP Version 3.01 spreadsheet. The Rational Method was used to estimate stormwater runoff to the proposed inlets, storm sewer pipes, and detention/water quality facilities.

FLOODPLAIN STATEMENT

No portion of this site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C 0543F effective date, March 17, 1997 (See Appendix).

DRAINAGE AND BRIDGE FEES FILING NO. 1

The Windermere development is located in the Sand Creek Basin and consists of a total acreage of 52.068 acres with a total of 201 single family home lots (3.86 DU/Acre). Filing No. 1 will be platted at this time and contains a total of 14.957 acres. The 2014 El Paso County Drainage Fees are $15,000 per impervious acrea and the Bridge Fees are $4,544 per impervious acre. An impervious value of 4 DU/Acre was applied (38%).

Drainage Fees Filing 1:	
$15,000/acre x 5.684 acres	$ 85,260.00
Bridge Fees Filing 1:	
$4,544/acre x 5.684 acres	$ 25,828.10
TOTALS:	**$ 111,088.10**

Fees or use of existing credits are due prior to plat recordation. Prior to issuance of building permits a plat will need to be recorded and appropriate drainage facility and erosion control assurances will need to be posted.

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CONSTRUCTION COST OPINION – WINDERMERE FILING NO. 1

Private Drainage Facilities Non-Reimbursable

ITEM	DESCRIPTION	QUANTITY		UNIT COST	COST
1.	Retaining Walls in Private Pond (Face foot)	1,789.00	FF	$ 35	$ 62,615.00
2.	Geotextile Fabric (Erosion Control) (Under riprap)	192.00	SY	$ 5	$ 960.00
3.	Rip Rap, d50 Size from 6" to 24"	192.00	CY	$ 98	$ 18,816.00
4.	Detention Facility Construction	1,760.00	CY	$ 11	$ 19,360.00
5.	Detention Outlet Structure	1.00	EA	$18,000	$ 18,000.00
6.	Detention Emergency Spillway	1.00	EA	$ 2,000	$ 2,000.00
	SUB TOTAL				**$ 121,751.00**
	10% ENGINEERING				**$ 12,175.10**
	5% CONTINGENCIES				**$ 6,087.55**
	TOTAL				**$ 140,013.65**

Public Drainage Facilities Non-Reimbursable

1.	10' Type R Inlet	1 EACH	$6,680/EA	$ 6,680.00
2.	15' Type R Inlet	2 EACH	$7,422/EA	$ 14,844.00
3.	Grated Inlet	1 EACH	$3,440/EA	$ 3,440.00
4.	18" RCP Storm Drain	54 LF	$53/LF	$ 2,862.00
5.	24" RCP Storm Drain	1,144 LF	$58/LF	$ 66,352.00
6.	30" RCP Storm Drain	44 LF	$77/LF	$ 3,388.00
7.	36" RCP Storm Drain	66 LF	$95/LF	$ 6,270.00
8.	36" FES	1 EA	$1,200/EA	$ 1,200.00
9.	Type I Storm MH (slab)	2 EACH	$4,575/EA	$ 9,150.00
10.	Type I Storm MH (box)	1 EACH	$7,160/EA	$ 7,160.00
	SUB-TOTAL			$ 121,346.00
	10% ENGINEERING			$ 12,134.60
	5% CONTINGENCIES			$ 6,067.30
	TOTAL			**$ 139,547.90**

Classic Consulting Engineers & Surveyors cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

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SUMMARY

Runoff for the proposed Windermere development is collected in on-site storm sewer systems and routed to two Public Full Spectrum Extended Detention Basin Water Quality facilities. This report describes the final design of the Filing No. 1 storm sewer system and detention/water quality pond. Preliminary design for the storm system and large regional facility at the north end of the site is included in the report. A final drainage report is required with the future Filing 2 & 3 of Windermere that will discuss final design of such facilities. The use of Full Spectrum outlet structures provides a release rate from the proposed facilities much less than historic and therefore the proposed Windermere development does not cause any downstream facility constraints. This report/development is in compliance with the Master Development Drainage Plan for Hilltop Subdivision, the Sand Creek Drainage Basin Planning Study, and the El Paso County Drainage Criteria Manual.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Matthew Larson
Project Engineer

mal/244100/REPORTS/PDR-FDR-FIL.1.doc

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REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual dated October 1991.

2. "Sand Creek Drainage Basin Planning Study," Kiowa Engineering Corp, dated March 1996.

3. "Master Development Drainage Plan for Hilltop Subdivision El Paso County, Colorado," by URS Greiner, Inc. prepared November 1, 1996 (last revised February 1998)

4. "Preliminary Drainage Report for Whispering Springs Development and Final Drainage Report for Whispering Springs Filing No. 1," by Rockwell Consulting, Inc. dated August 2013.

5. "Final Drainage Report and Erosion Control for Chateau at Antelope Ridge," by URS, dated December 1998.

6. "Preliminary Drainage Report for Pronghorn Meadows and Final Drainage Report for Pronghorn Meadows Filing No. 1," by URS, dated September 4, 2002.

7. "Final Drainage Report for Pronghorn Meadows Filing 2," by URS, dated July 2004.

8. "Final Drainage Report for Pronghorn Meadows Filing 3," by URS, dated May 2005.

9. 'North Carefree Circle Developed Drainage Basins Map,' by URS, dated February 2003.

10. "Final Drainage Report Marksheffel Road from Constitution Ave. to Dublin Rd.," by CH2M Hill, dated May 2008 and Marksheffel Road Construction Drawings by Wilson & Company.

11. Drainage Criteria Manual (Volume 3) latest revision April 2008, Urban Drainage and Flood Criteria District.

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APPENDIX

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VICINITY MAP

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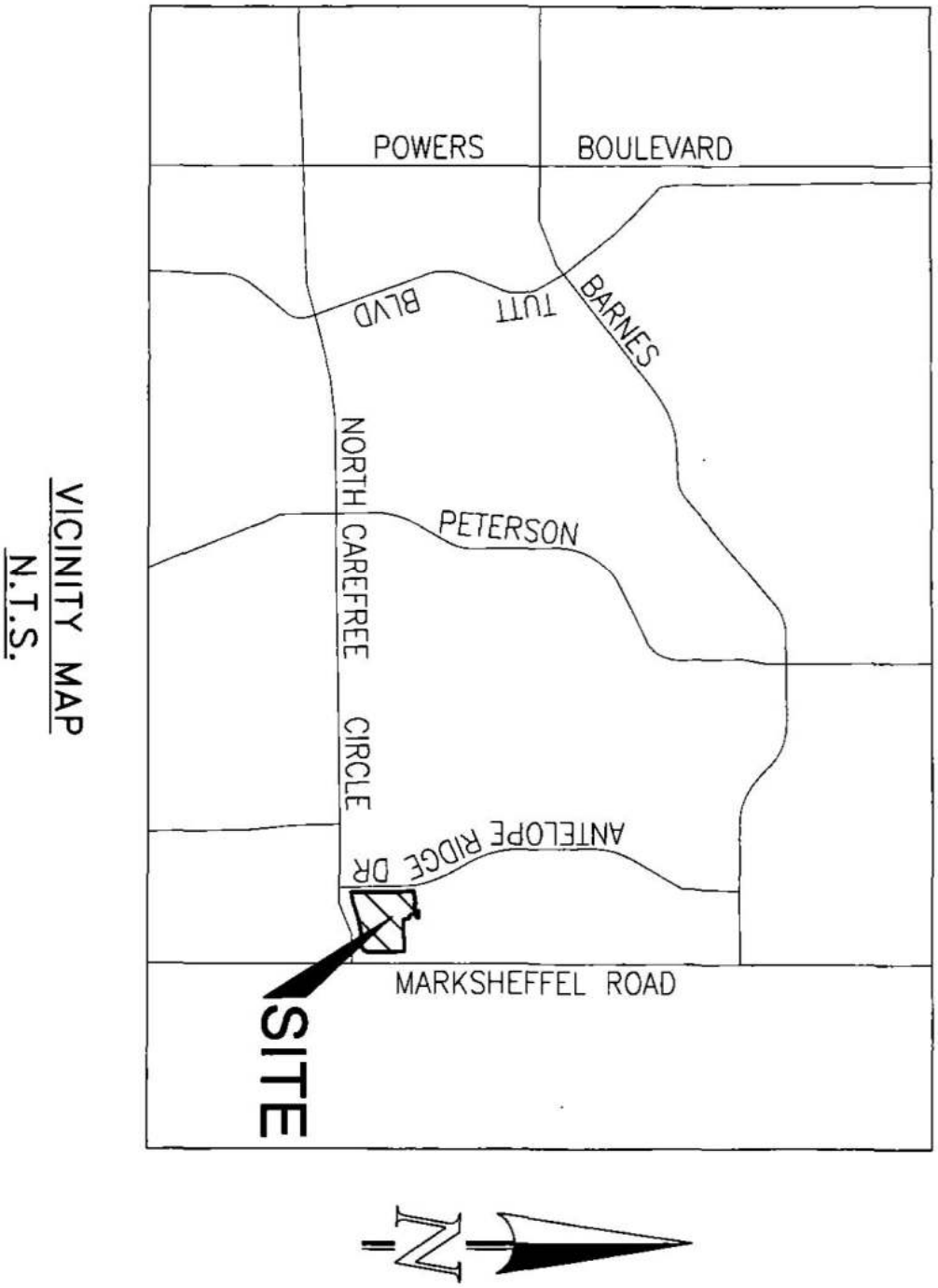

VICINITY MAP
N.T.S.

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SOILS MAP (S.C.S SURVEY)

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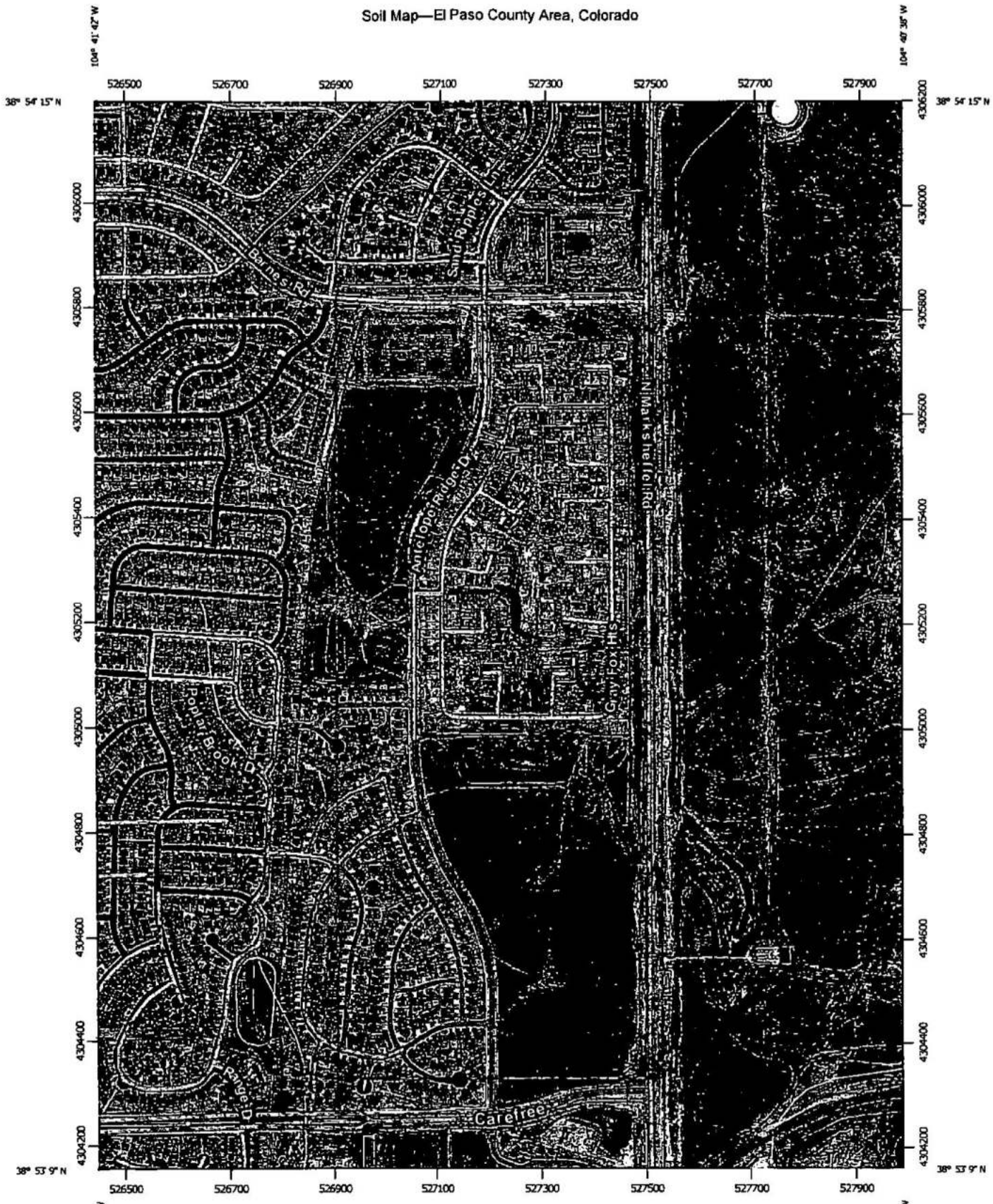

Map Scale: 1:9,950 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 100 200 400 600

Feet: 0 450 900 1800 2700

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

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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: 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: El Paso County Area, Colorado
Survey Area Data: Version 10, Dec 23, 2013

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 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.

PAGE 28
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Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
97	Truckton sandy loam, 3 to 9 percent slopes	261.8	100.0%
Totals for Area of Interest		**261.8**	**100.0%**

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F.E.M.A. MAP

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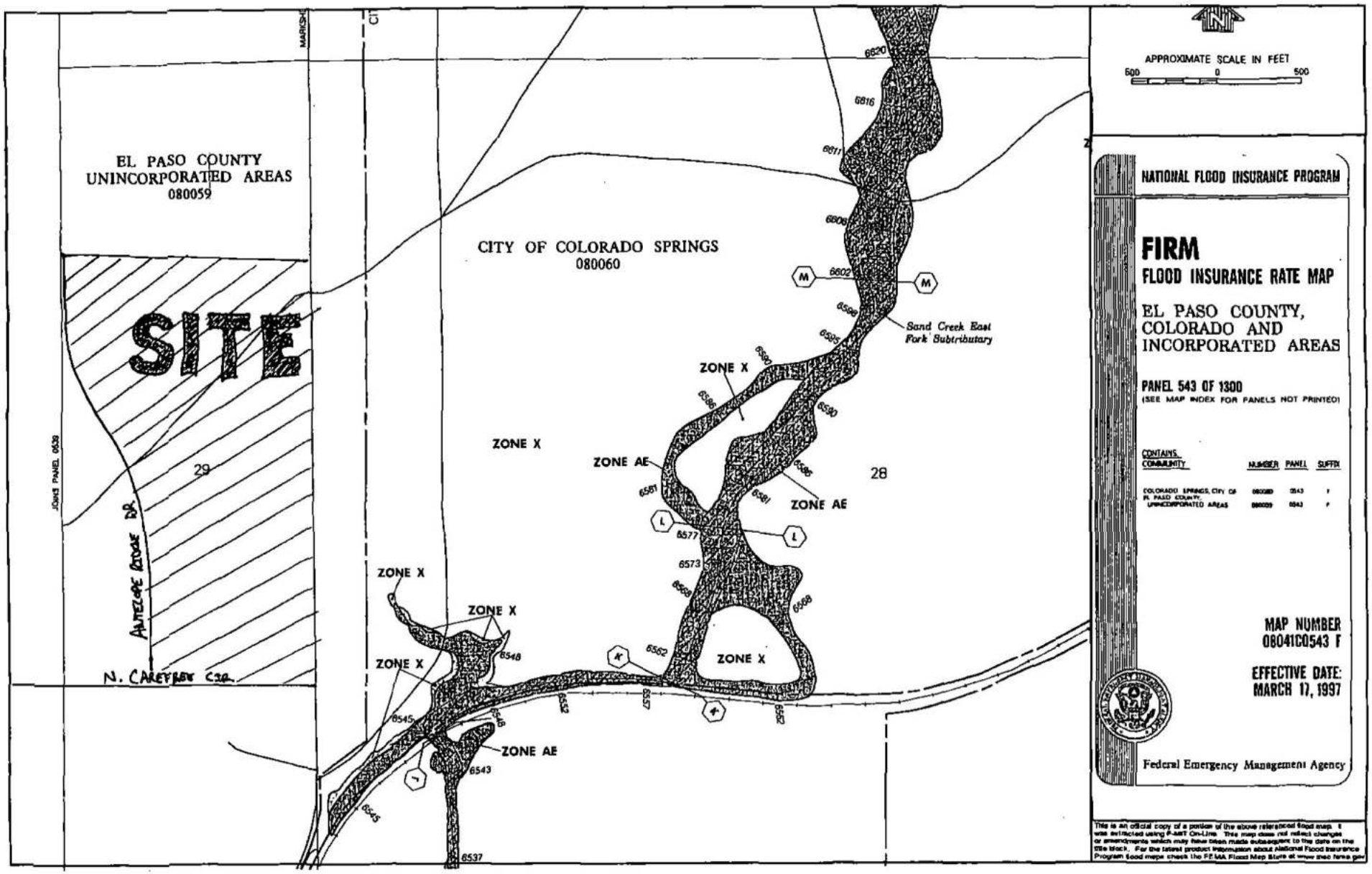

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REFERENCE MATERIAL FROM ADJACENT STUDIES

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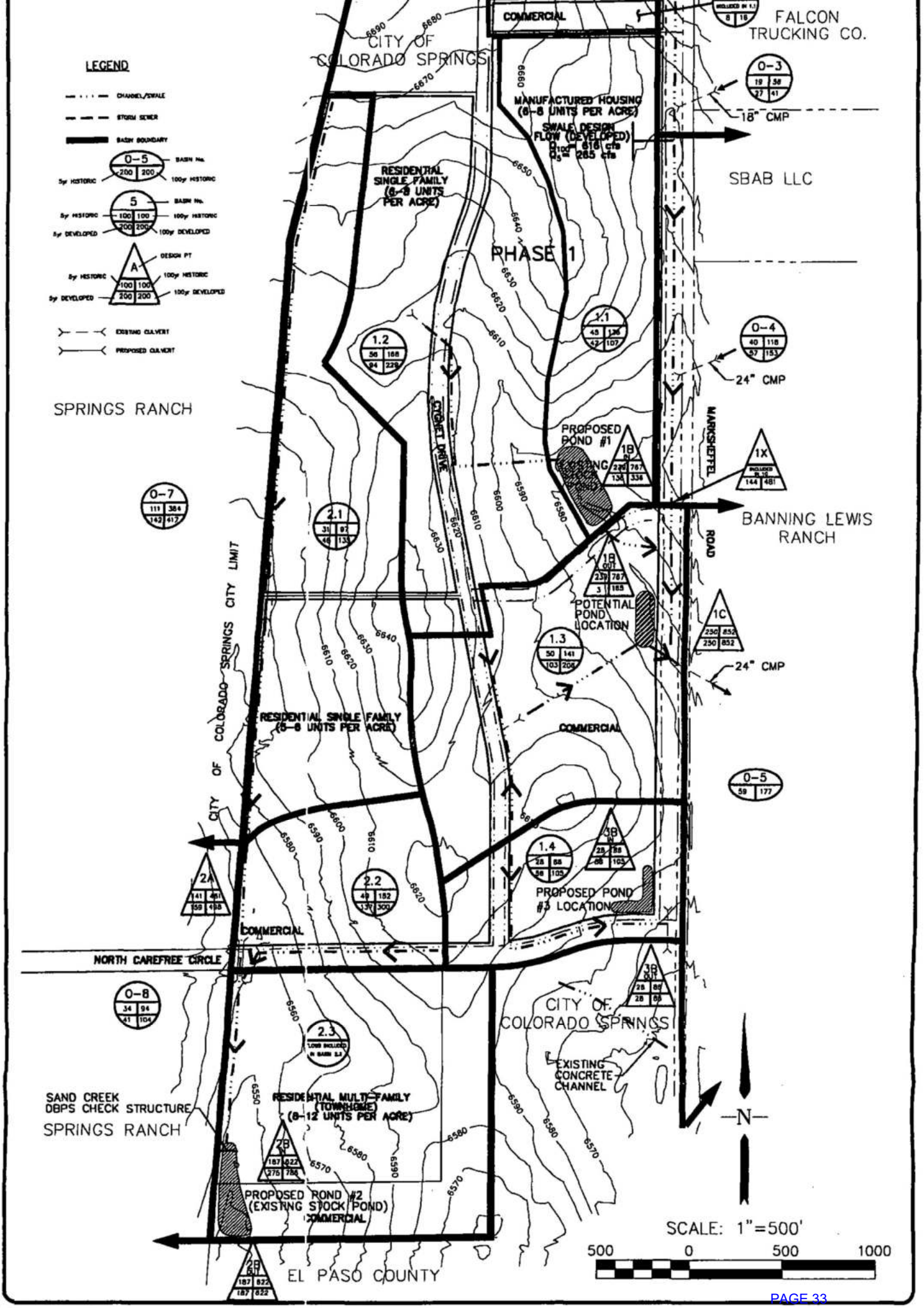

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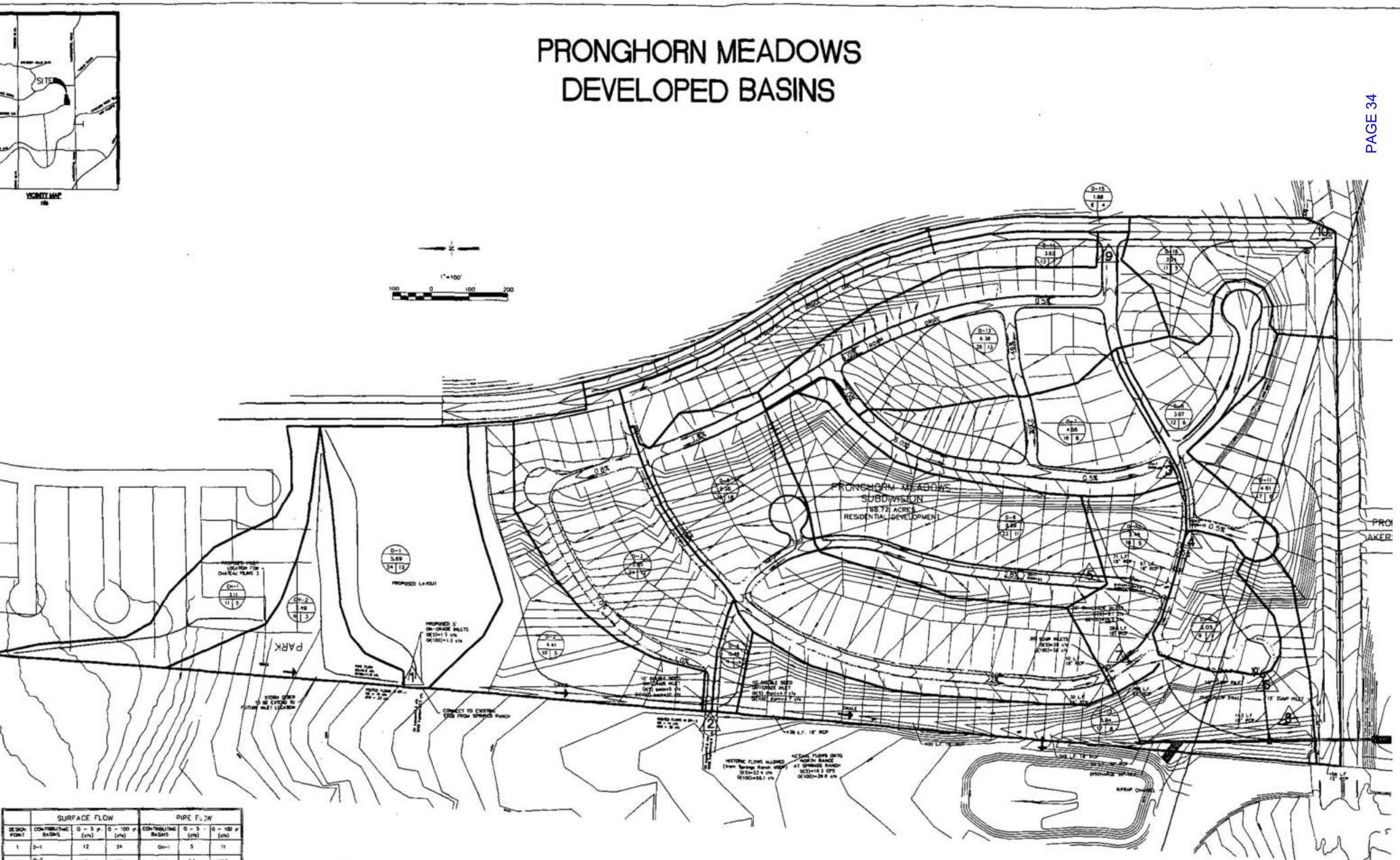
FIGURE

PRONGHORN MEADOWS
DEVELOPED BASINS



DESIGN POINT	SURFACE FLOW			PIPE FLOW		
	CONTRIBUTING BASINS	Q - 5 yr. (cfs)	Q - 100 yr. (cfs)	CONTRIBUTING BASINS	Q - 5 yr. (cfs)	Q - 100 yr. (cfs)
1	D-1	12	24	DI-1	5	11
2	D-2	5	10	D-1	7.5	10.5
3	D-7	8	16	D-3	9.1	14.7
4	D-8	8	12	-	-	-
5	D-4	11	23	DI-GRADE DP-3	11	23
6	D-9 FLOWBY DP-4	9	18	SUMP INLETS DP-7	28	58
7	D-5,D-10 FLOWBY DP-5	28	58			
8	D-13	13	26			
9	D-15 FLOWBY DP-8	16	32			
10						

LEGEND

PROPOSED COUNTOURS

DEVELOPED BASINS

TOC LINE

DIRECTION OF FLOW

DRAINAGE BASIN — D-5 BASIN DESIGNATION, AREA 9.38, Q 100YR 28, Q 5YR 16

REVISIONS		
NO	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: DC DATE: 5/9/02
DRAWN BY: BG DATE: 7/11/02
CHECKED BY: DC DATE: 10/29/03

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
DEPT. OF COLORADO SPRINGS DEPT. OF UTILITIES GAS, ELECTRIC, WATER AND WASTEWATER

URS
1050 FEDERAL DRIVE, SUITE 600
COLORADO SPRINGS, COLORADO

PROJECT PRONGHORN MEADOWS
SHEET TITLE DEVELOPED BASINS
CLIENT WATT/CDO, LLC
JOB NO. 42539

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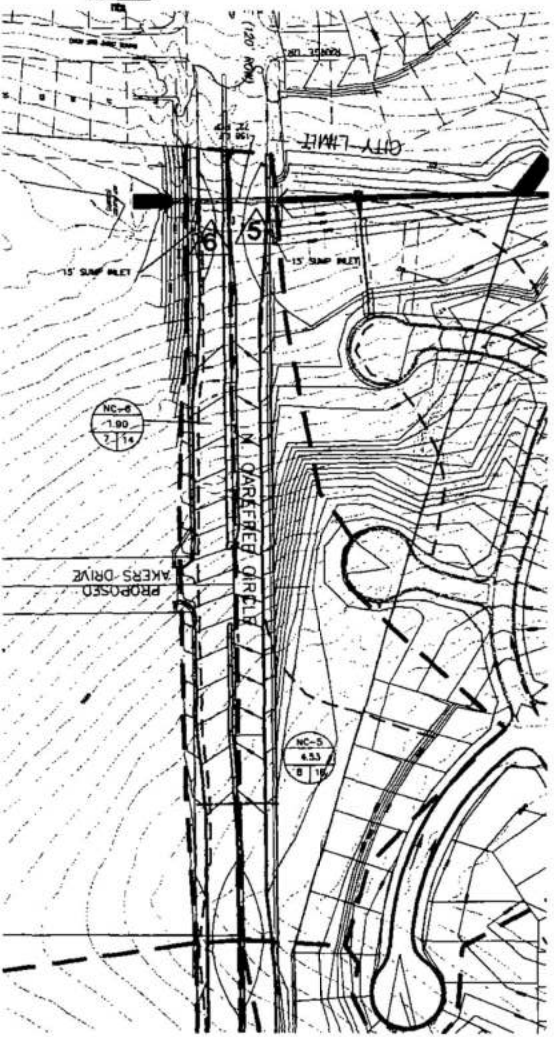
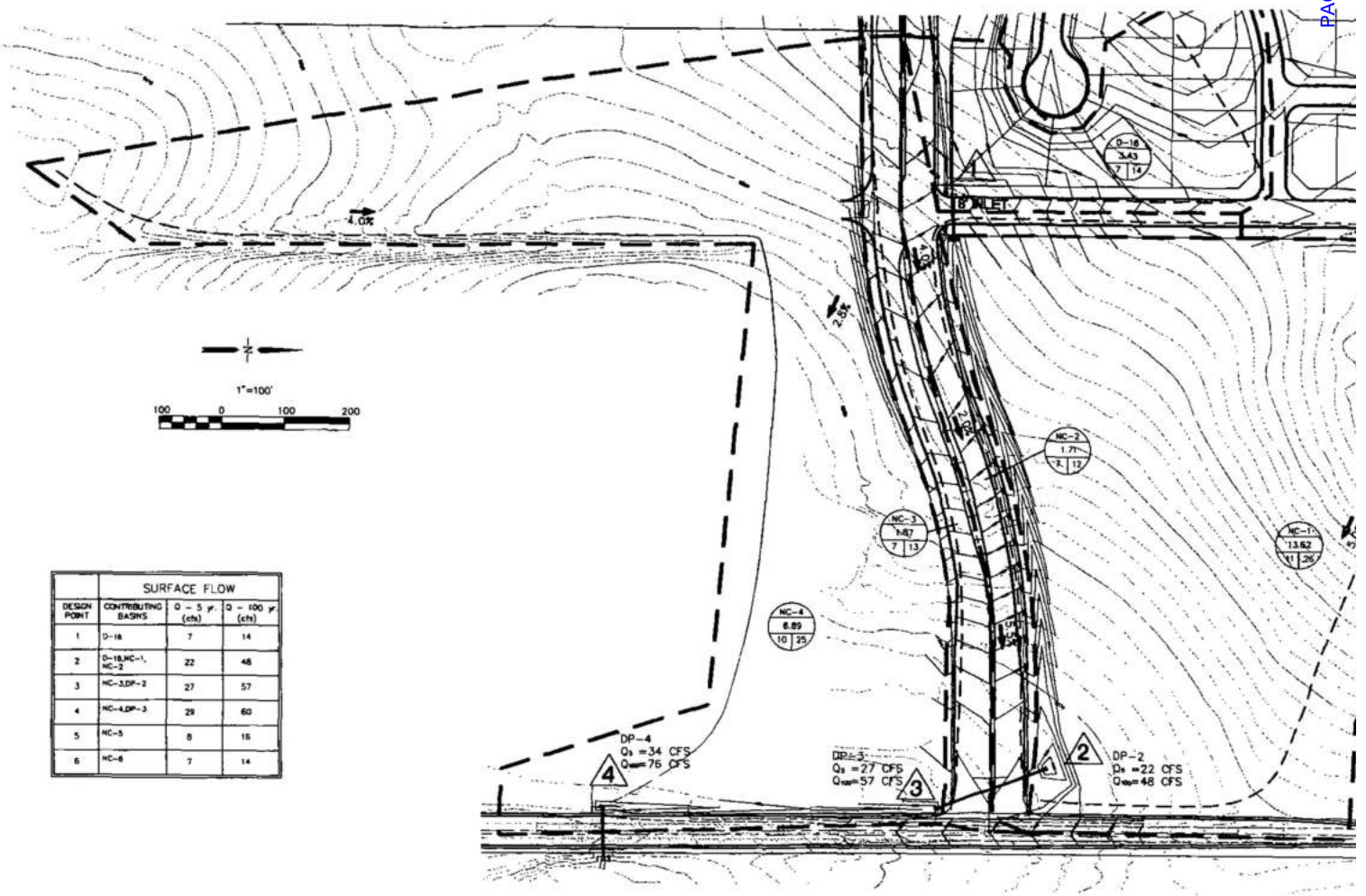
NORTH CAREFREE CIRCLE
DEVELOPED DRAINAGE BASINS





	SURFACE FLOW		
DESIGN POINT	CONTRIBUTING BASINS	Q - 5 yr. (cfs)	Q - 100 yr. (cfs)
1	D-18	7	14
2	D-18,NC-1, NC-2	22	48
3	NC-3,DP-2	27	57
4	NC-4,DP-3	29	60
5	NC-5	8	15
6	NC-6	7	14

LEGEND

PROPOSED COUNTOURS

DEVELOPED BASINS

TOC LINE

DIRECTION OF FLOW

DRAINAGE BASIN — AREA — BASIN DESIGNATION — Q 5-YR — Q 100-YR

REVISIONS:		
NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: DC DATE: 2/12/03
DRAWN BY: DC DATE: 2/13/03
CHECKED BY: CKC DATE: 2/14/03

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(SEE COVER FOR LIST OF UTILITY CONTACTS)

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8960 FEDERAL DRIVE #300
COLORADO SPRINGS, COLORADO 80921

PROJECT NORTH CAREFREE CIR
SHEET TITLE DEVELOPED DRAINAGE PLA
FROM _____ TO _____
JOB NO. 21706978 S

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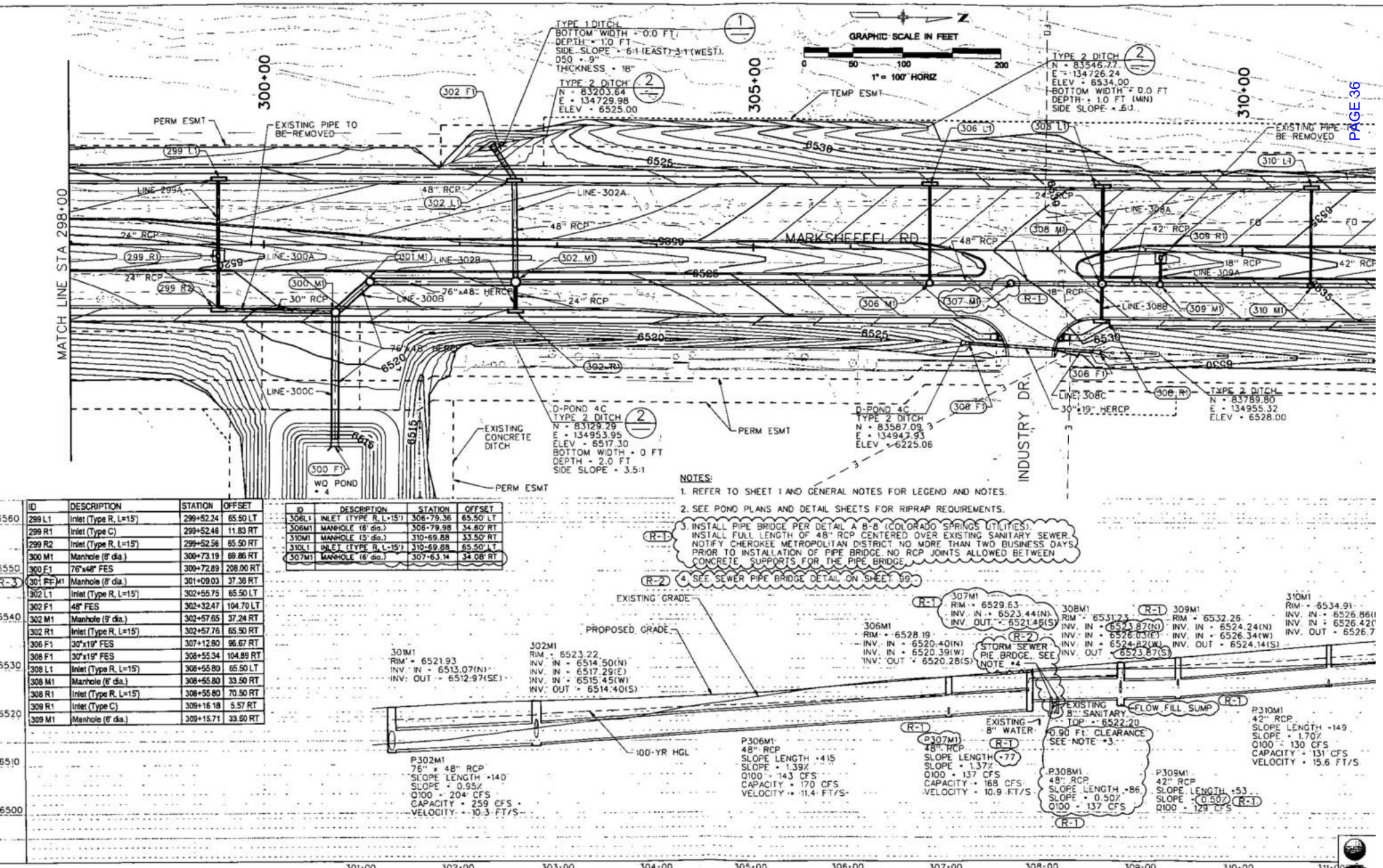

ID	DESCRIPTION	STATION	OFFSET
299 L1	Inlet (Type R, L=15')	299+52.24	65.50 LT
299 R1	Inlet (Type C)	299+52.46	11.83 RT
299 R2	Inlet (Type R, L=15')	299+52.56	65.50 RT
300 M1	Manhole (8' dia.)	300+73.19	69.86 RT
300 F1	76"x48" FES	300+72.89	208.00 RT
301 FF M1	Manhole (8' dia.)	301+09.03	37.36 RT
302 L1	Inlet (Type R, L=15')	302+55.75	65.50 LT
302 F1	48" FES	302+32.47	104.70 LT
302 M1	Manhole (8' dia.)	302+57.65	37.24 RT
302 R1	Inlet (Type R, L=15')	302+57.76	65.50 RT
306 F1	30"x19" FES	307+12.80	96.67 RT
308 F1	30"x19" FES	308+55.34	104.89 RT
308 L1	Inlet (Type R, L=15')	308+55.80	65.50 LT
308 M1	Manhole (6' dia.)	308+55.80	33.50 RT
308 R1	Inlet (Type R, L=15')	308+55.80	70.50 RT
309 R1	Inlet (Type C)	309+16.18	5.57 RT
309 M1	Manhole (6' dia.)	309+15.71	33.50 RT

ID	DESCRIPTION	STATION	OFFSET
306L1	INLET (TYPE R, L=15')	306+79.36	65.50' LT
306M1	MANHOLE (6' dia.)	306+79.98	34.60' RT
310M1	MANHOLE (5' dia.)	310+69.88	33.50' RT
310L1	INLET (TYPE R, L=15')	310+69.88	65.50' LT
307M1	MANHOLE (6' dia.)	307+63.14	34.08' RT

NOTES:
1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.
3. INSTALL PIPE BRIDGE PER DETAIL A 8-8 (COLORADO SPRINGS UTILITIES). INSTALL FULL LENGTH OF 48" RCP CENTERED OVER EXISTING SANITARY SEWER. NOTIFY CHEROKEE METROPOLITAN DISTRICT NO MORE THAN TWO BUSINESS DAYS PRIOR TO INSTALLATION OF PIPE BRIDGE. NO RCP JOINTS ALLOWED BETWEEN CONCRETE SUPPORTS FOR THE PIPE BRIDGE.
4. SEE SEWER PIPE BRIDGE DETAIL ON SHEET 99.

Computer File Information	
eation Date: 10/23/2007	Initials: LMS
nt Date: 08/25/2009	Initials: ADH
Name: drpp04.dgn	

	Sheet Revisions		
	Date:	Comments	Init.
R-1	3/15/2011	Add 307M1 & Pipe Raise	GCS
R-2	4/8/2011	Add Storm Sewer Pipe Bridge	GMH
R-3	1/7/2011	Revised ID Table	GMH

EL PASO COUNTY COLORADO
PPRTA
WILSON & COMPANY Engineers & Architects
5755 Mark Dabling Blvd. Ste. 200 Colorado Springs, CO 80918 Phone: 719-520-0200 Fax: 719-520-0108

As Constructed	
No Revisions:	
Revised: GMH 12-12-11	
Void:	

Markshaffel Road
Drainage Plan and Profile

Designer: GCS	Structure Numbers
Detailer: ADH	
Sheet Subset: Drainage	Subset Sheets: 7 of 14

Proj
Sheet

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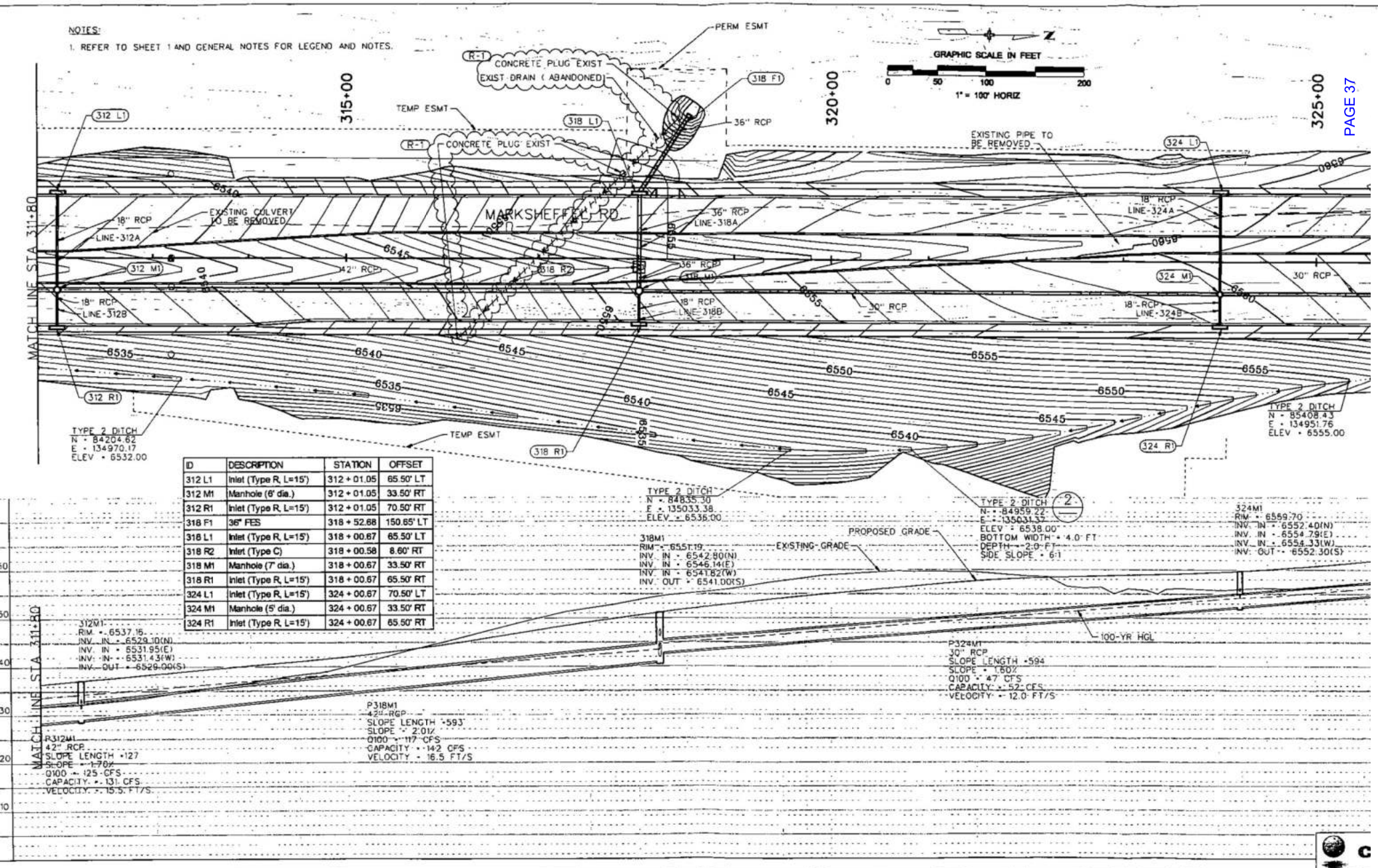
NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.



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312 M1	Manhole (6' dia.)	312 + 01.05	33.50' RT
312 R1	Inlet (Type R, L=15')	312 + 01.05	70.50' RT
318 F1	36" FES	318 + 52.68	150.65' LT
318 L1	Inlet (Type R, L=15')	318 + 00.67	65.50' LT
318 R2	Inlet (Type C)	318 + 00.58	8.60' RT
318 M1	Manhole (7' dia.)	318 + 00.67	33.50' RT
318 R1	Inlet (Type R, L=15')	318 + 00.67	65.50' RT
324 L1	Inlet (Type R, L=15')	324 + 00.67	70.50' LT
324 M1	Manhole (5' dia.)	324 + 00.67	33.50' RT
324 R1	Inlet (Type R, L=15')	324 + 00.67	65.50' RT

Computer File Information		
...ion Date: 10/23/2007	Initials: LMS	
...Date: 08/25/2009	Initials: ADH	
...me: drpp05.dgn		

Sheet Revisions		
Date:	Comments	Init.
7-6-11	PLUG & ABANDONED EXIST DRAIN	GMH

R-1

EL PASO COUNTY COLORADO

PPRTA

WILSON & COMPANY Engineers & Architects
5755 Mark Dabling Blvd. Ste. 220
Colorado Springs, CO 80919
Phone: 719-520-5800
Fax: 719-520-0188

As Constructed
No Revisions:
Revised: GMH 12-6-11
Void:

Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Structure Numbers
Sheet Subset: Drainage
Subset Sheets: 10 of 14

Projec...
PF...
7...
Sheet Nu...

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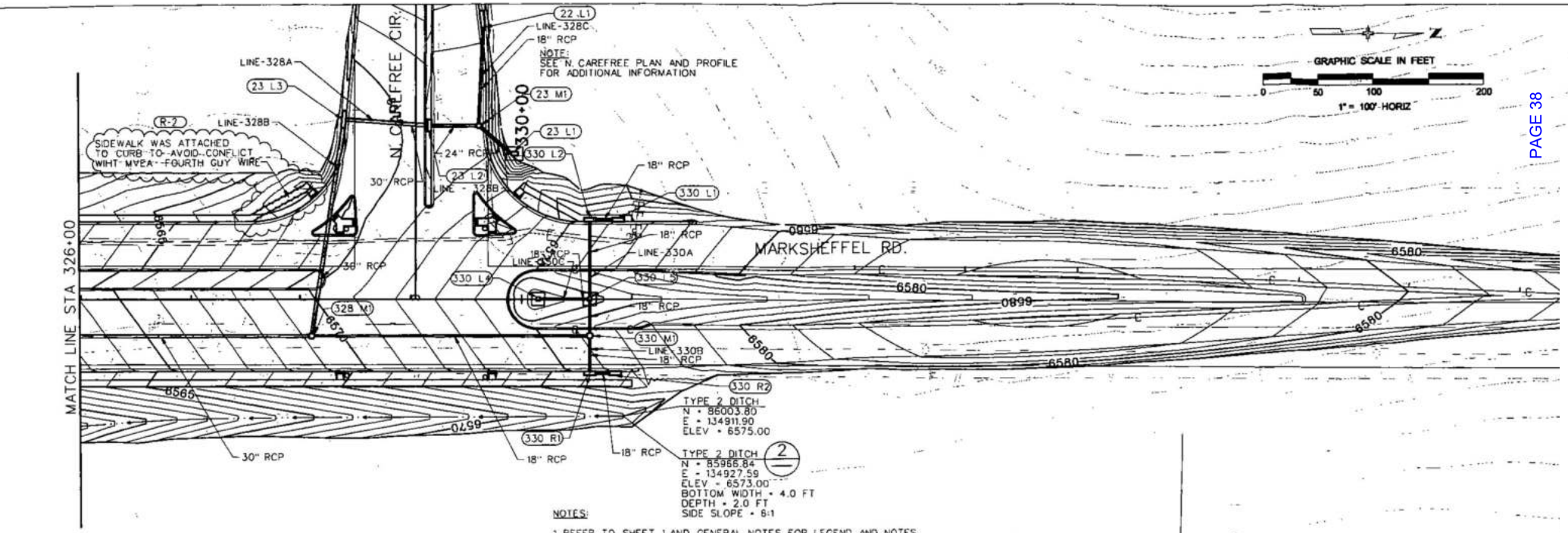
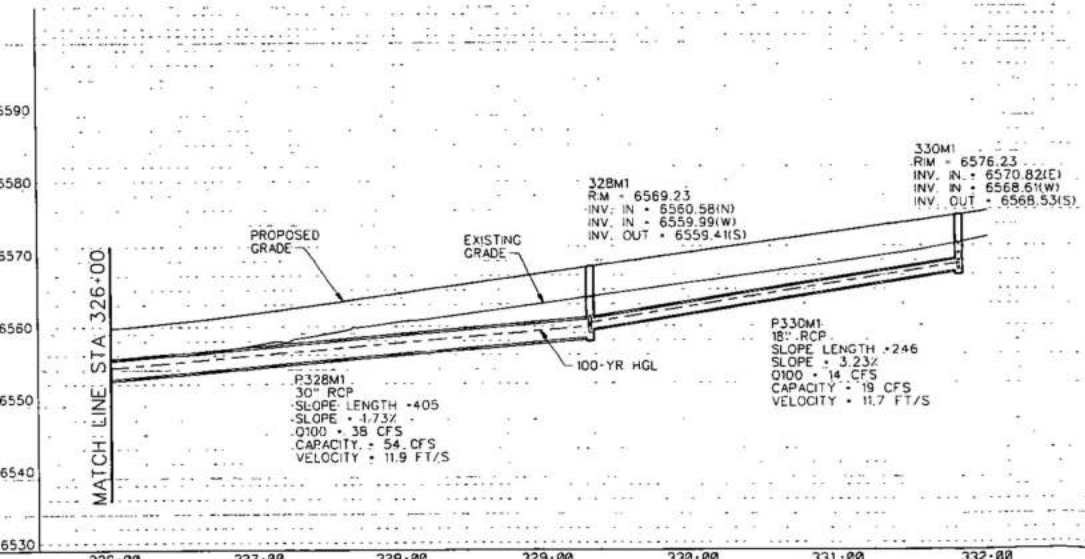


NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.



