

**PRELIMINARY DRAINAGE REPORT
FOR
JUDGE ORR ROAD COMMERCIAL PARK
EL PASO COUNTY, COLORADO**

May 2025

Prepared For:

Phils Boys Falcon, LLC
3507 N. El Paso Street
Colorado Springs, CO 80907

Prepared By:

JR ENGINEERING
5475 Tech Center Drive
Colorado Springs, CO 80919
(719) 593-2593

Job No. 25315.00

PCD File No.: XXXXX

SP264

ENGINEER'S STATEMENT:

The attached drainage report and plan was 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 omissions on my part in preparing this report.

Bryan T. Law, Colorado P.E. # 25043
For and On Behalf of JR Engineering, LLC

Date

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: Phils Boys Falcon, LLC

By: Teddy McDonald

Title: _____
Address: 3607 N. El Paso Street
Colorado Springs, CO 80907

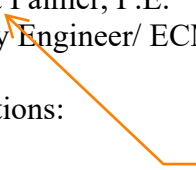
El Paso County:

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

Joshua Palmer, P.E.
County Engineer/ ECM Administrator

Date

Conditions:

Joshua J. Palmer, P.E.



CONTENTS

PURPOSE	1
GENERAL LOCATION AND DESCRIPTION	1
GENERAL LOCATION	1
DESCRIPTION OF PROPERTY	1
FLOODPLAIN STATEMENT	1
DRAINAGE DESIGN CRITERIA	2
DEVELOPMENT CRITERIA REFERENCE	2
HYDROLOGIC CRITERIA	2
HYDRAULIC CRITERIA	2
MAJOR DRAINAGE BASINS AND SUB-BASINS	2
MAJOR BASIN DESCRIPTIONS	2
EXISTING DRAINAGE CONDITIONS	3
EXISTING SUB-BASIN DRAINAGE	3
PROPOSED DRAINAGE CONDITIONS	4
PROPOSED DRAINAGE CONVEYANCE	4
PROPOSED SUB-BASIN DRAINAGE	4
COMPARISON OF FLOWS	8
DRAINAGE FACILITY DESIGN	8
GENERAL CONCEPT	8
SPECIFIC DETAILS	8
<i>Four Step Process to Minimize Adverse Impacts of Urbanization</i>	9
<i>Proposed Full-Spectrum EDBs</i>	10
<i>Erosion Control Plan</i>	11
<i>Operation & Maintenance</i>	11
<i>Drainage and Bridge Fees</i>	11
<i>Construction Cost Opinion</i>	11
SUMMARY	11
REFERENCES:	12
APPENDICES	
A. Figures and Exhibits	
B. Hydrologic Calculations	
C. Hydraulic Calculations	
D. Reference Materials	
E. Drainage Maps	

PURPOSE

This document is the Preliminary Drainage Report for Judge Orr Road Commercial Park. The purpose of this report is to identify on-site and off-site drainage patterns, culverts, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

GENERAL LOCATION AND DESCRIPTION

General Location

The proposed Judge Orr Road Commercial Park development (herby referred to as the “site”) is located within the south half of the southeast quarter of Section 32, and the south half of the southwest quarter of Section 33, Township 12 South, Range 64 West of the Sixth Principal Meridian, El Paso County, Colorado.

The site is bound by existing Range Flower Way and Judge Orr Road RV Park & Storage to the east, existing Judge Orr Road to the south, existing State Highway 24 to the west and Sun Prairie Subdivision Filing No 1 Lot 1 to the north. A vicinity map is presented in Appendix A.

Description of Property

The proposed Judge Orr Road Commercial Park development contains approximately 40 acres will be comprised of proposed El Paso County (EPC) urban local roadway (Sagefield Drive), 6 commercial lots, 3 light industrial lots, open space areas and a detention pond. The site is currently unoccupied and undeveloped. The existing ground cover is sparse short and mixed prairie vegetation with the exception of a couple existing dirt roads are located on the site. There is an existing 24” CMP culvert crossing under State Highway 24 (US 24) about 1,000 feet northeast of the intersection of US 24 and Judge Orr Road. There is also an existing 30” HDPE storm sewer located on the eastern side of the site which captures off-site flows and existing triple 36” X 30” HERCP culverts capturing off-site flows along Judge Orr Road swale. Additionally, there is an existing avigation easement located on the southwest part of the site that will remain preserved without any development in that area.

Per a NRCS web soil survey of the area, the site is made up of Hydrologic Group A soils. Type A soils are typically deep well-drained to excessively drained sands that have a high infiltration rate when thoroughly wet. A NRCS soil survey map is presented in Appendix A.

Floodplain Statement

Based on the FEMA Flood Insurance Rate Map (FIRM) number 08041C0554G dated December 7, 2018, the site lies within Zone X. Zone X is defined as area outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FIRMette is presented in Appendix A for the site.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the “City of Colorado Spring/El Paso County Drainage Criteria Manual” Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the “Urban Storm Drainage Criteria Manual” Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the “Colorado Springs Drainage Criteria Manual (CCSDCM)”, dated May 2014, as adopted by El Paso County, as well as the El Paso County “Engineering Criteria Manual” (ECM), dated October 14, 2020.

Hydrologic Criteria

All hydrologic data was obtained from the “El Paso Drainage Criteria Manual” Volumes 1 and 2, and the “Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual” Volumes 1, 2, and 3. On-site flows were determined based on the 5-year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Figure 6-5 Intensity Duration Frequency Curve of the Colorado Springs DCM. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the DCM. One-hour point rainfall data for the storm events are 1.50 inches for the 5-year and 2.52 inches for the 100-year storm.

Hydraulic Criteria

The Rational Method and USDCM’s SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site. The MHFD-Detention_v4.06 spreadsheet was utilized for evaluating proposed detention and water quality for the proposed pond. Required detention volumes and allowable release rates were designed per USDCM and CCS/EPCDCM. Autodesk Inc.’s Hydraflow Express Extension (Volume 10.5) will be used in the Final Drainage Report to size the roadside ditches and drainage swales per criteria. The hydraulic design and analysis will be finalized with the Final Drainage Report.

Note that the existing culverts will be analyzed also, if they are to remain.

MAJOR DRAINAGE BASINS AND SUB-BASINS

Major Basin Descriptions

The site lies within the Haegler Ranch Drainage Basin. The “Haegler Ranch Basin Drainage Basin Planning Study” by URS Corporation dated May, 2009 describes the characteristics