	ID	DESCRIPTION	STATION	OFFSET
	22 L1	Inlet (Type R, L=15')	22+25.23	57.79' LT
	23 M1	Manhole (4' dia.)	23+21.64	57.00' LT
	23 L1	Inlet (Type D)	23+47.10	89.22' LT
	23 L2	Inlet (Type R, L=10')	23+21.64	15.00' LT
	23 L3	Inlet (Type R, L=15')	23+16.06	62.23' RT
	328 M1	Manhole (8' dia.)	325+10.74	33.50' RT
R-1	330 L1	Inlet (Type R, L=10')	330 + 87.57	70.50' LT
	330 L2	Inlet (Type R, L=10')	330 + 62.07	70.50' LT
	330 L4	Inlet (Type C)	330 + 14.95	0.36' LT
	330 L5	Inlet (Type C)	330 + 62.12	0.25' LT
	330 M1	Manhole (6' dia.)	330 + 62.07	33.50' RT
	330 R1	Inlet (Type R, L=10')	330 + 62.07	65.50' RT
	330 R2	Inlet (Type R, L=10')	330 + 85.07	65.50' RT

Computer File Information	
eation Date: 10/23/2007	Initials: SAK
nt Date: 08/25/2009	Initials: ADH
Name: drpp06.dgn	

Sheet Revisions			
	Date:	Comments	Init.
R-1	3/25/10	Addendum 4	GCS
R-2	10/3/11	MOVED SIDEWALK	GMH

EL PASO COUNTY
COLORADO

PPRTA

WILSON & COMPANY
Engineers & Architects
5755 Mark Dabling Blvd.
Ste. 200
Colorado Springs, CO 80919
Phone: 719-520-0200
Fax: 719-520-0199

As Constructed
No Revisions:
Revised: GMH 12-6-11
Void:

Markshieffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 12 of 14

Proj
Sheet

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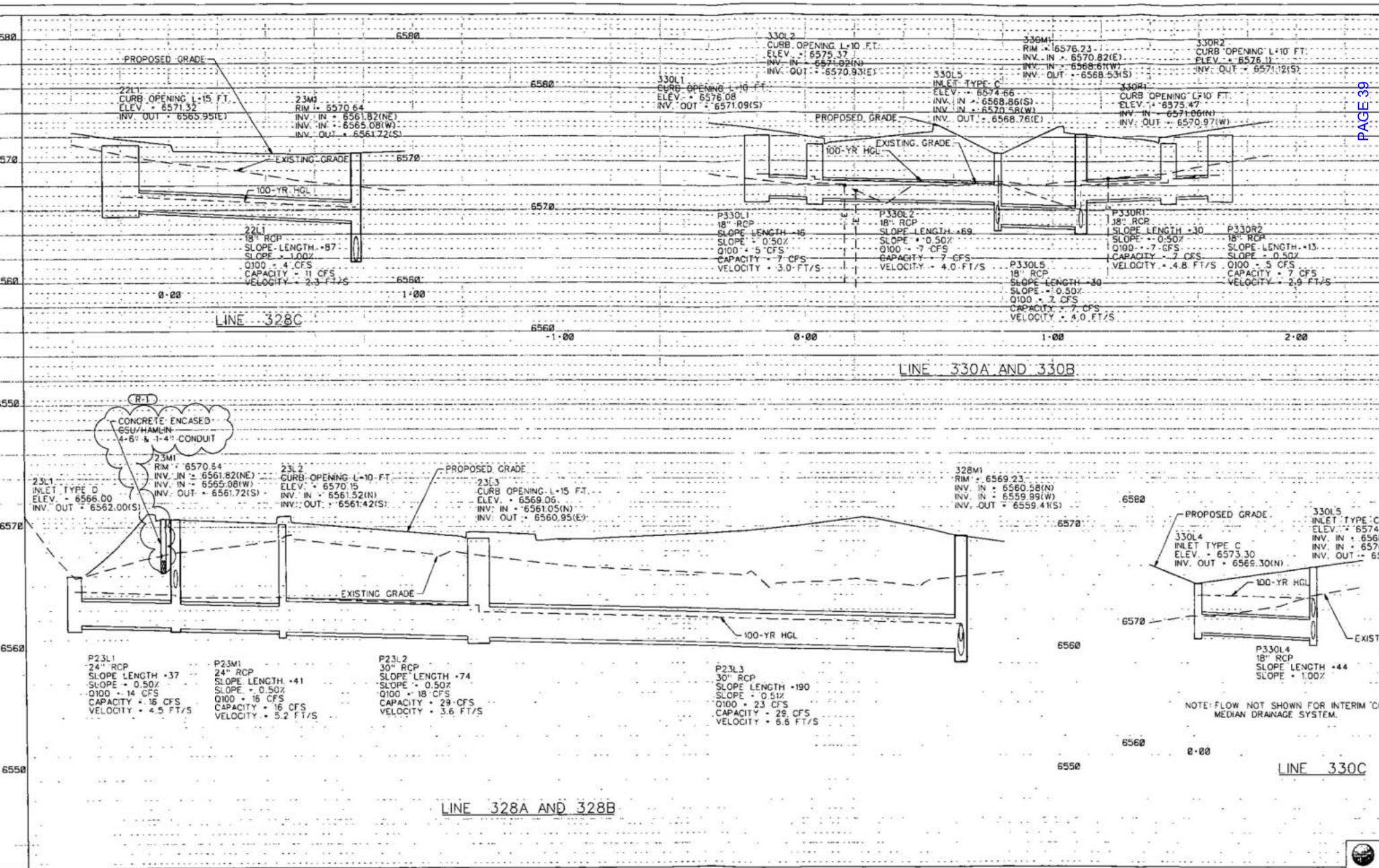

Computer File Information		Sheet Revisions				As Constructed	Marksheffel Road Storm Drain Lateral Profile		Proj
eation Date: 10/23/2007	Initials: LMS	Date:	Comments	Init.	EL PASO COUNTY COLORADO	No Revisions:	Designer: GCS	Structure Numbers	
int Date: 08/25/2009	Initials: ADH	12-6-11	ADDED CONCRETE ENCASEMENT	GMH		Revised: GMH 12-6-11	Detailer: ADH		
e Name: DRPR06.dgn						Void:	Sheet Subset: Drainage	Subset Sheets: 13 of 14	Sheet

WILSON & COMPANY
Engineers & Architects
5755 Mark Dabling Blvd.
Ste. 220
Colorado Springs, CO 80919
Phone: 719-520-5800
Fax: 719-520-0108

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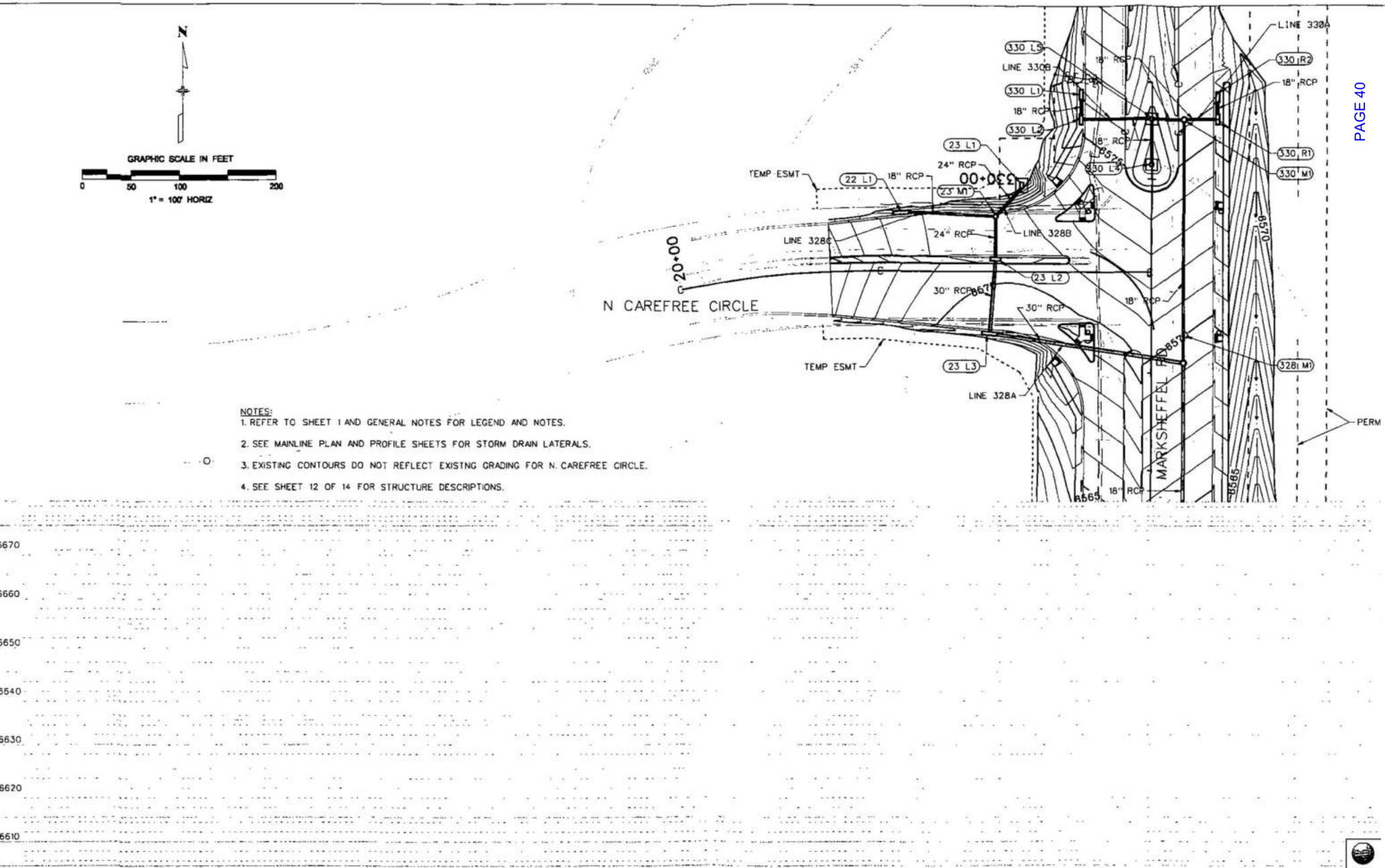

NOTES:
1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE MAINLINE PLAN AND PROFILE SHEETS FOR STORM DRAIN LATERALS.
3. EXISTING CONTOURS DO NOT REFLECT EXISTNG GRADING FOR N. CAREFREE CIRCLE.
4. SEE SHEET 12 OF 14 FOR STRUCTURE DESCRIPTIONS.

Computer File Information		Sheet Revisions						
eation Date: 02/06/2008 Initials: ADH		Date:	Comments	Init.	EL PASO COUNTY COLORADO	WILSON & COMPANY Engineers & Architects	As Constructed	Marksheffel Road Drainage Plan and Profile - N. Carefree
nt Date: 08/25/2009 Initials: ADH							No Revisions: GMH 12-12-11	
Name: drpp17.dgn							Revised:	Designer: GCS / Structure Numbers
							Void:	Detailer: ADH
								Sheet Subset: Drainage / Subset Sheets: 14 of 14

Pro

Sheet

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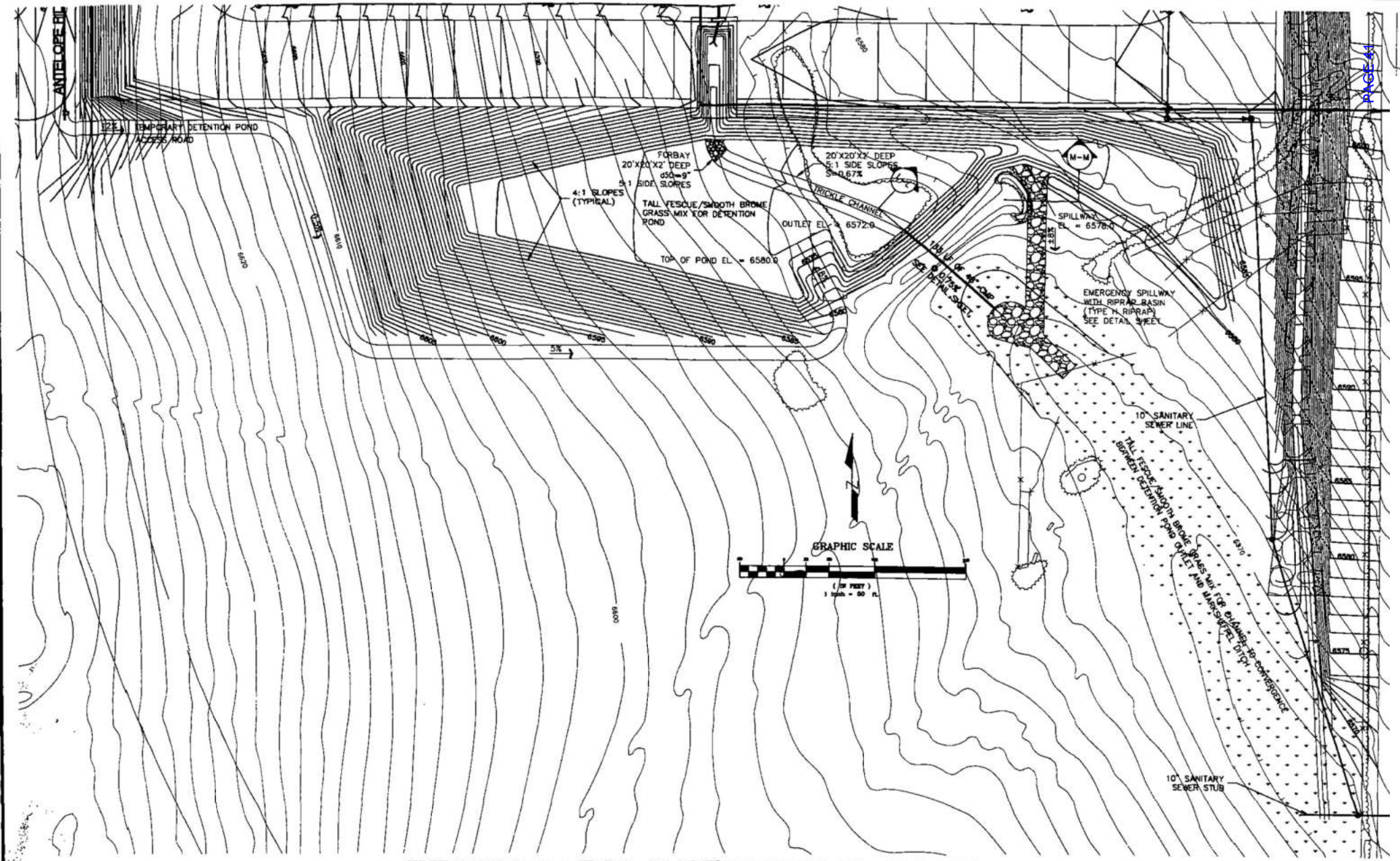

TEMPORARY DETENTION POND
CHATEAU AT ANTELOPE RIDGE

URS Greiner Woodward

DRAWN BY: EDE
DATE: 09/03/
PROJ. NO.: 674221

SHEET 11 OF 17

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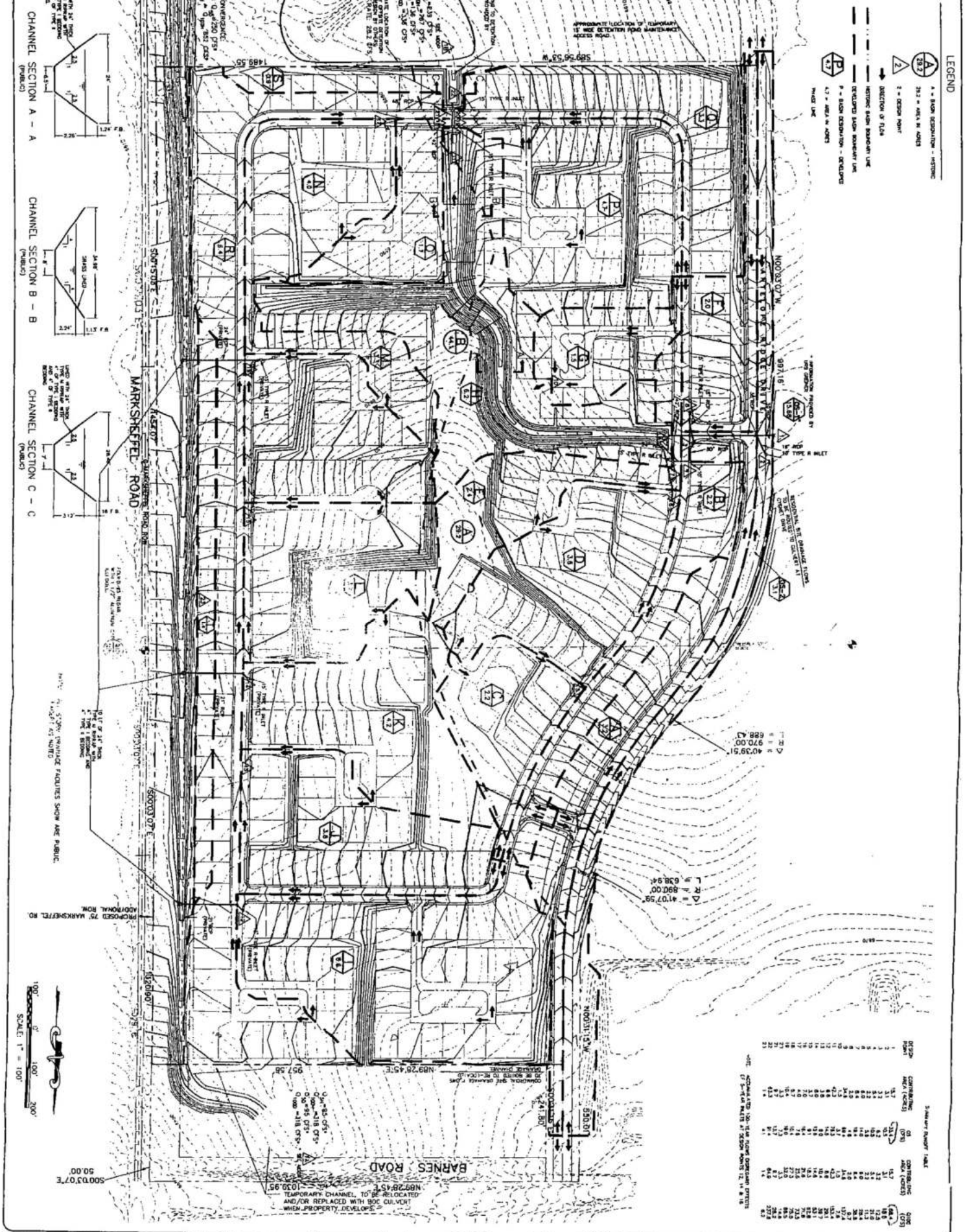

sheet no. 69 of 74

Project No.:	CHA100
Date of Issue	11/11/98
Designed by	GTW
Drawn by:	ATV
Checked by	GTW
CAD File No.:	CHA100\GRADING\DRAIN-1.DWG
CAD File Date	11/11/98 ATV

DCI
DEVELOPMENT SERVICES GROUP, INC.
11184 Huron Street, Suite 13
Denver, Colorado 80234-3344
(303) 280-9200 Fax: (303) 450-0917

Antelope Ridge

El Paso County, Colorado.
Final Construction Plans
Final Drainage Plan

NO.	REVISIONS	DATE

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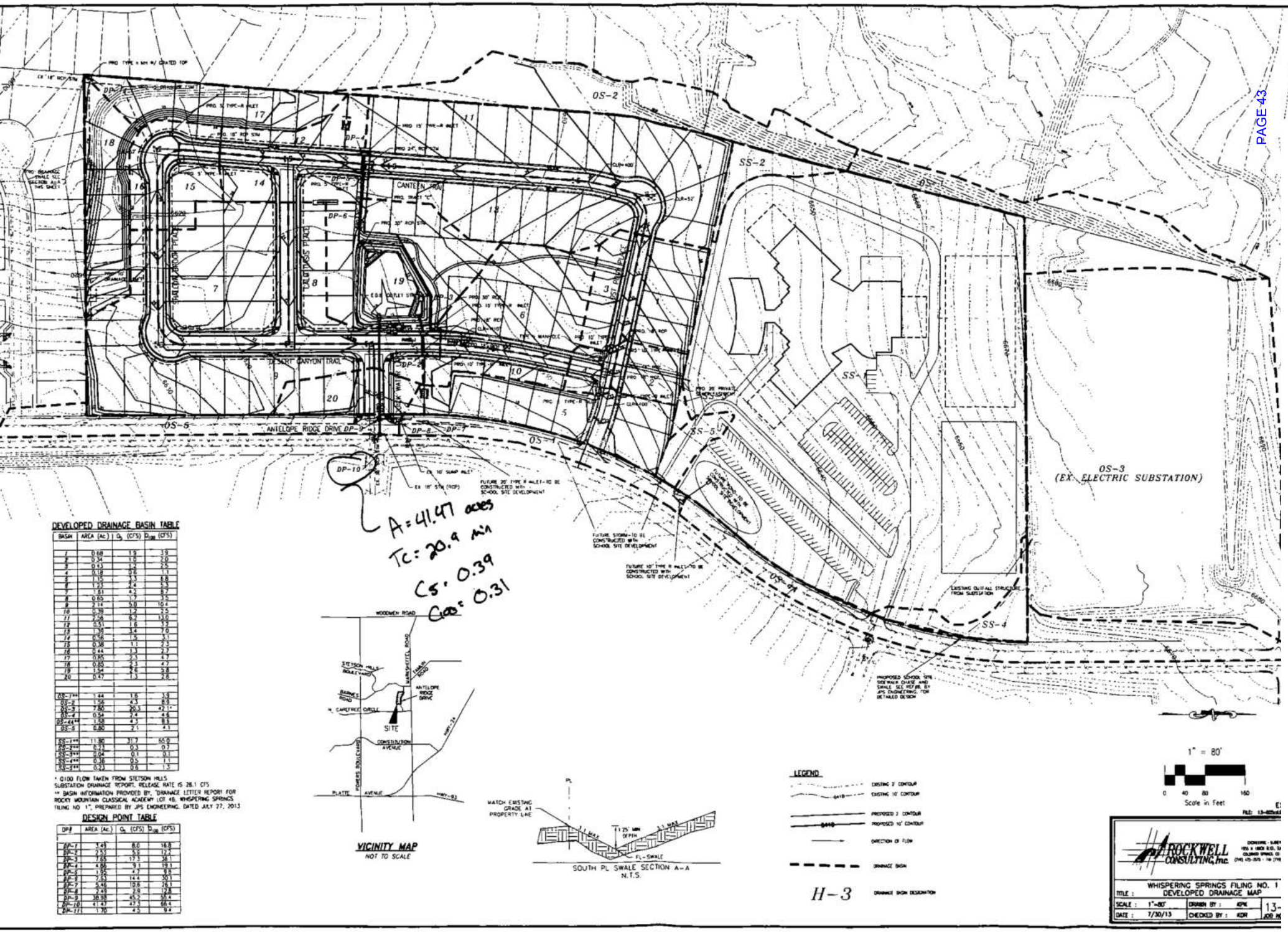

DEVELOPED DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
1	0.68	1.9	3.9
2	0.34	1.0	2.0
3	0.43	1.2	2.5
4	0.18	0.6	1.1
5	1.11	3.3	6.8
6	1.23	3.4	5.3
7	1.81	4.2	8.7
8	0.85	1.9	3.5
9	2.14	5.8	10.4
10	0.39	1.2	2.5
11	2.56	6.2	13.0
12	0.51	1.6	3.3
13	1.36	3.4	7.0
14	0.56	1.5	3.1
15	0.38	1.1	2.3
16	0.44	1.3	2.7
17	0.85	2.3	4.7
18	0.85	2.3	4.7
19	1.54	4.6	5.8
20	0.47	1.3	2.6
OS-1**	1.44	1.6	3.8
OS-2	1.56	2.3	8.5
OS-3*	7.80	20.3	42.1*
OS-4	0.54	2.4	4.6
OS-4A**	1.58	4.1	8.5
OS-5	0.80	2.1	4.1
SS-1**	11.80	31.7	65.0
SS-2**	0.23	0.3	0.7
SS-3**	0.04	0.1	0.1
SS-4**	0.38	0.5	1.1
SS-5**	0.22	0.6	1.3

* Q100 FLOW TAKEN FROM STETSON HILLS SUBSTATION DRAINAGE REPORT. RELEASE RATE IS 28.1 CFS
** BASIN INFORMATION PROVIDED BY, "DRAINAGE LETTER REPORT FOR ROCKY MOUNTAIN CLASSICAL ACADEMY LOT 48, WHISPERING SPRINGS FILING NO 1", PREPARED BY JPS ENGINEERING, DATED JULY 27, 2013

DESIGN POINT TABLE

DP#	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
DP-1	3.49	8.0	14.8
DP-2	2.53	5.9	12.2
DP-3	7.80	17.3	36.1
DP-4	4.86	9.1	19.1
DP-5	1.92	4.7	9.8
DP-6	7.53	14.4	30.1
DP-7	9.45	18.8	39.1
DP-8	7.45	2.8	12.8
DP-9	38.38	45.2	55.4
DP-10	41.47	47.1	66.4
DP-11	1.70	4.5	9.4

VICINITY MAP
NOT TO SCALE

SOUTH PL SWALE SECTION A-A
N.T.S.

LEGEND
- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- PROPOSED 2' CONTOUR
- PROPOSED 10' CONTOUR
- DIRECTION OF FLOW
- DRAINAGE BASIN

H-3 DRAINAGE BASIN DESIGNATION

1" = 80'
0 40 80 160
Scale in Feet

ROCKWELL CONSULTING, Inc.

WHISPERING SPRINGS FILING NO. 1
DEVELOPED DRAINAGE MAP

SCALE :	1"=80'	DRAWN BY :	KDW
DATE :	7/30/13	CHECKED BY :	KDR

13-

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EXISTING DRAINAGE CONDITIONS CALCULATIONS

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JOB :

JOB NUMBER: 2441.00
DATE: 10/03/14
CALCULATED BY: MAL

EXISTING DRAINAGE CONDITIONS ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
EX-A	13.20	0.00	0.90	0.95	13.20	0.25	0.35	0.25	0.35	3.30	4.62
EX-B	7.30	0.00	0.90	0.95	7.30	0.25	0.35	0.25	0.35	1.83	2.56
EX-C	24.28	0.00	0.90	0.95	24.28	0.25	0.35	0.25	0.35	6.07	8.50
EX-D	6.19	0.00	0.90	0.95	6.19	0.25	0.35	0.25	0.35	1.55	2.17
EX-E	1.10	0.00	0.90	0.95	1.10	0.25	0.35	0.25	0.35	0.28	0.39
EX-F	3.15	0.00	0.90	0.95	3.15	0.25	0.35	0.25	0.35	0.79	1.10
EX-R	0.53	0.32	0.90	0.95	0.21	0.25	0.35	0.64	0.71	0.34	0.38
D-13	6.79	1.37	0.90	0.95	5.42	0.53	0.64	0.60	0.70	4.11	4.77
D-14	3.88	1.66	0.90	0.95	2.22	0.37	0.52	0.60	0.70	2.32	2.73
D-15	1.36	1.36	0.90	0.95	0.00	0.25	0.35	0.90	0.95	1.22	1.29
D-16	2.73	0.77	0.90	0.95	1.96	0.53	0.64	0.63	0.73	1.73	1.99
NC-1	0.42	0.42	0.90	0.95	0.00	0.25	0.35	0.90	0.95	0.38	0.40
NC-2	1.49	1.49	0.90	0.95	0.00	0.25	0.35	0.90	0.95	1.34	1.42
WS	41.47		0.90	0.95		0.55	0.65	0.39	0.31	16.05	12.67
CT	42.07	8.67	0.90	0.95	33.40	0.55	0.65	0.62	0.71	26.17	29.95

PAGE 45
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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALC'D BY: *MAL*

EXISTING DRAINAGE CONDITIONS ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
EX-A	3.30	4.62	0.25	250	16	13.6	700	3.9%	6.9	1.7	15.3	3.43	6.10	11.3	28.2
EX-B	1.83	2.56	0.25	450	40	16.4	600	1.7%	4.5	2.2	18.6	3.13	5.56	5.7	14.2
EX-C	6.07	8.50	0.25	450	24	19.4	750	3.7%	6.7	1.9	21.3	2.92	5.19	17.7	44.1
EX-D	1.55	2.17	0.25	260	24	12.3	150	20.0%	15.7	0.2	12.5	3.75	6.68	5.8	14.5
EX-E	0.28	0.39	0.25	200	12	12.4	50	12.0%	12.1	0.1	12.5	3.75	6.67	1.0	2.6
EX-F	0.79	1.10	0.25	30	8	2.9	400	1.0%	3.5	1.9	5.0	5.10	9.07	4.0	10.0
EX-R	0.34	0.38	0.25	20	2	3.3	320	2.0%	4.9	1.1	5.0	5.10	9.07	1.7	3.4
D-13	4.11	4.77	0.25	270	21	13.3	1380	6.0%	8.6	2.7	16.0	3.36	5.98	13.8	28.5
D-14	2.32	2.73	0.25	125	2.5	14.1	1250	1.7%	4.6	4.6	18.7	3.12	5.54	7.2	15.1
D-15	1.22	1.29	0.25	25	1	5.0	2050	1.7%	4.6	7.5	12.5	3.75	6.66	4.6	8.6
D-16	1.73	1.99	0.53	200	10	8.9	350	3.5%	6.5	0.9	9.8	4.14	7.36	7.2	14.6
NC-1	0.38	0.40	0.25	10	2	1.9	25	3.5%	6.5	0.1	5.0	5.10	9.07	1.9	3.6
NC-2	1.34	1.42	0.25	15	2	2.6	1125	3.5%	6.5	2.9	5.5	4.98	8.86	6.7	12.5
WS	16.05	12.67	0.25			#DIV/0!		2.0%	4.9	0.0	20.9	2.95	5.24	47.3	66.4
CT	26.17	29.95	0.25	100	4	10.1	1450	2.0%	4.9	4.9	14.9	3.47	6.17	90.8	184.7

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/04/14*
CALCULATED BY: *MAL*

EXISTING DRAINAGE CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
4	BASIN D-16	1.73	1.99	9.8	4.14	7.36	7.2	14.6	8' Existing Sump Inlet
6	BASIN EX-R + BASIN EX-A + DP-4-EXIST	5.37	6.98	15.3	3.43	6.10	18.4	42.6	Existing Type D Grated Inlet
7	BASIN D-13 & BASIN D-14	6.42	7.50	18.7	3.12	5.54	20.0	41.6	Existing 25' Type R Inlet
8	BASIN D-15 & BASIN EX-E	1.50	1.68	12.5	3.75	6.66	5.6	11.2	Existing 10' Type R Inlet
19	BASIN NC-2	1.34	1.42	5.5	4.98	8.86	6.7	12.5	15' Existing At-Grade Inlet
20	BASIN NC-1 + Flow-by DP-19	0.75	0.90	5.5	4.98	8.86	3.7	8.0	10' Exising sump median inlet
24	BASIN WS + BASIN CT	42.22	42.62	25.8	2.64	4.69	111.3	199.7	OFF-SITE TO POND
25	DP-24 + BASIN EX-D + BASIN EX-F	44.56	45.88	25.8	2.64	4.69	117.5	215.1	EXIST. TO POND
26	DP-25 + BASIN EX-B + BASIN EX-C	52.45	56.94	25.8	2.64	4.69	138.3	266.9	EXIST. TO MARKSHEFFEL (Not including Marksheffel Ditch)

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALCULATED BY: *MAL*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

EXISTING DRAINAGE CONDITIONS ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Pipe Size*
6a	DP-19-EXIST (Intercept)	0.97	0.91	5.5	4.98	8.86	4.8	8.1	EX. 18" RCP
6b	DP-6	5.37	6.98	15.3	3.43	6.10	18.4	42.6	EX. 24" RCP
6c	PIPE 6a + PIPE 6b	6.34	7.90	15.5	3.41	6.06	21.6	47.9	EX. 24" RCP
7	PIPE 6C + DP-20-EXIST	7.09	8.80	15.5	3.41	6.06	24.2	53.3	EX. 30" RCP
8	DP-7-EXIST & DP-8-EXIST	7.92	9.18	18.7	3.12	5.54	24.7	50.9	EX. 36" RCP

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EXISTING DRAINAGE CONDITIONS - BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA/STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
EX-A	13.20	0.00	0.90	0.95	13.20	0.09	0.36	0.09	0.36	1.19	4.75
EX-B	7.30	0.00	0.90	0.95	7.30	0.09	0.36	0.09	0.36	0.66	2.63
EX-C	24.28	0.00	0.90	0.95	24.28	0.09	0.36	0.09	0.36	2.19	8.74
EX-D	6.19	0.00	0.90	0.95	6.19	0.09	0.36	0.09	0.36	0.56	2.23
EX-E	1.10	0.00	0.90	0.95	1.10	0.09	0.36	0.09	0.36	0.10	0.40
EX-F	3.15	0.00	0.90	0.95	3.15	0.09	0.36	0.09	0.36	0.28	1.13
EX-R	0.53	0.32	0.90	0.95	0.21	0.09	0.36	0.58	0.72	0.31	0.38
D-13	6.79	1.37	0.90	0.95	5.42	0.53	0.64	0.60	0.70	4.11	4.77
D-14	3.88	1.66	0.90	0.95	2.22	0.37	0.52	0.60	0.70	2.32	2.73
D-15	1.36	1.36	0.90	0.95	0.00	0.09	0.35	0.90	0.95	1.22	1.29
D-16	2.73	0.77	0.90	0.95	1.96	0.53	0.64	0.63	0.73	1.73	1.99
NC-1	0.42	0.42	0.90	0.95	0.00	0.09	0.36	0.90	0.95	0.38	0.40
NC-2	1.49	1.49	0.90	0.95	0.00	0.09	0.36	0.90	0.95	1.34	1.42
WS	41.47		0.90	0.95		0.09	0.36	0.21	0.46	8.68	19.06
CT	42.07	8.67	0.90	0.95	33.40	0.09	0.36	0.26	0.48	10.81	20.26

EXISTING DRAINAGE CONDITIONS - BASIN RUNOFF SUMMARY

	WEIGHTED CA		OVERLAND					STREET/CHANNEL FLOW				TC (min)	INTENSITY (in/hr)		TOTAL FLOWS (cfs)	
BASIN	CA(5)	CA(100)	C(5)	LENGTH (FT)	HEIGHT (FT)	SLOPE (%)	TC (MIN)	LENGTH (FT)	SLOPE (%)	VELOCITY (fps)	TC (min)	TOTAL	I (5)	I (100)	Q(5)	Q(100)
EX-A	1.19	4.75	0.09	250	16	6.40	15.8	700	3.9	6.9	1.7	17.5	3.22	5.42	3.8	25.7
EX-B	0.66	2.63	0.09	450	40	8.89	19.0	600	1.7	4.5	2.2	21.2	2.93	4.92	1.9	12.9
EX-C	2.19	8.74	0.09	450	24	5.33	22.5	750	3.7	6.7	1.9	24.3	2.72	4.57	5.9	39.9
EX-D	0.56	2.23	0.09	260	24	9.23	14.2	150	20	15.7	0.2	14.4	3.53	5.93	2.0	13.2
EX-E	0.10	0.40	0.09	200	12	6.00	14.4	50	12	12.1	0.1	14.5	3.52	5.91	0.3	2.3
EX-F	0.28	1.13	0.09	30	8	26.67	3.4	400	1	3.5	1.9	5.3	5.03	8.45	1.4	9.6
EX-R	0.31	0.38	0.58	20	2	10.00	2.0	320	2	4.9	1.1	3.1	5.67	9.52	1.7	3.6
D-13	4.11	4.77	0.60	270	21	7.78	7.5	1380	6	8.6	2.7	10.2	4.07	6.84	16.7	32.6
D-14	2.32	2.73	0.60	125	2.5	2.00	8.2	1250	1.7	4.6	4.5	12.7	3.72	6.26	8.6	17.1
D-15	1.22	1.29	0.90	25	1	4.00	1.2	2050	1.7	4.6	7.4	8.6	4.34	7.29	5.3	9.4
D-16	1.73	1.99	0.63	200	10	5.00	7.1	350	3.5	6.5	0.9	8.0	4.45	7.48	7.7	14.9
NC-1	0.38	0.40	0.90	10	2	20.00	0.4	25	3.5	6.5	0.1	0.5	6.70	11.25	2.5	4.5
NC-2	1.34	1.42	0.90	15	2	13.33	0.6	1125	3.5	6.5	2.9	3.5	5.54	9.30	7.4	13.2
WS	8.68	19.06	0.21									20.9	2.95	4.95	25.6	94.4
CT	10.81	20.26	0.26	100	4	4.00	9.7	1450	2	4.9	4.9	14.7	3.50	5.88	37.8	119.0

JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT **EX-8**

Total Flow: Q_5 = 6 cfs

Q_{100} = 11 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [4] foot inlet required

100-Year Event: [4] foot inlet required

EXISTING [10] FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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CALCULATED BY:	*MAL*

DESIGN POINT **EX-19** **100 YEAR FLOW**

Q(100)	12.5	I(100)	8.9		
DEPTH	0.35	Fr	2.46	Inlet size ? L(i) =	15
SPREAD	11.0	L(1)	20.8	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	12.5	If Li > L(2) then Qi =	8
STREET SLOPE	4.0%	L(3)	44.7	FB =	4.4
				CA(eqv.)=	0.50

5 YEAR FLOW

Q(5)	6.7	I(5)	5.0		
DEPTH	0.30	Fr	2.35	Inlet size ? L(i) =	15
SPREAD	8.8	L(1)	15.8	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	9.5	If Li > L(2) then Qi =	5
STREET SLOPE	4.0%	L(3)	33.9	FB =	1.9
				CA(eqv.)=	0.37

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DESIGN POINT **EX-20**

Total Flow: Q_5 = 4 cfs

Q_{100} = 8 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.50 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [4] foot inlet required

100-Year Event: [4] foot inlet required

EXISTING [10] FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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DEVELOPED DRAINAGE CONDITIONS CALCULATIONS

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
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DEVELOPED CONDITIONS ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
A	3.35	0.88	0.90	0.95	2.47	0.60	0.7	0.68	0.77	**2.27**	**2.57**
B	2.72	0.56	0.90	0.95	2.16	0.60	0.7	0.66	0.75	**1.80**	**2.04**
C	4.20	1.10	0.90	0.95	3.10	0.60	0.7	0.68	0.77	**2.85**	**3.22**
D	1.75	1.08	0.60	0.70	0.67	0.25	0.35	0.47	0.57	**0.82**	**0.99**
E	1.47	0.21	0.90	0.95	1.26	0.51	0.61	0.57	0.66	**0.83**	**0.97**
F	2.85	0.76	0.90	0.95	2.09	0.60	0.7	0.68	0.77	**1.94**	**2.19**
G	3.97	0.67	0.90	0.95	3.30	0.60	0.7	0.65	0.74	**2.58**	**2.95**
H	1.42	0.43	0.90	0.95	0.99	0.60	0.7	0.69	0.78	**0.98**	**1.10**
I	4.44	1.12	0.90	0.95	3.32	0.56	0.66	0.65	0.73	**2.87**	**3.26**
J	3.30	0.74	0.90	0.95	2.56	0.60	0.7	0.67	0.76	**2.20**	**2.50**
K	3.74	0.61	0.90	0.95	3.13	0.60	0.7	0.65	0.74	**2.43**	**2.77**

PAGE 55
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JOB NAME: *WINDERMERE*
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CALCULATED BY: *MAL*

DEVELOPED CONDITIONS ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
L	3.86	1.15	0.90	0.95	2.71	0.60	0.7	0.69	0.77	**2.66**	**2.99**
M	9.96	0.00	0.90	0.95	9.96	0.25	0.35	0.25	0.35	**2.49**	**3.49**
N	0.58	0.12	0.90	0.95	0.46	0.60	0.7	0.66	0.75	**0.38**	**0.44**
P	0.60	0.00	0.90	0.95	0.60	0.25	0.35	0.25	0.35	**0.15**	**0.21**
Q	1.70	0.62	0.90	0.95	1.08	0.60	0.7	0.71	0.79	**1.21**	**1.35**
R	1.18	0.25	0.90	0.95	0.93	0.50	0.6	0.58	0.67	**0.69**	**0.80**
S	4.52	1.55	0.60	0.70	2.97	0.25	0.35	0.37	0.47	**1.67**	**2.12**
D-13	6.79	1.37	0.90	0.95	5.42	0.53	0.64	0.60	0.70	**4.11**	**4.77**
D-14	3.88	1.66	0.90	0.95	2.22	0.37	0.52	0.60	0.70	**2.32**	**2.73**
D-15	1.36	1.36	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**1.22**	**1.29**
D-16	2.73	0.77	0.90	0.95	1.96	0.53	0.64	0.63	0.73	**1.73**	**1.99**
NC-1	0.42	0.42	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**0.38**	**0.40**
NC-2	1.49	1.49	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**1.34**	**1.42**
WS	41.47		0.90	0.95		0.55	0.65	0.39	0.31	**16.05**	**12.67**
CT	42.07	8.67	0.90	0.95	33.40	0.55	0.65	0.62	0.71	**26.17**	**29.95**

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DEVELOPED CONDITIONS ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
A	2.27	2.57	0.6	170	5	8.5	680	2.2%	5.2	2.2	10.7	3.99	7.10	9.1	18.2
B	1.80	2.04	0.6	10	1	1.4	715	2.5%	5.5	2.2	5.0	5.10	9.07	9.2	18.5
C	2.85	3.22	0.6	50	1	5.3	790	3.5%	6.5	2.0	7.3	4.59	8.15	13.1	26.2
D	0.82	0.99	0.6	100	7	4.9	490	3.9%	6.9	1.2	6.1	4.84	8.60	3.9	8.5
E	0.83	0.97	0.6	60	4	3.9	400	1.5%	4.3	1.6	5.4	5.00	8.88	4.2	8.6
F	1.94	2.19	0.25	70	20	4.4	550	2.9%	6.0	1.5	5.9	4.87	8.67	9.4	18.9
G	2.58	2.95	0.6	190	12	7.0	480	1.5%	4.3	1.9	8.9	4.29	7.62	11.1	22.4
H	0.98	1.10	0.6	50	1	5.3	480	1.5%	4.3	1.9	7.1	4.62	8.21	4.5	9.0
I	2.87	3.26	0.6	120	8	5.5	800	2.8%	5.8	2.3	7.8	4.49	7.98	12.9	26.0
J	2.20	2.50	0.6	115	8	5.3	470	2.1%	5.1	1.5	6.8	4.68	8.31	10.3	20.7
K	2.43	2.77	0.6	50	1	5.3	945	4.0%	7.0	2.3	7.5	4.54	8.07	11.0	22.4

PAGE 57
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DEVELOPED CONDITIONS ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
L	2.66	2.99	0.6	130	3	8.1	1265	3.5%	6.5	3.2	11.3	3.91	6.95	10.4	20.8
M	2.49	3.49	0.25	170	54	6.6	760	0.5%	2.5	5.1	11.7	3.85	6.85	9.6	23.9
N	0.38	0.44	0.5	100	4	7.1	160	4.0%	7.0	0.4	7.5	4.54	8.08	1.7	3.5
P	0.15	0.21	0.25	90	22	5.3	0	1.0%	3.5	0.0	5.3	5.04	8.96	0.8	1.9
Q	1.21	1.35	0.25	145	10	10.1	530	4.5%	7.4	1.2	11.3	3.91	6.95	4.7	9.3
R	0.69	0.80	0.5	70	6	4.6	380	4.5%	7.4	0.9	5.5	4.99	8.86	3.4	7.1
S	1.67	2.12	0.25	100	14	6.7	720	1.8%	4.7	2.6	9.2	4.23	7.52	7.1	16.0
D-13	4.11	4.77	0.25	270	21	13.3	1380	6.0%	8.6	2.7	16.0	3.36	5.98	13.8	28.5
D-14	2.32	2.73	0.25	125	2.5	14.1	1250	1.7%	4.6	4.6	18.7	3.12	5.54	7.2	15.1
D-15	1.22	1.29	0.25	25	1	5.0	2050	1.7%	4.6	7.5	12.5	3.75	6.66	4.6	8.6
D-16	1.73	1.99	0.53	200	10	8.9	350	3.5%	6.5	0.9	9.8	4.14	7.36	7.2	14.6
NC-1	0.38	0.40	0.25	10	2	1.9	25	3.5%	6.5	0.1	5.0	5.10	9.07	1.9	3.6
NC-2	1.34	1.42	0.25	15	2	2.6	1125	3.5%	6.5	2.9	5.5	4.98	8.86	6.7	12.5
WS	16.05	12.67	0.25			#DIV/0!		2.0%	4.9	0.0	20.9	2.95	5.24	47.3	66.4
CT	26.17	29.95	0.25	100	4	10.1	1450	2.0%	4.9	4.9	14.9	3.47	6.17	90.8	184.7

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DEVELOPED CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
1	BASIN C	2.85	3.22	7.3	4.59	8.15	13.1	26.2	15' At-Grade Type R Inlet
2	BASIN B + Flow-by DP-1	2.70	3.35	7.3	4.59	8.15	12.4	27.3	15' Sump Type R Curb Inlet
3	BASIN A	2.27	2.57	10.7	3.99	7.10	9.1	18.2	10' Sump Type R Curb Inlet
4	BASIN D-16	1.73	1.99	9.8	4.14	7.36	7.2	14.6	8' Existing Sump Inlet
5	BASIN P + PIPE 3b	7.07	8.03	10.8	3.98	7.07	28.1	56.8	SWQ/DETENTION POND
6	BASIN R	0.69	0.80	5.5	4.99	8.86	3.4	7.1	Relocated Type D Grated Inlet
7	BASIN D-13 & BASIN D-14	6.42	7.50	18.7	3.12	5.54	20.0	41.6	Existing 25' Type R Inlet
8	BASIN D-15 & BASIN E	2.06	2.26	12.5	3.75	6.66	7.7	15.1	Existing 10' Type R Inlet
9	BASIN I	2.87	3.26	7.8	4.49	7.98	12.9	26.0	20' At-Grade Type R Inlet
10	BASIN N + Flow-by DP-9	1.24	1.69	7.8	4.49	7.98	5.6	13.5	15' At-Grade Type R Inlet

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DEVELOPED CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
11	BASIN J + Flow-by DP-10	2.49	3.12	7.8	4.49	7.98	11.2	24.8	10' At-Grade Type R Inlet
12	BASIN K	2.43	2.77	7.5	4.54	8.07	11.0	22.4	20' At-Grade Type R Inlet
14	BASIN F + BASIN Q	3.14	3.53	11.3	3.91	6.95	12.3	24.5	20' At-Grade Type R Inlet
15	BASIN G + Flow-by DP-11 + Flow-by DP 12 + Flow-by DP-14	5.24	7.29	11.3	3.91	6.95	20.5	50.7	20' Sump Type R Inlet
16	BASIN L	2.66	2.99	11.3	3.91	6.95	10.4	20.8	10' At-Grade Type R Inlet
17	BASIN H + Flow-by DP-16	1.98	2.75	11.3	3.91	6.95	7.8	19.1	10' Sump Type R Curb Inlet
19	BASIN NC-2 + BASIN D	2.16	2.41	6.1	4.84	8.60	10.4	20.7	15' Existing At-Grade Inlet
20	BASIN NC-1 + Flow-by DP-19	0.93	1.31	6.1	4.84	8.60	4.5	11.3	10' Exising sump median inlet
23	PIPE 22 + BASIN M	28.22	32.77	20.6	2.97	5.28	83.8	173.0	WINDERMERE TO POND
24	BASIN WS + BASIN CT	42.22	42.62	25.8	2.64	4.69	111.3	199.7	OFF-SITE TO POND
25	DP-23 + DP-24	70.44	75.39	25.8	2.64	4.69	185.7	353.3	FILING 2 POND TOTAL IN
26	PIPE 23 + BASIN S	2.89	19.33	25.8	2.64	4.69	7.6	90.6	Developed to Marksheffel (Not Including Marksheffel Ditch)

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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

DEVELOPED CONDITIONS ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Pipe Size*
1	DP-1 (Intercept.)	1.95	1.91	7.3	4.59	8.15	8.9	15.6	24" RCP
2	PIPE 1 + DP-2	4.65	5.26	7.8	4.49	7.98	20.9	41.9	30" RCP
3a	DP-3	2.27	2.57	10.7	3.99	7.10	9.1	18.2	24" RCP
3b	PIPE 2b + PIPE 3a	6.92	7.82	10.7	3.99	7.10	27.6	55.5	36" RCP
4	DP-4	1.73	1.99	9.8	4.14	7.36	7.2	14.6	EX. 24" RCP
5	POND RELEASE	0.16	1.38	10.8	3.98	7.07	0.6	9.8	24" RCP
6a	DP-19 (Intercept)	1.85	1.49	6.1	4.84	8.60	9.0	12.8	EX. 18" RCP
6b	PIPE 4 + PIPE 5 + DP-6	2.58	4.16	10.8	3.98	7.07	10.3	29.4	EX. 24" RCP
6c	PIPE 6a + PIPE 6b	4.43	5.65	11.0	3.95	7.02	17.5	39.7	EX. 24" RCP
7	PIPE 6C + DP-20	5.36	6.97	11.0	3.95	7.02	21.2	48.9	EX. 30" RCP
8	DP-7 & DP-8	8.48	9.76	18.7	3.12	5.54	26.4	54.1	36" RCP
9	DP-9 (Intercepted)	2.01	2.00	7.8	4.49	7.98	9.0	16.0	24" RCP
10	PIPE 8 + PIPE 9	10.49	11.76	19.0	3.09	5.50	32.4	64.7	36" RCP

PAGE 61
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JOB NAME: *WINDERMERE*
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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE. REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

DEVELOPED CONDITIONS ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
11	DP-10 (Intercepted)	0.95	1.07	7.8	4.49	7.98	4.3	8.5	18" RCP
12	PIPE 11 + DP-11 (Intercept.)	2.18	2.06	7.8	4.49	7.98	9.8	16.4	24" RCP
13	PIPE 10 + PIPE 12	12.67	13.82	19.2	3.07	5.46	38.9	75.5	42" RCP
14	DP-14 (Intercepted)	2.26	2.17	11.3	3.91	6.95	8.8	15.1	24" RCP
15	PIPE 13 + PIPE 14	14.92	16.00	19.2	3.07	5.46	45.9	87.4	42" RCP
16	DP-12 (Intercepted)	1.92	1.91	7.5	4.54	8.07	8.7	15.4	24" RCP
17	DP-16 (Intercepted)	1.66	1.34	11.3	3.91	6.95	6.5	9.3	18" RCP
18	PIPE 15 + PIPE 21	22.14	26.03	19.4	3.06	5.44	67.7	141.5	60" RCP
19	DP-15	5.24	7.29	11.3	3.91	6.95	20.5	50.7	36" RCP
20	DP-17	1.98	2.75	11.3	3.91	6.95	7.8	19.1	24" RCP
21	PIPE 19 + PIPE 20	7.22	10.04	11.3	3.91	6.95	28.2	69.8	42" RCP
22	PIPE 16 + PIPE 17 + PIPE 18	25.73	29.29	19.7	3.04	5.40	78.1	158.1	60" RCP
23	DP-25 POND RELEASE	1.22	17.21	25.8	2.64	4.69	3.2	80.6	54" RCP

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DEVELOPED CONDITIONS ~ PIPE TRAVEL TIMES

PIPE RUN	STREET / CHANNEL FLOW				
	Pipe Diameter (ft)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)
1	2.0	220	1.0%	7.2	0.5
3b	3.0	60	1.0%	9.5	0.1
4	2.0	750	4.0%	14.4	0.9
8	3.0	300	3.0%	16.4	0.3
10	3.0	270	4.0%	18.9	0.2
15	3.5	250	4.0%	21.0	0.2
18	5.0	155	0.5%	9.4	0.3
22	5.0	490	0.5%	9.4	0.9

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JOB NAME:	*WINDERMERE*
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DESIGN POINT 1 **100 YEAR FLOW**

Q(100)	26.2	I(100)	8.2		
DEPTH	0.52	Fr	1.68	Inlet size ? L(i) =	15
SPREAD	19.5	L(1)	25.3	If Li < L(2) then Qi =	16
CROSS SLOPE	2.0%	L(2)	15.2	If Li > L(2) then Qi =	16
STREET SLOPE	1.5%	L(3)	54.2	FB =	11
				CA(eqv.)=	1.31

5 YEAR FLOW

Q(5)	13.1	I(5)	4.6		
DEPTH	0.42	Fr	1.60	Inlet size ? L(i) =	15
SPREAD	14.8	L(1)	18.1	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	10.9	If Li > L(2) then Qi =	9
STREET SLOPE	1.5%	L(3)	38.9	FB =	4
				CA(eqv.)=	0.90

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JOB NUMBER:	*2441.00*
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CALCULATED BY:	*MAL*

DESIGN POINT 2

Total Flow: Q_5 = 12 cfs

Q_{100} = 27 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [8] foot inlet required

100-Year Event: [14] foot inlet required

INSTALL A PUBLIC [15] FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 3

Total Flow: Q_5 = 9 cfs

Q_{100} = 18 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [4] foot inlet required

100-Year Event: [8] foot inlet required

INSTALL A PUBLIC [10] FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT **4**

Total Flow: Q_5 = 7 cfs

Q_{100} = 15 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [4] foot inlet required

100-Year Event: [4] foot inlet required

EXISTING [8] FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 7

Total Flow: Q_5 = 20 cfs

Q_{100} = 42 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event:	14	foot inlet required
100-Year Event:	24	foot inlet required
EXISTING	25	FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT **8**

Total Flow: Q_5 = 8 cfs

Q_{100} = 15 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [4] foot inlet required

100-Year Event: [6] foot inlet required

EXISTING [10] FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 9 **100 YEAR FLOW**

Q(100)	26.0	I(100)	8.0		
DEPTH	0.44	Fr	2.63	Inlet size ? L(i) =	20
SPREAD	15.5	L(1)	31.4	If Li < L(2) then Qi =	17
CROSS SLOPE	2.0%	L(2)	18.9	If Li > L(2) then Qi =	16
STREET SLOPE	4.0%	L(3)	67.3	FB =	10
				CA(eqv.)=	1.25

5 YEAR FLOW

Q(5)	12.9	I(5)	4.5		
DEPTH	0.36	Fr	2.49	Inlet size ? L(i) =	20
SPREAD	11.8	L(1)	22.6	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	13.6	If Li > L(2) then Qi =	9
STREET SLOPE	4.0%	L(3)	48.4	FB =	4
				CA(eqv.)=	0.85

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 10 **100 YEAR FLOW**

Q(100)	13.5	I(100)	8.0		
DEPTH	0.36	Fr	2.48	Inlet size ? L(i) =	15
SPREAD	11.5	L(1)	22.0	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	13.2	If Li > L(2) then Qi =	9
STREET SLOPE	4.0%	L(3)	47.1	FB =	5
				CA(eqv.)=	0.62

5 YEAR FLOW

Q(5)	5.6	I(5)	4.5		
DEPTH	0.28	Fr	2.28	Inlet size ? L(i) =	15
SPREAD	7.8	L(1)	13.6	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	8.2	If Li > L(2) then Qi =	4
STREET SLOPE	4.0%	L(3)	29.2	FB =	1
				CA(eqv.)=	0.29

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 11 **100 YEAR FLOW**

Q(100)	24.8	I(100)	8.0		
DEPTH	0.44	Fr	2.63	Inlet size ? L(i) =	10
SPREAD	15.5	L(1)	31.4	If Li < L(2) then Qi =	8
CROSS SLOPE	2.0%	L(2)	18.9	If Li > L(2) then Qi =	12
STREET SLOPE	4.0%	L(3)	67.3	FB =	17
				CA(eqv.)=	2.12

5 YEAR FLOW

Q(5)	11.2	I(5)	4.5		
DEPTH	0.34	Fr	2.45	Inlet size ? L(i) =	10
SPREAD	10.8	L(1)	20.3	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	12.2	If Li > L(2) then Qi =	6
STREET SLOPE	4.0%	L(3)	43.4	FB =	6
				CA(eqv.)=	1.26

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 12 **100 YEAR FLOW**

Q(100)	22.4	I(100)	8.1		
DEPTH	0.50	Fr	1.67	Inlet size ? L(i) =	20
SPREAD	18.5	L(1)	23.7	If Li < L(2) then Qi =	19
CROSS SLOPE	2.0%	L(2)	14.3	If Li > L(2) then Qi =	15
STREET SLOPE	1.5%	L(3)	50.9	FB =	7
				CA(eqv.)=	0.86

5 YEAR FLOW

Q(5)	11.0	I(5)	4.5		
DEPTH	0.40	Fr	1.58	Inlet size ? L(i) =	20
SPREAD	13.8	L(1)	16.7	If Li < L(2) then Qi =	13
CROSS SLOPE	2.0%	L(2)	10.0	If Li > L(2) then Qi =	9
STREET SLOPE	1.5%	L(3)	35.7	FB =	2
				CA(eqv.)=	0.50

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 14 **100 YEAR FLOW**

Q(100)	24.5	I(100)	6.9		
DEPTH	0.44	Fr	2.63	Inlet size ? L(i) =	20
SPREAD	15.5	L(1)	31.4	If Li < L(2) then Qi =	16
CROSS SLOPE	2.0%	L(2)	18.9	If Li > L(2) then Qi =	15
STREET SLOPE	4.0%	L(3)	67.3	FB =	9
				CA(eqv.)=	1.36

5 YEAR FLOW

Q(5)	12.3	I(5)	3.9		
DEPTH	0.35	Fr	2.47	Inlet size ? L(i) =	20
SPREAD	11.3	L(1)	21.4	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	12.9	If Li > L(2) then Qi =	9
STREET SLOPE	4.0%	L(3)	45.9	FB =	3
				CA(eqv.)=	0.89

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 15

Total Flow: Q_5 = 20 cfs

Q_{100} = 51 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.87 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [16] foot inlet required

100-Year Event: [20] foot inlet required

INSTALL A PUBLIC [20] FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 16 **100 YEAR FLOW**

Q(100)	20.8	I(100)	6.9		
DEPTH	0.48	Fr	1.65	Inlet size ? L(i) =	10
SPREAD	17.5	L(1)	22.2	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	13.4	If Li > L(2) then Qi =	11
STREET SLOPE	1.5%	L(3)	47.6	FB =	11
				CA(eqv.)=	1.64

5 YEAR FLOW

Q(5)	10.4	I(5)	3.9		
DEPTH	0.38	Fr	1.55	Inlet size ? L(i) =	10
SPREAD	12.8	L(1)	15.2	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	9.2	If Li > L(2) then Qi =	6
STREET SLOPE	1.5%	L(3)	32.7	FB =	4
				CA(eqv.)=	1.00

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 17

Total Flow: Q_5 = 8 cfs

Q_{100} = 19 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: [4] foot inlet required

100-Year Event: [8] foot inlet required

INSTALL A PUBLIC [10] FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 19 **100 YEAR FLOW**

Q(100)	20.7	I(100)	8.6		
DEPTH	0.37	Fr	2.50	Inlet size ? L(i) =	15
SPREAD	12.0	L(1)	23.1	If Li < L(2) then Qi =	13
CROSS SLOPE	2.0%	L(2)	13.9	If Li > L(2) then Qi =	13
STREET SLOPE	4.0%	L(3)	49.6	FB =	7.9
				CA(eqv.)=	0.91

5 YEAR FLOW

Q(5)	10.4	I(5)	4.8		
DEPTH	0.29	Fr	2.32	Inlet size ? L(i) =	15
SPREAD	8.3	L(1)	14.7	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	8.8	If Li > L(2) then Qi =	8
STREET SLOPE	4.0%	L(3)	31.5	FB =	2.7
				CA(eqv.)=	0.55

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 20

Total Flow: Q_5 = 5 cfs

Q_{100} = 11 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.50 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 6 foot inlet required

EXISTING 10 FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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Design Point 20-DS

Worksheet for Gutter - 5yr

Project Description

Solve For	Spread

Input Data

Channel Slope	0.02800	ft/ft
Discharge	33.80	ft³/s
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.013	

Results

Spread	20.07	ft
Flow Area	4.15	ft²
Depth	0.53	ft
Gutter Depression	0.13	ft
Velocity	8.14	ft/s

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Design Point 20-DS

Worksheet for Gutter - 100yr

Project Description

Solve For	Spread

Input Data

Channel Slope	0.02800	ft/ft
Discharge	84.50	ft³/s
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.013	

Results

Spread	28.67	ft
Flow Area	8.34	ft²
Depth	0.70	ft
Gutter Depression	0.13	ft
Velocity	10.13	ft/s

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FILING NO. 1 –
FULL SPECTRUM EDB FINAL DESIGN

CLASSIC CONSULTING SURVEYORS

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	M.Larson
Company:	Classic Consulting
Date:	October 4, 2014
Project:	Windermere
Location:	FILING NO. 1 POND

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 73.3 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.733

C) Contributing Watershed Area — Area = 10.870 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$) — V_{DESIGN} = 0.316 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$) — $V_{DESIGN\ OTHER}$ = 0.309 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = _____ ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
- ○ A
- ◉ B
- ○ C / D

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = (0.1878i - 0.0104) * Area$
For HSG B: $EURV_B = (0.1178i - 0.0042) * Area$
For HSG C/D: $EURV_{C/D} = (0.1043i - 0.0031) * Area$

EURV = 0.893 ac-ft

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 3.00 ft / ft
DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4 Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

Concrete box forebay

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 1 POND

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.008 ac-ft

B) Actual Forebay Volume — V_F = 0.009 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 57.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.14 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = _____ in

G) Rectangular Notch Width — Calculated W_N = 5.8 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ◉ Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0100 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 107 sq ft

C) Outlet Type

Choose One
- ◉ Orifice Plate
- ○ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E. — H = 7.00 feet

E) Volume to Drain Over Prescribed Time — EURV = 0.893 ac-ft

F) Drain Time (Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours) — T_D = 72 hours

G) Recommended Maximum Outlet Area per Row, (A_o) — A_o = 0.47 square inches

H) Orifice Dimensions:
i) Circular Orifice Diameter or — $D_{orifice}$ = 3 / 4 inches
ii) Width of 2" High Rectangular Orifice — $W_{orifice}$ = _____ inches

I) Number of Columns — n_c = 1 number

J) Actual Design Outlet Area per Row (A_o) — A_o = 0.44 square inches

K) Number of Rows (nr) — n_r = 21 number

L) Total Outlet Area (A_{ot}) — A_{ot} = 9.3 square inches

M) Depth of WQCV (H_{WQCV}) (Estimate using actual stage-area-volume relationship and V_{WQCV}) — H_{WQCV} = _____ feet

N) Ensure Minimum 40 Hour Drain Time for WQCV — $T_{D\,WQCV}$ = _____ hours

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 1 POND

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4.0 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 34.4 cu ft

C) Initial Surcharge Provided Above Micropool — V_s = 35.7 cu ft

9. Trash Rack

A) Type of Water Quality Orifice Used

Choose One
- (●) Circular (up to 2" diameter)
- ( ) Rectangular (2" high)

B) Water Quality Screen Open Area: $A_t = 38.5*(e^{-0.095D})*A_{ot}$ — A_t = 333 square inches

C) For 2", or Smaller, **Circular Opening** (See Fact Sheet T-12):

i) Width of Water Quality Screen and Concrete Opening ($W_{opening}$) — $W_{opening}$ = 12.0 inches

ii) Height of Water Quality Screen (H_{TR}) — H_{TR} = 112.0 inches

iii) Type of Screen, Describe if "Other"

Choose One
- (●) S.S. Well Screen with 60% Open Area*
- ( ) Other (Describe):

D) For 2" High Rectangular Opening

i) Width of Rectangular Opening (W_{recta}) — W_t = _____ inches

ii) Width of Water Quality Screen Opening ($W_{opening}$) — $W_{opening}$ = _____ ft

iii) Height of Water Quality Screen (H_{TR}) — H_{TR} = _____ ft

iv) Type of Screen, Describe if "Other"

Choose One
- ( ) Aluminum Amico-Klemp SR Series (or equal)
- ( ) Other (Describe):

v) Cross-bar Spacing — _____ inches

vi) Minimum Bearing Bar Size

4, 3:08 PM
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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	M.Larson
Company:	Classic Consulting
Date:	October 4, 2014
Project:	Windermere
Location:	FILING NO. 1 POND

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z_E = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

14, 3:08 PM

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING NO. 1 POND - EURV (TOP OF BOX)

POND SIZING WITH PONDPACK EQUATION:
NSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)
6562.50
6562.50
6562.50
6562.83
6564.00
6566.00
6568.00
6570.00

AREA (BTM to TOP):		
	-	acres
-	-	acres
435	0.01	acres
488	0.01	acres
4,247	0.10	acres
5,558	0.13	acres
6,866	0.16	acres
8,219	0.19	acres
	-	acres
	-	acres
	-	acres
	-	acres

PRELIMINARY SIZE:

VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

						CUMMULATIVE VOLUME:
-	AC-FT	from	6,563	to	6,563	
-	AC-FT	from	6,563	to	6,563	-
0.00	AC-FT	from	6,563	to	6,563	0.00
0.05	AC-FT	from	6,563	to	6,564	0.06
0.22	AC-FT	from	6,564	to	6,566	0.28
0.28	AC-FT	from	6,566	to	6,568	0.56
0.34	AC-FT	from	6,568	to	6,570	0.90
-	AC-FT	from	6,570	to	-	0.90
-	AC-FT	from	-	to	-	0.90
-	AC-FT	from	-	to	-	0.90
-	AC-FT	from	-	to	-	0.90

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 0.90 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	0.90	=	39,404	9,851
6	0.90	=	39,404	6,567
8	0.90	=	39,404	4,925
10	0.90	=	39,404	3,940

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING NO. 1 POND - VOLUME TO SPILLWAY

POND SIZING WITH PONDPACK EQUATION:
NSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)
6562.50
6562.50
6562.50
6562.83
6564.00
6566.00
6568.00
6570.00
6571.00

AREA (BTM to TOP):		
	-	acres
-	-	acres
435	0.010	acres
488	0.011	acres
4,247	0.098	acres
5,558	0.128	acres
6,866	0.158	acres
8,219	0.189	acres
10,977	0.252	acres
	-	acres
	-	acres
	-	acres

PRELIMINARY SIZE:

VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

							CUMMULATIVE VOLUME:
-	AC-FT	from	6,563	to	6,563		
-	AC-FT	from	6,563	to	6,563		-
0.00	AC-FT	from	6,563	to	6,563		0.00
0.05	AC-FT	from	6,563	to	6,564		0.06
0.22	AC-FT	from	6,564	to	6,566		0.28
0.28	AC-FT	from	6,566	to	6,568		0.56
0.34	AC-FT	from	6,568	to	6,570		0.90
0.22	AC-FT	from	6,570	to	6,571		1.12
-	AC-FT	from	6,571	to	-		1.12
-	AC-FT	from	-	to	-		1.12
-	AC-FT	from	-	to	-		1.12

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 1.12 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	1.12	=	48,873	12,218
6	1.12	=	48,873	8,146
8	1.12	=	48,873	6,109
10	1.12	=	48,873	4,887

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FILING NO. 1 - 5 YEAR

Project Summary	
Title	WINDERMERE - FILING NO. 1
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 1 5 YEAR POND ROUTING W/ STORMWATER QUALITY

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Table of Contents

	Master Network Summary	2
PO-1 (IN)	Level Pool Pond Routing Summary	3
FIL-1	Modified Rational Hydrograph	4

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FILING NO. 1 - 5 YEAR

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
FIL-1	Base	5	0.617	0.180	20.50

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Base	5	0.607	0.550	0.63

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	5	0.619	0.200	20.50	(N/A)	(N/A)
PO-1 (OUT)	Base	5	0.607	0.550	0.63	6,568.19	0.599

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FILING NO. 1 - 5 YEAR

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,562.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	20.50 ft³/s	Time to Peak (Flow, In)	0.200 hours
Flow (Peak Outlet)	0.63 ft³/s	Time to Peak (Flow, Outlet)	0.550 hours

Elevation (Water Surface, Peak)	6,568.19 ft
Volume (Peak)	0.599 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.619 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.607 ac-ft
Volume (Retained)	0.010 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.3 %

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FILING NO. 1 - 5 YEAR

Subsection: Modified Rational Hydrograph
Label: FIL-1

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Modified Rational Method

Q = CiA * Unit Conversion; Where Conversion = 43560 / (12 * 3600)

Frequency (years)	C Coefficient	C Adjustment Factor	C Coefficient (Final)	Intensity (in/h)	Area (acres)	Flow (Peak) (ft³/s)
5	1.000	1.000	0.650	2.878	10.870	20.50

Peak Discharge	20.50 ft³/s
Time to Peak	0.300 hours
Hydrograph Volume	1.214 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.050	3.42	9.11	14.81	20.50	20.50
0.300	20.50	20.50	18.99	13.29	7.59
0.550	1.90	0.00	(N/A)	(N/A)	(N/A)

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Index

F

FIL-1 (Modified Rational Hydrograph, 5 years)...4

M

Master Network Summary...2

P

PO-1 (IN) (Level Pool Pond Routing Summary, 5 years)...3

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100-YR - FILING NO. 1

Project Summary	
Title	WINDERMERE - FILING NO. 1
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 1 100 YEAR POND ROUTING W/ STORMWATER QUALITY

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Table of Contents

	Master Network Summary	2
PO-1 (IN)	Level Pool Pond Routing Summary	3
FIL-1	Modified Rational Graph	4

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100-YR - FILING NO. 1

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
FIL-1	Base	100	1.126	0.180	46.07

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
O-1	Base	100	1.063	0.450	9.77

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	100	1.130	0.200	46.07	(N/A)	(N/A)
PO-1 (OUT)	Base	100	1.063	0.450	9.77	6,570.61	1.043

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100-YR - FILING NO. 1

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,562.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	46.07 ft³/s	Time to Peak (Flow, In)	0.200 hours
Flow (Peak Outlet)	9.77 ft³/s	Time to Peak (Flow, Outlet)	0.450 hours

Elevation (Water Surface, Peak)	6,570.61 ft
Volume (Peak)	1.043 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.130 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.063 ac-ft
Volume (Retained)	0.065 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.1 %

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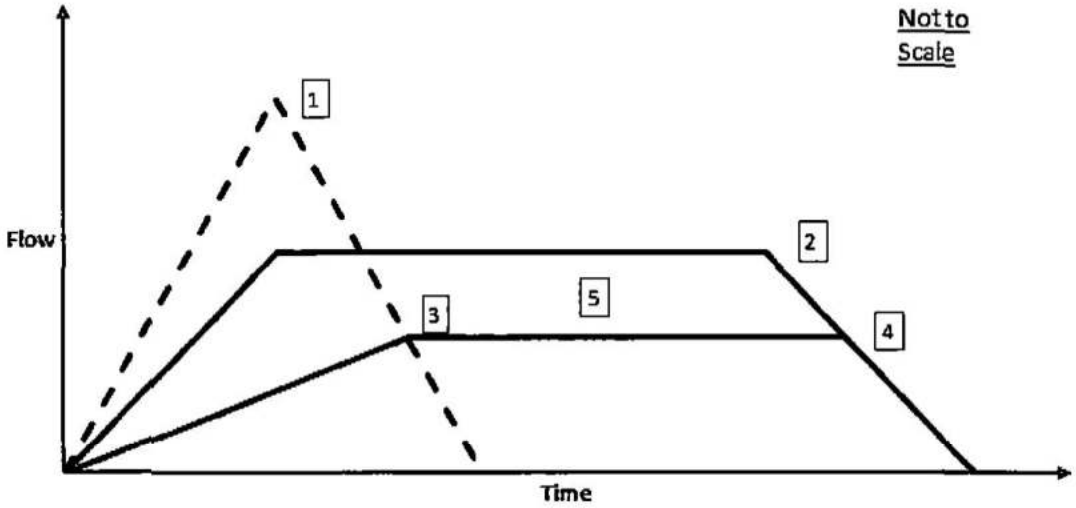
100-YR - FILING NO. 1

Subsection: Modified Rational Graph
Label: FIL-1

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.300 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.180	hours	Time of Duration (Modified Rational, Critical)	0.300	hours
Intensity (Modified Rational, Peak)	7.109	in/h	Intensity (Modified Rational, Critical)	5.680	in/h
Flow (Modified Rational, Peak)	57.66	ft³/s	Flow (Modified Rational, Critical)	46.07	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.379 hours
Flow (Modified Rational, Allowable)	25.80 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.279	hours	Storage (Modified Rational, Estimated)	0.524	ac-ft
Flow (Modified Rational, Allowable)	25.80	ft³/s			

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Index

F

FIL-1 (Modified Rational Graph, 100 years)...4

M

Master Network Summary...2

P

PO-1 (IN) (Level Pool Pond Routing Summary, 100 years)...3

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FILING NO. 2 –
FULL SPECTRUM EDB PRELIMINARY DESIGN

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 2 REGIONAL FACILITY

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 45.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.454
C) Contributing Watershed Area	Area = 132.860 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$)	V_{DESIGN} = 2.577 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$ = 2.518 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$ = ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ○ A ◉ B ○ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = (0.1878i - 0.0104) * Area$ For HSG B: $EURV_B = (0.1178i - 0.0042) * Area$ For HSG C/D: $EURV_{C/D} = (0.1043i - 0.0031) * Area$	EURV = 6.548 ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	Forebay with depressed bottom and riprap berm.

014, 3:07 PM
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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 2 REGIONAL FACILITY

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.063 ac-ft

B) Actual Forebay Volume — V_F = 0.070 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 199.70 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 3.99 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = n

G) Rectangular Notch Width — Calculated W_N = 11.4 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ◉ Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 1000 sq ft

C) Outlet Type

Choose One
- ◉ Orifice Plate
- ○ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E. — H = 5.50 feet

E) Volume to Drain Over Prescribed Time — EURV = 6.548 ac-ft

F) Drain Time (Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours) — T_D = 72 hours

G) Recommended Maximum Outlet Area per Row, (A_o) — A_o = 3.73 square inches

H) Orifice Dimensions:
i) Circular Orifice Diameter or — $D_{orifice}$ = 1-1/2 inches
ii) Width of 2" High Rectangular Orifice — $W_{orifice}$ = inches

I) Number of Columns — n_c = 2 number

J) Actual Design Outlet Area per Row (A_o) — A_o = 3.53 square inches

K) Number of Rows (nr) — n_r = 16 number

L) Total Outlet Area (A_{ot}) — A_{ot} = 56.3 square inches

M) Depth of WQCV (H_{WQCV}) (Estimate using actual stage-area-volume relationship and V_{WQCV}) — H_{WQCV} = feet

N) Ensure Minimum 40 Hour Drain Time for WQCV — $T_{D\ WQCV}$ = hours

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 2 REGIONAL FACILITY

8 Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4.0 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 280.7 cu ft

C) Initial Surcharge Provided Above Micropool — V_S = 333.3 cu ft

9. Trash Rack

A) Type of Water Quality Orifice Used — Choose One: (●) Circular (up to 2" diameter) ( ) Rectangular (2" high)

B) Water Quality Screen Open Area: $A_t \approx 38.5*(e^{-0.095D})*A_{ot}$ — A_t = 1,947 square inches

C) For 2", or Smaller, Circular Opening (See Fact Sheet T-12):

i) Width of Water Quality Screen and Concrete Opening ($W_{opening}$) — $W_{opening}$ = 35.0 inches

ii) Height of Water Quality Screen (H_{TR}) — H_{TR} = 94.0 inches

iii) Type of Screen, Describe if "Other" — Choose One: (●) S.S. Well Screen with 60% Open Area* ( ) Other (Describe):

D) For 2" High Rectangular Opening

i) Width of Rectangular Opening (W_{screen}) — W_s = _____ inches

ii) Width of Water Quality Screen Opening ($W_{opening}$) — $W_{opening}$ = _____ ft

iii) Height of Water Quality Screen (H_{TR}) — H_{TR} = _____ ft

iv) Type of Screen Describe if "Other" — Choose One: ( ) Aluminum Amico-Klemp SR Series (or equal) ( ) Other (Describe):

v) Cross-bar Spacing — _____ inches

vi) Minimum Bearing Bar Size

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	M.Larson
Company:	Classic Consulting
Date:	October 4, 2014
Project:	Windermere
Location:	FILING NO. 2 REGIONAL FACILITY

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z_E = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING 2 - EURV (TOP OF BOX)

POND SIZING WITH PONDPACK EQUATION:
ISERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)	AREA (BTM to TOP):		
6571.00		-	acres
6571.00	4,724	0.11	acres
6572.00	7,502	0.17	acres
6574.00	49,737	1.14	acres
6576.00	135,006	3.10	acres
6576.50	153,596	3.53	acres
		-	acres
		-	acres
		-	acres
		-	acres
		-	acres
		-	acres

PRELIMINARY SIZE:

VOLUME ≈ 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

							CUMMULATIVE VOLUME:
-	AC-FT	from	6,571	to	6,571		
0.14	AC-FT	from	6,571	to	6,572		0.14
1.16	AC-FT	from	6,572	to	6,574		1.30
4.04	AC-FT	from	6,574	to	6,576		5.34
1.64	AC-FT	from	6,576	to	6,577		6.98
-	AC-FT	from	6,577	to	-		6.98
-	AC-FT	from	-	to	-		6.98
-	AC-FT	from	-	to	-		6.98
-	AC-FT	from	-	to	-		6.98
-	AC-FT	from	-	to	-		6.98
-	AC-FT	from	-	to	-		6.98

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME ≈ 6.98 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	6.98	=	######	75,980
6	6.98	=	######	50,653
8	6.98	=	######	37,990
10	6.98	=	######	30,392

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING 2 VOLUME TO SPILLWAY

POND SIZING WITH PONDPACK EQUATION:
ISERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)	AREA (BTM to TOP):		
6571.00		-	acres
6571.00	4,724	0.108	acres
6572.00	7,502	0.172	acres
6574.00	49,737	1.142	acres
6576.00	135,006	3.099	acres
6578.00	198,782	4.563	acres
6579.00	216,813	4.977	acres
		-	acres
		-	acres
		-	acres
		-	acres
		-	acres

PRELIMINARY SIZE:

VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

							CUMMULATIVE VOLUME:
-	AC-FT	from	6,571	to	6,571		
0.14	AC-FT	from	6,571	to	6,572		0.14
1.16	AC-FT	from	6,572	to	6,574		1.30
4.04	AC-FT	from	6,574	to	6,576		5.34
7.54	AC-FT	from	6,576	to	6,578		12.88
4.72	AC-FT	from	6,578	to	6,579		17.60
-	AC-FT	from	6,579	to	-		17.60
-	AC-FT	from	-	to	-		17.60
-	AC-FT	from	-	to	-		17.60
-	AC-FT	from	-	to	-		17.60
-	AC-FT	from	-	to	-		17.60

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 17.60 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	17.60	=	######	191,654
6	17.60	=	######	127,769
8	17.60	=	######	95,827
10	17.60	=	######	76,661

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FILING NO. 2 - 5 YEAR

Project Summary	
Title	WINDERMERE - FILING NO. 2
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 2 5 YEAR POND ROUTING W/ STORMWATER QUALITY

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Table of Contents

	Master Network Summary	2
PO-1 (IN)	Level Pool Pond Routing Summary	3
DP-24	Modified Rational Graph	4

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FILING NO. 2 - 5 YEAR

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
DP-23	Base	5	2.827	0.343	68.85
DP-24	Base	5	4.237	0.430	102.88

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Base	5	5.168	0.950	3.21

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	5	7.080	0.450	171.74	(N/A)	(N/A)
PO-1 (OUT)	Base	5	5.168	0.950	3.21	6,576.46	6.898

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FILING NO. 2 - 5 YEAR

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,571.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	171.74 ft³/s	Time to Peak (Flow, In)	0.450 hours
Flow (Peak Outlet)	3.21 ft³/s	Time to Peak (Flow, Outlet)	0.950 hours

Elevation (Water Surface, Peak)	6,576.46 ft
Volume (Peak)	6.898 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.080 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.168 ac-ft
Volume (Retained)	1.893 ac-ft
Volume (Unrouted)	-0.018 ac-ft
Error (Mass Balance)	0.3 %

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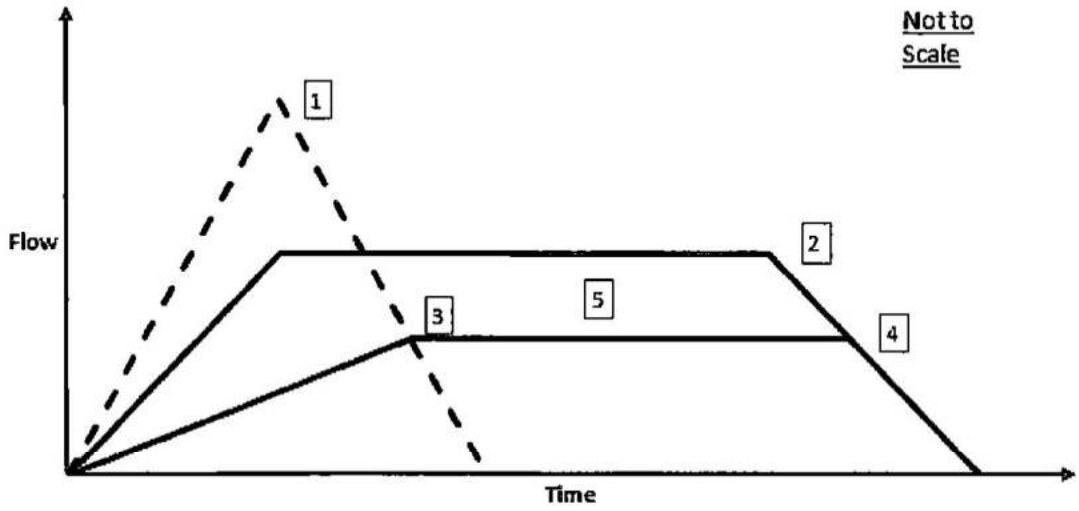
FILING NO. 2 - 5 YEAR

Subsection: Modified Rational Graph
Label: DP-24

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.500 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.430	hours	Time of Duration (Modified Rational, Critical)	0.500	hours
Intensity (Modified Rational, Peak)	2.638	in/h	Intensity (Modified Rational, Critical)	2.420	in/h
Flow (Modified Rational, Peak)	112.17	ft³/s	Flow (Modified Rational, Critical)	102.88	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.700 hours
Flow (Modified Rational, Allowable)	55.00 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.649	hours	Storage (Modified Rational, Estimated)	2.022	ac-ft
Flow (Modified Rational, Allowable)	55.00	ft³/s			

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Index

D

DP-24 (Modified Rational Graph, 5 years)...4

M

Master Network Summary...2

P

PO-1 (IN) (Level Pool Pond Routing Summary, 5 years)...3

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FILING 2 - 100 YEAR

Project Summary	
Title	WINDERMERE - FILING NO. 2
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 2 100 YEAR POND ROUTING W/ STORMWATER QUALITY

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Table of Contents

	Master Network Summary	2
PO-1 (IN)	Level Pool Pond Routing Summary	3
DP-24	Modified Rational Graph	4

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

FILING 2 - 100 YEAR

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
DP-23	Base	100	5.847	0.343	142.39
DP-24	Base	100	7.620	0.430	185.05

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Base	100	11.046	0.800	80.66

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	100	13.499	0.450	327.44	(N/A)	(N/A)
PO-1 (OUT)	Base	100	11.046	0.800	80.66	6,577.68	11.595

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FILING 2 - 100 YEAR

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,571.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	327.44 ft³/s	Time to Peak (Flow, In)	0.450 hours
Flow (Peak Outlet)	80.66 ft³/s	Time to Peak (Flow, Outlet)	0.800 hours

Elevation (Water Surface, Peak)	6,577.68 ft
Volume (Peak)	11.595 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	13.499 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	11.046 ac-ft
Volume (Retained)	2.415 ac-ft
Volume (Unrouted)	-0.038 ac-ft
Error (Mass Balance)	0.3 %

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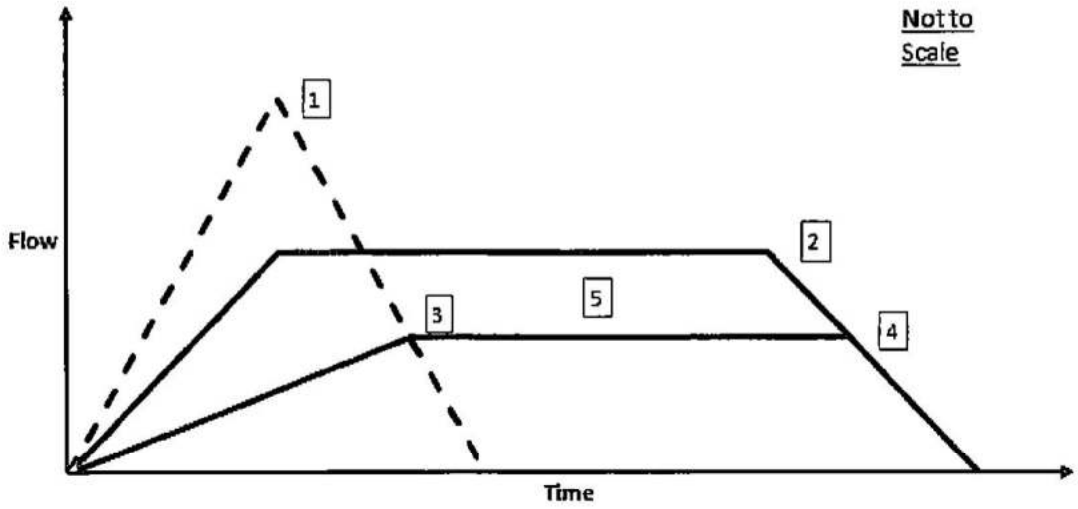
FILING 2 - 100 YEAR

Subsection: Modified Rational Graph
Label: DP-24

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.500 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.430	hours	Time of Duration (Modified Rational, Critical)	0.500	hours
Intensity (Modified Rational, Peak)	4.696	in/h	Intensity (Modified Rational, Critical)	4.310	in/h
Flow (Modified Rational, Peak)	201.64	ft³/s	Flow (Modified Rational, Critical)	185.05	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.612 hours
Flow (Modified Rational, Allowable)	137.00 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.568	hours	Storage (Modified Rational, Estimated)	2.134	ac-ft
Flow (Modified Rational, Allowable)	137.00	ft³/s			

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Index

D

DP-24 (Modified Rational Graph, 100 years)...4

M

Master Network Summary...2

P

PO-1 (IN) (Level Pool Pond Routing Summary, 100 years)...3

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COORESPONDANCE FROM YES! COMMUNITIES

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yes! communities

September 18, 2014

El Paso County
Development Services
2880 International Circle
Suite 110
Colorado Springs, CO 80910

ATTN: Ms. Kari Parsons – Project Manager/Planner II

RE: Proposed Windermere Development Public Detention and Stormwater Quality Facility

Dear Ms. Parsons:

Based upon a meeting with Mr. Campbell of Classic Consulting Engineers and Surveyors, LLC, a proposal was presented to create a regional public detention and SWQ facility in an area where our existing private facility currently resides. Based upon the multiple private and public drainage facilities (both existing and proposed) that drain to this area, we support the creation of one public facility.

While not required for the Windermere's initial Phase 1 area, we will continue to work with the adjacent southerly owner and their representatives as Phase 2 and 3 develop to support this effect.

If you have any questions or comments, please do not hesitate to call.

Sincerely,

Wally Moreland
Managing Director
YES! Communities

Ag/244100/public detention swq facility.docx

CC: Kyle R Campbell

YESI Communities, 2401 15th Street, Suite 200, Denver, CO 80202

Fax: (303) 468-0525

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DRAINAGE MAP

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BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
EX-A	11.3	28.2
EX-B	5.7	14.2
EX-C	17.7	44.1
EX-D	5.8	14.5
EX-E	1.0	2.6
EX-F	4.0	10.0
EX-R	1.7	3.4
D-13	13.8	28.5
D-14	7.2	15.1
D-15	4.6	8.6
D-16	7.2	14.6
NC-1	1.9	3.6
NC-2	6.7	12.5
WS	47.3	66.4
CT	90.8	184.7

PIPE RUN SUMMARY			
PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
6A	4.8	8.1	EX. 18"
6B	18.4	42.6	EX. 24"
6C	21.6	47.9	EX. 24"
7	24.2	53.3	EX. 30"
8	24.7	50.9	EX. 36"

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	FACILITY
4	7.2	14.6	EX. 8' SUMP INLET
6	18.4	42.6	EX. TYPE D GRATED INLET
7	20.0	41.6	EX. 25' SUMP INLET
8	5.6	11.2	EX. 10' SUMP INLET
19	6.7	12.5	EX. 15' AT-GRADE INLET
20	3.7	8.0	EX. 10' SUMP INLET
24	111.3	199.7	OFF-SITE RUNOFF TO POND
25	117.5	215.1	TOTAL EXISTING TO POND
26	138.3	266.9	EX. TO MARKSHEFFEL RD.

MDDP DP-1X
Q5 = 185 CFS
Q100 = 600 CFS
(SEE REPORT TEXT)

MDDP DP-1C
Q5 = 250 CFS
Q100 = 852 CFS

ULTRA RESOURCES INC UNPLATTED

EXISTING 24" CMP TO BE UPGRADED TO BOX CULVERT WITH MARKSHEFFEL ROAD IMPROVEMENTS

EXISTING 30" RCP UNDERSIZED FOR EXISTING TRIBUTARY RUNOFF

MARKSHEFFEL ROAD

EX-R 0.53

NC-1 0.42

EXISTING GRATED SUMP INLET

EXISTING 48" CMP TEMPORARY POND OUTFALL

EX-B 7.30

EX-A 13.20

EXISTING ROADSIDE DITCH

NORTH GAINSBOROUGH CIRCLE

EX-F 3.15

EX-C 24.28

NC-2 1.49

EXISTING 24" RCP DAYLIGHTS ONTO PROPOSED SITE

GRAY FOX HEIGHTS

TRACT A DRAINAGE

EXISTING TEMPORARY DETENTION POND

KINGFISHER POINT

CT 42.07

EX-E 1.10

ANTELOPE RIDGE DRIVE

EX-D 6.19

D-16 2.73

PRONGHORN MEADOWS SUBDIVISION FILING NO. 2

D-15 1.36

D-14 3.88

D-13 6.79

PRONGHORN MEADOWS SUBDIVISION FILING NO. 3

CHATEAU AT ANTELOPE RIDGE FILING NO. 2 LOT 1

WS 41.47

WHISPERING SPRINGS DEVELOPMENT

PRONGHORN MEADOWS SUBDIVISION FILING NO. 1

LEGEND

- EXISTING GROUND CONTOUR (5810)
- PROPOSED BASIN BOUNDARY
- EXISTING STORM SEWER
- BASIN IDENTIFIER / AREA IN ACRES (D / 1.41)
- DESIGN POINT (12)
- PIPE RUN (1)

N

100 50 0 100 200

SCALE: 1" = 100'

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
8-1-1
UTILITY NOTIFICATION OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CLASSIC CONSULTING ENGINEERS & SURVEYORS
6385 Corporate Drive, Suite 101 (719)785-0790
Colorado Springs, Colorado 80919 (719)785-0799(Fax)

WINDERMERE
EXISTING CONDITIONS DRAINAGE MAP
PRELIMINARY DRAINAGE REPORT WINDERMERE
FINAL DRAINAGE REPORT WINDERMERE FIL. NO. 1

DESIGNED BY	MAL	SCALE		DATE	09/01//14
DRAWN BY	MAL	(H) 1"= 100'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	2241.000

X:\2241\001\DRAWING\DP\EX-MAP.dwg, 6/16/2015 4:33:33 PM, Canon iR8300.pc3

BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
A	9.1	18.2
B	9.2	18.5
C	13.1	26.2
D	3.9	8.5
E	4.2	8.6
F	9.4	18.9
G	11.1	22.4
H	4.5	9.0
I	12.9	26.0
J	10.3	20.7
K	11.0	22.4
L	10.4	20.8
M	9.6	23.9
N	1.7	3.5
P	0.8	1.9
Q	4.7	9.3
R	3.4	7.1
S	7.1	16.0
D-13	13.8	28.5
D-14	7.2	15.1
D-15	4.6	8.6
D-16	7.2	14.6
NC-1	1.9	3.6
NC-2	6.7	12.5
WS	47.3	66.4
CT	90.8	184.7

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	FACILITY
1	13.1	26.2	PROP. 15' AT-GRADE INLET
2	12.4	27.3	PROP. 15' SUMP INLET
3	9.1	18.2	PROP. 10' SUMP INLET
4	7.2	14.6	EX. 8' SUMP INLET
5	28.1	56.8	SWQ/DETENTION POND
6	3.4	7.1	RELOCATE TYPE D INLET
7	20.0	41.6	EX. 25' SUMP INLET
8	7.7	15.1	EX. 10' SUMP INLET
9	12.9	26.0	PROP. 20' AT-GRADE INLET
10	5.6	13.5	PROP. 15' AT-GRADE INLET
11	11.2	24.8	PROP. 10' AT-GRADE INLET
12	11.0	22.4	PROP. 20' AT-GRADE INLET
14	12.3	24.5	PROP. 20' AT-GRADE INLET
15	20.5	50.7	PROP. 20' SUMP INLET
16	10.4	20.8	PROP. 10' AT-GRADE INLET
17	7.8	19.1	PROP. 10' SUMP INLET
19	10.4	20.7	EX. 15' AT-GRADE INLET
20	4.5	11.3	EX. 10' SUMP NLET
23	83.8	173.0	PROP. SITE TO POND
24	111.3	199.7	OFF-SITE RUNOFF TO POND
25	185.7	353.3	TOTAL DEVELOPED TO POND
26	7.6	90.9	DEV. TO MARKSHEFFEL RD.

PIPE RUN SUMMARY			
PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
1	8.9	15.6	PROP. 24"
2	20.9	41.9	PROP. 30"
3A	9.1	18.2	PROP. 24"
3B	27.6	55.5	PROP. 36"
4	7.2	14.6	EX. 24"
5	0.6	9.8	PROP. 24"
6A	9.0	12.8	EX. 18"
6B	10.3	29.4	EX. 24"
6C	17.5	39.7	EX. 24"
7	21.2	48.9	EX. 30"
8	26.4	54.1	EX./PROP. 36"
9	9.0	16.0	PROP. 24"
10	32.4	64.7	PROP. 36"
11	4.3	8.5	PROP. 18"
12	9.8	16.4	PROP. 24"
13	38.9	75.5	PROP. 42"
14	8.8	15.1	PROP. 24"
15	45.9	87.4	PROP. 42"
16	8.7	15.4	PROP. 24"
17	6.5	9.3	PROP. 18"
18	67.7	141.5	PROP. 60"
19	20.5	50.7	PROP. 36"
20	7.8	19.1	PROP. 24"
21	28.2	69.8	PROP. 42"
22	78.1	158.1	PROP. 60"
23	3.2	80.6	PROP. 54"

MDDP DP-1X
Q5 = 185 CFS
Q100 = 600 CFS
(SEE REPORT TEXT)

MDDP DP-1C
Q5 = 250 CFS
Q100 = 852 CFS

ULTRA RESOURCES INC UNPLATTED

EXISTING 24" CMP TO BE UPGRADED TO BOX CULVERT WITH MARKSHEFFEL ROAD IMPROVEMENTS

EXISTING 30" RCP UNDERSIZED FOR EXISTING TRIBUTARY RUNOFF & REDUCED DETAINED RELEASE

MARKSHEFFEL ROAD

EMERGENCY OVERFLOW ROUTING THROUGH TRACT

BURIED RIPRAP EMERGENCY SPILLWAY

MICROPOOL AT OUTLET BOX

SWQ

EXISTING TEMPORARY POND TO BE INCORPORATED INTO SUB-REGIONAL FACILITY AS SHOWN

CHATEAU AT ANTELOPE RIDGE FILING NO. 2 LOT 1

GRAY FOX HEIGHTS

FOREBAY AT ENTRY POINT

CONCRETE LOW-FLOW CHANNEL

TRACT A DRAINAGE

FILING 2

FILING 3

FILING 2 22.36 AC.

FILING 1 14.96 AC.

FILING 3 14.75 AC.

WASDALE WAY

PATTERDALE PLACE

BLOOMSDALE LANE

MARSDALE LANE

GRIZEDALE TERRACE

RYEDALE WAY

NORTH GARNETTE CREEK

ANTELOPE RIDGE DRIVE

EXISTING 36" RCP CONNECT TO PROP. 36" RCP

EXISTING 24" RCP CONNECT TO PROP. 24" RCP

PROMONTORY MEADOWS SUBDIVISION FILING NO. 1

PROMONTORY MEADOWS SUBDIVISION FILING NO. 2

PROMONTORY MEADOWS SUBDIVISION FILING NO. 3

WHISPERING SPRINGS DEVELOPMENT

PROPOSED FULL SPECTRUM DETENTION FACILITY INFORMATION					
FACILITY/D.P.	EURV/TOP OF BOX (AC.-FT.)	EMERGENCY SPILLWAY ELEV./VOL.	100-YR W.S.E.	Q5 (CFS) OUT	Q100 (CFS) OUT
FILING 1/DP-5	0.893	6571.00 / 1.09 AC.-FT.	6570.61	0.63	9.77
FILING 2/DP-25	6.548	6579.00 / 17.60 AC.-FT.	6577.68	3.22	80.70

LEGEND

- EXISTING GROUND CONTOUR (5910)
- PROPOSED FINISHED CONTOUR 5910
- SUBDIVISION BOUNDARY
- PROPOSED BASIN BOUNDARY
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- BASIN IDENTIFIER / AREA IN ACRES (D / 1.41)
- DESIGN POINT (10)
- PIPE RUN

100 50 0 100 200

SCALE 1" = 100'

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CLASSIC CONSULTING ENGINEERS & SURVEYORS

6385 Corporate Drive, Suite 101 (719)785-0790
Colorado Spngs, Colorado 80919 (719)785-0799(Fax)

WINDERMERE
DEVELOPED CONDITIONS DRAINAGE MAP
PRELIMINARY DRAINAGE REPORT WINDERMERE
FINAL DRAINAGE REPORT WINDERMERE FIL. NO. 1

DESIGNED BY	MAL	SCALE		DATE	09/01/114
DRAWN BY	MAL	(H) 1"= 100'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	2241.000

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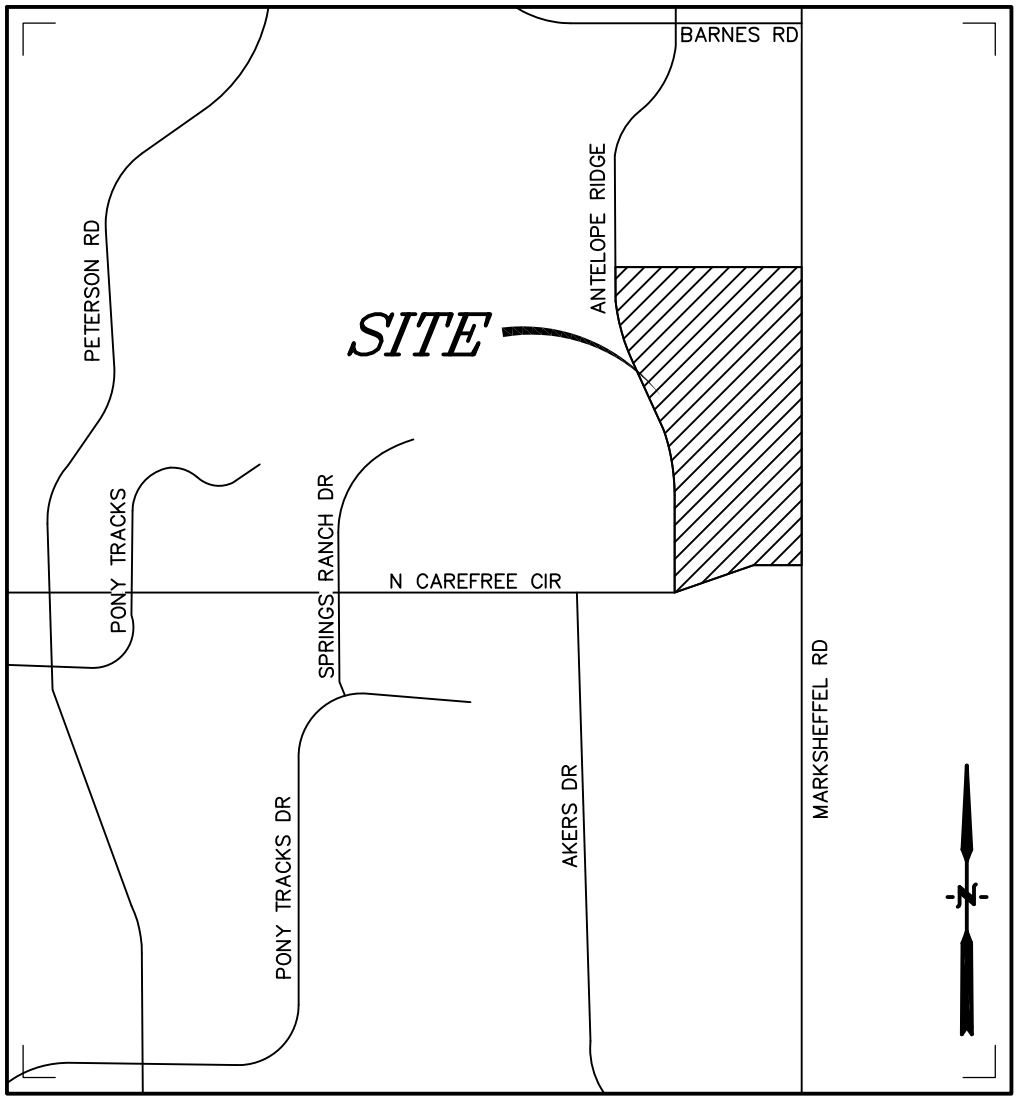


Vicinity Map

Not to scale

WINDERMERE
COLORADO SPRINGS, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:

JOB NO: 21187-00CSCV

DWG. NO. VMAP

SHEET 1 OF 1

104° 41' 21" W
104° 40' 54" W
38° 53' 38" N
38° 53' 10" N
527000
527100
527200
527300
527400
527500
527600
4305000
4304900
4304800
4304700
4304600
4304500
4304400
4304300
97
N Marksheffel Rd
Carefree
Soil Map may not be valid at this scale.
Map Scale: 1:4,170 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 200 400 800 1200
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N 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 1:24,000.

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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: Apr 15, 2011—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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
97	Truckton sandy loam, 3 to 9 percent slopes	A	56.4	100.0%
Totals for Area of Interest			**56.4**	**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

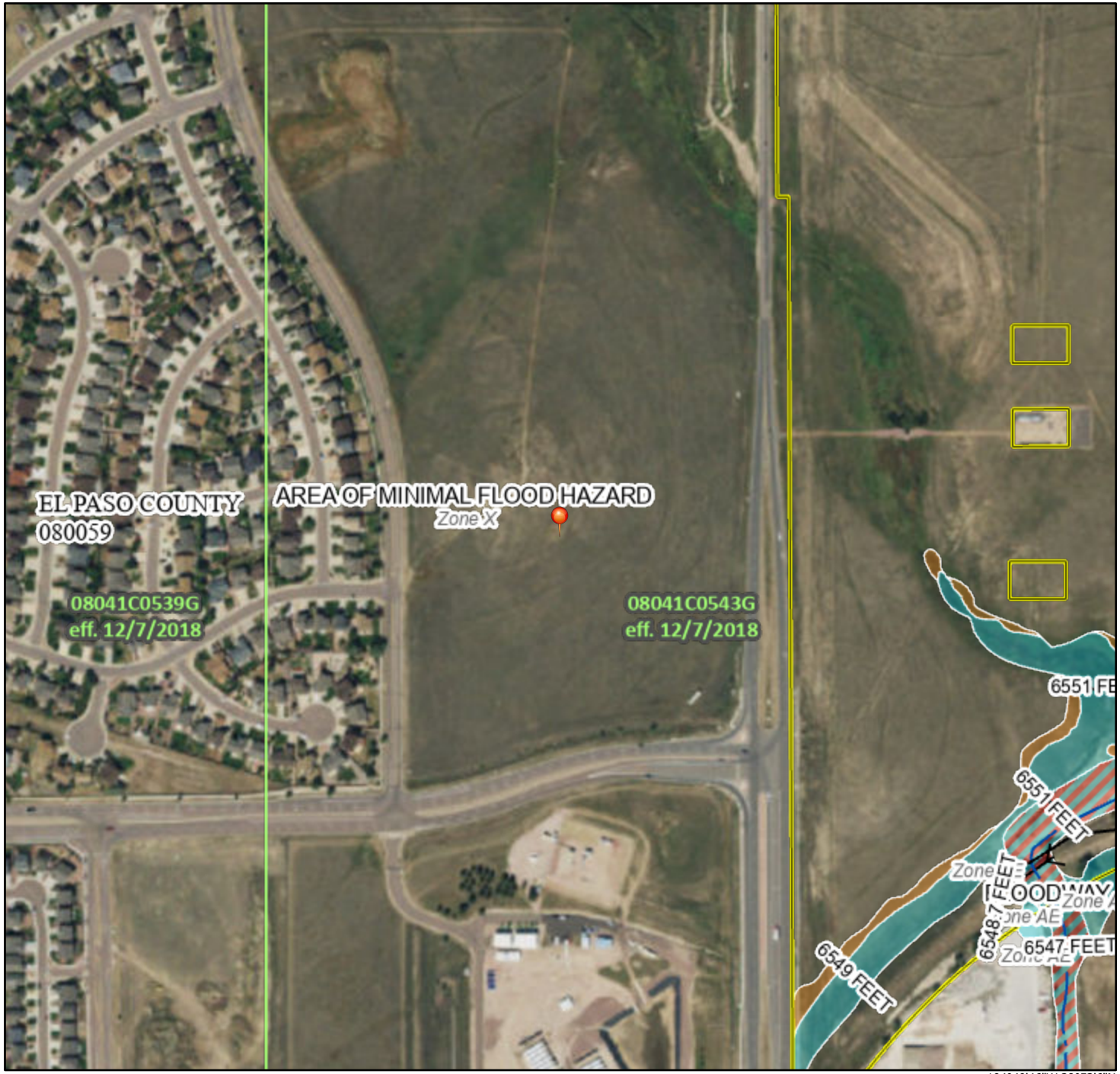
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

National Flood Hazard Layer FIRMette

FEMA

104°41'24"W 38°53'34"N



104°40'46"W 38°53'6"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/8/2021 at 3:46 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

September 18, 2020

Mr. Tim McConnell, PE
Principal / Regional Manager
Drexel, Barrell & Co.
3 S. 7th Street
Colorado Springs, CO 80905

Re: Proposed Windermere Development Pubic Detention and Stormwater Quality Facility

Dear Mr. McConnell,

Following to our recent correspondence, this is to confirm that YES Communities (YES) has no objection to proceeding forward with design and construction of a public detention pond and stormwater quality facility in conjunction with the proposed Windermere residential development currently under design. The specific property in question is owned by YES and is situated in the southwest quadrant of the intersection of Barnes Road on the north, and Marksheffel Road on the east. It is platted as Chateau at Antelope Ridge, Filing No. 2 in El Paso County, Colorado. The proposed pond location will be within Tract A, as situated on the south side of the property and which is currently used for storm water conveyance and detention. The Windermere property is located adjacent to the east, south, and west sides of Tract A.

It is understood that no adverse impacts to the existing homes and other infrastructure improvements within the YES property will be incurred with the proposed pond construction. The pond will serve local area drainage requirements from both the YES and Windermere properties. All pond improvements will be constructed and paid for by the Windermere developer. No financial burdens or liabilities will be incurred by YES with the work as proposed.

Please let us know if any additional information should be required. Thank you,

Sincerely,
YES Communities

Craig P. Schellbach, PE
Development Manager

c: Mike Askins

5605 N. MacArthur Blvd.; Suite 280; Irving, TX 75038
972-379-9610: | Email: cschellbach@yescommunities.com

PROJECT INFORMATION								
PROJECT:	Windermere							
PROJECT NO:	21187-01							
DESIGN BY:	SBN						Drexel, Barrell & Co.	
REV. BY:	TDM							
AGENCY:	El Paso County							
REPORT TYPE:	Final							
DATE:	1/5/2022							
Soil Type: A								
				C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn					0.15		0.50	0
Residential (<1/8 acre)					0.45		0.59	65
Asphalt/Sidewalk					0.90		0.96	100
PROPOSED								
SUB-BASIN	SURFACE DESIGNATION		AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
			ACRE	C2	C5	C10	C100	
WS	Historic Flow (interpolated)		41.47		0.09		0.36	2
	Residential (<1/8 acre)		0.00		0.45		0.59	65
	Asphalt/Sidewalk		0.00		0.90		0.96	100
	WEIGHTED AVERAGE				0.09		0.36	2%
TOTAL WS			41.47					
CT	Landscape/Lawn		0.00		0.15		0.50	0
	Residential (interpolated)		42.07		0.62		0.71	70
	Asphalt/Sidewalk		0.00		0.90		0.96	100
	WEIGHTED AVERAGE				0.62		0.71	70%
TOTAL CT			42.07					
D13	Landscape/Lawn		0.00		0.15		0.50	0
	Residential (<1/8 acre)		6.79		0.45		0.59	65
	Asphalt/Sidewalk		0.00		0.90		0.96	100
	WEIGHTED AVERAGE				0.45		0.59	65%
TOTAL D13			6.79					
D14	Landscape/Lawn		0.00		0.15		0.50	0
	Residential (<1/8 acre)		3.25		0.45		0.59	65
	Asphalt/Sidewalk		0.63		0.90		0.96	100
	WEIGHTED AVERAGE				0.52		0.65	71%
TOTAL D14			3.88					
D15	Landscape/Lawn		0.32		0.15		0.50	0
	Residential (<1/8 acre)		0.00		0.45		0.59	65
	Asphalt/Sidewalk		1.04		0.90		0.96	100
	WEIGHTED AVERAGE				0.72		0.85	76%
TOTAL D15			1.36					
A1	Landscape/Lawn		0.00		0.15		0.50	0
	Residential (<1/8 acre)		1.56		0.45		0.59	65
	Asphalt/Sidewalk		0.00		0.90		0.96	100
	WEIGHTED AVERAGE				0.45		0.59	65%
TOTAL A1			1.56					
A2	Landscape/Lawn		0.00		0.15		0.50	0
	Residential (<1/8 acre)		4.61		0.45		0.59	65
	Asphalt/Sidewalk		0.00		0.90		0.96	100
	WEIGHTED AVERAGE				0.45		0.59	65%
TOTAL A2			4.61					
A3	Landscape/Lawn		0.00		0.15		0.50	0
	Residential (<1/8 acre)		2.18		0.45		0.59	65

	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A3		2.18					
A4	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.01		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A4		1.01					
A5	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.98		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A5		1.98					
A6	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	3.73		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A6		3.73					
A7	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.56		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A7		1.56					
A8	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.96		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A8		2.96					
A9	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.86		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A9		1.86					
A10	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	4.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A10		4.00					
A11	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.67		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A11		2.67					
A12	Landscape/Lawn	7.50		0.15		0.50	0
	Residential (<1/8 acre)	1.96		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.21		0.52	13%
TOTAL A12		9.46					
B1	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	3.33		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B1		3.33					
B2	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.49		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%

TOTAL B2		0.49					
B3	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	5.86		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B3		5.86					
B4	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.16		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B4		0.16					
B5	Landscape/Lawn	1.05		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL B5		1.05					
C1	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.59		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL C1		0.59					
C2	Landscape/Lawn	3.58		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C2		3.58					
C3	Landscape/Lawn	0.63		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C3		0.63					
C4	Landscape/Lawn	1.07		0.15		0.50	0
	Residential (<1/8 acre)	0.72		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.27		0.54	26%
TOTAL C4		1.79					
C5	Landscape/Lawn	0.11		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C5		0.11					
NC2	Landscape/Lawn	0.27		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	1.34		0.90		0.96	100
	WEIGHTED AVERAGE			0.77		0.88	83%
TOTAL NC2		1.61					
NC1	Landscape/Lawn	0.03		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.40		0.90		0.96	100
	WEIGHTED AVERAGE			0.85		0.93	93%
TOTAL NC1		0.43					
D16	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.73		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL D16		2.73					
EXR	Landscape/Lawn	0.00		0.15		0.50	0

	Residential (<1/8 acre)		0.00		0.45		0.59	65
	Asphalt/Sidewalk		0.53		0.90		0.96	100
	WEIGHTED AVERAGE				0.90		0.96	100%
TOTAL EXR			0.53					
TOTAL SITE			**55.17**		**1.02**		**0.57**	**48.6%**
ONSITE TO NORTH POND			37.58					52.0%
OFFSITE BASINS TO NORTH POND			95.57					36.3%
TOTAL TO NORTH POND			**133.15**					**40.7%**
AREA TO SOUTH POND			**10.89**					**58.8%**

PROJECT INFORMATION

PROJECT: Windermere
PROJECT NO: 21187-01
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 1/5/2022

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)				TRAVEL TIME (t_t)					PIPE TRAVEL TIME (t_p)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	LENGTH	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t_c	t_c	**Min**
WS		0.09	0.36	41.47	100	2	2.0	14.7	1450	29	2.0	4.9	4.9					19.6	5	**19.6**
CT		0.62	0.71	42.07	100	4	4.0	5.5	1450	29	2.0	4.9	4.9					10.5	5	**14.9**
	24	0.36	0.54	83.54														19.6	5	**19.6**
D13		0.45	0.59	6.79	270	21	7.8	9.9	1380	83	6.0	8.6	2.7					12.6	5	**16.0**
D14		0.52	0.65	3.88	125	2.5	2.0	9.6	1250	12	1.0	4.6	4.5					14.1	5	**18.7**
D13+D14	*7*	0.48	0.61	10.67									18.7					18.7	5	**18.7**
D15		0.72	0.85	1.36	25	1	4.0	2.2	2050	20	1.0	7.5	4.6					6.8	5	**6.8**
A1		0.45	0.59	1.56	125	12	9.6	6.4	300	4	1.3	7.2	0.7					7.1	5	**7.1**
7+A1+D15	A	0.50	0.63	13.59									18.7	50	1	6.7	0.1	18.8	5	**18.8**
A2	B	0.45	0.59	4.61	100	5	5.1	7.1	1051	21	2.0	8.3	2.1					9.2	5	**9.2**
A3	C	0.48	0.62	2.18	35	1	3.5	4.5	600	16	2.6	9.4	1.1					5.6	5	**5.6**
A+B+C	C1	0.48	0.62	20.38										450	0.5	5.4	1.4	20.2	5	**20.2**
A4	D	0.45	0.59	1.01	100	1	1.0	12.2	205	10	4.8	12.8	0.3					12.4	5	**12.4**
C1+D	D1	0.48	0.62	21.39										220	4.0	15.3	0.2	20.4	5	**20.4**
A5	E	0.45	0.59	1.98	100	12	11.9	5.3	385	9	2.4	9.1	0.7					6.0	5	**6.0**
A6	F	0.45	0.59	3.73	100	3	3.0	8.4	790	32	4.0	11.7	1.1					9.6	5	**9.6**
D1+E+F	F1	0.47	0.61	27.10										90	3.5	14.3	0.1	20.6	5	**20.6**
A7	G	0.45	0.59	1.56	75	2	2.7	7.6	610	9	1.4	6.9	1.5					9.1	5	**9.1**
A8	H	0.45	0.59	2.96	100	10	10.4	5.6	740	11	1.5	7.2	1.7					7.3	5	**7.3**
G+H	H1	0.45	0.59	4.52										36	1.0	5.0	0.1	9.2	5	**9.2**
A9	I	0.45	0.59	1.86	100	10	10.5	5.6	460	8	1.6	7.4	1.0					6.6	5	**6.6**
H1+I	J	0.45	0.59	6.38										300	1.0	5.9	0.9	10.0	5	**10.0**
F1+J	K	0.47	0.61	33.48										275	3.5	12.7	0.4	20.9	5	**20.9**
A10	L	0.45	0.59	4.00	100	3	3.0	8.4	770	25	3.2	10.5	1.2					9.7	5	**9.7**

K+L	L1	0.47	0.61	37.48										115	1.0	9.3	0.2	21.1	5	**21.1**
A11	M	0.45	0.59	2.67	40	1	1.5	6.7	945	40	4.2	12.0	1.3					8.0	5	**8.0**
L1+A11	M1	0.47	0.60	40.15										35	1.0	9.3	0.1	21.2	5	**21.2**
A12		0.21	0.52	9.46	100	30	29.6	5.4	1005	18	1.8	8.3	2.0					7.4	5	**7.4**
M1+A12+24	N	0.38	0.56	133.15					260	4	1.4	8.3	0.5	180	3.5	14.3	0.2	21.9	5	**21.9**
B1		0.45	0.59	3.33	35	1	3.5	4.7	885	30	3.4	10.8	1.4					6.1	5	**6.1**
B2		0.45	0.59	0.49	50	2	4.0	5.4	725	20	2.8	9.8	1.2					6.6	5	**6.6**
B1+B2	O	0.45	0.59	3.82				6.6										6.6	5	**6.6**
B3		0.45	0.59	5.86	100	5	5.3	7.0	825	21	2.5	9.3	1.5					8.4	5	**8.4**
B4		0.45	0.59	0.16	50	17	33.3	2.7	185	2.7	1.5	4.0	0.8					3.4	5	**5.0**
B5	s. pond	0.15	0.50	1.05	85	24	28.5	5.4	75	4	5.3	14.3	0.1					5.5	5	**5.5**
DPO+B3+B4+B5	R	0.42	0.58	10.89					75	4	5.3	14.3	0.1	70	25.0	29.3	0.0	8.6	5	**8.6**
C3		0.15	0.50	0.63	60	12	20.0	5.1	455	15	3.3	5.6	1.3					6.4	5	**6.4**
C4		0.27	0.54	1.79	100	5	5.5	8.8	75	2	2.1	4.5	0.3					9.1	5	**9.1**
D16	*4*	0.45	0.59	2.73	200	10	5.0	10.1	350	12	3.5	6.5	0.9					11.0	5	**11.0**
EXR		0.90	0.96	0.53	20	2	10.0	0.8	320	6	2.0	4.9	1.1					1.9	5	**5.0**
	S	0.40	0.60	16.57										105	2.0	8.3	0.2	11.2	5	**11.2**
NC2	19	0.77	0.88	1.61					625	25	4.0	11.7	0.9					10.0	5	**10.0**
	J1	0.42	0.60	18.18										90	2	8.3	0.2	10.2	5	**10.2**
NC1		0.85	0.93	0.43	45	1	2.2	2.4	185	4	2.2	8.7	0.4					0.4	5	**5.0**
	20	0.45	0.62	18.61										45	2	9.6	0.1	10.2	5	**10.2**
C1		0.45	0.59	0.59	50	16.67	33.3	2.7	640	9.5	1.5	4.0	2.7					5.3	5	**5.3**
C2		0.15	0.50	3.58	100	13	13.0	7.6	90	7	7.8	8.7	0.2					7.7	5	**7.7**
	T	0.27	0.38	437.97														5.0	5	**5.0**
C5	V	0.15	0.50	0.11	35	6	15.9	4.2										4.2	5	**5.0**

PROJECT INFORMATION

PROJECT: Windermere
PROJECT NO: 21187-01
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 1/5/2022

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **RUNOFF** **5 YR STORM** **P1=** **1.50**

BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
WS		41.47	0.09	19.6	3.73	3.04	**11.4**
CT		42.07	0.62	14.9	26.08	3.47	**90.6**
	24	83.54	0.36	19.6	29.82	3.04	**90.7**
D13		6.79	0.45	16.0	3.06	3.36	**10.3**
D14		3.88	0.52	18.7	2.03	3.12	**6.3**
	7	10.67	0.48	18.7	5.09	3.12	**15.9**
D15		1.36	0.72	6.8	0.98	4.69	**4.6**
A1		1.56	0.45	7.1	0.70	4.62	**3.2**
	A	13.59	0.50	18.8	6.77	3.11	**21.0**
A2	B	4.61	0.45	9.2	2.07	4.23	**8.8**
A3	C	2.18	0.48	5.6	1.05	4.96	**5.2**
	C1	20.38	0.48	20.2	9.82	3.00	**29.5**
A4	D	1.01	0.45	12.4	0.45	3.76	**1.7**
	D1	21.39	0.48	20.4	10.28	2.98	**30.6**
A5	E	1.98	0.45	6.0	0.89	4.85	**4.3**
A6	F	3.73	0.45	9.6	1.68	4.17	**7.0**
	F1	27.10	0.47	20.6	12.85	2.97	**38.2**
A7	G	1.56	0.45	9.1	0.70	4.26	**3.0**
A8	H	2.96	0.45	7.3	1.33	4.58	**6.1**
	H1	4.52	0.45	9.2	2.03	4.23	**8.6**
A9	I	1.86	0.45	6.6	0.84	4.73	**4.0**
	J	6.38	0.45	10.0	2.87	4.10	**11.8**
	K	33.48	0.47	20.9	15.72	2.95	**46.3**
A10	L	4.00	0.45	9.7	1.80	4.16	**7.5**
	L1	37.48	0.47	21.1	17.52	2.93	**51.4**
A11	M	2.67	0.45	8.0	1.20	4.45	**5.3**
	M1	40.15	0.47	21.2	18.72	2.93	**54.8**
A12		9.46	0.21	7.4	2.01	4.56	**9.2**
	N	133.15	0.38	21.9	50.54	2.88	**145.4**
North Pond Release							**1.8**
C1		0.59	0.45	5.3	0.26	5.02	**1.3**
C2		3.58	0.15	7.7	0.54	4.50	**2.4**
	T	437.97					**190.5**
B1		3.33	0.45	6.1	1.50	4.84	**7.2**
B2		0.49	0.45	6.6	0.22	4.72	**1.0**
	O	3.82	0.45	6.6	1.72	4.72	**8.1**
B3		5.86	0.45	8.4	2.64	4.36	**11.5**
B4		0.16	0.45	5.0	0.07	5.10	**0.4**
B5		1.05	0.15	5.5	0.16	4.99	**0.8**
	R	10.89	0.42	8.6	4.59	4.34	**19.9**
South Pond Release							**0.2**
C3		0.63	0.15	6.4	0.10	4.77	**0.5**
C4		1.79	0.27	9.1	0.48	4.25	**2.1**
D16	4	2.73	0.45	11.0	1.23	3.96	**4.9**
EXR		0.53	0.90	5.0	0.48	5.10	**2.4**
	S	16.57					**10.0**
NC2	19	1.61	0.77	10.0	1.25	4.11	**5.1**
	J1	18.18					**15.1**
NC1		0.43	0.85	5.0	0.36	5.10	**1.9**
	20	18.61					**17.0**
C5	V	0.11	0.15	5.0	0.02	5.10	**0.1**

PROJECT INFORMATION

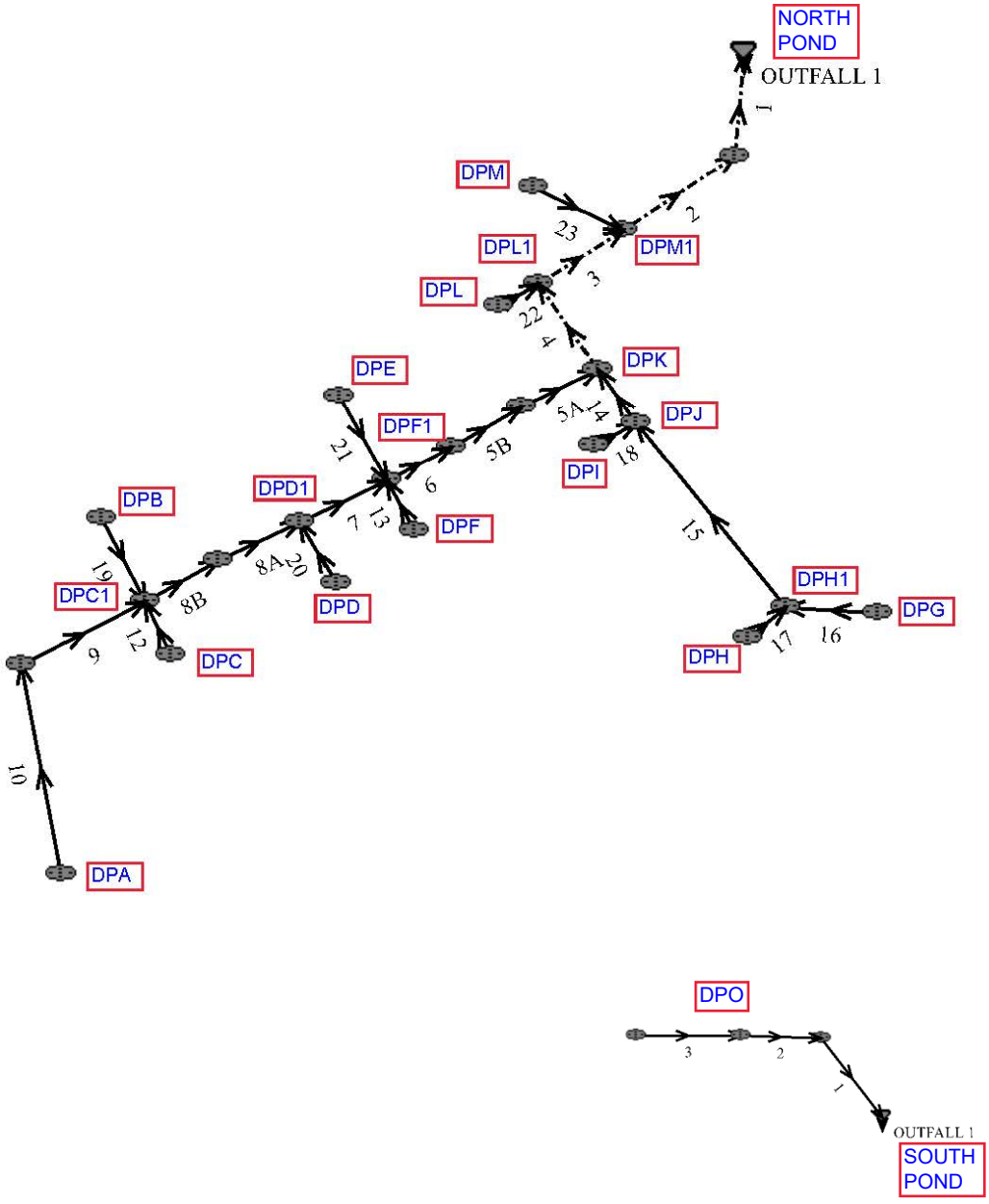
PROJECT: Windermere
PROJECT NO: 21187-01
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 1/5/2022

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **RUNOFF** **100 YR STORM** **P1=** **2.52**

BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
WS		41.47	0.36	19.6	14.93	5.11	**76.3**
CT		42.07	0.71	14.9	29.87	5.83	**174.3**
	24	83.54	0.54	19.6	44.80	5.11	**229.0**
D13		6.79	0.59	16.0	4.01	5.65	**22.6**
		3.88	0.65	18.7	2.52	5.24	**13.2**
D13+D14	7	10.67	0.61	18.7	6.53	5.24	**34.2**
D15		1.36	0.85	6.8	1.16	7.87	**9.1**
A1		1.56	0.59	7.1	0.92	7.77	**7.1**
	A	13.59	0.63	18.8	8.61	5.22	**44.9**
A2	B	4.61	0.59	9.2	2.72	7.11	**19.4**
A3	C	2.18	0.62	5.6	1.35	8.34	**11.2**
	C1	20.38	0.62	20.2	12.61	5.04	**63.5**
A4	D	1.01	0.59	12.4	0.60	6.32	**3.8**
	D1	21.39	0.62	20.4	13.21	5.01	**66.1**
A5	E	1.98	0.59	6.0	1.17	8.15	**9.5**
A6	F	3.73	0.59	9.6	2.20	7.01	**15.4**
	F1	27.10	0.61	20.6	16.58	4.99	**82.8**
A7	G	1.56	0.59	9.1	0.92	7.15	**6.6**
A8	H	2.96	0.59	7.3	1.75	7.70	**13.4**
	H1	4.52	0.59	9.2	2.67	7.11	**19.0**
A9	I	1.86	0.59	6.6	1.10	7.94	**8.7**
	J	6.38	0.59	10.0	3.76	6.88	**25.9**
	K	33.48	0.61	20.9	20.34	4.95	**100.7**
A10	L	4.00	0.59	9.7	2.36	6.98	**16.5**
	L1	37.48	0.61	21.1	22.70	4.92	**111.8**
A11	M	2.67	0.59	8.0	1.58	7.47	**11.8**
	M1	40.15	0.60	21.2	24.28	4.92	**119.4**
A12		9.46	0.52	7.4	4.91	7.67	**37.6**
	N	133.15	0.56	21.9	73.98	4.83	**357.5**
North Pond Release							**66.0**
C1		0.59	0.59	5.3	0.35	8.43	**2.9**
C2		3.58	0.50	7.7	1.79	7.55	**13.5**
	T	437.97					**682.4**
B1		3.33	0.59	6.1	1.96	8.12	**16.0**
B2		0.49	0.59	6.6	0.29	7.93	**2.3**
	O	3.82	0.59	6.6	2.26	7.93	**17.9**
B3		5.86	0.59	8.4	3.46	7.33	**25.3**
B4		0.16	0.59	5.0	0.09	8.58	**0.8**
B5		1.05	0.50	5.5	0.52	8.38	**4.4**
	R	10.89	0.58	8.6	6.33	7.29	**46.2**
South Pond Release							**9.2**
C3		0.63	0.50	6.4	0.32	8.01	**2.5**
C4		1.79	0.54	9.1	0.96	7.14	**6.9**
D16	4	2.73	0.59	11.0	1.61	6.65	**10.7**
EXR		0.53	0.96	5.0	0.51	8.58	**4.4**
	S	16.57	0.40	11.2	6.66	6.60	**33.7**
NC2	19	1.61	0.88	10.0	1.42	6.90	**9.8**
	J1	18.18	0.60	10.2	10.82	6.85	**43.5**
NC1		0.43	0.93	5.0	0.40	8.58	**3.4**
	20	18.61	0.45	10.2	8.30	6.83	**46.9**
C5	V	0.11	0.50	5.0	0.06	8.58	**0.5**


NORTH POND
OUTFALL 1
1
DPM
23
2
DPL1
DPM1
3
DPL
22
4
DPK
DPE
DPF1
5A
14
DPJ
21
5B
DPI
18
DPD1
6
DPB
7
13
DPF
15
19
8A
20
DPH1
DPG
DPC1
8B
DPD
17
16
DPH
12
9
DPC
10
DPA
DPO
3
2
1
OUTFALL 1
SOUTH POND

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 2/9/2022 8:58:16 AM	# UDSewer Results Summary **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 1.50
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6575.69

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6575.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	6581.88	54.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2	6583.43	54.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6583.03	51.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	6583.87	46.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5A	6583.93	38.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5B	6587.27	38.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	6592.86	38.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	6584.13	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	6586.77	8.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	6587.33	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	6587.15	6.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	6584.26	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	6583.41	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	6583.41	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	7.96	6.88	0.22	54.80	Surface Water Present (Upstream)
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.80	Surface Water Present (Downstream)
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.80	
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.40	
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	46.30	
5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.20	
5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.20	
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.20	
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.60	
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.10	
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.50	
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.30	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**

1	51.12	6575.47	0.5	6575.73	0.014	0.03	0.00	ELLIPSE	43.00 in	68.00 in
2	116.91	6575.72	0.5	6576.30	0.014	0.38	0.00	ELLIPSE	43.00 in	68.00 in
3	42.20	6576.38	0.5	6576.59	0.014	0.05	0.00	ELLIPSE	43.00 in	68.00 in
4	113.08	6576.92	0.6	6577.60	0.014	1.32	0.00	ELLIPSE	43.00 in	68.00 in
5A	32.36	6578.19	1.8	6578.77	0.014	1.32	0.00	CIRCULAR	36.00 in	36.00 in
5B	89.17	6578.77	1.8	6580.38	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
6	145.96	6581.39	3.5	6586.50	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
14	27.22	6578.68	1.1	6578.98	0.014	0.05	0.00	CIRCULAR	30.00 in	30.00 in
15	297.18	6578.89	1.1	6582.16	0.014	0.05	0.00	CIRCULAR	30.00 in	30.00 in
16	36.48	6583.15	1.0	6583.51	0.014	0.38	0.00	CIRCULAR	18.00 in	18.00 in
17	7.73	6582.66	2.3	6582.84	0.014	1.32	0.00	CIRCULAR	24.00 in	24.00 in
18	9.62	6579.98	2.0	6580.17	0.014	0.38	0.00	CIRCULAR	18.00 in	18.00 in
22	7.70	6577.97	6.9	6578.50	0.014	0.05	0.00	CIRCULAR	30.00 in	30.00 in
23	18.34	6577.48	3.2	6578.07	0.014	0.38	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
1	131.72	9.43	25.54	7.26	24.19	7.79	1.11	Supercritical	54.80	0.00	
2	131.72	9.43	25.54	7.26	24.19	7.79	1.11	Supercritical	54.80	0.00	
3	131.72	9.43	24.70	7.11	23.34	7.66	1.11	Supercritical	51.40	0.00	
4	144.29	10.33	23.38	6.89	20.97	7.96	1.23	Supercritical	46.30	0.00	
5A	83.32	11.79	24.13	7.58	17.11	11.53	1.93	Supercritical	38.20	0.00	
5B	83.32	11.79	24.13	7.58	17.11	11.53	1.93	Supercritical	38.20	0.00	
6	116.18	16.44	24.13	7.58	14.21	14.73	2.76	Supercritical	38.20	0.00	
14	40.05	8.16	13.82	5.34	11.16	7.10	1.51	Supercritical	11.80	0.00	
15	40.05	8.16	11.72	4.84	9.44	6.50	1.52	Supercritical	8.60	0.00	
16	9.78	5.53	7.90	4.02	6.84	4.87	1.32	Supercritical	3.00	0.00	
17	31.94	10.17	10.48	4.63	7.11	7.84	2.11	Supercritical	6.10	0.00	
18	13.74	7.78	9.18	4.41	6.65	6.74	1.86	Supercritical	4.00	0.00	
22	100.32	20.44	10.91	4.65	5.55	12.00	3.73	Supercritical	7.50	0.00	
23	68.32	13.92	9.12	4.20	5.65	8.26	2.54	Supercritical	5.30	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element	Peak	Cross	Rise	Span	Rise	Span	Rise	Span	Area	Comment

Name	Flow (cfs)	Section							(ft^2)	
1	54.80	ELLIPSE	43.00 in	68.00 in	42.00 in	42.00 in	43.00 in	68.00 in	13.97	
2	54.80	ELLIPSE	43.00 in	68.00 in	42.00 in	42.00 in	43.00 in	68.00 in	13.97	
3	51.40	ELLIPSE	43.00 in	68.00 in	42.00 in	42.00 in	43.00 in	68.00 in	13.97	
4	46.30	ELLIPSE	43.00 in	68.00 in	36.00 in	36.00 in	43.00 in	68.00 in	13.97	
5A	38.20	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
5B	38.20	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
6	38.20	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
14	11.80	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
15	8.60	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
16	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
17	6.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
18	4.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
22	7.50	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
23	5.30	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6575.69

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
1	6575.47	6575.73	0.00	0.00	6577.49	6577.86	6578.43	0.24	6578.68
2	6575.72	6576.30	0.09	0.00	6578.23	6578.43	6578.77	0.48	6579.25
3	6576.38	6576.59	0.01	0.00	6578.64	6578.65	6579.26	0.18	6579.43
4	6576.92	6577.60	0.23	0.00	6579.13	6579.55	6579.66	0.63	6580.28
5A	6578.19	6578.77	0.60	0.00	6580.15	6580.85	6581.68	0.00	6581.68
5B	6578.77	6580.38	0.02	0.00	6580.87	6582.39	6582.27	1.02	6583.28
6	6581.39	6586.50	0.02	0.00	6582.58	6588.51	6585.94	3.46	6589.40
14	6578.68	6578.98	0.00	0.00	6579.61	6580.13	6580.39	0.18	6580.57
15	6578.89	6582.16	0.00	0.00	6580.47	6583.14	6580.58	2.92	6583.50
16	6583.15	6583.51	0.02	0.00	6583.72	6584.17	6584.08	0.34	6584.42
17	6582.66	6582.84	0.08	0.00	6583.25	6584.07	6584.21	0.00	6584.21
18	6579.98	6580.17	0.03	0.00	6580.59	6580.94	6581.13	0.11	6581.24
22	6577.97	6578.50	0.00	0.00	6578.65	6580.62	6580.67	0.00	6580.67
23	6577.48	6578.07	0.01	0.00	6579.22	6579.22	6579.25	0.06	6579.31

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
1	51.12	6.67	8.00	9.78	0.00	1.22	0.00	11.80	7.37	2.01	80.48	Sewer Too Shallow
2	116.91	6.67	8.00	9.78	11.83	7.39	2.03	13.76	8.35	2.99	344.04	
3	42.20	6.67	8.00	9.78	13.60	8.27	2.91	12.38	7.66	2.30	125.95	
4	113.08	6.67	8.00	9.78	11.72	7.33	1.97	12.04	7.49	2.13	308.15	
5A	32.36	4.00	6.00	6.67	9.36	6.52	2.35	8.32	5.99	1.83	51.48	
5B	89.17	4.00	6.00	6.67	8.31	5.99	1.82	11.78	7.72	3.56	162.86	
6	145.96	4.00	6.00	6.67	9.76	6.71	2.55	10.72	7.19	3.03	268.13	
14	27.22	3.50	6.00	6.08	8.88	5.98	2.40	8.80	5.94	2.36	38.48	
15	297.18	3.50	6.00	6.08	8.98	6.03	2.45	7.72	5.40	1.82	397.95	
16	36.48	2.50	4.00	4.92	6.75	4.17	1.92	7.14	4.36	2.11	29.73	
17	7.73	3.00	4.00	5.50	7.22	4.69	1.86	7.62	4.89	2.06	7.81	
18	9.62	2.50	4.00	4.92	7.80	4.69	2.44	7.68	4.63	2.38	8.88	
22	7.70	3.50	6.00	6.08	8.62	5.85	2.27	8.32	5.70	2.12	10.43	
23	18.34	3.50	6.00	6.08	10.39	6.74	3.16	9.18	6.13	2.55	28.98	

Total earth volume for sewer trenches = 1863 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 9/7/2021 7:11:54 AM	# UDSewer Results Summary **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 1.50
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6587.68

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6592.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	6593.12	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

7	6596.54	30.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	6596.83	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8A	6600.15	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8B	6603.84	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	6604.14	5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	6604.14	8.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	6593.16	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	6.17	6.79	0.39	41.90	
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.60	
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	
8A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
8B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20	
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.80	
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
21	30.74	6587.89	2.6	6588.69	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in
7	101.44	6586.92	3.7	6590.67	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
20	7.73	6592.27	5.6	6592.70	0.014	1.00	0.00	CIRCULAR	18.00 in	18.00 in
8A	107.21	6590.72	3.6	6594.58	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
8B	108.31	6594.63	3.5	6598.42	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
12	7.67	6599.72	2.0	6599.87	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in
19	30.67	6599.73	1.0	6600.04	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in
13	7.53	6587.89	2.7	6588.09	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length	Comment

										(ft)	
21	33.96	10.81	8.74	4.16	5.77	7.40	2.24	Supercritical	4.30	0.00	
7	119.45	16.90	21.51	6.94	12.43	14.14	2.86	Supercritical	30.60	0.00	
20	23.14	13.10	5.88	3.39	3.30	7.65	3.08	Supercritical	1.70	0.00	
8A	117.83	16.67	21.10	6.85	12.28	13.86	2.82	Supercritical	29.50	0.00	
8B	116.18	16.44	21.10	6.85	12.37	13.72	2.78	Supercritical	29.50	0.00	
12	29.79	9.48	9.65	4.40	6.79	7.12	1.97	Supercritical	5.20	0.00	
19	21.06	6.70	12.70	5.22	10.82	6.40	1.36	Supercritical	8.80	0.00	
13	34.61	11.02	11.26	4.83	7.32	8.63	2.29	Supercritical	7.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
21	4.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
7	30.60	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
20	1.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
8A	29.50	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
8B	29.50	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
12	5.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
19	8.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
13	7.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6587.68

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
21	6587.89	6588.69	0.00	0.00	6588.37	6589.42	6589.22	0.46	6589.69
7	6586.92	6590.67	0.00	0.00	6587.95	6592.46	6591.06	2.15	6593.21
20	6592.27	6592.70	0.01	0.00	6592.54	6593.38	6593.45	0.00	6593.45

8A	6590.72	6594.58	0.01	0.00	6592.48	6596.34	6594.73	2.34	6597.07
8B	6594.63	6598.42	0.01	0.00	6596.35	6600.18	6598.58	2.32	6600.91
12	6599.72	6599.87	0.04	0.00	6600.28	6600.92	6601.07	0.00	6601.07
19	6599.73	6600.04	0.12	0.00	6600.63	6601.10	6601.27	0.25	6601.52
13	6587.89	6588.09	0.00	0.00	6588.50	6589.52	6589.65	0.00	6589.65

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
21	30.74	3.00	4.00	5.50	8.94	5.55	2.72	7.86	5.01	2.18	35.56	
7	101.44	4.00	6.00	6.67	9.89	6.78	2.61	9.74	6.70	2.54	178.12	
20	7.73	2.50	4.00	4.92	8.05	4.81	2.56	7.76	4.67	2.42	7.32	
8A	107.21	4.00	6.00	6.67	9.64	6.65	2.49	9.14	6.40	2.24	180.23	
8B	108.31	4.00	6.00	6.67	9.04	6.35	2.19	8.84	6.25	2.09	173.78	
12	7.67	3.00	4.00	5.50	7.25	4.71	1.87	7.54	4.85	2.02	7.72	
19	30.67	3.00	4.00	5.50	7.21	4.69	1.86	7.20	4.68	1.85	30.11	
13	7.53	3.00	4.00	5.50	8.95	5.56	2.72	9.14	5.65	2.82	9.47	

Total earth volume for sewer trenches = 622 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 9/7/2021 7:15:14 AM	# UDSewer Results Summary **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 1.50
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6599.45

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6603.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	6611.72	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

10	6607.04	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	3.22	6.52	0.93	21.00	
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
9	166.22	6598.78	0.6	6599.78	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
10	268.70	6600.02	0.7	6601.90	0.014	0.29	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
9	48.10	6.81	17.66	6.09	16.64	6.57	1.12	Supercritical	21.00	0.00	
10	51.96	7.35	17.66	6.09	15.93	6.96	1.22	Supercritical	21.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
9	21.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
10	21.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6599.45

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
9	6598.78	6599.78	0.00	0.00	6600.17	6601.25	6600.84	0.99	6601.83
10	6600.02	6601.90	0.04	0.00	6601.35	6603.37	6602.10	1.85	6603.95

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

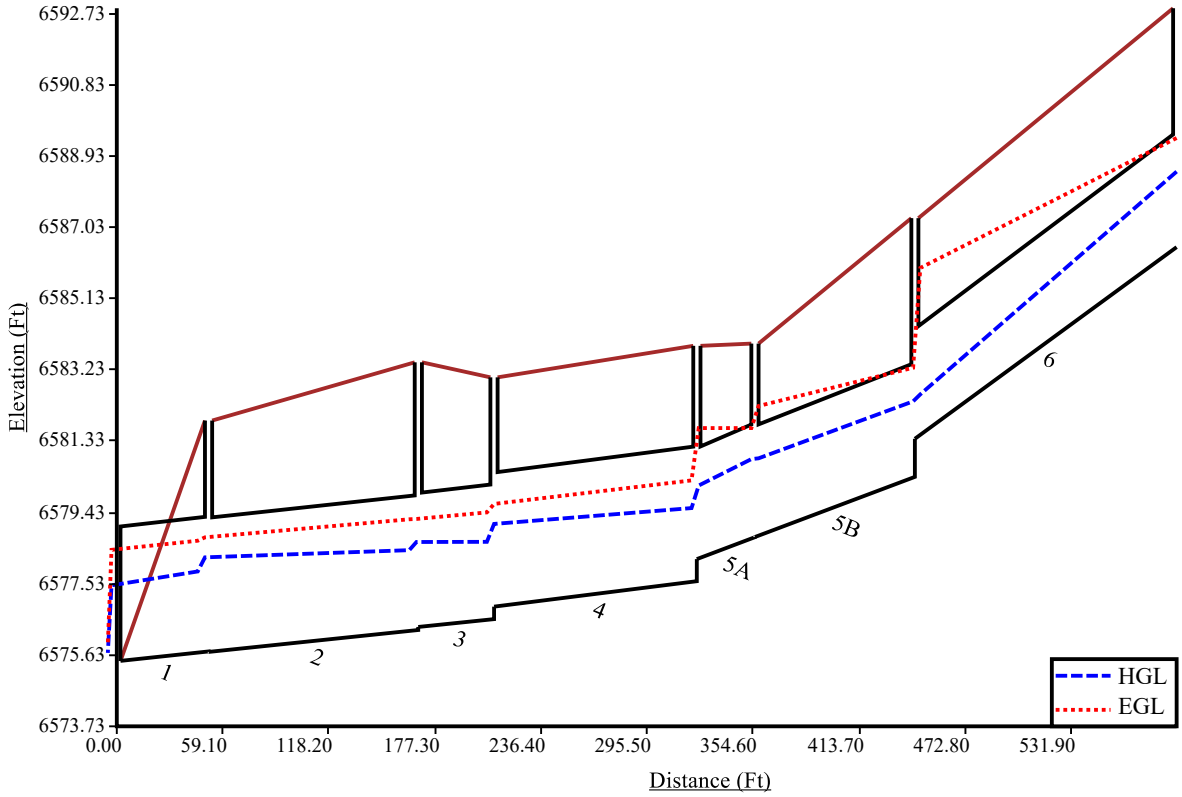
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
9	166.22	4.00	6.00	6.67	8.11	5.89	1.72	21.88	12.77	8.61	562.72	
10	268.70	4.00	6.00	6.67	21.40	12.53	8.37	8.28	5.97	1.81	887.28	

Total earth volume for sewer trenches = 1450 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

1-6


6592.73
6590.83
6588.93
6587.03
6585.13
6583.23
6581.33
6579.43
6577.53
6575.63
6573.73
Elevation (Ft)
0.00
59.10
118.20
177.30
236.40
295.50
354.60
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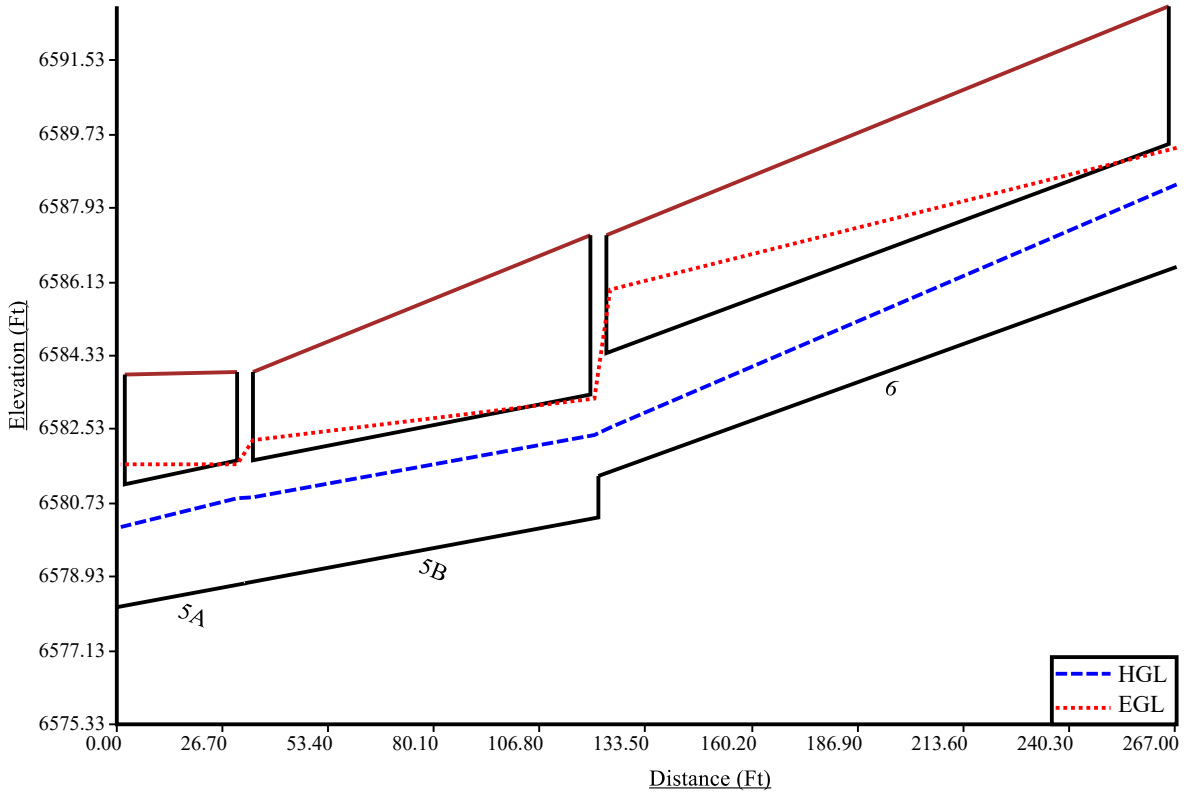
Distance (Ft)
1
2
3
4
5A
5B
6
HGL
EGL

4-6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80.10
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Distance (Ft)
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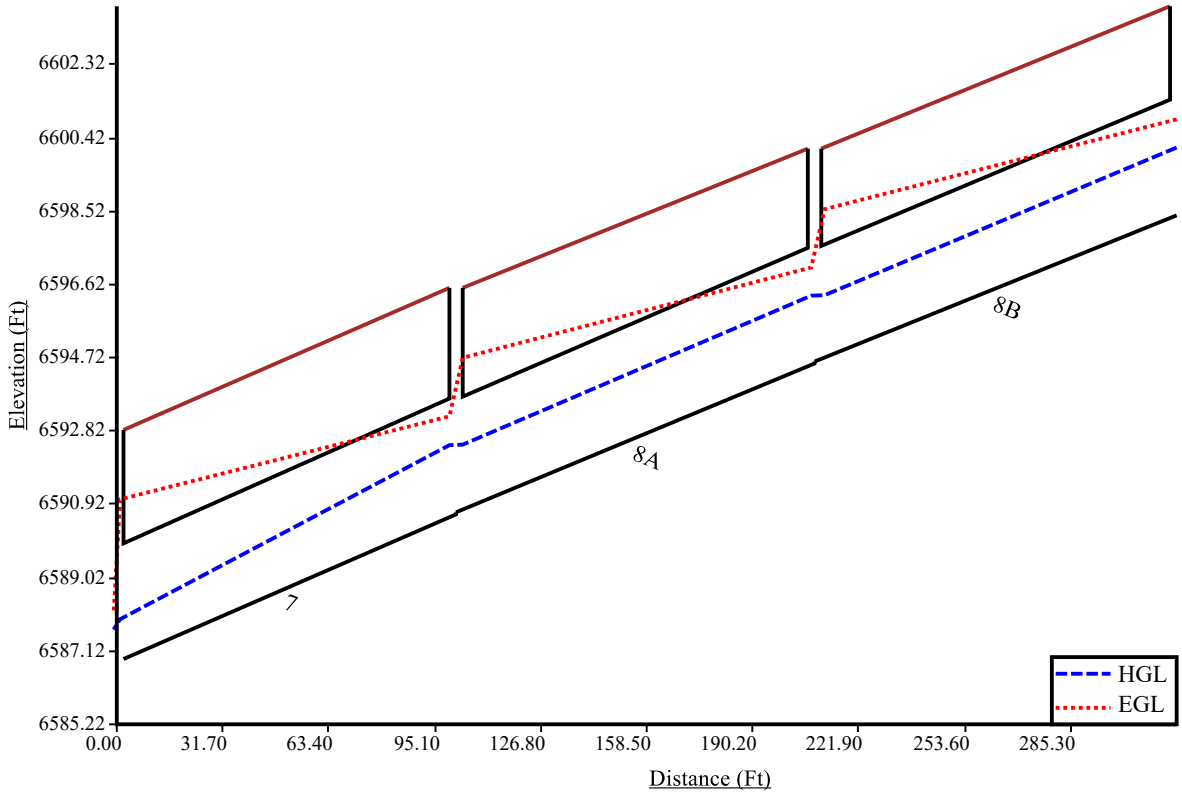
HGL
EGL

4

7-8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8A
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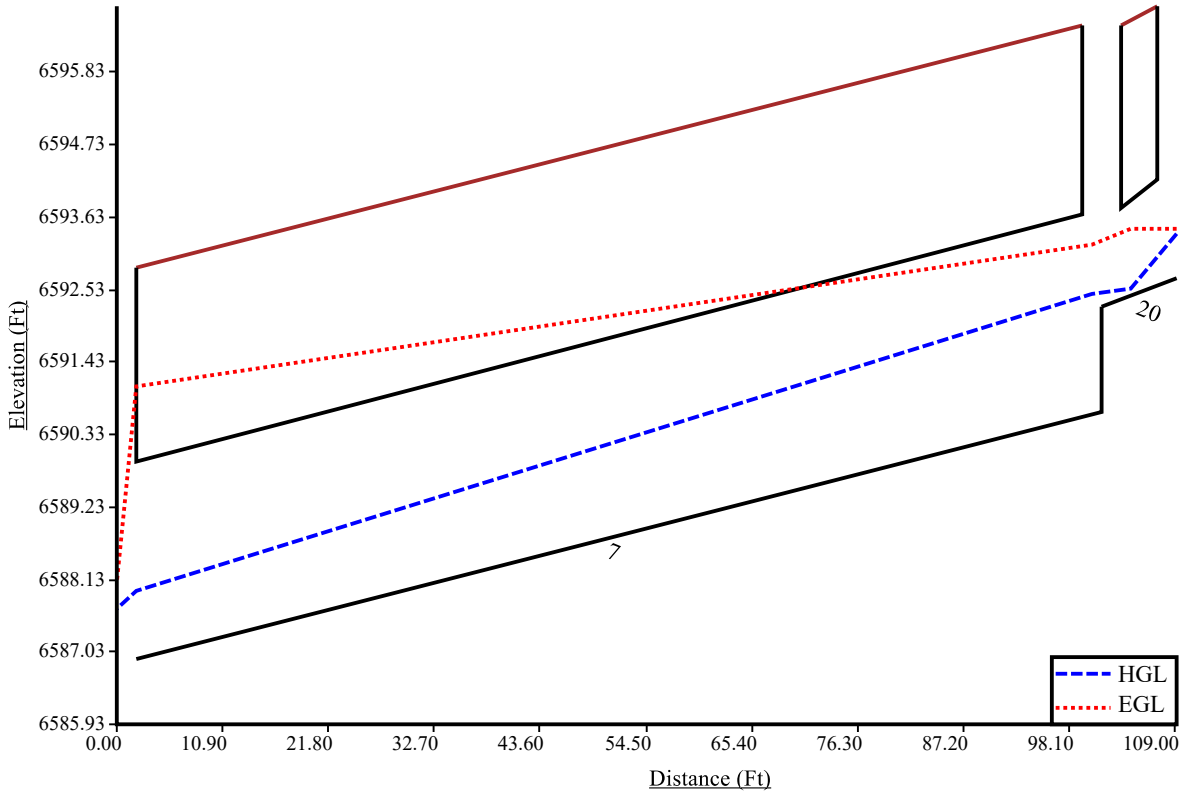
HGL
EGL

20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32.70
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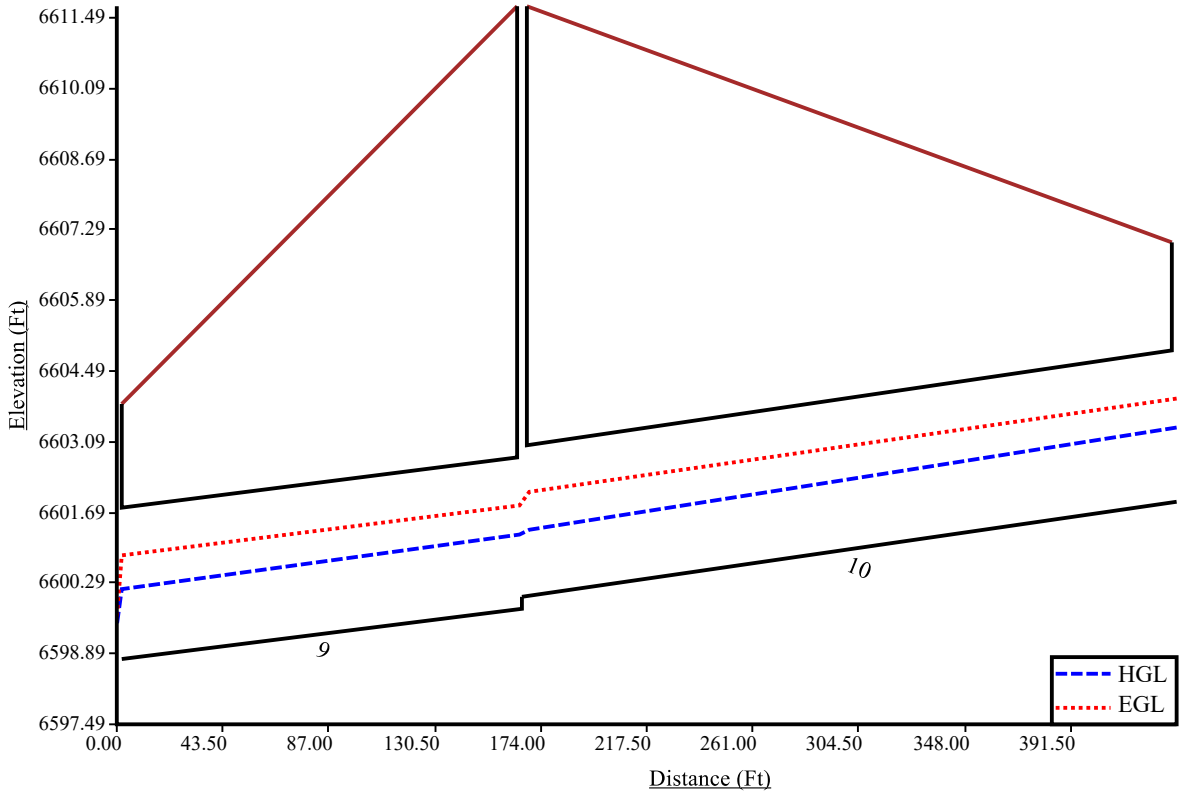
Distance (Ft)
HGL
EGL
7
20

9-10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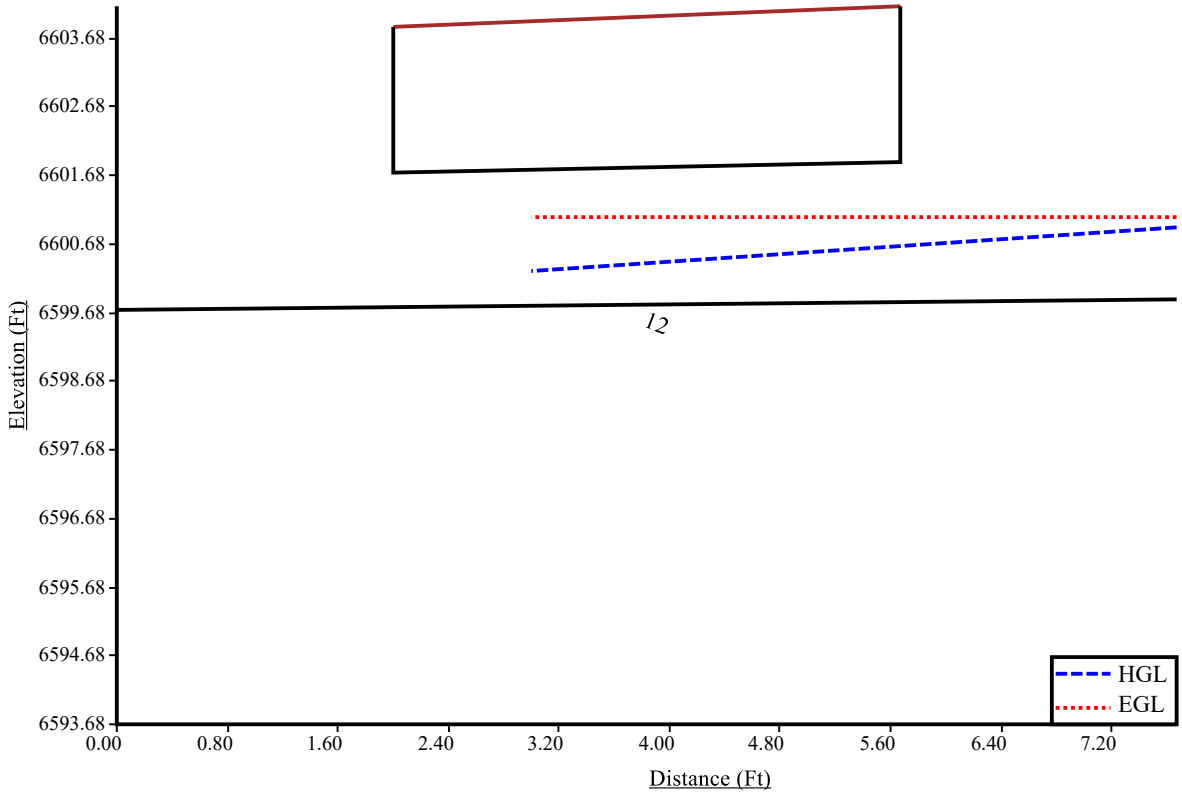
10
HGL
EGL

12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12
HGL
EGL
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2.40
3.20
4.00
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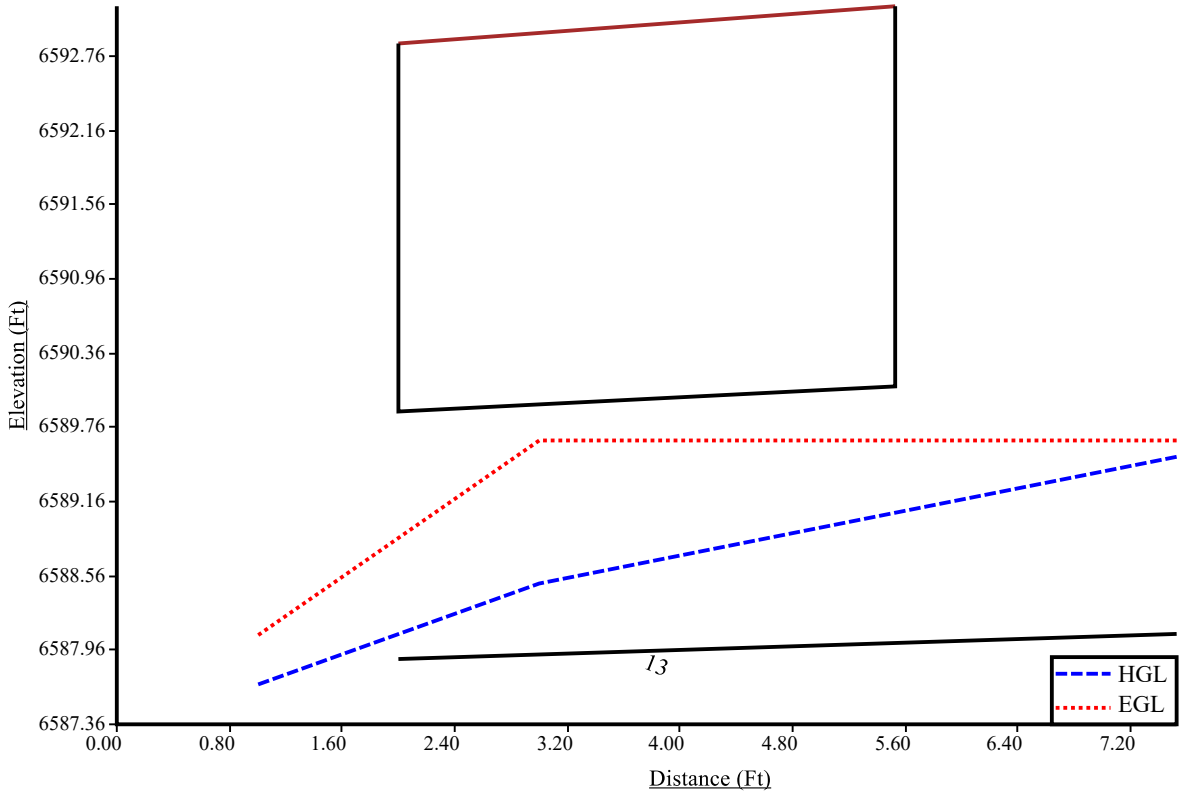
5.60
6.40
7.20
Distance (Ft)

13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0.80
1.60
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4.00
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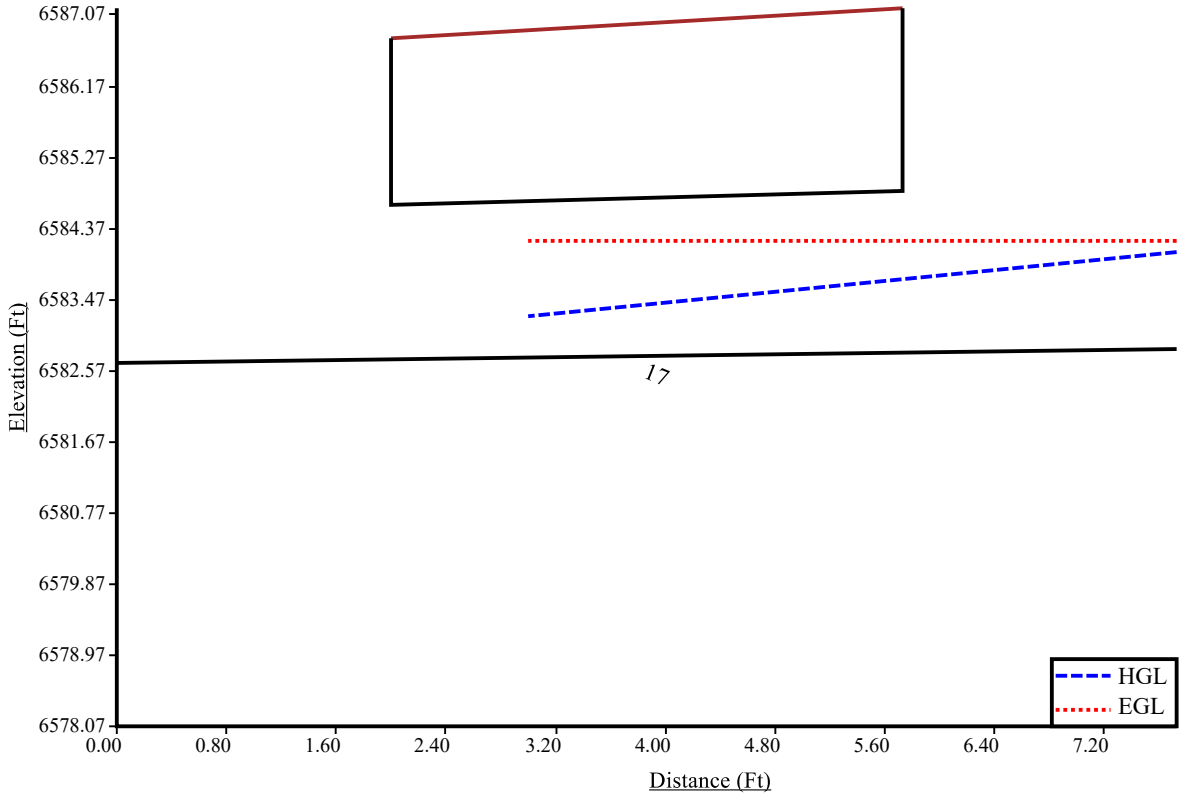
5.60
6.40
7.20
Distance (Ft)
13
HGL
EGL

17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Elevation (Ft)
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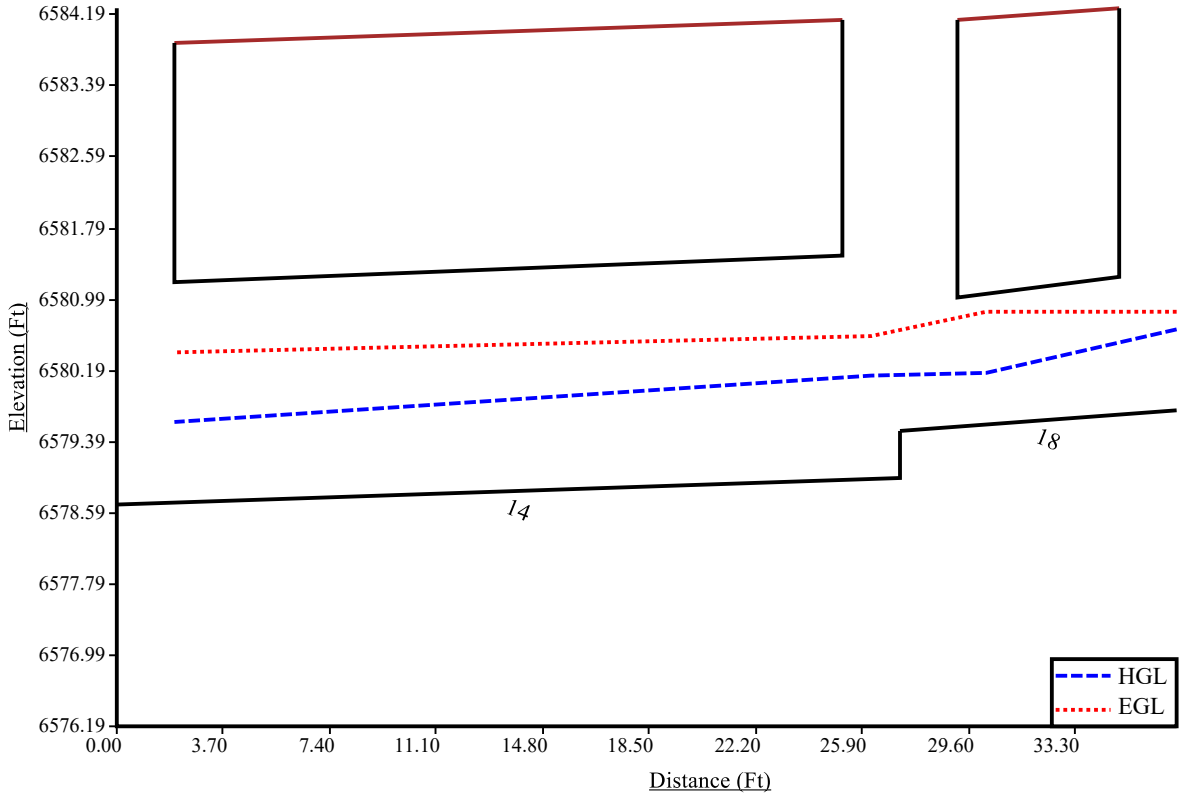
3.20
4.00
4.80
5.60
6.40
7.20
Distance (Ft)
HGL
EGL

18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7.40
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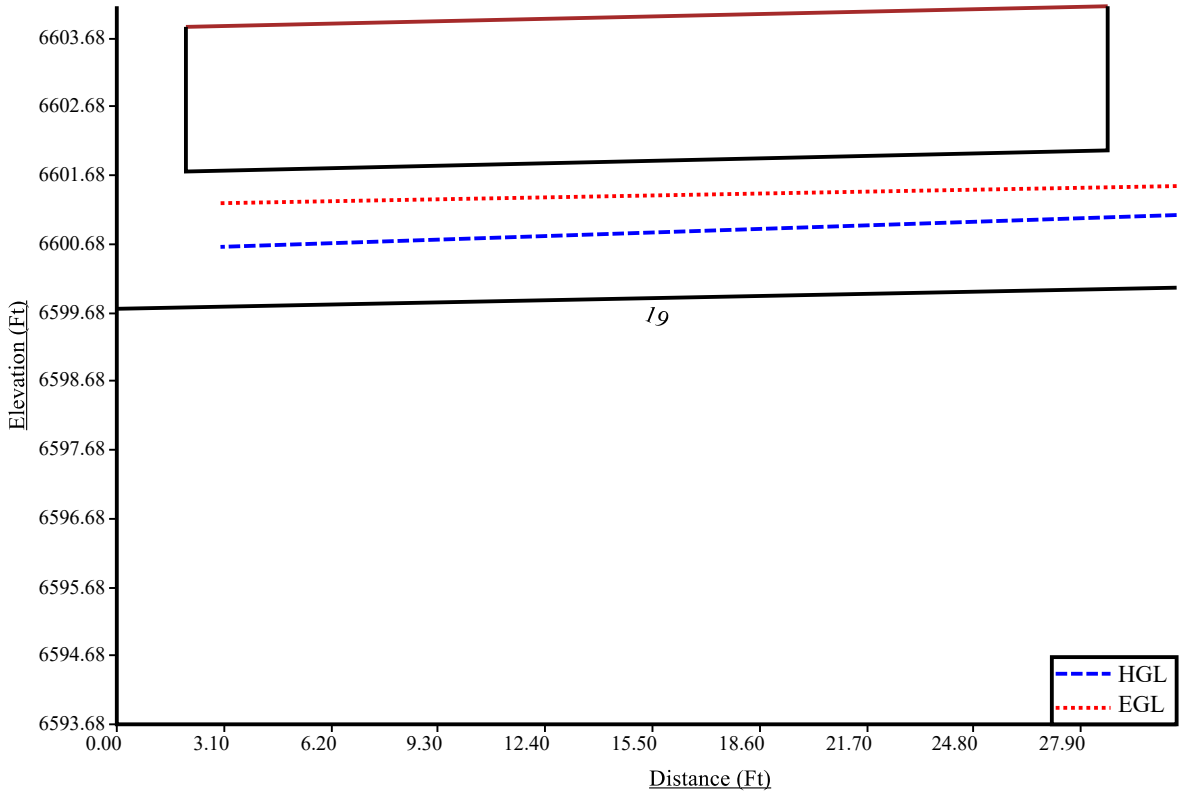
18.50
22.20
25.90
29.60
33.30
Distance (Ft)
14
18
HGL
EGL

19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19
0.00
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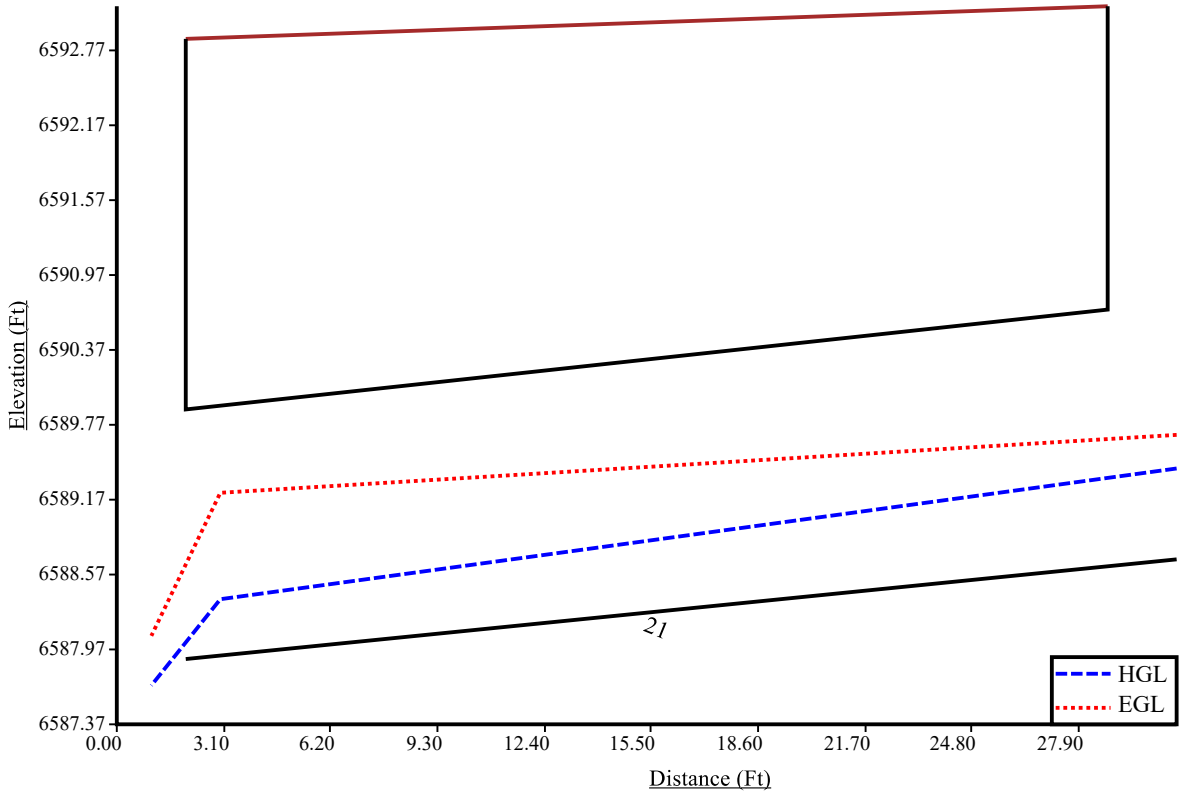
12.40
15.50
18.60
21.70
24.80
27.90
Distance (Ft)
HGL
EGL

21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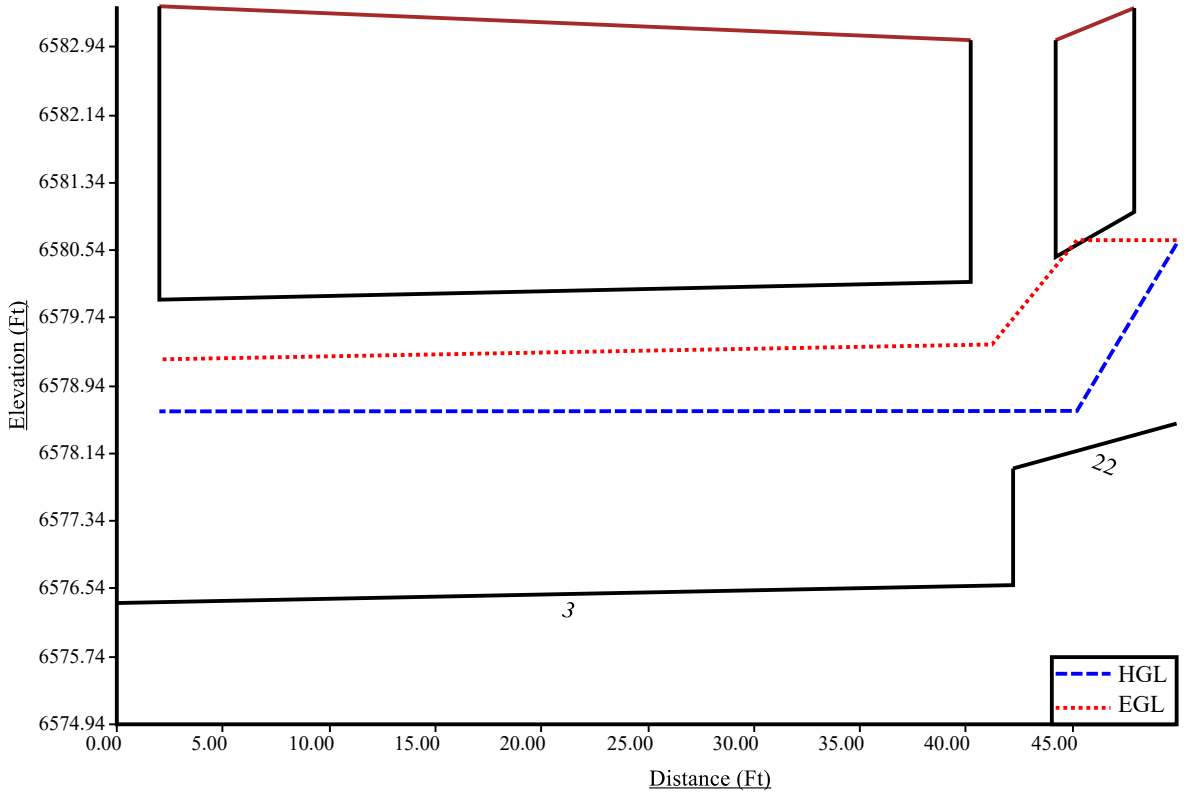
Elevation (Ft)
0.00
3.10
6.20
9.30
12.40
15.50
18.60
21.70
24.80
27.90
Distance (Ft)
21
HGL
EGL

2-22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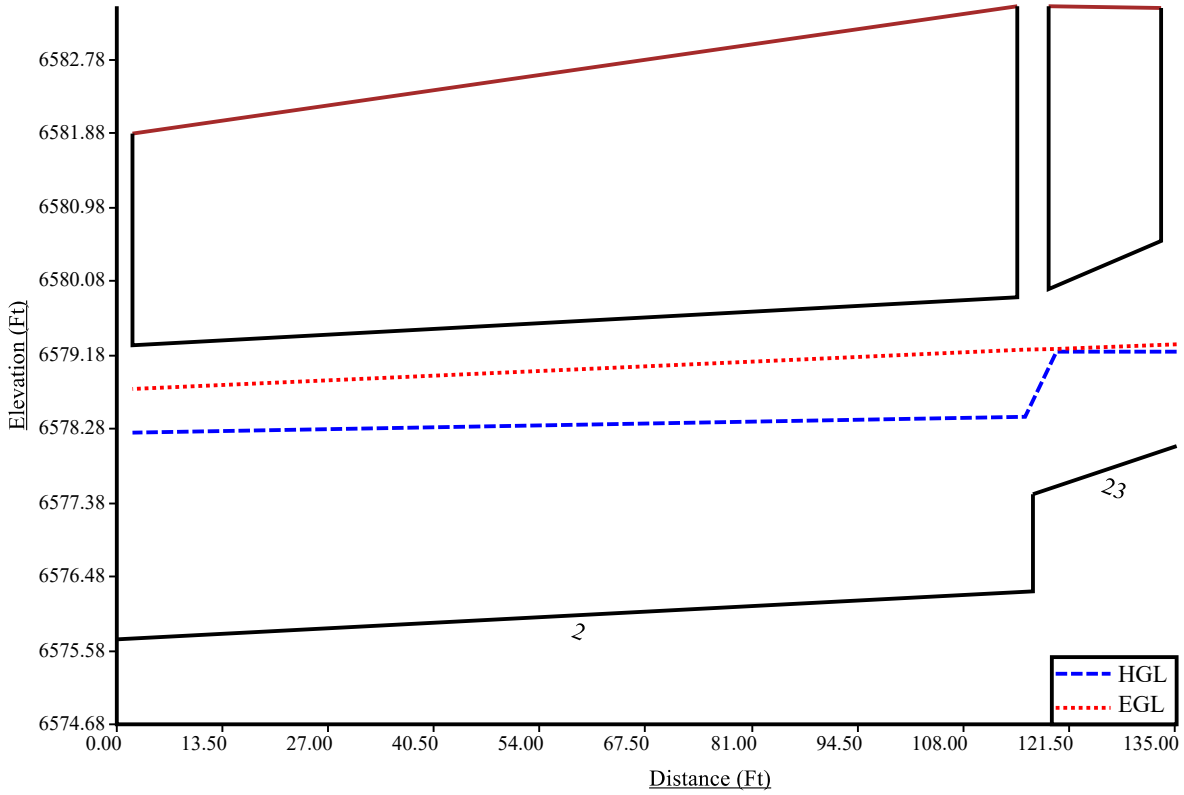
Elevation (Ft)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Distance (Ft)
22
3
HGL
EGL

23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13.50
27.00
40.50
54.00
67.50
81.00
94.50
108.00
121.50
135.00
Distance (Ft)
HGL
EGL
2
23

1

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 2/9/2022 8:41:03 AM	**UDSewer Results Summary** **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6576.89

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6575.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	6581.88	119.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2	6583.43	119.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6583.03	111.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	6583.87	100.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	6584.13	25.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	6586.77	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	6587.33	6.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	6587.15	13.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	6584.26	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	6583.41	16.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	6583.41	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	10.24	11.66	0.10	119.40	Surface Water Present (Upstream)
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	119.40	Surface Water Present (Downstream)
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	119.40	
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	111.80	
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.70	
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.90	
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.60	
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.40	
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.70	
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.50	
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
1	51.12	6575.47	0.5	6575.73	0.014	0.03	0.00	ELLIPSE	43.00 in	68.00 in
2	116.91	6575.72	0.5	6576.30	0.014	0.38	0.00	ELLIPSE	43.00 in	68.00 in
3	42.20	6576.38	0.5	6576.59	0.014	0.05	0.00	ELLIPSE	43.00 in	68.00 in
4	113.08	6576.92	0.6	6577.60	0.014	1.32	0.00	ELLIPSE	43.00 in	68.00 in
14	27.22	6578.68	1.1	6578.98	0.014	0.05	0.00	CIRCULAR	30.00 in	30.00 in
15	297.18	6578.89	1.1	6582.16	0.014	0.05	0.00	CIRCULAR	30.00 in	30.00 in

16	36.48	6583.15	1.0	6583.51	0.014	0.38	0.00	CIRCULAR	18.00 in	18.00 in
17	7.73	6582.66	2.3	6582.84	0.014	1.32	0.00	CIRCULAR	24.00 in	24.00 in
18	9.62	6579.98	2.0	6580.17	0.014	0.38	0.00	CIRCULAR	18.00 in	18.00 in
22	7.70	6577.97	6.9	6578.50	0.014	0.05	0.00	CIRCULAR	30.00 in	30.00 in
23	18.34	6577.48	3.2	6578.07	0.014	0.38	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
1	131.72	9.43	38.32	9.65	39.57	9.32	0.94	Subcritical	119.40	0.00	
2	131.72	9.43	38.32	9.65	39.57	9.32	0.94	Pressurized	119.40	116.91	
3	131.72	9.43	37.05	9.38	37.64	9.22	0.97	Pressurized	111.80	42.20	
4	144.29	10.33	35.10	8.99	32.92	9.70	1.13	Pressurized	100.70	113.08	
14	40.05	8.16	20.81	7.13	17.56	8.68	1.39	Pressurized	25.90	27.22	
15	40.05	8.16	17.73	6.29	14.54	8.05	1.46	Supercritical Jump	19.00	166.88	
16	9.78	5.53	11.93	5.31	10.83	5.94	1.20	Supercritical	6.60	0.00	
17	31.94	10.17	15.81	6.10	10.84	9.72	2.06	Supercritical	13.40	0.00	
18	13.74	7.78	13.70	6.03	10.39	8.23	1.72	Pressurized	8.70	9.62	
22	100.32	20.44	16.47	5.98	8.23	15.09	3.80	Pressurized	16.50	7.70	
23	68.32	13.92	13.82	5.34	8.44	10.42	2.59	Pressurized	11.80	18.34	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
1	119.40	ELLIPSE	43.00 in	68.00 in	54.00 in	54.00 in	43.00 in	68.00 in	13.97	Existing height is smaller than the suggested height. Exceeds max. Depth/Rise
2	119.40	ELLIPSE	43.00 in	68.00 in	54.00 in	54.00 in	43.00 in	68.00 in	13.97	Existing height is smaller than the suggested height. Exceeds max. Depth/Rise
3	111.80	ELLIPSE	43.00 in	68.00 in	54.00 in	54.00 in	43.00 in	68.00 in	13.97	Existing height is smaller than the suggested height.
4	100.70	ELLIPSE	43.00 in	68.00 in	48.00 in	48.00 in	43.00 in	68.00 in	13.97	Existing height is smaller than the suggested height.
14	25.90	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

15	19.00	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
16	6.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
17	13.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
18	8.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
22	16.50	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
23	11.80	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6576.89

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
1	6575.47	6575.73	0.00	0.00	6578.67	6579.05	6580.11	0.26	6580.38
2	6575.72	6576.30	0.43	0.00	6579.67	6580.16	6580.81	0.48	6581.29
3	6576.38	6576.59	0.05	0.00	6580.34	6580.50	6581.34	0.15	6581.49
4	6576.92	6577.60	1.07	0.00	6581.75	6582.08	6582.56	0.33	6582.89
14	6578.68	6578.98	0.02	0.00	6582.48	6582.60	6582.91	0.13	6583.03
15	6578.89	6582.16	0.01	0.00	6582.81	6583.64	6583.05	1.21	6584.25
16	6583.15	6583.51	0.08	0.00	6584.05	6584.50	6584.60	0.35	6584.94
17	6582.66	6582.84	0.37	0.00	6584.01	6584.74	6585.03	0.00	6585.03
18	6579.98	6580.17	0.14	0.00	6582.80	6582.88	6583.18	0.08	6583.25
22	6577.97	6578.50	0.01	0.00	6581.33	6581.34	6581.50	0.01	6581.51
23	6577.48	6578.07	0.03	0.00	6581.23	6581.25	6581.32	0.02	6581.34

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment

1	51.12	6.67	8.00	9.78	0.00	1.22	0.00	11.80	7.37	2.01	80.48	w r Too hallow
2	116.91	6.67	8.00	9.78	11.83	7.39	2.03	13.76	8.35	2.99	344.04	
3	42.20	6.67	8.00	9.78	13.60	8.27	2.91	12.38	7.66	2.30	125.95	
4	113.08	6.67	8.00	9.78	11.72	7.33	1.97	12.04	7.49	2.13	308.15	
14	27.22	3.50	6.00	6.08	8.88	5.98	2.40	8.80	5.94	2.36	38.48	
15	297.18	3.50	6.00	6.08	8.98	6.03	2.45	7.72	5.40	1.82	397.95	
16	36.48	2.50	4.00	4.92	6.75	4.17	1.92	7.14	4.36	2.11	29.73	
17	7.73	3.00	4.00	5.50	7.22	4.69	1.86	7.62	4.89	2.06	7.81	
18	9.62	2.50	4.00	4.92	7.80	4.69	2.44	7.68	4.63	2.38	8.88	
22	7.70	3.50	6.00	6.08	8.62	5.85	2.27	8.32	5.70	2.12	10.43	
23	18.34	3.50	6.00	6.08	10.39	6.74	3.16	9.18	6.13	2.55	28.98	

Total earth volume for sewer trenches = 1381 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 9/3/2021 12:37:40 PM	# UDSewer Results Summary **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6580.34

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6583.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5A	6583.93	82.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5B	6587.27	82.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	6592.86	82.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	6593.12	9.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	6596.54	66.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	6596.83	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8A	6600.15	63.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8B	6603.84	63.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	6604.14	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	6611.72	44.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6607.04	44.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	6604.14	19.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	6593.16	15.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	7.07	11.71	0.05	82.80	
5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.80	
5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.80	
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.80	
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.10	
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.80	
8A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.00	
8B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.50	
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.90	
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.90	
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.40	
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.40	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
5A	32.36	6578.19	1.8	6578.77	0.014	1.00	0.00	CIRCULAR	36.00 in	36.00 in
5B	89.17	6578.77	1.8	6580.38	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
6	145.96	6581.39	3.5	6586.50	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
21	30.74	6587.89	2.6	6588.69	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in

7	101.44	6586.92	3.7	6590.67	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
20	7.73	6592.27	5.6	6592.70	0.014	1.00	0.00	CIRCULAR	18.00 in	18.00 in
8A	107.21	6590.72	3.6	6594.58	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
8B	108.31	6594.63	3.5	6598.42	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
12	7.67	6599.72	2.0	6599.87	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in
9	166.22	6598.78	0.6	6599.78	0.014	0.05	0.00	CIRCULAR	36.00 in	36.00 in
10	268.70	6600.02	0.7	6601.90	0.014	0.29	0.00	CIRCULAR	36.00 in	36.00 in
19	30.67	6599.73	1.0	6600.04	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in
13	7.53	6587.89	2.7	6588.09	0.014	1.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
5A	83.32	11.79	33.54	12.07	29.31	13.44	1.46	Supercritical	82.80	0.00	
5B	83.32	11.79	33.54	12.07	29.31	13.44	1.46	Supercritical	82.80	0.00	
6	116.18	16.44	33.54	12.07	22.46	17.85	2.49	Supercritical	82.80	0.00	
21	33.96	10.81	13.22	5.36	8.68	9.27	2.24	Pressurized	9.50	30.74	
7	119.45	16.90	31.22	10.15	19.12	17.33	2.70	Supercritical	66.10	0.00	
20	23.14	13.10	8.94	4.34	4.93	9.67	3.14	Pressurized	3.80	7.73	
8A	117.83	16.67	30.64	9.83	18.73	16.95	2.68	Supercritical	63.00	0.00	
8B	116.18	16.44	30.73	9.88	18.98	16.80	2.64	Supercritical	63.50	0.00	
12	29.79	9.48	14.41	5.69	10.20	8.81	1.94	Pressurized	11.20	7.67	
9	48.10	6.81	26.19	8.15	27.56	7.73	0.90	Subcritical Surcharged	44.90	153.91	
10	51.96	7.35	26.19	8.15	25.83	8.27	1.03	Supercritical	44.90	0.00	
19	21.06	6.70	19.00	7.27	18.16	7.61	1.10	Pressurized	19.40	30.67	
13	34.61	11.02	16.97	6.48	11.21	10.70	2.22	Pressurized	15.40	7.53	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
5A	82.80	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
5B	82.80	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
6	82.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
21	9.50	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

7	66.10	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
20	3.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
8A	63.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
8B	63.50	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
12	11.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
9	44.90	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
10	44.90	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
19	19.40	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
13	15.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6580.34

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
5A	6578.19	6578.77	0.00	0.00	6580.63	6581.56	6583.43	0.39	6583.83
5B	6578.77	6580.38	0.11	0.00	6581.67	6583.17	6584.02	1.42	6585.44
6	6581.39	6586.50	0.11	0.00	6583.28	6589.29	6588.21	3.35	6591.56
21	6587.89	6588.69	0.14	0.00	6591.56	6591.62	6591.70	0.06	6591.76
7	6586.92	6590.67	0.07	0.00	6589.36	6593.27	6593.17	1.70	6594.87
20	6592.27	6592.70	0.07	0.00	6594.87	6594.88	6594.94	0.01	6594.96
8A	6590.72	6594.58	0.06	0.00	6593.33	6597.13	6596.74	1.89	6598.63
8B	6594.63	6598.42	0.06	0.00	6597.20	6600.98	6600.59	1.90	6602.50
12	6599.72	6599.87	0.20	0.00	6602.50	6602.52	6602.69	0.02	6602.72
9	6598.78	6599.78	0.03	0.00	6601.90	6602.77	6602.53	0.87	6603.40
10	6600.02	6601.90	0.18	0.00	6602.95	6604.08	6603.58	1.53	6605.11
19	6599.73	6600.04	0.59	0.00	6602.50	6602.76	6603.09	0.26	6603.35
13	6587.89	6588.09	0.37	0.00	6591.56	6591.60	6591.93	0.04	6591.97

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

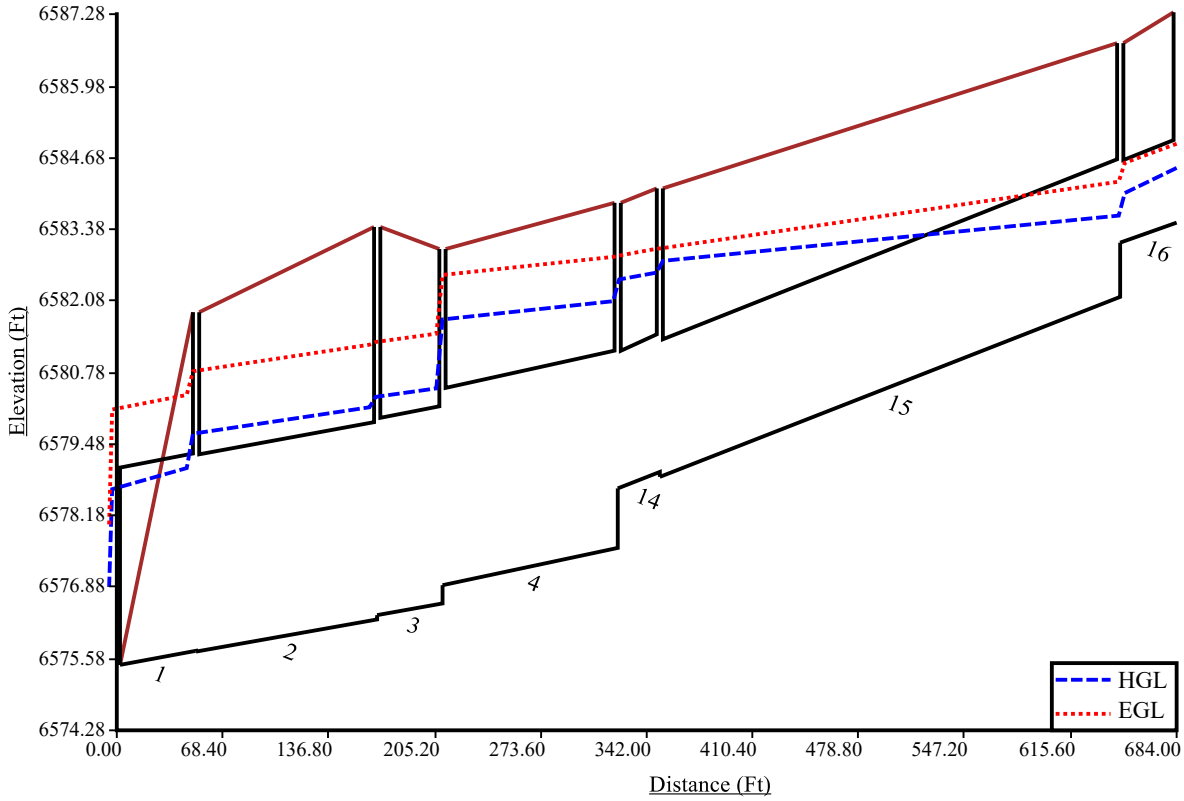
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
5A	32.36	4.00	6.00	6.67	9.36	6.52	2.35	8.32	5.99	1.83	51.48	
5B	89.17	4.00	6.00	6.67	8.31	5.99	1.82	11.78	7.72	3.56	162.86	
6	145.96	4.00	6.00	6.67	9.76	6.71	2.55	10.72	7.19	3.03	268.13	
21	30.74	3.00	4.00	5.50	8.94	5.55	2.72	7.86	5.01	2.18	35.56	
7	101.44	4.00	6.00	6.67	9.89	6.78	2.61	9.74	6.70	2.54	178.12	
20	7.73	2.50	4.00	4.92	8.05	4.81	2.56	7.76	4.67	2.42	7.32	
8A	107.21	4.00	6.00	6.67	9.64	6.65	2.49	9.14	6.40	2.24	180.23	
8B	108.31	4.00	6.00	6.67	9.04	6.35	2.19	8.84	6.25	2.09	173.78	
12	7.67	3.00	4.00	5.50	7.25	4.71	1.87	7.54	4.85	2.02	7.72	
9	166.22	4.00	6.00	6.67	8.11	5.89	1.72	21.88	12.77	8.61	562.72	
10	268.70	4.00	6.00	6.67	21.40	12.53	8.37	8.28	5.97	1.81	887.28	
19	30.67	3.00	4.00	5.50	7.21	4.69	1.86	7.20	4.68	1.85	30.11	
13	7.53	3.00	4.00	5.50	8.95	5.56	2.72	9.14	5.65	2.82	9.47	

Total earth volume for sewer trenches = 2555 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

1-16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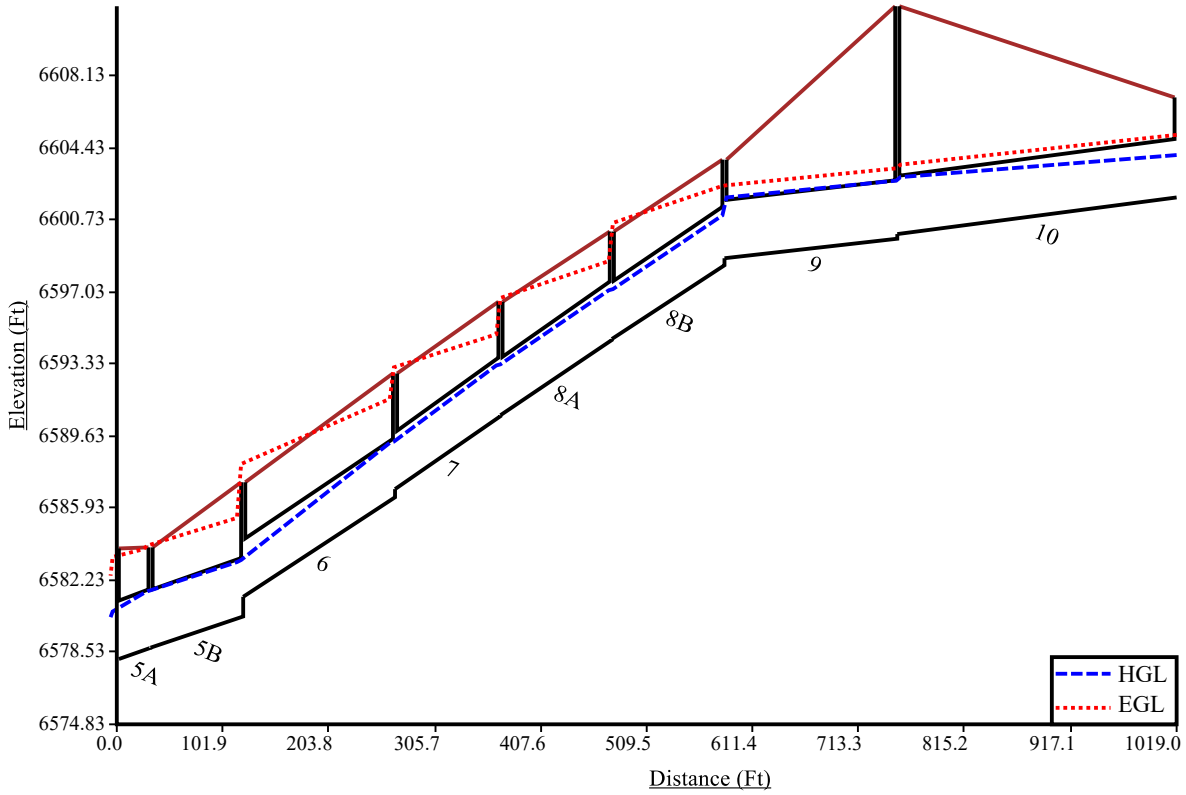
EGL

5-10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5B
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8B
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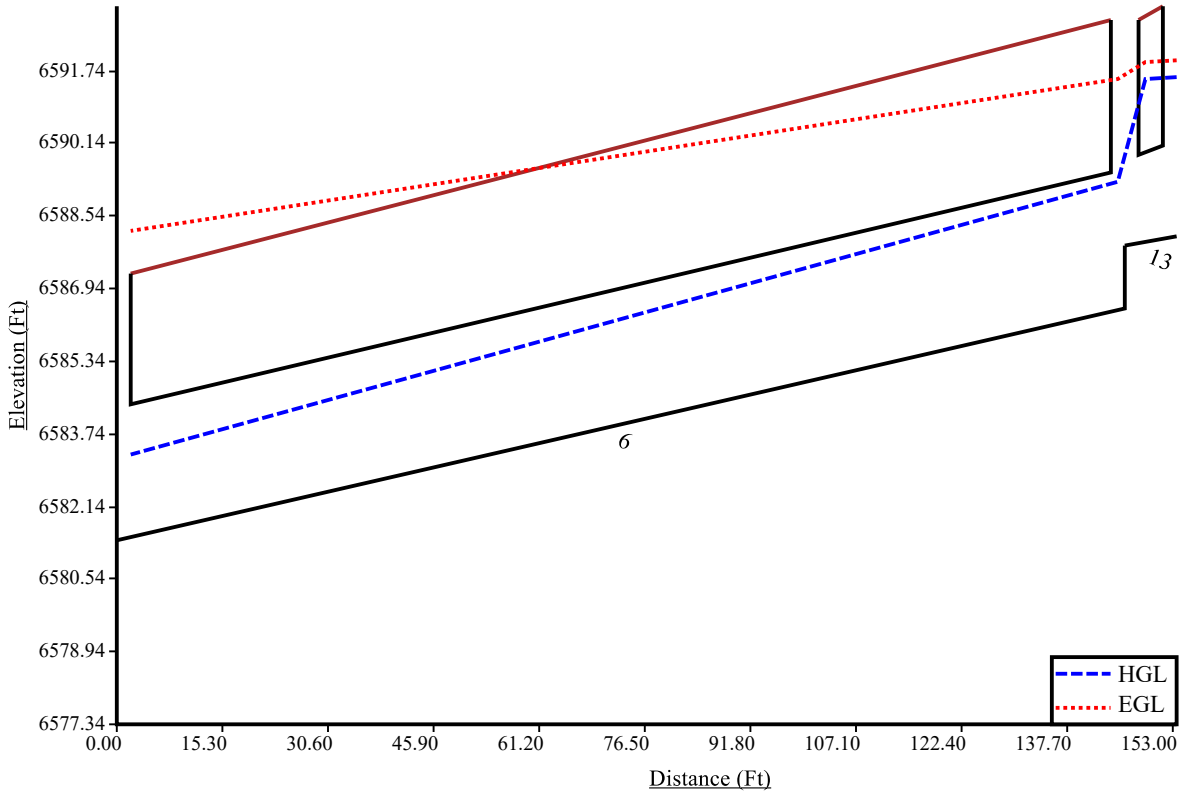
EGL

5-13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6
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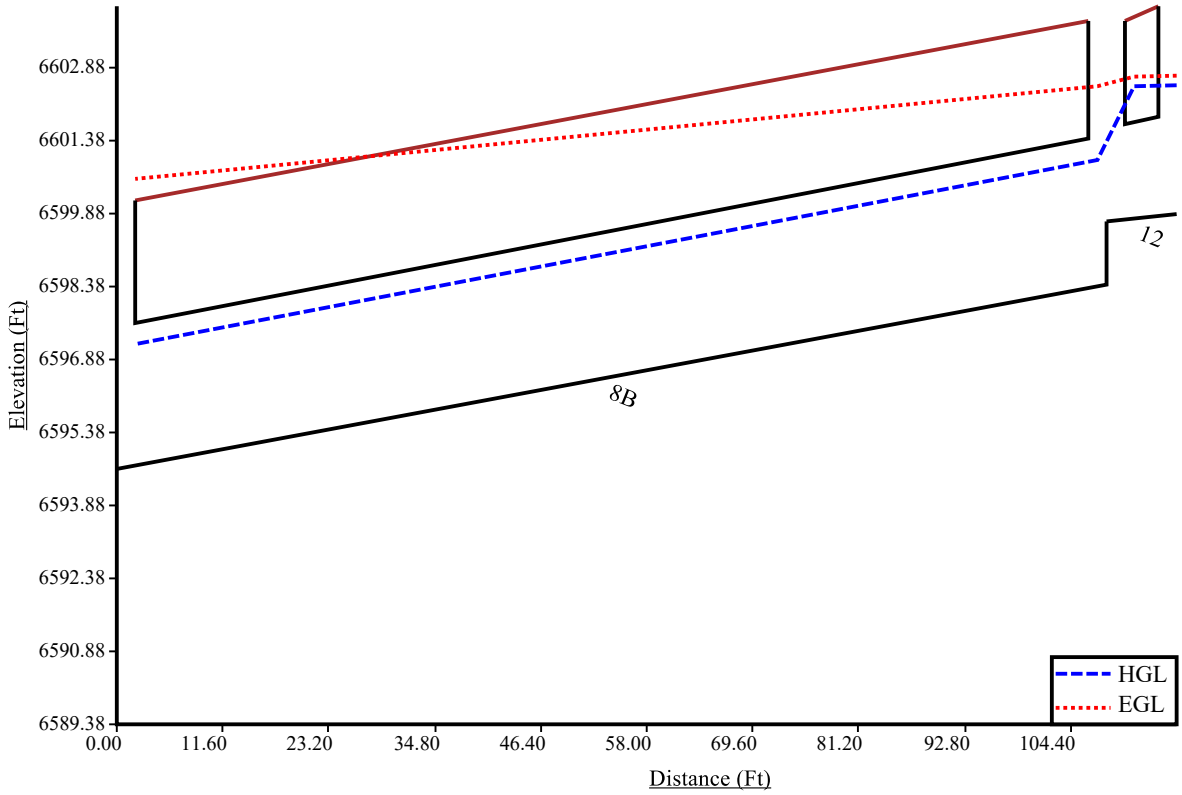
8-12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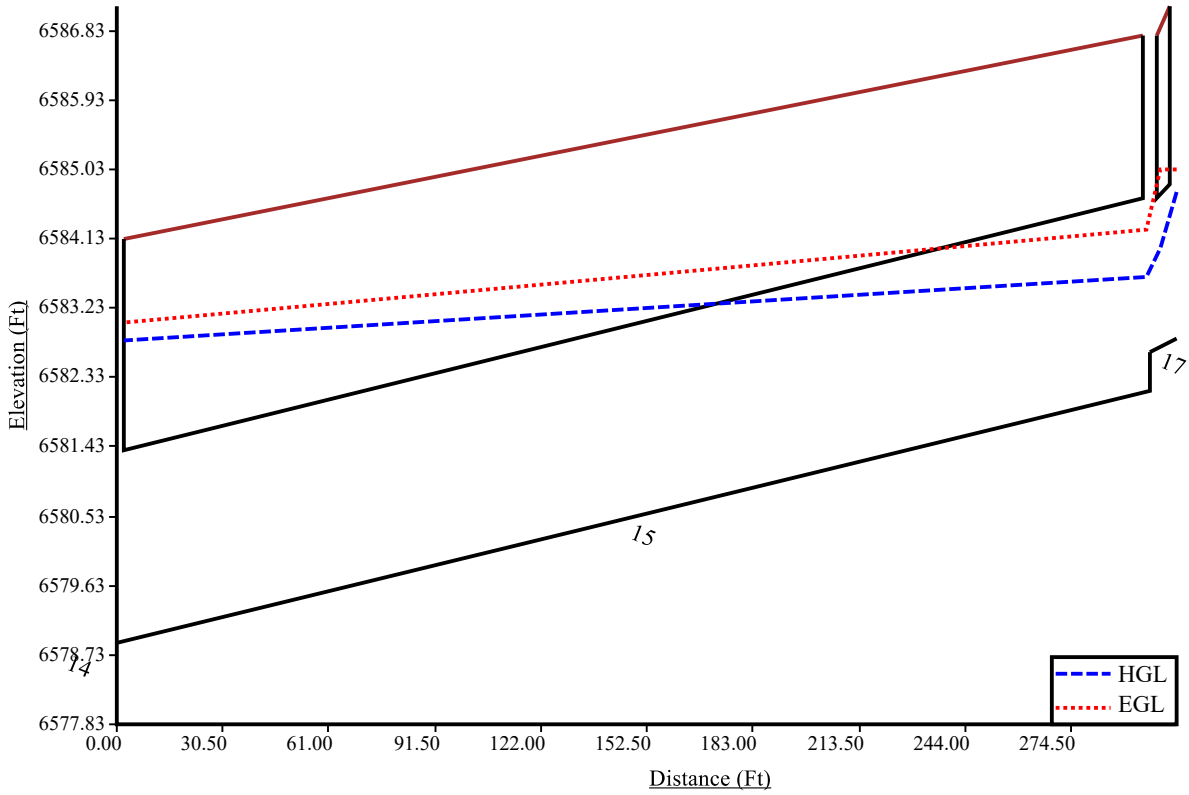
14-17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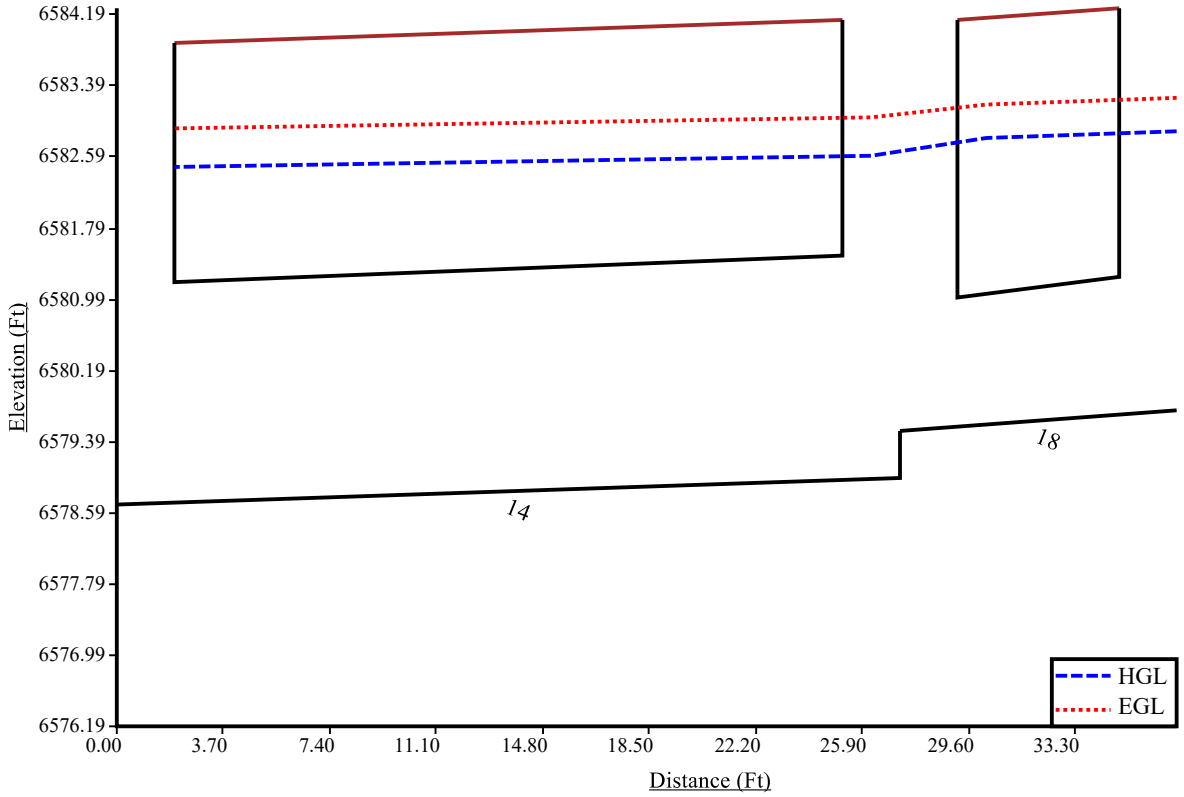
4-18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Distance (Ft)
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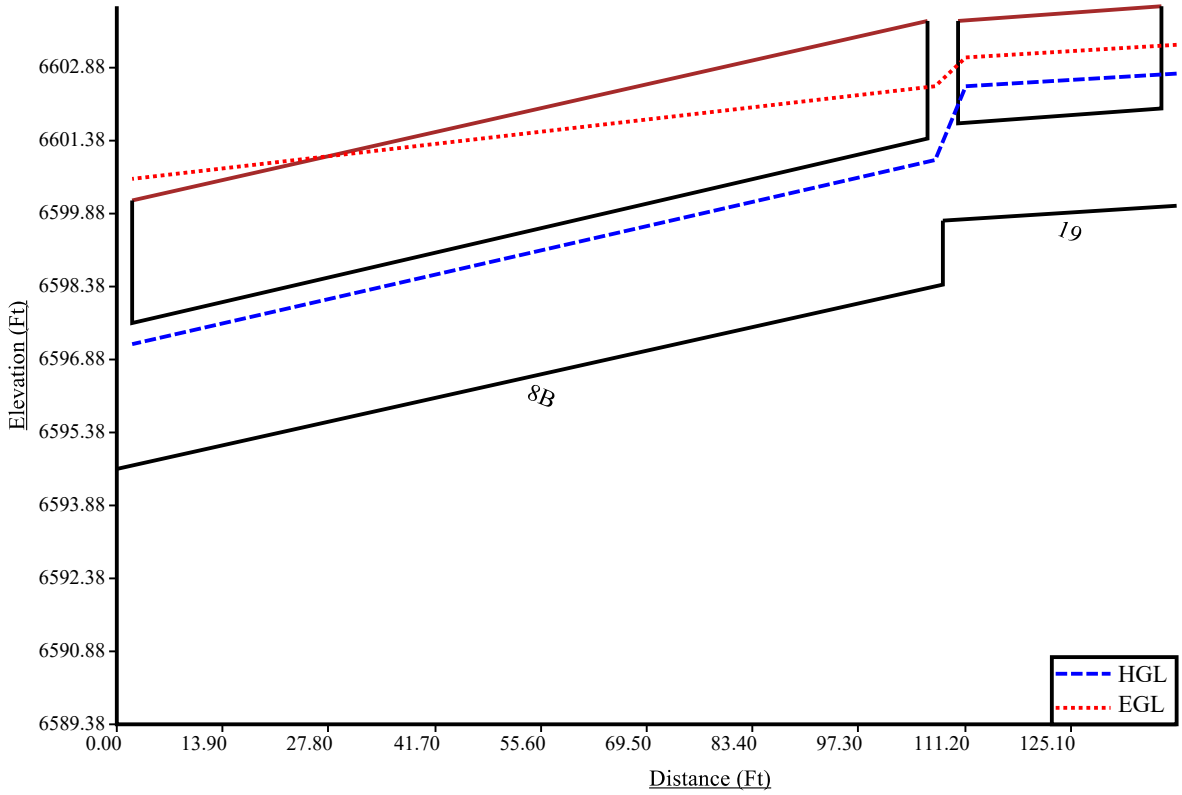
18
HGL
EGL

8-19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Distance (Ft)
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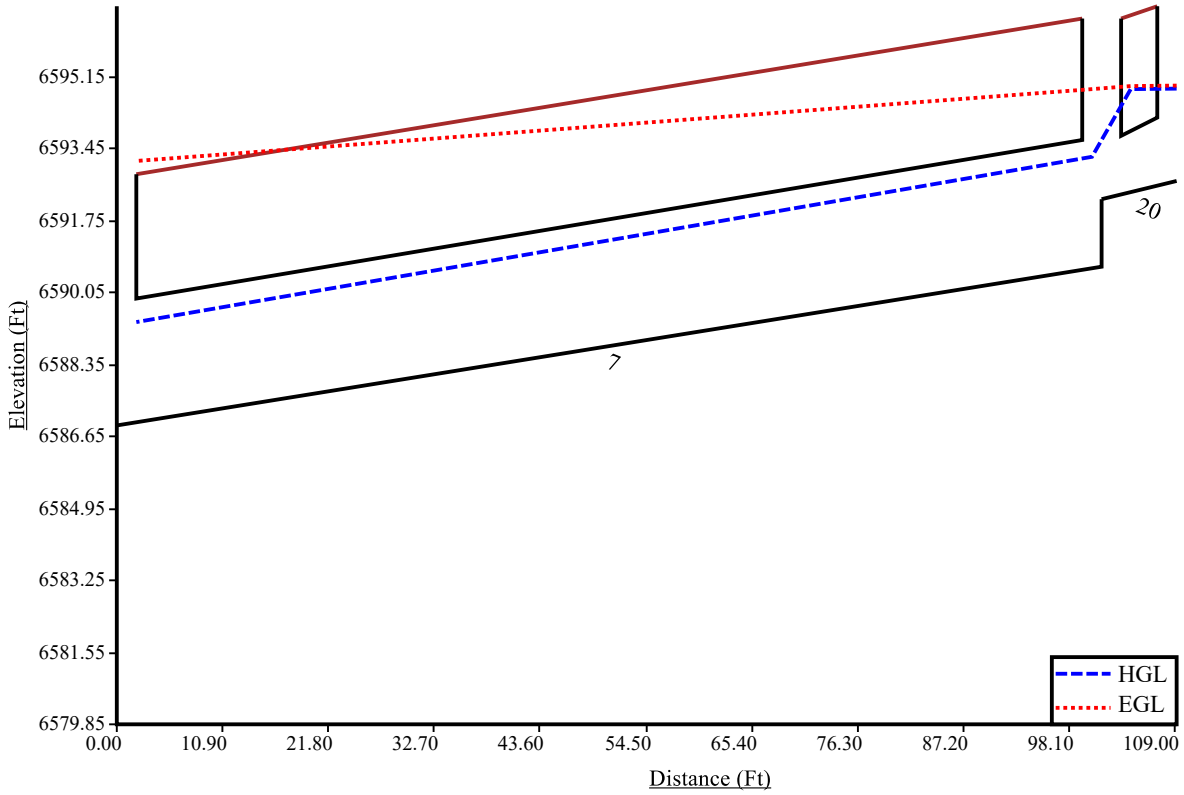
19
HGL
EGL

6-20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Elevation (Ft)
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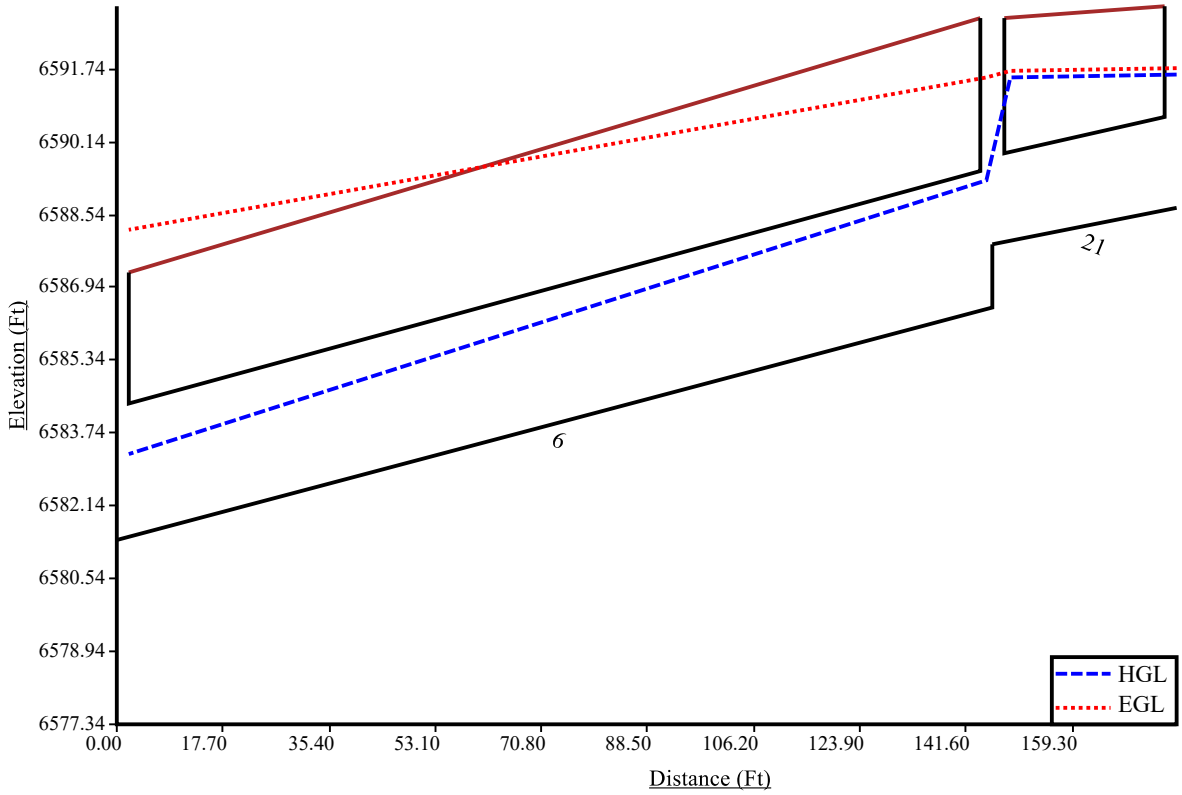
10.90
21.80
32.70
43.60
54.50
65.40
76.30
87.20
98.10
109.00
Distance (Ft)
HGL
EGL
7
20

5-21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Elevation (Ft)
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35.40
53.10
70.80
88.50
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123.90
141.60
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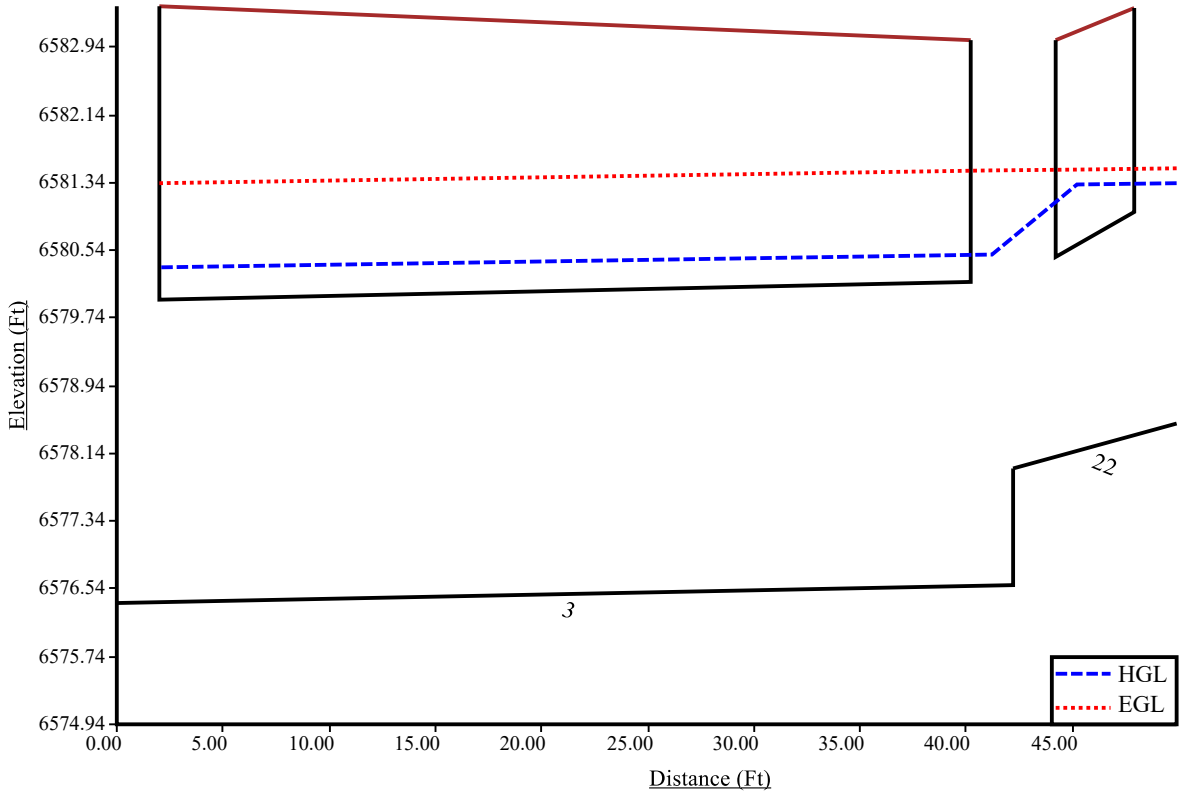
Distance (Ft)
HGL
EGL
6
21
5B

2-22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Elevation (Ft)
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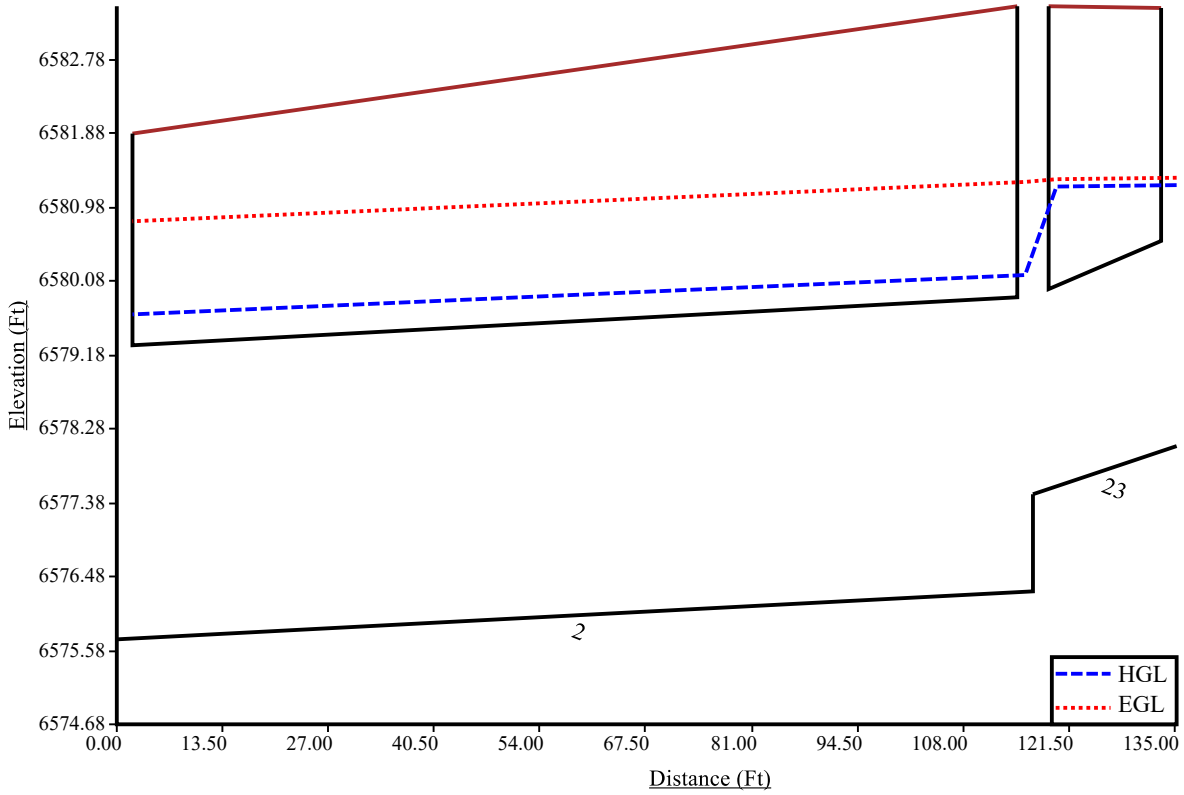
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Distance (Ft)
22
3
HGL
EGL

1-23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27.00
40.50
54.00
67.50
81.00
94.50
108.00
121.50
135.00
Distance (Ft)
HGL
EGL
2
23

1

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 3/8/2022 10:43:32 AM	# UDSewer Results Summary **Project Title:** New UDSEWER System Module **Project Description:** Default system

---

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 1.50
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6579.60

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6578.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	6585.00	8.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2	6592.62	8.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6592.55	7.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	1.19	6.92	0.15	8.20	Surface Water Present (Upstream)
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.20	Surface Water Present (Downstream)
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.20	
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
1	22.76	6578.00	9.8	6580.24	0.014	0.03	0.00	CIRCULAR	24.00 in	24.00 in
2	48.50	6580.24	9.8	6585.00	0.014	0.38	0.00	CIRCULAR	24.00 in	24.00 in
3	38.26	6587.79	0.8	6588.10	0.014	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
1	66.08	21.03	12.24	5.09	5.71	14.32	4.35	Supercritical	8.20	0.00	
2	65.98	21.00	12.24	5.09	5.71	14.31	4.35	Supercritical	8.20	0.00	
3	18.84	6.00	11.43	4.88	10.29	5.60	1.22	Supercritical	7.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

	(cfs)									
1	8.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
2	8.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
3	7.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6579.60

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
1	6578.00	6580.24	0.00	0.00	6579.60	6581.26	6581.66	0.00	6581.66
2	6580.24	6585.00	0.04	0.00	6581.30	6586.02	6583.90	2.53	6586.42
3	6587.79	6588.10	0.00	0.00	6588.65	6589.05	6589.14	0.28	6589.42

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

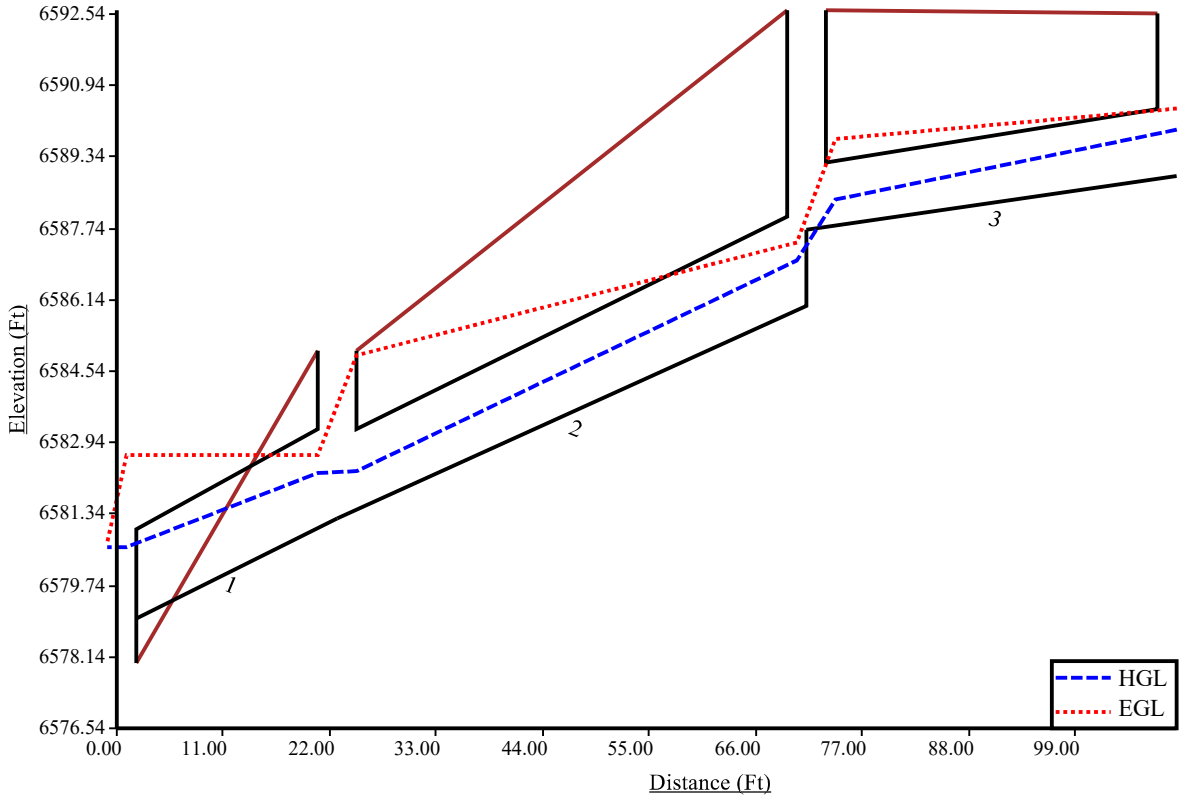
					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
1	22.76	3.00	4.00	5.50	0.00	0.58	0.00	8.52	5.34	2.51	14.70	Sewer Too Shallow
2	48.50	3.00	4.00	5.50	8.52	5.34	2.51	14.24	8.20	5.37	86.12	
3	38.26	3.00	4.00	5.50	8.65	5.41	2.58	7.90	5.03	2.20	43.47	

Total earth volume for sewer trenches = 144 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

1-3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6576.54
Elevation (Ft)
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11.00
22.00
33.00
44.00
55.00
66.00
77.00
88.00
99.00
Distance (Ft)
1
2
3
HGL
EGL

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 3/8/2022 10:28:07 AM	# UDSewer Results Summary **Project Title:** New UDSEWER System Module **Project Description:** Default system

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System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6580.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6578.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	6585.00	18.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2	6592.62	18.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6592.55	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	1.56	11.70	0.07	18.30	Surface Water Present (Upstream)
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.30	Surface Water Present (Downstream)
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.30	
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
1	22.76	6578.00	9.8	6580.24	0.014	0.03	0.00	CIRCULAR	24.00 in	24.00 in
2	48.50	6580.24	9.8	6585.00	0.014	0.38	0.00	CIRCULAR	24.00 in	24.00 in
3	38.26	6587.79	0.8	6588.10	0.014	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
1	66.08	21.03	18.48	7.05	8.63	17.99	4.35	Supercritical Jump	18.30	0.00	
2	65.98	21.00	18.48	7.05	8.64	17.97	4.35	Supercritical	18.30	0.00	
3	18.84	6.00	17.30	6.60	16.99	6.73	1.04	Supercritical	16.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element	Peak	Cross	Rise	Span	Rise	Span	Rise	Span	Area	Comment

Name	Flow (cfs)	Section							(ft^2)	
1	18.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
2	18.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
3	16.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6580.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
1	6578.00	6580.24	0.00	0.00	6580.00	6581.78	6580.53	2.02	6582.55
2	6580.24	6585.00	0.20	0.00	6581.98	6586.54	6585.97	1.34	6587.31
3	6587.79	6588.10	0.02	0.00	6589.21	6589.54	6589.91	0.31	6590.22

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

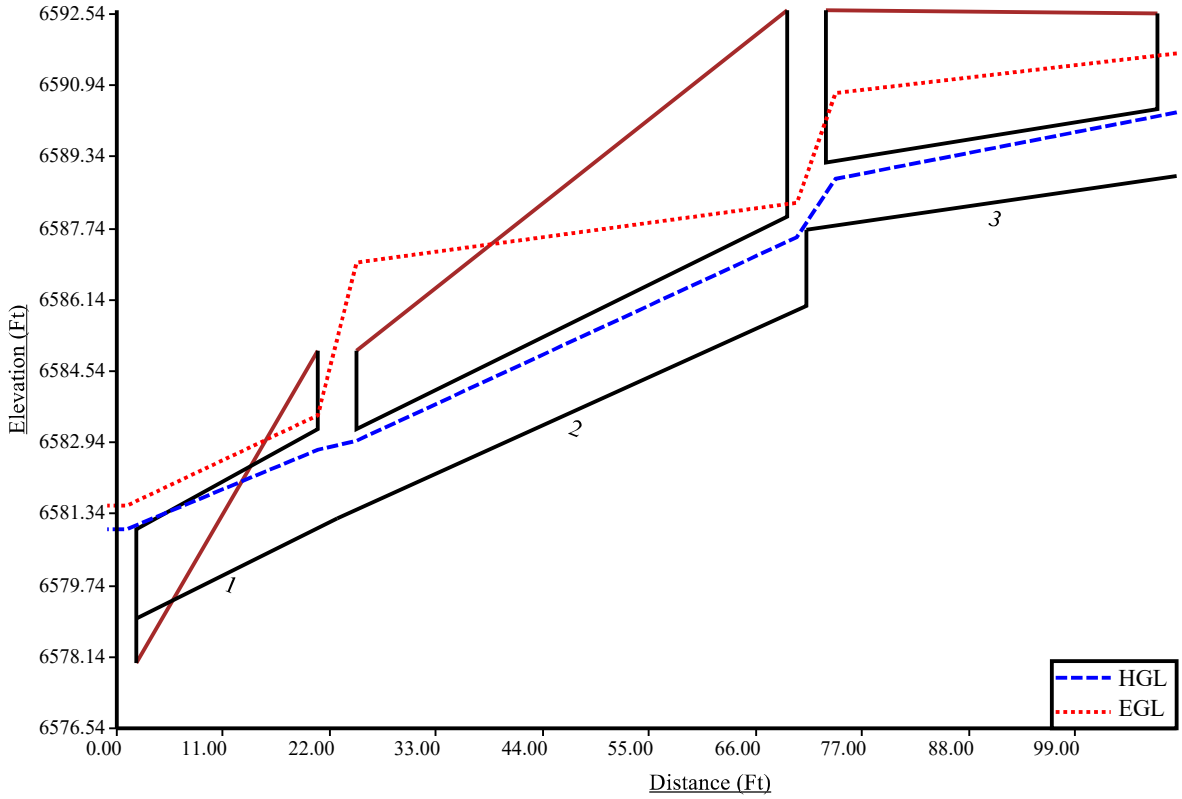
					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
1	22.76	3.00	4.00	5.50	0.00	0.58	0.00	8.52	5.34	2.51	14.70	Sewer Too Shallow
2	48.50	3.00	4.00	5.50	8.52	5.34	2.51	14.24	8.20	5.37	86.12	
3	38.26	3.00	4.00	5.50	8.65	5.41	2.58	7.90	5.03	2.20	43.47	

Total earth volume for sewer trenches = 144 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:

- Four inches for pipes less than 33 inches.
- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

1-3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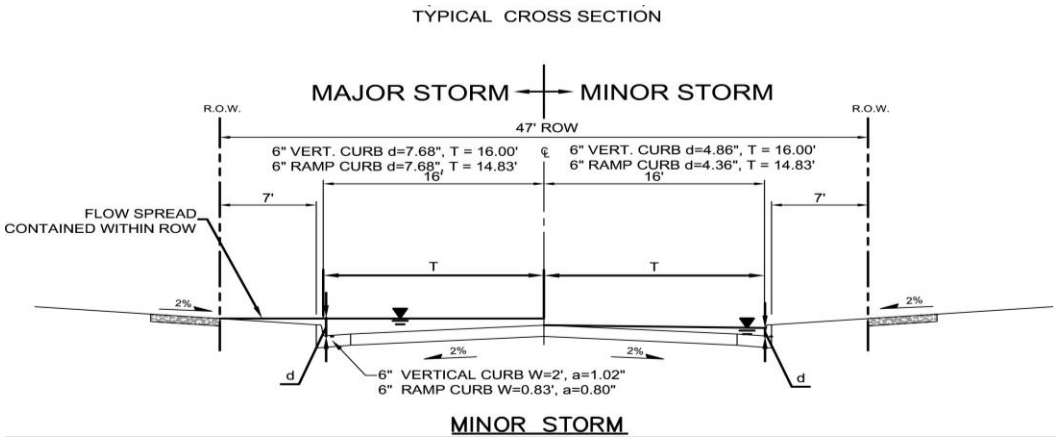
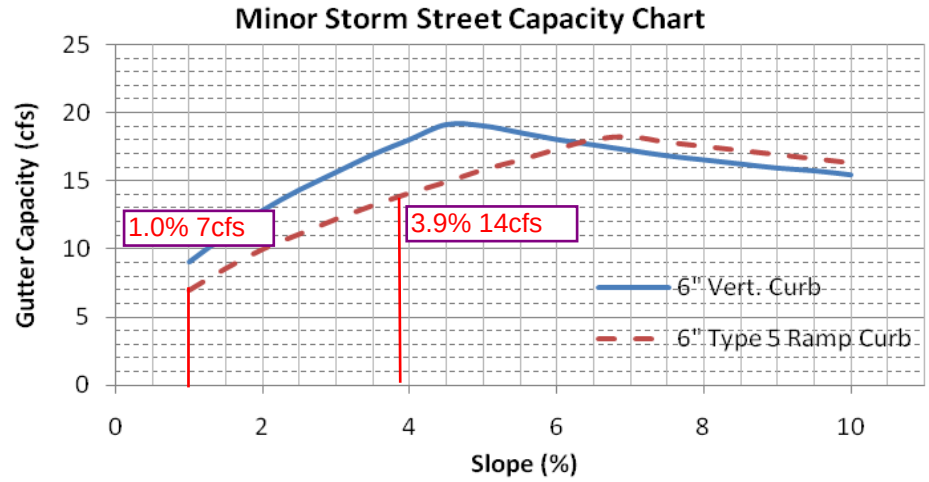
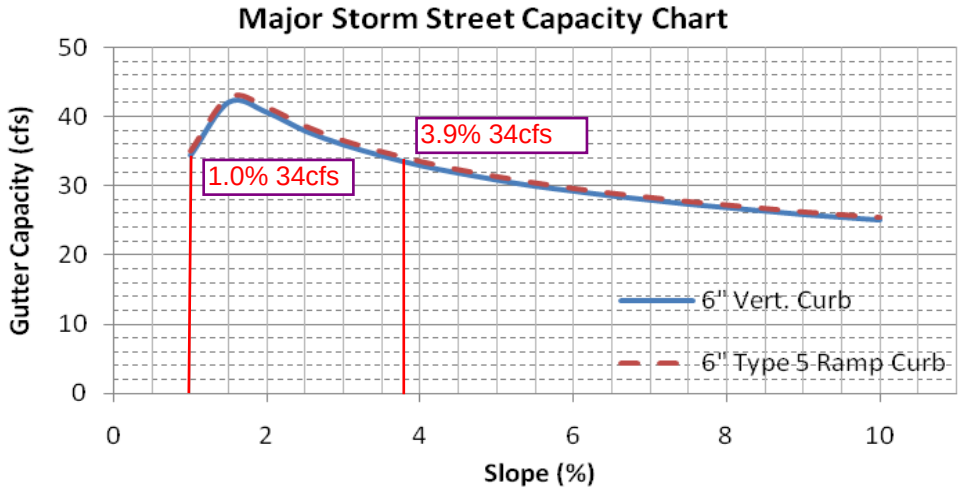
6590.94
6589.34
6587.74
6586.14
6584.54
6582.94
6581.34
6579.74
6578.14
6576.54
Elevation (Ft)
0.00
11.00
22.00
33.00
44.00
55.00
66.00
77.00
88.00
99.00
Distance (Ft)
1
2
3
HGL
EGL

Figure 7-8. Street Capacity Charts Minor Residential (Detached Sidewalk)

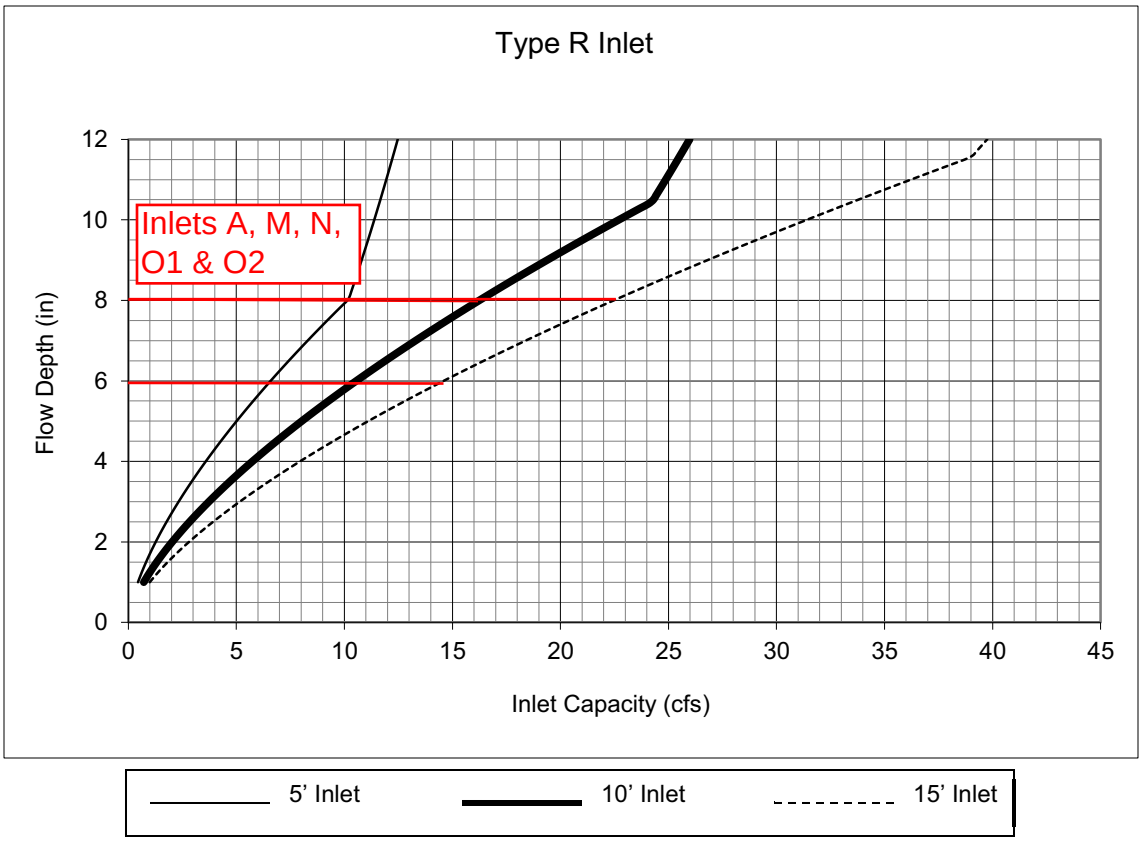






These charts shall only be used for the standard street sections as shown. The capacity shown is based on ½ the street section as calculated by the UD-Inlet spreadsheets. Minor storm capacities are based on no crown overtopping, curb height or maximum allowable spread widths. Major storm capacities are based on flow being containing within the public right-of-way, including conveyance capacity behind the curb. The UDFCD Safety Reduction Factor was applied. An 'n_{STREET}' of 0.016 and 'n_{BACK}' of 0.020 was used. Calculations were done using UD-Inlet 3.00.xls, March, 2011.

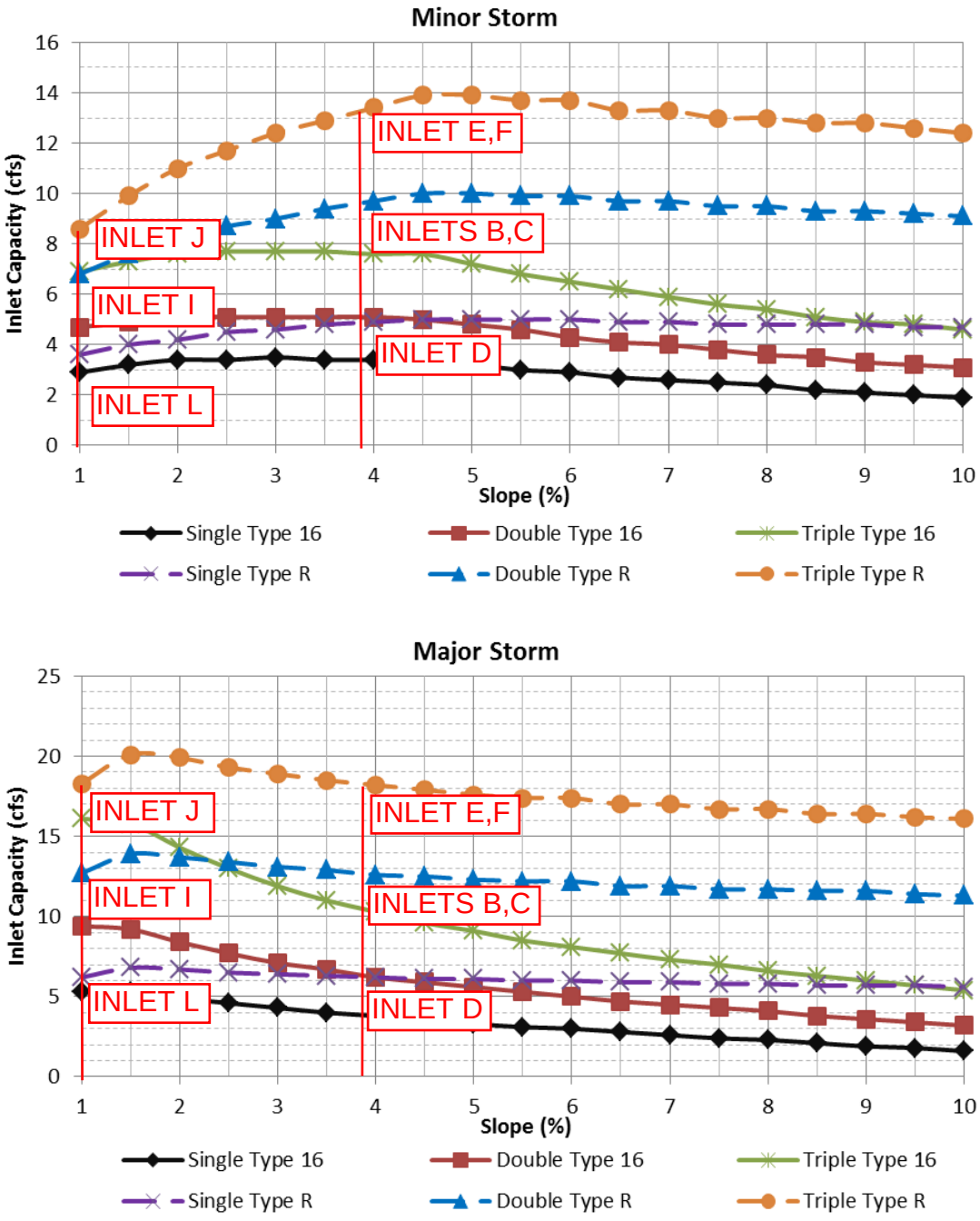
Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



Notes:
1. The standard inlet parameters must apply to use this chart.

Figure 8-8. Inlet Capacity Chart Continuous Grade Conditions, Minor Residential (Local)
(Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 32'
Type of Curb and Gutter = 6" vertical



The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Windermere Inlet Summary

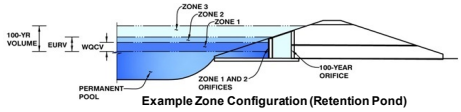
Location	Inlet #	Basin/DP	Q5 (cfs)	Q100 (cfs)	Street grade %	Pro. Inlet Type	Q5 capture (cfs)	Q5 bypass (cfs)	Q5 % capture	Q100 capture (cfs)	Q100 bypass (cfs)	Q100 % capture	Downstream
DP8		Basin D15	4.5	8.6									
		Basin A1	3.2	7.1									
	A	Total	7.7	15.7	sump	10' Type R (S)	10.5	*0.0*	100%	16.0	*0.0*	100%	Sump ok
				.									
DPB	**B**	Basin A2	8.8	19.4	3.8%	10' Type R (AG)	9.5	*0.0*	100%	13.0	*6.4*	67%	Bypass to E
DPC	**C**	Basin A3	5.2	11.2	3.8%	10' Type R (AG)	9.5	*0.0*	100%	13.0	*0.0*	116%	Bypass to D
DPD		Basin A4	1.7	3.8									
		Inlet C Bypass	0.0	0.0									
	D	Total	1.7	3.8	3.9%	5' Type R (AG)	3.3	*0.0*	100%	6.2	*0.0*	100%	No Bypass
DPE		Basin A5	4.3	9.5									
		Inlet B Bypass	0.0	6.4									
	E	Total	4.3	15.9	3.9%	15' Type R (AG)	13.3	*0.0*	100%	18.0	*0.0*	100%	No Bypass
DPF		Basin A6	7.0	15.4									
		Inlet C Bypass	0.0	0.0									
	F	Total	7.0	15.4	3.9%	15' Type R (AG)	13.3	*0.0*	100%	18.0	*0.0*	100%	No Bypass
DPH	**J**	Basin A8	6.1	13.4	0.8%	10' Type R (AG)	7.0	*0.0*	100%	12.5	*0.9*	100%	Bypass to I
DPG	**L**	Basin A7	3.0	6.6	0.8%	5' Type R (AG)	3.8	*0.0*	100%	6.0	*0.6*	91%	Bypass to N
DPI		Basin A9	4.0	8.7									
		Inlet J Bypass	0.0	0.9									
	I	Total	4.0	9.7	1.0%	10' Type R (AG)	7.0	*0.0*	100%	12.5	*0.0*	100%	No Bypass
DPL		Basin A10	7.5	16.5									
	M	Total	7.5	16.5	Sump	15' Type R (S)	14.5	*0.0*	100%	22.5	*0.0*	100%	Sump ok
Basin A11		Basin A11	5.3	11.8									
		Inlet L Bypass	0.0	0.6									
	N	Total	5.3	12.3	Sump	10' Type R (S)	10.5	*0.0*	100%	16.0	*0.0*	100%	Sump ok
		Basin B1	7.2	16.0									
	O1	Total	7.2	16.0	3.9%	10' Type R (S)	16.0	*0.0*	100%	16.0	*0.0*	100%	No Bypass
		Basin B2	1.0	2.3									
	O2	Total	1.0	2.3	3.9%	5' Type R (S)	6.3	*0.0*	100%	6.3	*0.0*	100%	No Bypass

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Windermere Filing No. 1**

Basin ID: **North Pond**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	133.15	acres
Watershed Length =	4,000	ft
Watershed Length to Centroid =	600	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	40.70%	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
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	2.016	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	5.899	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.477	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.022	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.245	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.501	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	11.710	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	14.604	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	24.649	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	3.759	acre-feet		
Approximate 5-yr Detention Volume =	4.975	acre-feet		
Approximate 10-yr Detention Volume =	6.130	acre-feet		
Approximate 25-yr Detention Volume =	7.597	acre-feet		
Approximate 50-yr Detention Volume =	8.584	acre-feet		
Approximate 100-yr Detention Volume =	9.941	acre-feet		

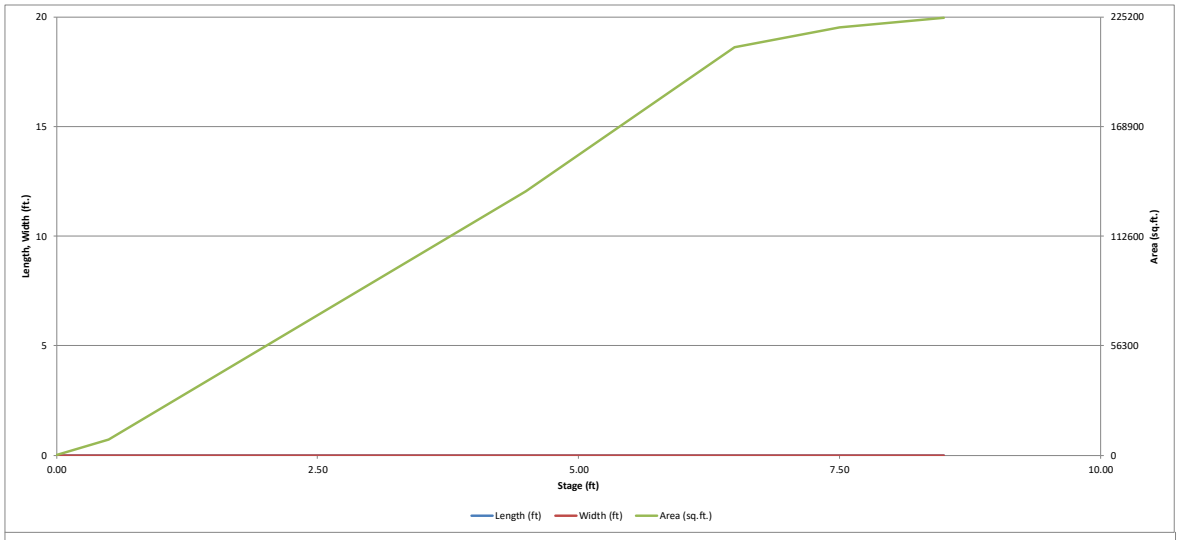
Define Zones and Basin Geometry

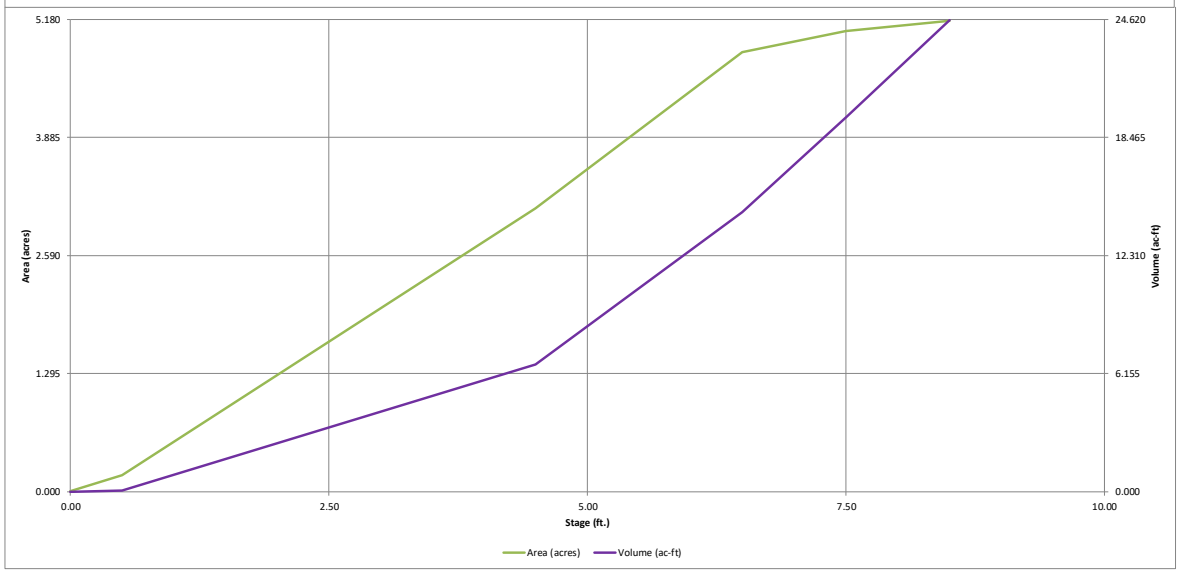
Zone 1 Volume (WQCV) =	2.016	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.883	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.043	acre-feet
Total Detention Basin Volume =	9.941	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	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_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	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_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	250	0.006		
6572	--	0.50	--	--	--	7,926	0.182	2,044	0.047
6576	--	4.50	--	--	--	135,531	3.111	288,957	6.634
6578	--	6.50	--	--	--	209,825	4.817	634,313	14.562
6579	--	7.50	--	--	--	220,020	5.051	849,236	19.496
6580	--	8.50	--	--	--	225,118	5.168	1,071,805	24.605


20
15
10
5
0
225200
168900
112600
56300
0
Length, Width (ft.)
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

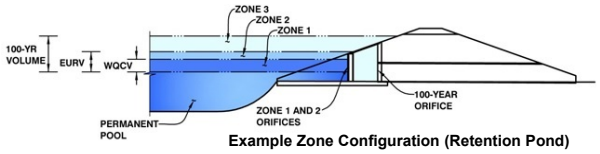

5.180
3.885
2.590
1.295
0.000
24.620
18.465
12.310
6.155
0.000
Area (acres)
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Windermere Filing No. 1

Basin ID: North Pond



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.59	2.016	Orifice Plate
Zone 2 (EURV)	4.26	3.883	Orifice Plate
Zone 3 (100-year)	5.45	4.043	Weir&Pipe (Circular)
Total (all zones)		9.941	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	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)

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.26	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	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	1.42	2.83					
Orifice Area (sq. inches)	11.00	11.00	11.00					

	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		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.30	N/A	feet
Overflow Weir Front Edge Length =	6.75	N/A	feet	Overflow Weir Slope Length =	6.75	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.49	N/A	
Horiz. Length of Weir Sides =	6.75	N/A	feet	Overflow Grate Open Area w/o Debris =	31.71	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	15.86	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Circular	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	7.07	N/A	ft^2
Circular Orifice Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	1.50	N/A	feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.92	feet
Spillway Crest Length =	70.00	feet	Stage at Top of Freeboard =	7.92	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	5.10	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	21.63	acre-ft

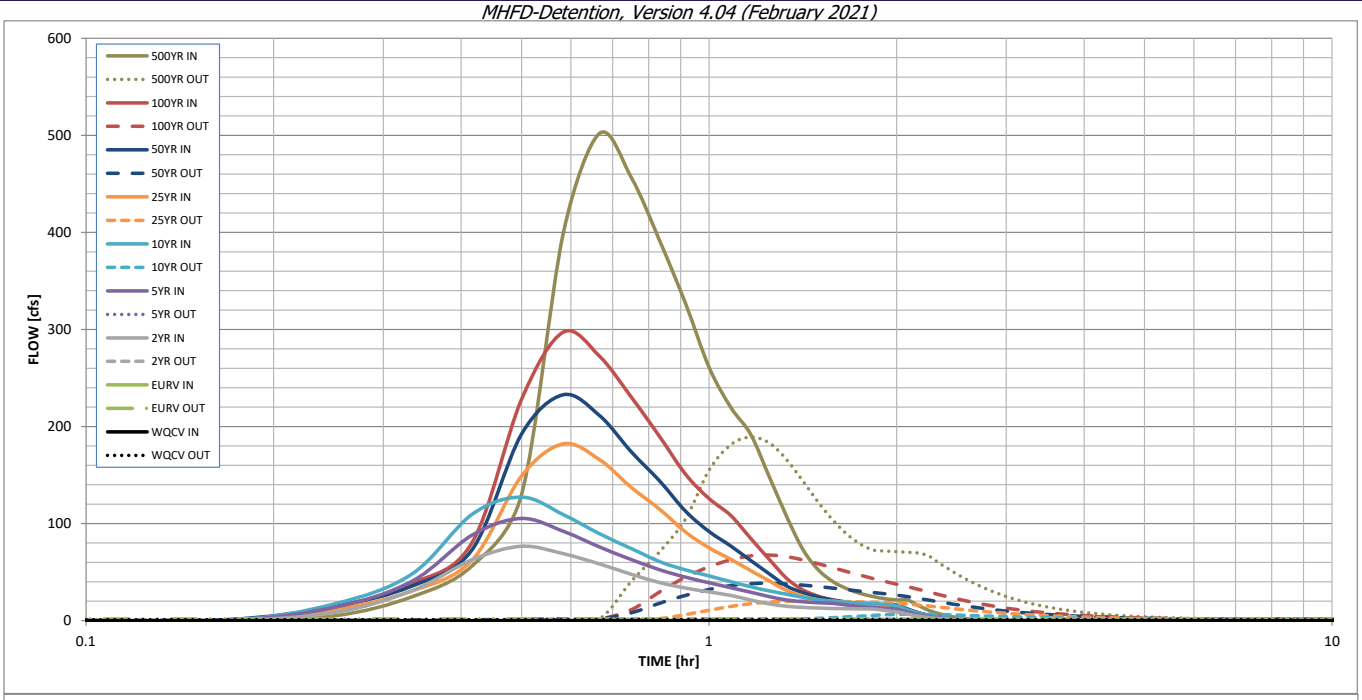
Routed Hydrograph Results

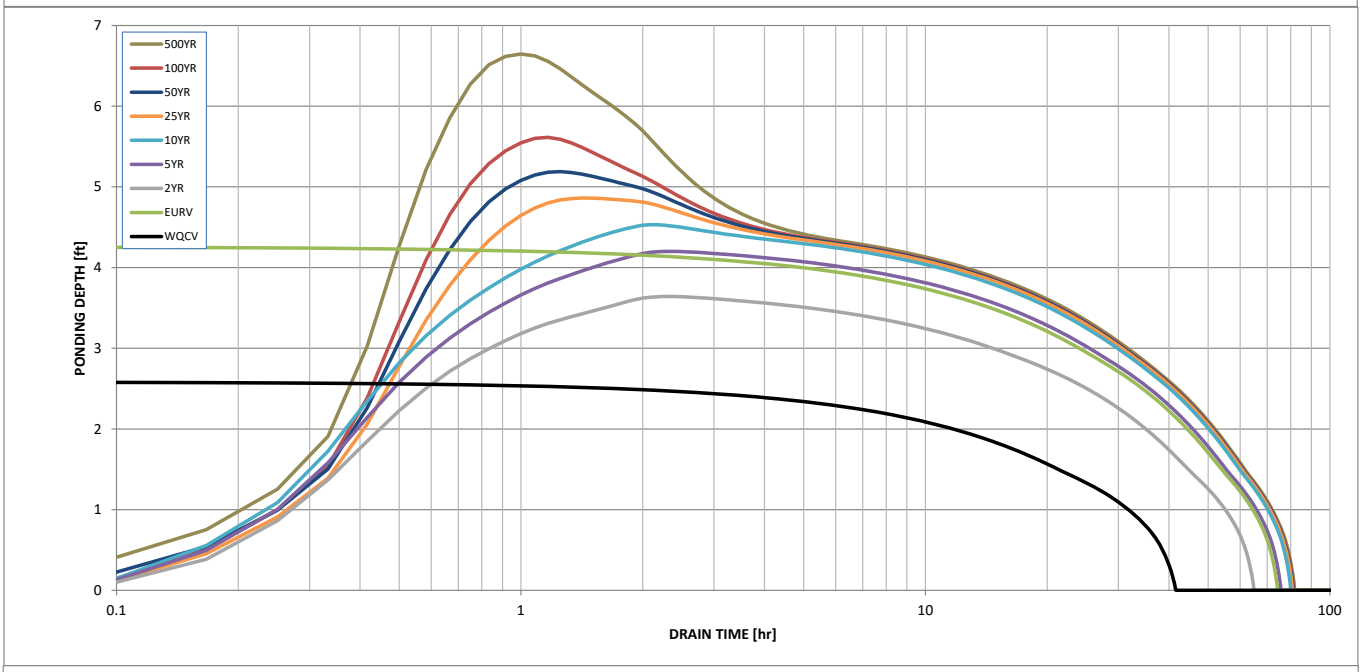
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

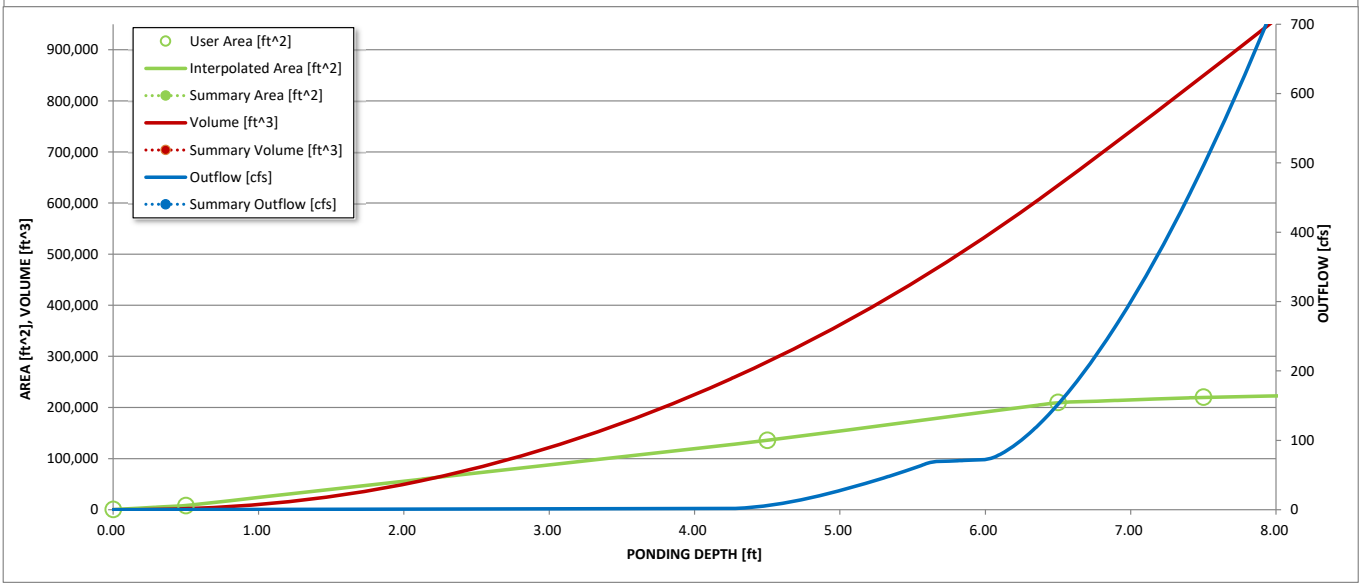
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	2.016	5.899	4.477	6.022	7.245	9.501	11.710	14.604	24.649
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.477	6.022	7.245	9.501	11.710	14.604	24.649
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.4	2.7	3.8	35.3	69.5	113.7	257.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.26	0.52	0.85	1.93
Peak Inflow Q (cfs) =	N/A	N/A	76.6	105.2	127.2	182.0	232.6	297.1	501.8
Peak Outflow Q (cfs) =	1.0	1.8	1.6	1.8	6.7	20.3	38.5	67.6	189.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	1.8	0.6	0.6	0.6	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	0.6	1.2	2.06	2.4
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) =	38	66	59	68	71	69	68	65	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	71	62	72	76	76	75	75	72
Maximum Ponding Depth (ft) =	2.59	4.26	3.64	4.20	4.53	4.86	5.19	5.61	6.64
Area at Maximum Ponding Depth (acres) =	1.71	2.94	2.48	2.88	3.13	3.42	3.69	4.06	4.85
Maximum Volume Stored (acre-ft) =	2.027	5.908	4.229	5.704	6.696	7.809	8.946	10.613	15.238

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.10	4.89
	0:15:00	0.00	0.00	8.43	13.70	17.10	11.56	14.58	14.23	24.49
	0:20:00	0.00	0.00	30.74	40.52	47.99	30.48	35.64	38.25	56.56
	0:25:00	0.00	0.00	62.81	88.22	109.59	62.45	73.18	80.56	129.60
	0:30:00	0.00	0.00	76.61	105.23	127.22	148.81	191.98	227.72	398.73
	0:35:00	0.00	0.00	68.99	92.04	109.28	182.05	232.65	297.12	501.84
	0:40:00	0.00	0.00	58.41	75.95	89.55	166.00	211.44	272.59	456.80
	0:45:00	0.00	0.00	47.77	62.86	74.24	137.32	173.97	230.44	391.32
	0:50:00	0.00	0.00	39.18	52.44	60.72	114.76	143.79	189.60	326.66
	0:55:00	0.00	0.00	33.53	44.79	52.23	91.23	112.69	150.74	260.96
	1:00:00	0.00	0.00	29.56	39.09	46.05	74.92	91.80	125.68	219.78
	1:05:00	0.00	0.00	25.94	33.94	40.17	63.18	76.88	108.39	191.86
	1:10:00	0.00	0.00	21.24	29.29	34.83	51.49	61.91	84.72	147.77
	1:15:00	0.00	0.00	17.22	24.62	30.56	40.82	48.10	62.86	106.86
	1:20:00	0.00	0.00	14.80	21.26	27.21	31.00	35.52	43.30	72.52
	1:25:00	0.00	0.00	13.58	19.46	23.99	25.21	28.68	31.52	51.94
	1:30:00	0.00	0.00	12.90	18.42	21.62	21.22	23.98	25.08	39.92
	1:35:00	0.00	0.00	12.54	17.72	20.00	18.63	21.01	21.34	32.79
	1:40:00	0.00	0.00	12.28	16.02	18.87	16.87	18.99	18.84	27.95
	1:45:00	0.00	0.00	12.09	14.51	18.09	15.82	17.80	17.20	24.78
	1:50:00	0.00	0.00	11.95	13.46	17.55	15.05	16.92	16.03	22.54
	1:55:00	0.00	0.00	10.47	12.69	16.71	14.56	16.35	15.35	21.32
	2:00:00	0.00	0.00	9.08	11.79	15.16	14.25	16.01	15.14	20.99
	2:05:00	0.00	0.00	6.73	8.81	11.16	10.69	11.98	11.35	15.67
	2:10:00	0.00	0.00	4.66	6.09	7.69	7.32	8.20	7.80	10.72
	2:15:00	0.00	0.00	3.21	4.20	5.32	5.06	5.65	5.40	7.39
	2:20:00	0.00	0.00	2.20	2.82	3.61	3.43	3.82	3.65	4.97
	2:25:00	0.00	0.00	1.43	1.84	2.38	2.25	2.50	2.38	3.23
	2:30:00	0.00	0.00	0.91	1.22	1.56	1.51	1.67	1.58	2.13
	2:35:00	0.00	0.00	0.52	0.75	0.92	0.92	1.00	0.94	1.25
	2:40:00	0.00	0.00	0.24	0.40	0.46	0.47	0.50	0.47	0.61
	2:45:00	0.00	0.00	0.09	0.16	0.16	0.17	0.17	0.15	0.19
	2:50:00	0.00	0.00	0.02	0.03	0.02	0.01	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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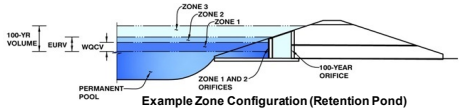
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Windermere Filing No. 1

Basin ID: South Pond - Interim Condition



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	10.89	acres
Watershed Length =	700	ft
Watershed Length to Centroid =	400	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	23.80%	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
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.118	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.243	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.156	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.221	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.279	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.448	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.608	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.825	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	1.590	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	0.151	acre-feet		
Approximate 5-yr Detention Volume =	0.203	acre-feet		
Approximate 10-yr Detention Volume =	0.256	acre-feet		
Approximate 25-yr Detention Volume =	0.328	acre-feet		
Approximate 50-yr Detention Volume =	0.388	acre-feet		
Approximate 100-yr Detention Volume =	0.496	acre-feet		

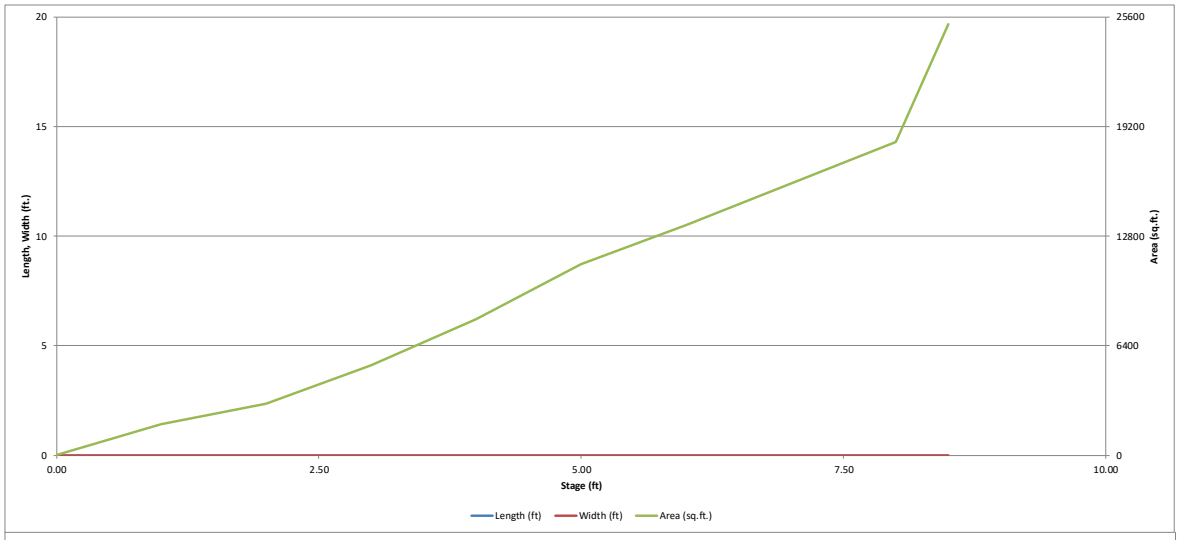
Define Zones and Basin Geometry

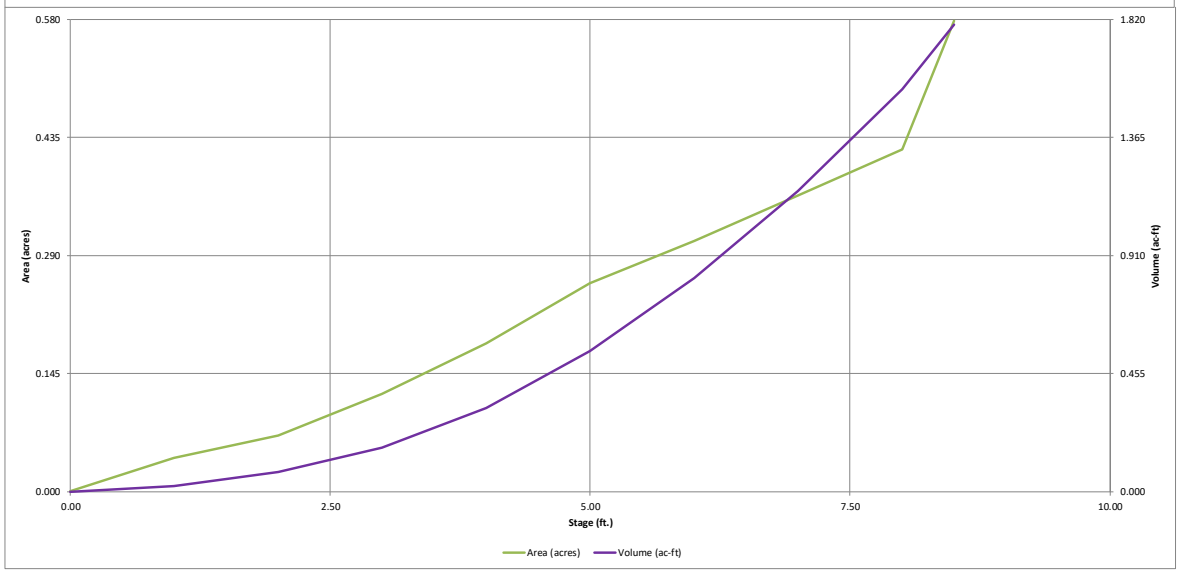
Zone 1 Volume (WQCV) =	0.118	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.124	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.253	acre-feet
Total Detention Basin Volume =	0.496	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	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_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	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_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6574	--	1.00	--	--	--	1,801	0.041	920	0.021
6575	--	2.00	--	--	--	3,008	0.069	3,325	0.076
6576	--	3.00	--	--	--	5,232	0.120	7,445	0.171
6577	--	4.00	--	--	--	7,923	0.182	14,022	0.322
6578	--	5.00	--	--	--	11,161	0.256	23,564	0.541
6579	--	6.00	--	--	--	13,425	0.308	35,857	0.823
6580	--	7.00	--	--	--	15,853	0.364	50,496	1.159
6581	--	8.00	--	--	--	18,293	0.420	67,569	1.551
6581.5	--	8.50	--	--	--	25,208	0.579	78,445	1.801


20
15
10
5
0
25600
19200
12800
6400
0
Length, Width (ft.)
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

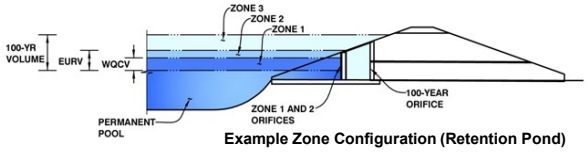

0.580
0.435
0.290
0.145
0.000
1.820
1.365
0.910
0.455
0.000
Area (acres)
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere Filing No. 1**

Basin ID: **South Pond - Interim Condition**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.52	0.118	Orifice Plate
Zone 2 (EURV)	3.53	0.124	Orifice Plate
Zone 3 (100-year)	4.82	0.253	Weir&Pipe (Restrict)
Total (all zones)		0.496	

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

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

Calculated Parameters for Underdrain

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)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.53	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	25.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.18	2.35					
Orifice Area (sq. inches)	0.67	0.67	0.67					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Front Edge Length =	3.92	N/A	feet	Overflow Weir Slope Length =	3.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	16.92	N/A	
Horiz. Length of Weir Sides =	3.92	N/A	feet	Overflow Grate Open Area w/o Debris =	10.76	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.38	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.64	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.34	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.35	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.94	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.55	feet
Spillway Crest Length =	27.00	feet	Stage at Top of Freeboard =	8.49	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.58	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.80	acre-ft

Calculated Parameters for Spillway

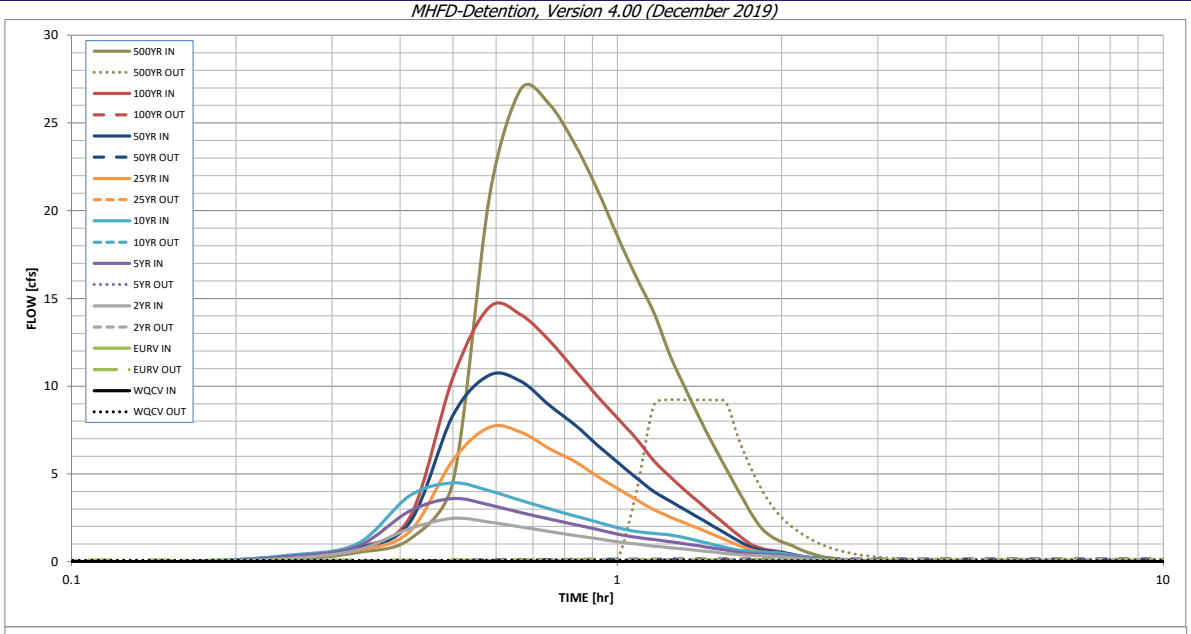
Routed Hydrograph Results

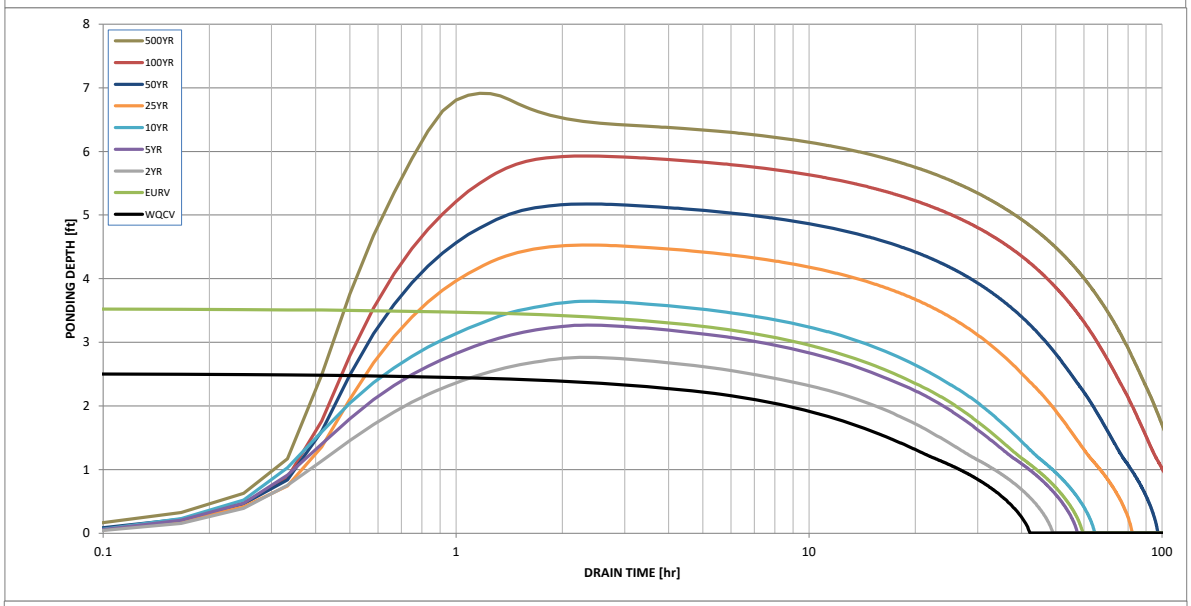
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

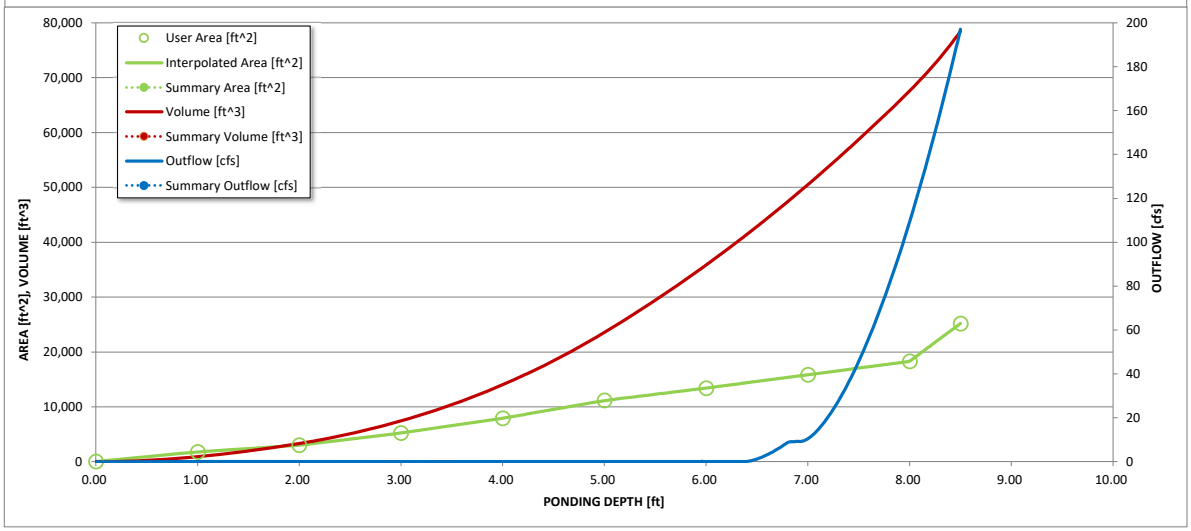
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.118	0.243	0.156	0.221	0.279	0.448	0.608	0.825	1.590
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.156	0.221	0.279	0.448	0.608	0.825	1.590
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.9	5.6	9.1	20.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.27	0.52	0.84	1.89
Peak Inflow Q (cfs) =	N/A	N/A	2.5	3.6	4.5	7.7	10.6	14.5	27.0
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.3	0.0	0.0	0.0	0.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8
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) =	38	53	44	51	57	71	83	99	103
Time to Drain 99% of Inflow Volume (hours) =	**40**	57	47	55	61	77	91	108	116
Maximum Ponding Depth (ft) =	2.51	3.53	2.76	3.27	3.64	4.53	5.17	5.93	6.91
Area at Maximum Ponding Depth (acres) =	0.10	0.15	0.11	0.14	0.16	0.22	0.27	0.30	0.36
Maximum Volume Stored (acre-ft) =	0.118	0.243	0.144	0.204	0.260	0.427	0.585	0.799	1.127

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.10
	0:15:00	0.00	0.00	0.18	0.30	0.37	0.25	0.31	0.30	0.52
	0:20:00	0.00	0.00	0.66	0.86	1.01	0.64	0.75	0.80	1.28
	0:25:00	0.00	0.00	1.87	2.88	3.75	1.72	2.23	2.52	4.55
	0:30:00	0.00	0.00	2.47	3.59	4.48	5.79	8.34	10.48	20.89
	0:35:00	0.00	0.00	2.25	3.22	4.03	7.67	10.63	14.52	26.95
	0:40:00	0.00	0.00	1.98	2.79	3.48	7.36	10.26	14.06	26.08
	0:45:00	0.00	0.00	1.71	2.42	3.01	6.45	8.92	12.61	23.86
	0:50:00	0.00	0.00	1.50	2.13	2.62	5.72	7.82	10.97	21.29
	0:55:00	0.00	0.00	1.31	1.84	2.26	4.89	6.68	9.47	18.56
	1:00:00	0.00	0.00	1.13	1.57	1.94	4.17	5.67	8.18	16.22
	1:05:00	0.00	0.00	1.00	1.38	1.72	3.54	4.78	7.01	14.18
	1:10:00	0.00	0.00	0.89	1.26	1.61	2.96	3.99	5.75	11.72
	1:15:00	0.00	0.00	0.79	1.14	1.52	2.54	3.44	4.83	9.85
	1:20:00	0.00	0.00	0.71	1.01	1.35	2.18	2.93	4.04	8.14
	1:25:00	0.00	0.00	0.62	0.89	1.16	1.86	2.47	3.34	6.64
	1:30:00	0.00	0.00	0.54	0.77	0.97	1.53	2.02	2.69	5.30
	1:35:00	0.00	0.00	0.46	0.65	0.81	1.23	1.59	2.08	4.03
	1:40:00	0.00	0.00	0.40	0.53	0.66	0.94	1.18	1.51	2.87
	1:45:00	0.00	0.00	0.36	0.45	0.59	0.69	0.84	1.03	1.94
	1:50:00	0.00	0.00	0.35	0.42	0.55	0.56	0.66	0.76	1.43
	1:55:00	0.00	0.00	0.31	0.39	0.52	0.49	0.58	0.63	1.13
	2:00:00	0.00	0.00	0.28	0.36	0.48	0.46	0.53	0.55	0.93
	2:05:00	0.00	0.00	0.22	0.29	0.38	0.36	0.41	0.42	0.68
	2:10:00	0.00	0.00	0.18	0.23	0.30	0.28	0.32	0.31	0.49
	2:15:00	0.00	0.00	0.14	0.18	0.23	0.21	0.24	0.23	0.34
	2:20:00	0.00	0.00	0.11	0.14	0.18	0.16	0.18	0.17	0.24
	2:25:00	0.00	0.00	0.08	0.11	0.14	0.13	0.14	0.13	0.18
	2:30:00	0.00	0.00	0.06	0.08	0.10	0.09	0.11	0.10	0.14
	2:35:00	0.00	0.00	0.05	0.06	0.08	0.07	0.08	0.07	0.10
	2:40:00	0.00	0.00	0.04	0.05	0.06	0.05	0.06	0.06	0.08
	2:45:00	0.00	0.00	0.03	0.03	0.04	0.04	0.04	0.04	0.06
	2:50:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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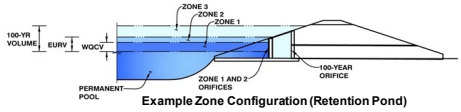
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere South - FINAL**

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	10.89	acres
Watershed Length =	700	ft
Watershed Length to Centroid =	400	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	68.00%	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
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

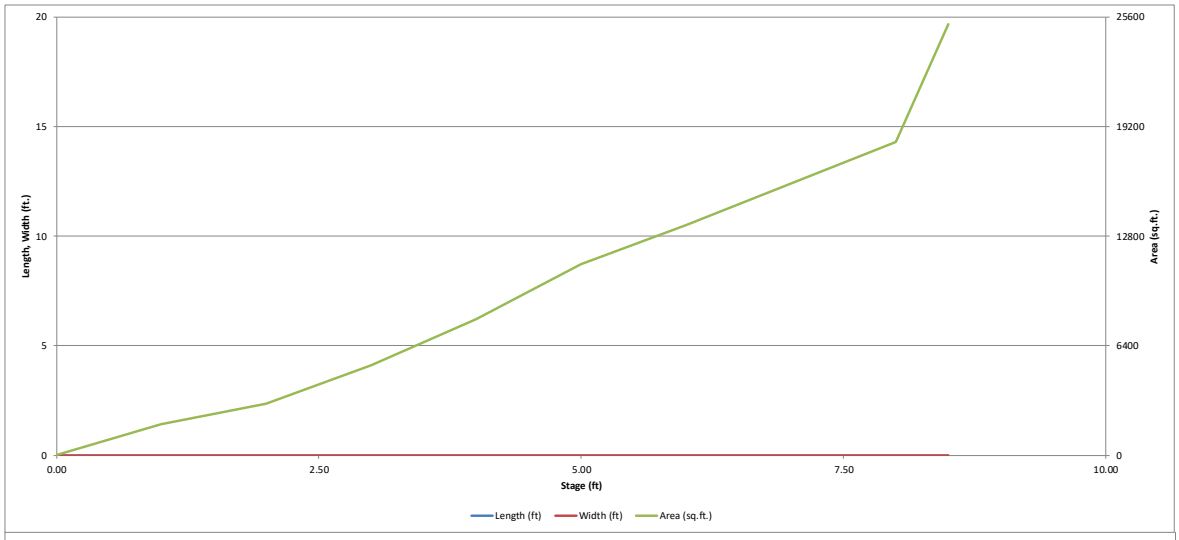
			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.242	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.931	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.641	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.838	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.996	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.198	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.395	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.633	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.49 in.) =	2.459	acre-feet	3.49 inches
Approximate 2-yr Detention Volume =	0.607	acre-feet	
Approximate 5-yr Detention Volume =	0.792	acre-feet	
Approximate 10-yr Detention Volume =	0.953	acre-feet	
Approximate 25-yr Detention Volume =	1.143	acre-feet	
Approximate 50-yr Detention Volume =	1.257	acre-feet	
Approximate 100-yr Detention Volume =	1.373	acre-feet	

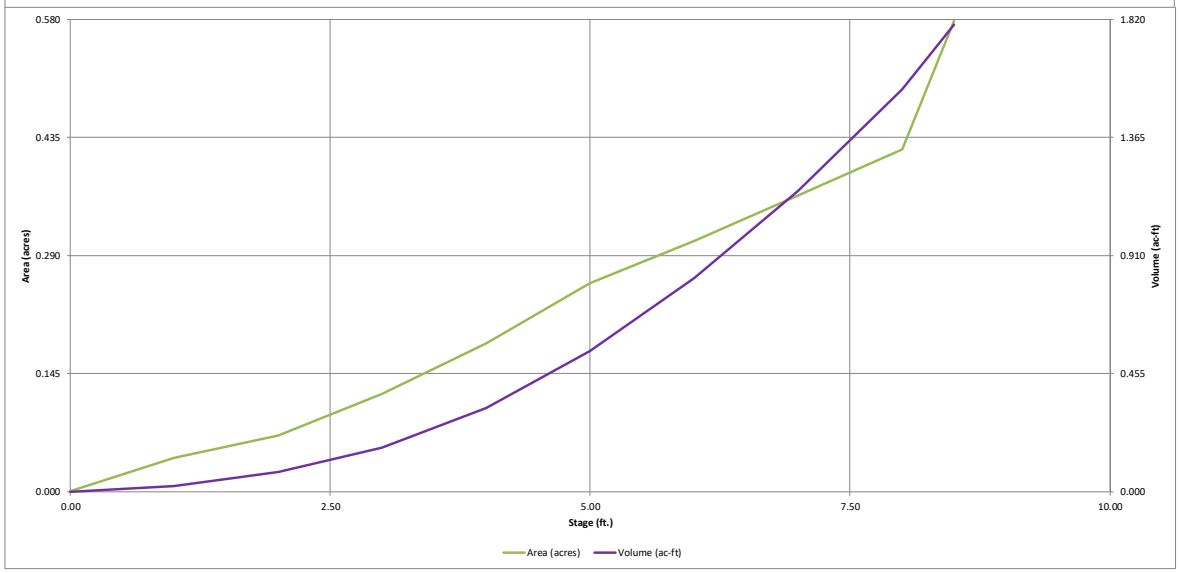
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.242	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.689	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.442	acre-feet
Total Detention Basin Volume =	1.373	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	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_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	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_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6574	--	1.00	--	--	--	1,801	0.041	920	0.021
6575	--	2.00	--	--	--	3,008	0.069	3,325	0.076
6576	--	3.00	--	--	--	5,232	0.120	7,445	0.171
6577	--	4.00	--	--	--	7,923	0.182	14,022	0.322
6578	--	5.00	--	--	--	11,161	0.256	23,564	0.541
6579	--	6.00	--	--	--	13,425	0.308	35,857	0.823
6580	--	7.00	--	--	--	15,853	0.364	50,496	1.159
6581	--	8.00	--	--	--	18,293	0.420	67,569	1.551
6581.5	--	8.50	--	--	--	25,208	0.579	78,445	1.801


20
15
10
5
0
25600
19200
12800
6400
0
Length, Width (ft.)
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

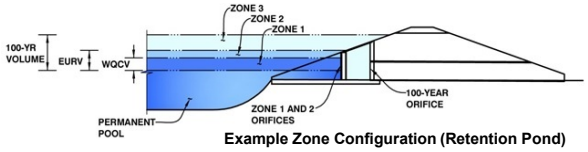

0.580
0.435
0.290
0.145
0.000
1.820
1.365
0.910
0.455
0.000
Area (acres)
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere South - FINAL**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.52	0.242	Orifice Plate
Zone 2 (EURV)	6.34	0.689	Orifice Plate
Zone 3 (100-year)	7.57	0.442	Weir&Pipe (Restrict)
Total (all zones)		1.373	

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

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

Calculated Parameters for Underdrain

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)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	6.34	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	25.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	2.11	4.23					
Orifice Area (sq. inches)	1.24	1.24	1.24					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Front Edge Length =	3.92	N/A	feet	Overflow Weir Slope Length =	3.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	16.92	N/A	
Horiz. Length of Weir Sides =	3.92	N/A	feet	Overflow Grate Open Area w/o Debris =	10.76	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.38	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.64	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.34	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.35	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.94	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.55	feet
Spillway Crest Length =	27.00	feet	Stage at Top of Freeboard =	8.49	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.58	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.80	acre-ft

Calculated Parameters for Spillway

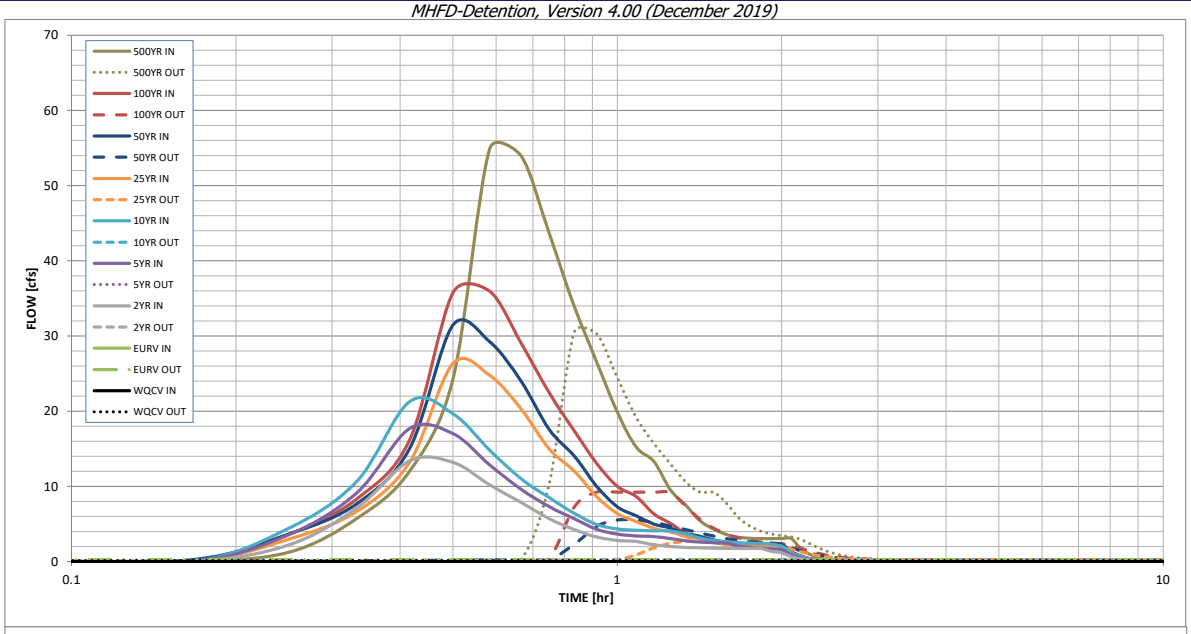
Routed Hydrograph Results

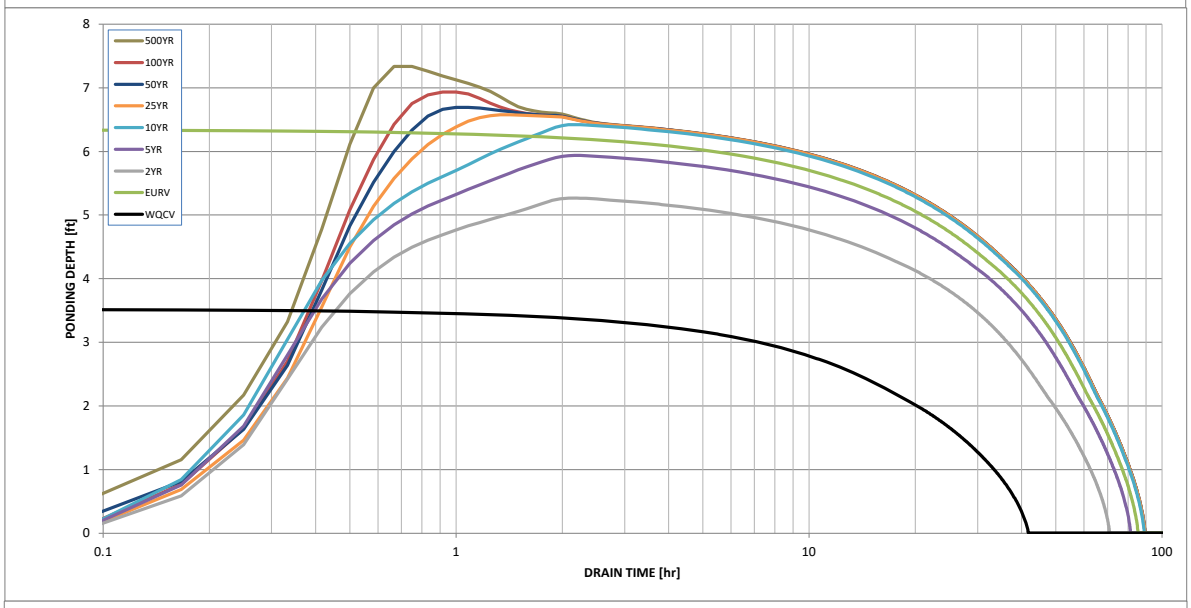
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

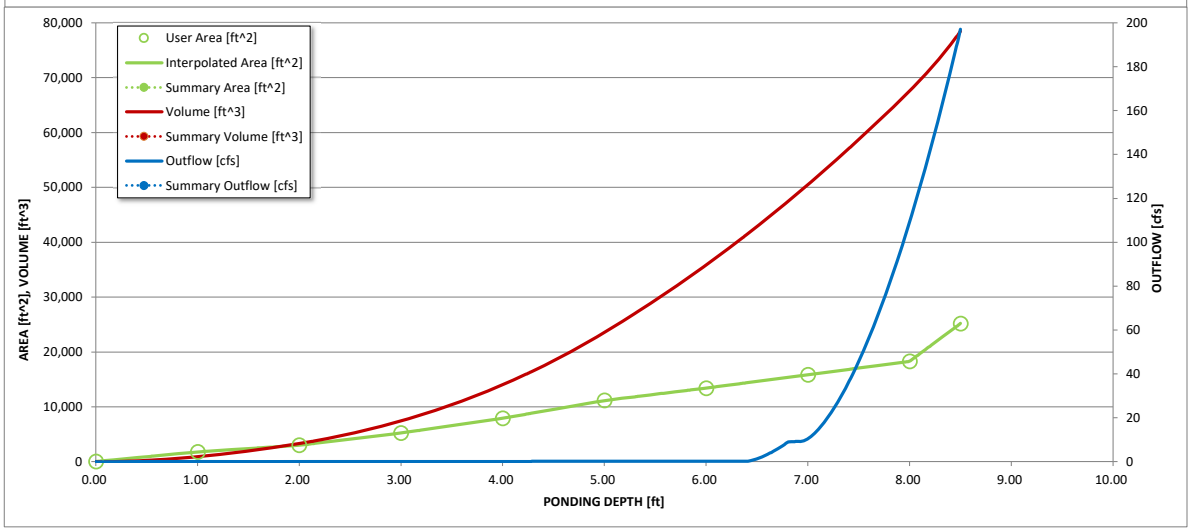
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.242	0.931	0.641	0.838	0.996	1.198	1.395	1.633	2.459
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.641	0.838	0.996	1.198	1.395	1.633	2.459
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.9	5.6	9.1	20.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.27	0.52	0.84	1.89
Peak Inflow Q (cfs) =	N/A	N/A	13.4	17.7	21.3	26.3	31.4	35.9	54.9
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.3	2.7	5.5	9.2	30.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.1	0.9	1.0	1.0	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.5	0.8	0.9
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) =	38	75	63	72	78	77	76	74	69
Time to Drain 99% of Inflow Volume (hours) =	**40**	81	68	77	84	84	83	83	80
Maximum Ponding Depth (ft) =	3.53	6.34	5.26	5.94	6.42	6.57	6.69	6.93	7.33
Area at Maximum Ponding Depth (acres) =	0.15	0.33	0.27	0.30	0.33	0.34	0.35	0.36	0.38
Maximum Volume Stored (acre-ft) =	0.243	0.931	0.609	0.802	0.954	1.008	1.046	1.134	1.282

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.02	1.24
	0:15:00	0.00	0.00	2.20	3.58	4.43	2.98	3.64	3.62	5.72
	0:20:00	0.00	0.00	7.15	9.15	10.68	6.68	7.69	8.35	12.02
	0:25:00	0.00	0.00	13.38	17.69	21.29	13.23	15.05	16.20	24.26
	0:30:00	0.00	0.00	13.20	16.99	19.67	26.35	31.45	35.75	54.89
	0:35:00	0.00	0.00	10.18	12.85	14.80	24.76	29.25	35.94	53.97
	0:40:00	0.00	0.00	7.86	9.61	11.02	20.31	24.00	29.05	43.65
	0:45:00	0.00	0.00	5.71	7.29	8.49	14.97	17.57	22.45	33.95
	0:50:00	0.00	0.00	4.27	5.70	6.40	12.02	14.05	17.39	26.56
	0:55:00	0.00	0.00	3.25	4.28	4.93	8.64	9.99	13.05	19.85
	1:00:00	0.00	0.00	2.81	3.64	4.33	6.38	7.27	9.99	15.21
	1:05:00	0.00	0.00	2.65	3.41	4.15	5.32	6.06	8.64	13.31
	1:10:00	0.00	0.00	2.23	3.33	4.09	4.41	4.99	6.33	9.55
	1:15:00	0.00	0.00	2.01	3.06	4.06	3.95	4.46	5.08	7.52
	1:20:00	0.00	0.00	1.88	2.76	3.68	3.31	3.73	3.74	5.42
	1:25:00	0.00	0.00	1.80	2.60	3.14	3.00	3.37	3.03	4.32
	1:30:00	0.00	0.00	1.76	2.50	2.81	2.55	2.87	2.57	3.60
	1:35:00	0.00	0.00	1.73	2.44	2.62	2.30	2.58	2.32	3.22
	1:40:00	0.00	0.00	1.73	2.08	2.51	2.16	2.42	2.24	3.10
	1:45:00	0.00	0.00	1.73	1.88	2.44	2.08	2.34	2.19	3.03
	1:50:00	0.00	0.00	1.73	1.76	2.41	2.05	2.30	2.19	3.03
	1:55:00	0.00	0.00	1.36	1.70	2.30	2.03	2.28	2.19	3.03
	2:00:00	0.00	0.00	1.15	1.57	2.02	2.03	2.28	2.19	3.03
	2:05:00	0.00	0.00	0.65	0.89	1.16	1.16	1.30	1.25	1.73
	2:10:00	0.00	0.00	0.36	0.50	0.65	0.66	0.74	0.71	0.98
	2:15:00	0.00	0.00	0.18	0.27	0.34	0.35	0.39	0.37	0.51
	2:20:00	0.00	0.00	0.08	0.13	0.16	0.18	0.20	0.19	0.26
	2:25:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.07	0.09
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

North Pond (North Forebay)

FOREBAY VOLUME

Req'd V=3% x WQCV

Ex DP 24	Impervious	Area	
	0.34	79.05	
WQCV=		1.0826	ac-ft
V=		0.0325	ac-ft
Actual V		0.0409	ac-ft

FOREBAY RELEASE NOTCH WIDTH

5-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}=	111.3	cfs
2% of Q=	2.23	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	10	in
	3	in min.

FOREBAY RELEASE NOTCH WIDTH

100-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}=	199.7	cfs
2% of Q=	3.99	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	18	in
	3	in min.

North Pond (South Forebay)

FOREBAY VOLUME

Req'd V=3% x WQCV

DPM1	Impervious	Area	
	0.65	40.15	
WQCV=		0.8503	ac-ft
V=		0.0255	ac-ft
Actual V		0.0310	ac-ft

FOREBAY RELEASE NOTCH WIDTH

5-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}=	54.8	cfs
2% of Q=	1.10	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	5	in
	3	in min.

FOREBAY RELEASE NOTCH WIDTH

100-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}=	119.4	cfs
2% of Q=	2.39	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	11	in
	3	in min.

South Pond (Forebay)

FOREBAY VOLUME

Req'd V=3% x WQCV

From Detention spreadsheet

WQCV=	0.052	ac-ft
V=	0.0016	ac-ft
Actual V	0.0040	ac-ft

FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{3/2}$

Q_{100}=	17.9	cfs
2% of Q=	0.36	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	2	in
	3	in min.

Figure 13-12c. Emergency Spillway Protection

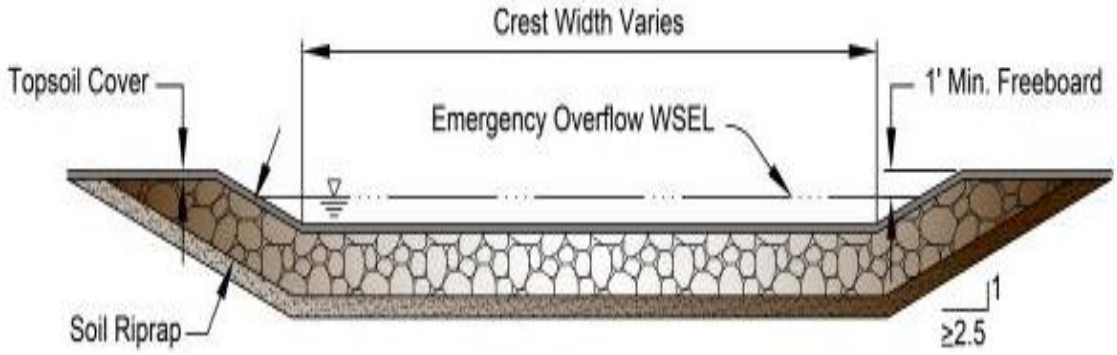
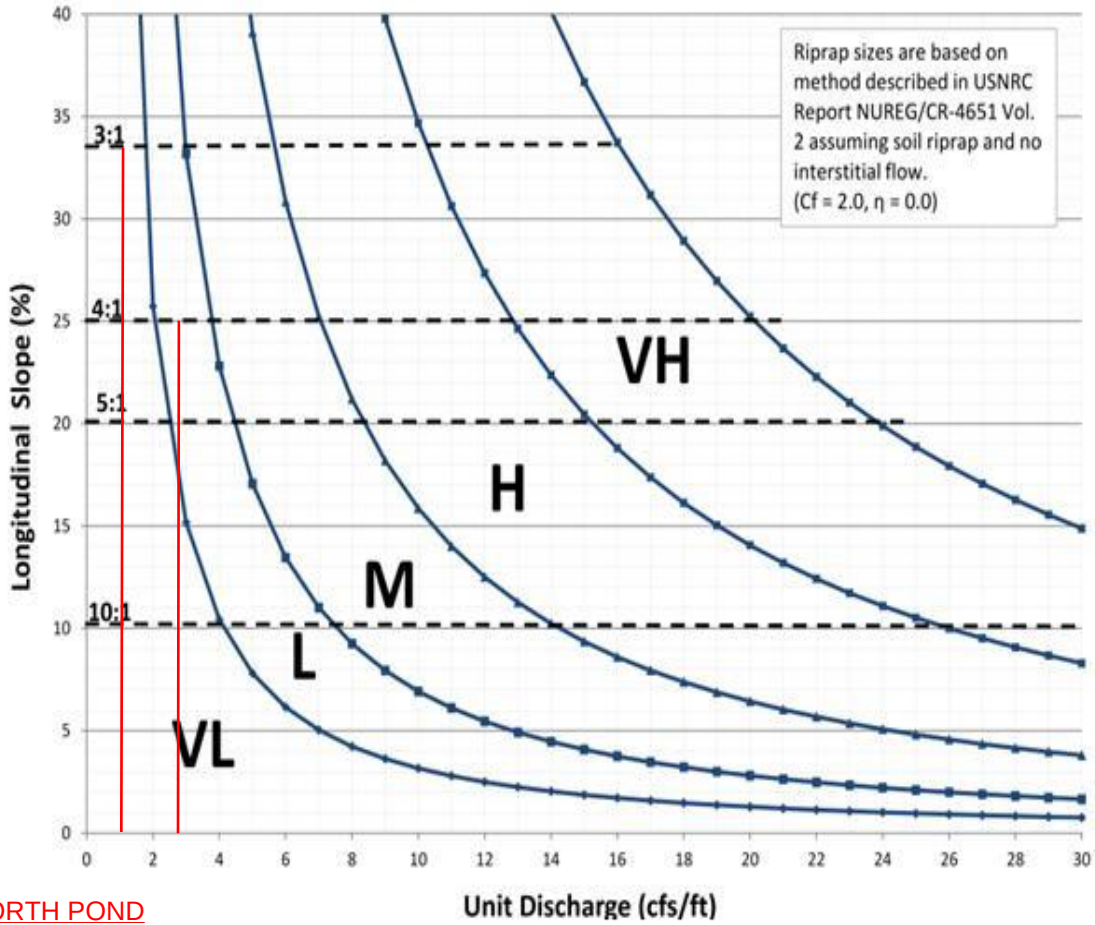


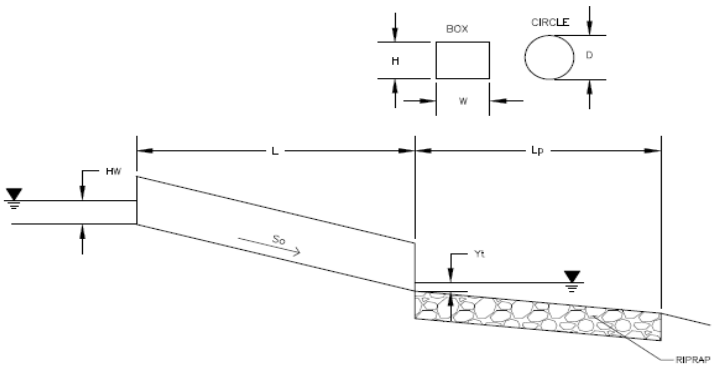
Figure 13-12d. Riprap Types for Emergency Spillway Protection



NORTH POND
UNIT DISCHARGE= 194.1/70=2.7cfs
SOUTH POND
UNIT DISCHARGE= 35.9/27= 1.3cfs

Determination of Culvert Headwater and Outlet Protection

Project: Blue cells are for user data entry
Basin ID: Green cells are calculated values



NORTH DETENTION POND
OUTFALL PROTECTION

Soil Type:
Choose One:
(•) Sandy
( ) Non-Sandy

Design Information (Input):

	Design Discharge	Q =	66	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Beveled Edge	
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	1	
	Inlet Elevation	Elev IN =	6571.5	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6570.6	ft
	Culvert Length	L =	136.7	ft
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =		ft
	Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

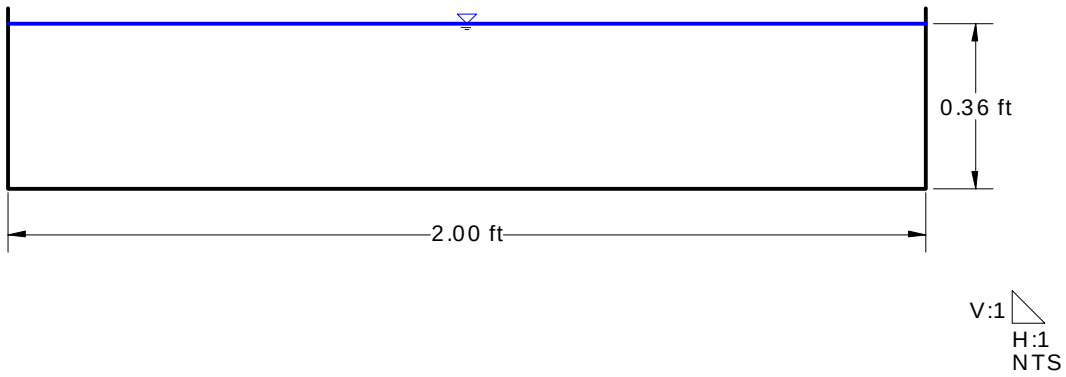
Tailwater Surface Height	Y_t =	1.20	ft
Flow Area at Max Channel Velocity	A_t =	13.20	ft^2
Culvert Cross Sectional Area Available	A =	7.07	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.84	
Sum of All Losses Coefficients	k_s =	2.04	ft
Culvert Normal Depth	Y_n =	2.22	ft
Culvert Critical Depth	Y_c =	2.60	ft
Tailwater Depth for Design	d =	2.80	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	3.25	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	4.23	$ft^{0.5}/s$
Froude Number	Fr =	-	**Pressure flow!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.40	
Inlet Control Headwater	HW_I =	4.63	ft
Outlet Control Headwater	HW_O =	4.66	
Design Headwater Elevation	**HW =**	**6,576.16**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.55**	**HW/D > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	11	in
Nominal Riprap Size	d_{50} =	12	in
UDFCD Riprap Type	**Type =**	**M**	
Length of Protection	**L_p =**	**27**	**ft**
Width of Protection	**T =**	**12**	**ft**

Cross Section
Cross Section for Rectangular Channel

Project Description	
Worksheet	Sound wall chas
Flow Element	Rectangular Cha
Method	Manning's Formu
Solve For	Channel Depth

2'X6" CONCRETE CHASE
AT SOUND WALL ALONG
MARKSHEFFEL ROAD

Section Data		
Mannings Coeffic	0.015	
Slope	010000	ft/ft
Depth	0.36	ft
Bottom Width	2.00	ft
Discharge	2.90	cfs



Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Tract A overflow
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

SUMP INLET OVERFLOW AT TRACT A TOWARDS NORTH DETENTION POND.

ASSUMES WORST CASE ALL FLOWS FROM BASINS A10 AND A11 OVERTOPPING CURB AND TRAVELING THROUGH 30-FT WIDE TRACT A BETWEEN LOTS 48 AND 49. FLOW DEPTH FOR THIS SCENARIO, AS LISTED LEFT IS 0.48-FT

Input Data		
Mannings Coeffic	0.030	
Slope	010000	ft/ft
Left Side Slope	5.00	V : H
Right Side Slope	5.00	V : H
Bottom Width	15.00	ft
Discharge	28.30	cfs

Results		
Depth	0.57	ft
Flow Area	8.7	ft²
Wetted Perim	16.17	ft
Top Width	15.23	ft
Critical Depth	0.48	ft
Critical Slope	0.017964	ft/ft
Velocity	3.27	ft/s
Velocity Head	0.17	ft
Specific Energ	0.74	ft
Froude Numb	0.76	
Flow Type	Subcritical	

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Tract D overflow
Flow Element	Trapezoidal Cha
Method	Manning's Formu
Solve For	Channel Depth

SUMP INLET OVERFLOW AT TRACT D.

ASSUMES WORST CASE ALL FLOWS FROM BASINS D15 AND A1 OVERTOPPING CURB AND TRAVELING THROUGH 40-FT WIDE TRACT D NORTH OF LOT 14. FLOW DEPTH FOR THIS SCENARIO, AS LISTED LEFT IS 0.29-FT

Input Data		
Mannings Coeffic	0.030	
Slope	010000	ft/ft
Left Side Slope	3.00	V : H
Right Side Slope	3.00	V : H
Bottom Width	18.00	ft
Discharge	16.20	cfs

Results		
Depth	0.36	ft
Flow Area	6.6	ft²
Wetted Perim	18.77	ft
Top Width	18.24	ft
Critical Depth	0.29	ft
Critical Slope	0.020405	ft/ft
Velocity	2.46	ft/s
Velocity Head	0.09	ft
Specific Energ	0.46	ft
Froude Numb	0.72	
Flow Type	Subcritical	

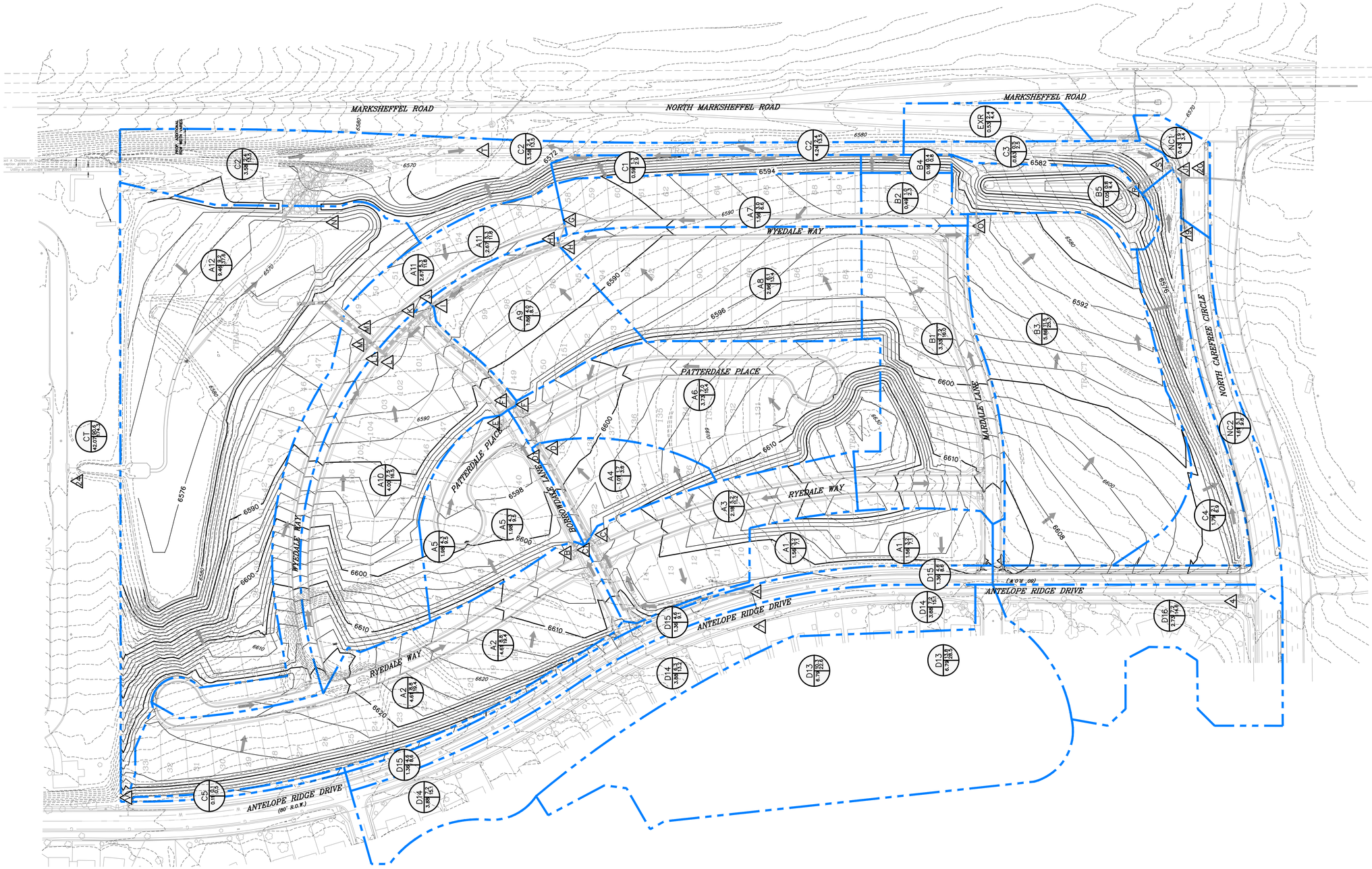
LEGEND

PROPOSED INTERMEDIATE CONTOUR	
PROPOSED INDEX CONTOUR	5750
EX. INTERMEDIATE CONTOUR	
EX. INDEX CONTOUR	5750
PROPOSED STORM SEWER	
PROPOSED INLET	
BASIN BOUNDARY	
FLOW DIRECTION	
DESIGN POINT	1

A1 — BASIN; AREA (ACRE); Q5 (cfs); Q100 (cfs)

100 0 100 200

SCALE: 1"=100'



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CLIENT:

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(719) 635-3200
CONTACT: JEFF MARK

DRAINAGE MAP FOR
WINDERMERE FILING NO. 1
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	7-9-21
RESUBMITTAL	1-5-22

DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: N/A

OVERALL PROPOSED DRAINAGE MAP

PROJECT NO. 21187-01CSCV

DRAWING NO.

DR1

SHEET: 1 OF 5

LEGEND

PROPOSED INTERMEDIATE CONTOUR
PROPOSED INDEX CONTOUR — 5750
EX. INTERMEDIATE CONTOUR
EX. INDEX CONTOUR — 5750
PROPOSED STORM SEWER
PROPOSED INLET
PROPOSED FLARED END SECTION
PROPOSED SITE LIGHTING

EX. MANHOLE
EX. STORM SEWER
BASIN BOUNDARY
EXISTING FLOWPATH
FLOW DIRECTION
DESIGN POINT — 1

BASIN — A1 — 2.38 | 4.7 — Q5 (cfs) / Q100 (cfs)
AREA (ACRE)

DEVELOPED AREA DRAINING OFFSITE SEE SHEET DR4

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
7	10.67	15.9	34.2
A	13.59	21.0	44.9
B	4.61	8.8	19.4
C	2.18	5.2	11.2
C1	20.38	29.5	63.5
D	1.01	1.7	3.8
D1	21.39	30.6	66.1
E	1.98	4.3	9.5
F	3.73	7.0	15.4
F1	27.10	38.2	82.8
G	1.56	3.0	6.6
H	2.96	6.1	13.4
H1	4.52	8.6	19.0
I	1.86	4.0	8.7
J	6.38	11.8	25.9
K	33.48	46.3	100.7
L	4.00	7.5	16.5
L1	37.48	51.4	111.8

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
M	2.67	5.3	11.8
M1	40.15	54.8	119.4
24	83.54	90.7	229.0
N	133.15	145.4	357.5
North Pond Release		1.8	66.0
T	437.97	190.5	682.4
O	3.82	8.1	17.9
R	10.89	19.9	46.2
South Pond Release		0.2	9.2
4	2.73	4.9	10.7
S	16.57	10.0	33.7
19	1.61	5.1	9.8
J1	18.18	15.1	43.5
20	18.61	17.0	46.9
V	0.11	0.1	0.5

N

50 20 0 50 100
SCALE: 1"=50'

NOTE

KEY MAP NO SCALE

CHATEAU AT ANTELOPE RIDGE FILING NO. 1

CT — 42.07 | 90.6 / 174.3

EXIST. TRAILERS

PROP. CONCRETE FOREBAY

ACCESS TO FOREBAYS ADJACENT TO TRICKLE CHANNEL

PROP. 6' WIDE CONCRETE TRICKLE CHANNEL

NORTH POND

PROP. ADDITIONAL ROW WIDTH VARIES

A12 — 9.46 | 9.2 / 37.6

EXIST. CHANNEL MAINTENANCE ALONG MARKSHEFFEL RD. BY EL PASO COUNTY/CITY OF COLORADO SPRINGS

C2 — 3.58 | 2.4 / 13.5

TRACT A

PROP. CONCRETE FOREBAY

MODIFIED TYPE C OUTLET STRUCTURE w/ MICROPOOL

15' MAINTENANCE ACCESS W/ MIN. 30' RADIUS

RIPRAP SPILLWAY

PVT. 43"X68" ELL RCP STORM SEWER

PVT. 43"X68" ELL RCP STORM SEWER

PVT. ELL 43"X68" 45° BEND

PUB. 30" RCP STORM SEWER

10' TYPE R INLET SUMP PUBLIC

TYPE I STM MH PUBLIC

PUB. 30" RCP STORM SEWER

15' TYPE R INLET SUMP PUBLIC

TYPE I STM MH PRIVATE

PUB. 43"X68" ELL RCP STORM SEWER

A11 — 2.67 | 5.3 / 11.8

TYPE I STM MH PUBLIC

PUB. 30" RCP STORM SEWER

18"X30" WYE PUBLIC

PUB. 18" RCP STORM SEWER

10' TYPE R INLET AT-GRADE PUBLIC

PUB. 43"X68" ELL RCP STORM SEWER

PUB. 36" RCP STORM SEWER

PUB. 36" RCP STORM SEWER

PUB. 36" RCP STORM SEWER

20' Electric Easement Reception #203217206

20' Electric Easement Reception #099119772

20' Electric Easement Reception #099167109

Sanitary Sewer Easement Reception #098109545

20'

30' EXIST. DITCH

ANTELOPE RIDGE DRIVE (80' R.O.W.)

WYEDALE WAY

RYEDALE WAY

MARKSHEFFEL ROAD

MATCHLINE SHEET DR3

C5 — 0.11 | 0.1 / 0.5

D15 — 1.36 | 4.6 / 8.6

D14 — 3.88 | 7.2 / 15.1

A2 — 4.61 | 8.8 / 19.4

A10 — 4.00 | 7.5 / 16.5

A5 — 1.98 | 4.3 / 9.5

X HP

6620 6600 6590 6580 6610 6576 6578 6574

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DRAINAGE MAP FOR
WINDERMERE FILING NO. 1
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	7-9-21
RESUBMITTAL	1-5-22

DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

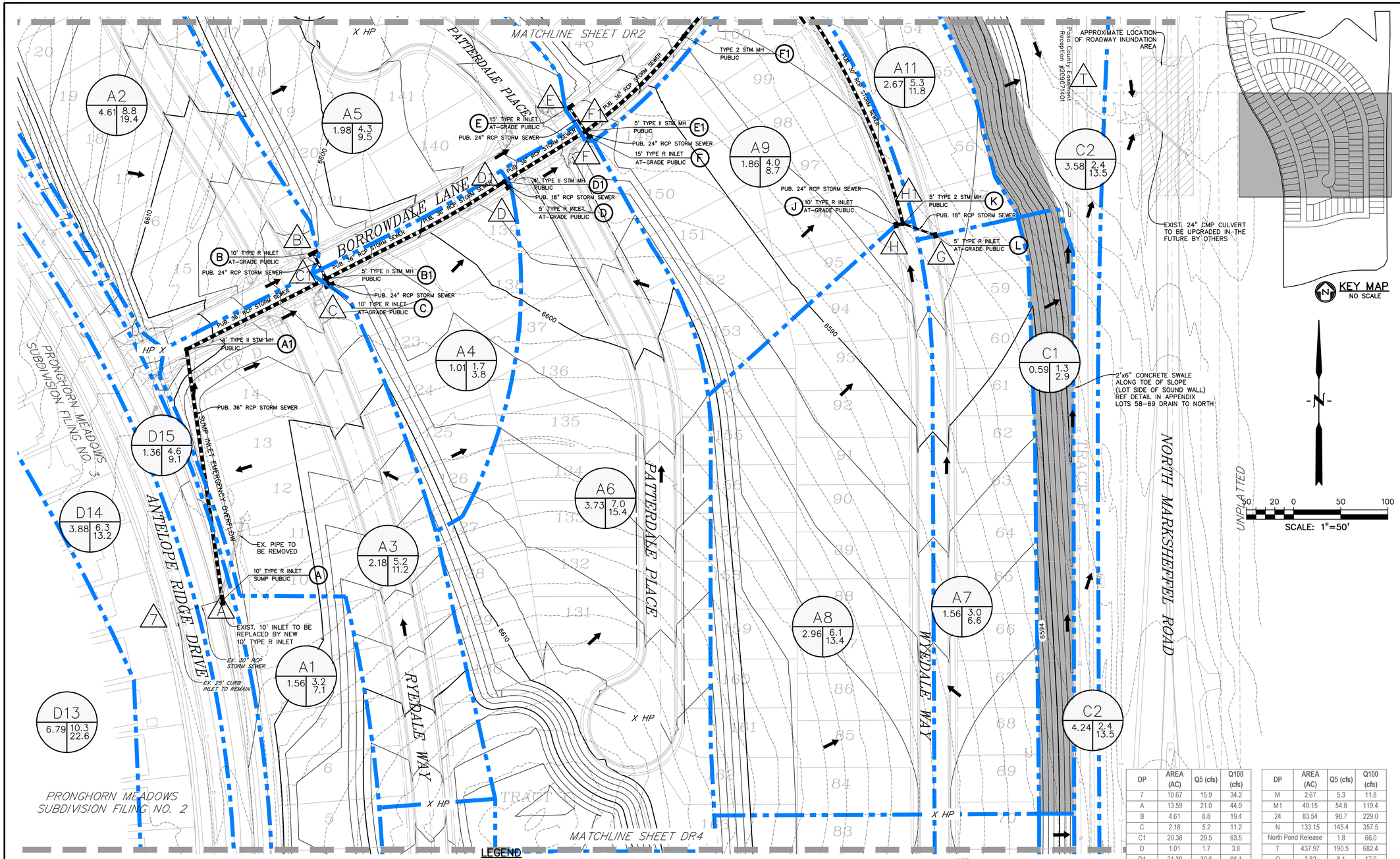
DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187-01CSCV
DRAWING NO.

DR2

SHEET: 2 OF 5



LEGEND

- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR — 5750
- EX. INTERMEDIATE CONTOUR
- EX. INDEX CONTOUR — 5750
- PROPOSED STORM SEWER
- PROPOSED INLET
- PROPOSED FLARED END SECTION
- PROPOSED SITE LIGHTING
- EX. MANHOLE
- EX. STORM SEWER
- BASIN BOUNDARY
- FLOW DIRECTION
- DESIGN POINT
- AREA (ACRE) / BASIN / Q5 (cfs) / Q100 (cfs)
- DEVELOPED AREA DRAINING OFFSITE SEE SHEET DR4

NOTE:
SEE "PRELIMINARY DRAINAGE REPORT FOR WINDERMERE," BY CLASSIC CONSULTING ENGINEERS & SURVEYORS, OCTOBER 2014 FOR EXISTING DRAINAGE MAP AND CALCULATIONS INCLUDING BASINS D13, D14, D15 AND THEIR DESIGN POINTS

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
7	10.67	15.9	34.2
A	13.59	21.0	44.9
B	4.61	8.8	19.4
C	2.18	5.2	11.2
C1	20.38	29.5	63.5
D	1.01	1.7	3.8
D1	21.39	30.6	66.1
E	1.98	4.3	9.5
F	3.73	7.0	15.4
F1	27.10	38.2	82.8
G	1.56	3.0	6.6
H	2.96	6.1	13.4
H1	4.52	8.6	19.0
I	1.86	4.0	8.7
J	6.38	11.8	25.9
K	33.48	46.3	100.7
L	4.00	7.5	16.5
L1	37.48	51.4	111.8

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
M	2.67	5.3	11.8
M1	40.15	54.8	119.4
24	83.54	90.7	229.0
N	133.15	145.4	357.5
North Pond Release		1.8	66.0
T	437.97	190.5	682.4
O	3.82	8.1	17.9
R	10.89	19.9	46.2
South Pond Release		0.2	9.2
4	2.73	4.9	10.7
S	16.57	10.0	33.7
19	1.61	5.1	9.8
J1	18.18	15.1	43.5
20	18.61	17.0	46.9
V	0.11	0.1	0.5

811 Know what's **below.** **Call** before you dig.
CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

PREPARED BY:
DREXEL, BARRELL & CO.
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(719)260-0887
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CLIENT:
THE LANDHUIS COMPANY
212 N. WAHSATCH AVE., #301
COLORADO SPRINGS, CO 80903
(719) 635-3200
CONTACT: JEFF MARK

DRAINAGE MAP FOR
WINDERMERE FILING NO. 1
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	7-9-21
RESUBMITTAL	1-5-22

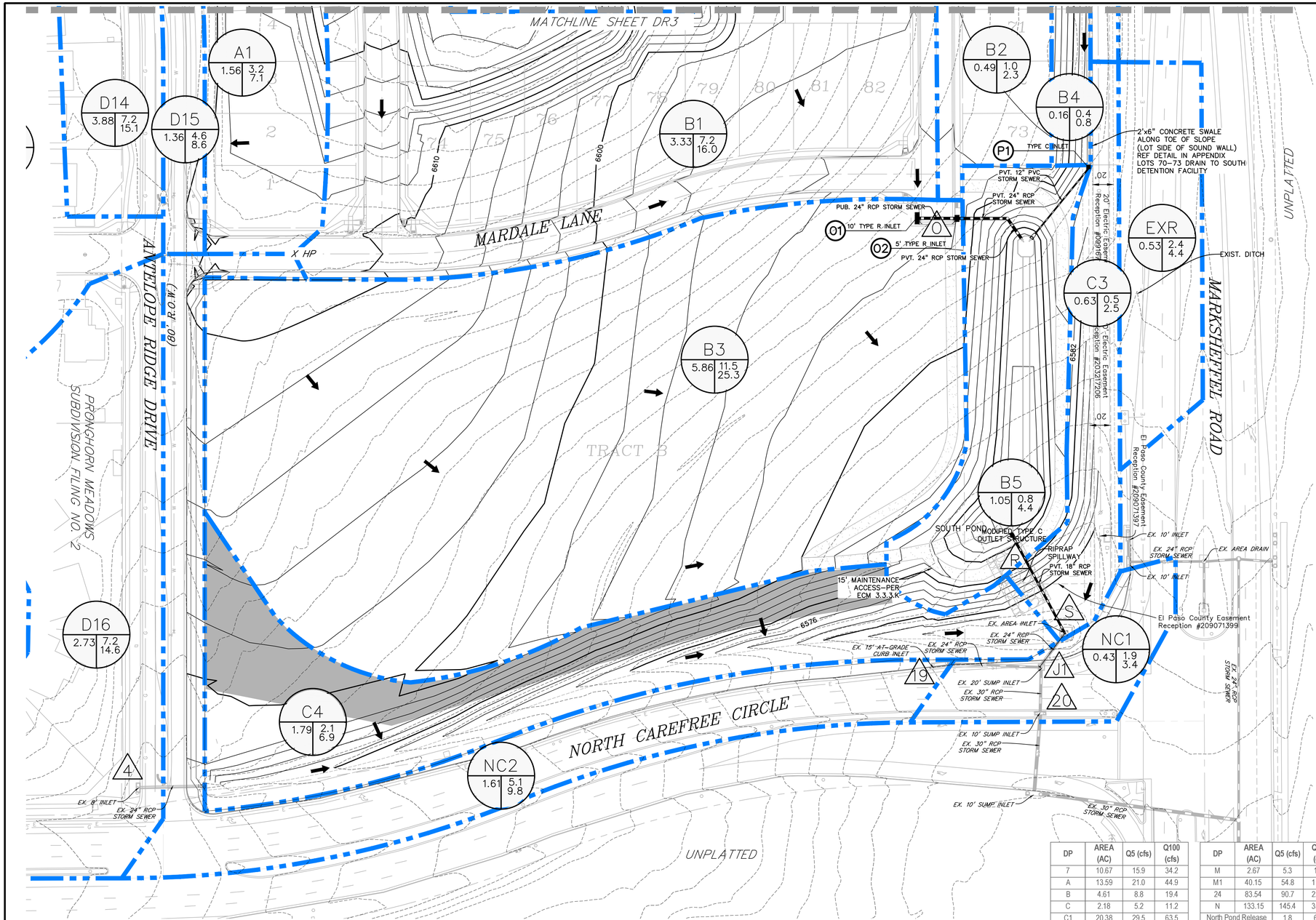
DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	

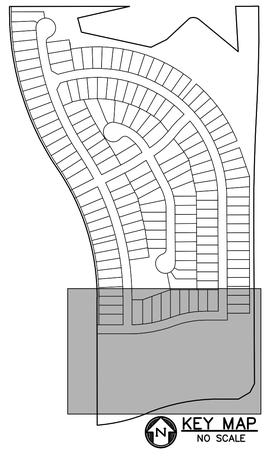
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187-01CSCV
DRAWING NO.
DR3





DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
7	10.67	15.9	34.2
A	13.59	21.0	44.9
B	4.61	8.8	19.4
C	2.18	5.2	11.2
C1	20.38	29.5	63.5
D	1.01	1.7	3.8
D1	21.39	30.6	66.1
E	1.98	4.3	9.5
F	3.73	7.0	15.4
F1	27.10	38.2	82.8
G	1.56	3.0	6.6
H	2.96	6.1	13.4
H1	4.52	8.6	19.0
I	1.86	4.0	8.7
J	6.38	11.8	25.9
K	33.48	46.3	100.7
L	4.00	7.5	16.5
L1	37.48	51.4	111.8

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
M	2.67	5.3	11.8
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19	1.61	5.1	9.8
J1	18.18	15.1	43.5
20	18.61	17.0	46.9
V	0.11	0.1	0.5

LEGEND

PROPOSED INTERMEDIATE CONTOUR
PROPOSED INDEX CONTOUR 5750
EX. INTERMEDIATE CONTOUR
EX. INDEX CONTOUR 5750
PROPOSED STORM SEWER
PROPOSED INLET
PROPOSED FLARED END SECTION
PROPOSED SITE LIGHTING
EX. MANHOLE
EX. STORM SEWER
BASIN BOUNDARY
FLOW DIRECTION
DESIGN POINT
AREA (ACRE) — A1 1.56 3.2 7.1 — BASIN, Q5 (cfs), Q100 (cfs)
DEVELOPED AREA DRAINING OFFSITE SEE SHEET DR4

Know what's below. Call before you dig.
CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

NOTE:
SEE "PRELIMINARY DRAINAGE REPORT FOR WINDERMERE," BY CLASSIC CONSULTING ENGINEERS & SURVEYORS, OCTOBER 2014 FOR EXISTING DRAINAGE MAP AND CALCULATIONS INCLUDING BASINS D16, NC1, NC2 AND THEIR DESIGN POINTS

PREPARED BY:

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CONTACT: JEFF MARK

DRAINAGE MAP FOR
WINDERMERE
FILING NO. 1
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	7-9-21
RESUBMITTAL	1-5-22

DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187-01CSCV

DRAWING NO.

DR4

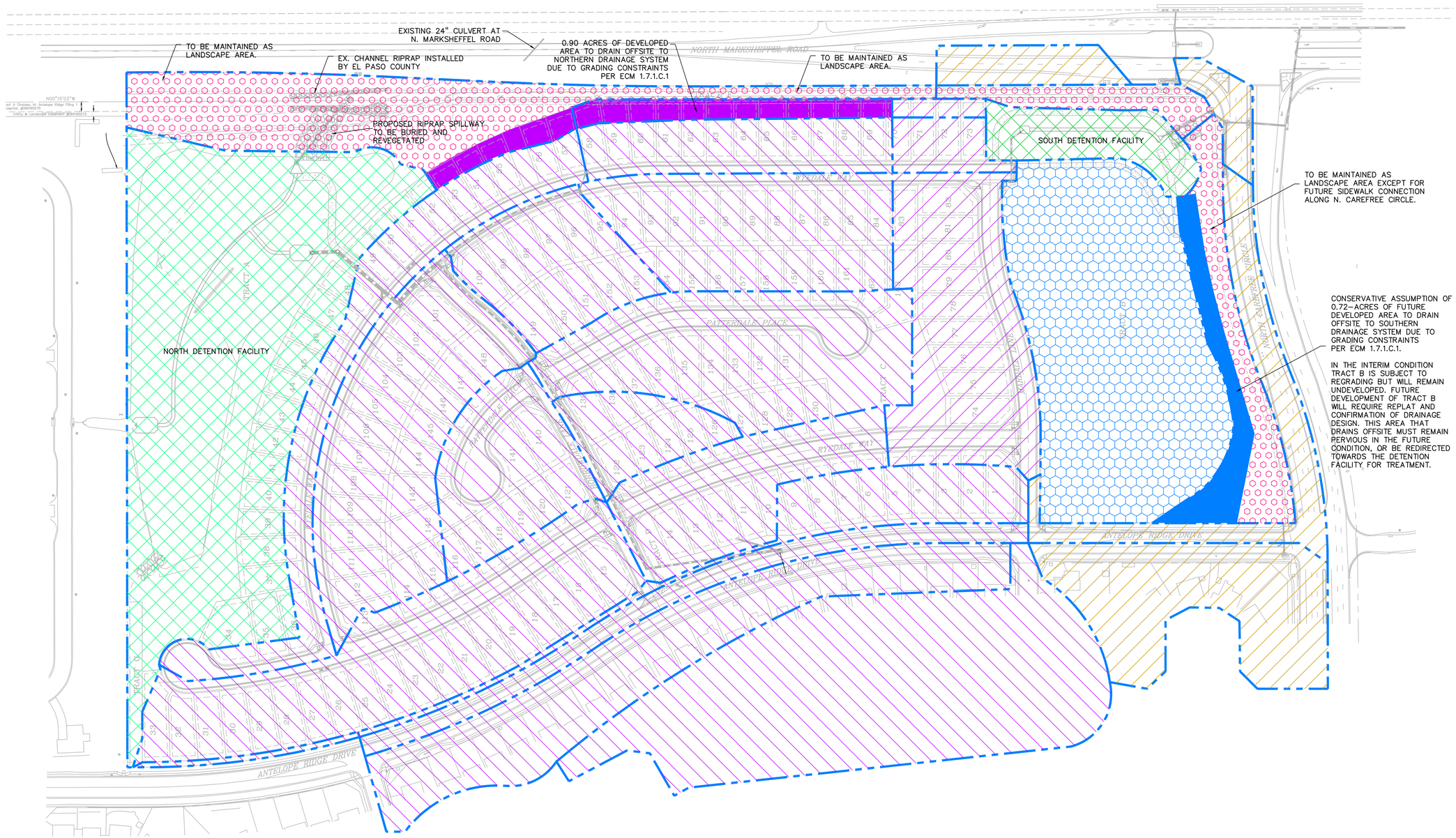
SHEET: 4 OF 5

LEGEND

- BASIN BOUNDARY
- BASINS TRIBUTARY TO NORTH DETENTION FACILITY
- NORTH DETENTION FACILITY
- OVERLOT GRADED BUT TO REMAIN UNDEVELOPED FOR THIS PHASE OF WORK
- OFFSITE BASINS REMAINING OFFSITE
- BASINS TRIBUTARY TO SOUTH DETENTION FACILITY
- SOUTH DETENTION FACILITY
- BASINS DRAINING OFFSITE WITHOUT WATER QUALITY REMAINING UNDEVELOPED WITH EXCLUSIONS BELOW
- DEVELOPED AREA DRAINING OFFSITE (NORTH) WITHOUT WATER QUALITY TREATMENT — 0.90 AC
- DEVELOPED AREA DRAINING OFFSITE (SOUTH) WITHOUT WATER QUALITY TREATMENT — 0.72 AC

100 0 100 200

SCALE: 1"=100'



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DRAINAGE MAP FOR
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N. MARKSHEFFEL ROAD
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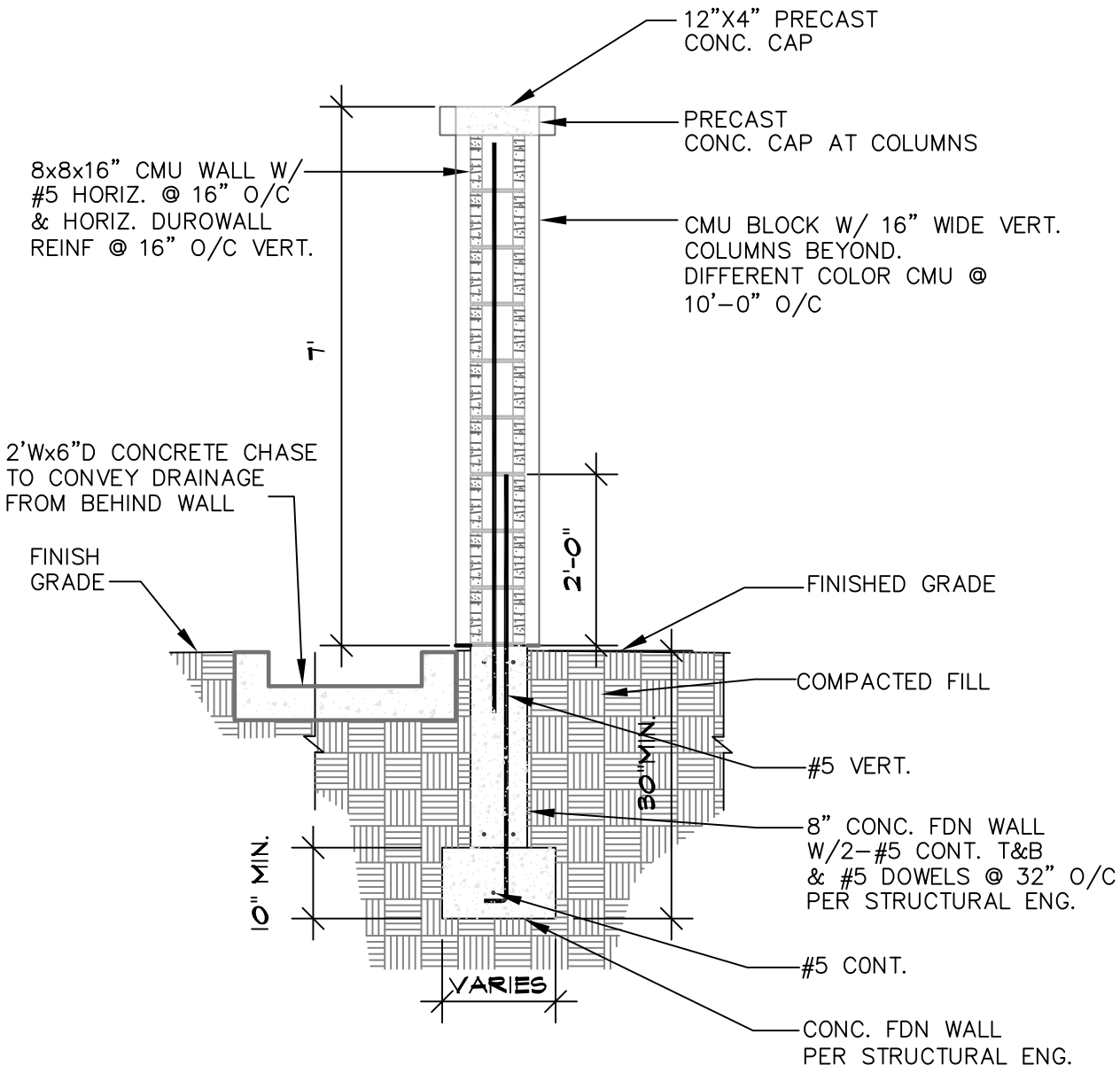
DRAWING SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: N/A

DRAINAGE ROUTING EXHIBIT

PROJECT NO. 21187-01CSCV

DRAWING NO.

DR5



WINDERMERE
COLORADO SPRINGS, CO
SOUND WALL CHASE

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:

JOB NO: 21187-00CSCV

DWG. NO. EX1

SHEET 1 OF 1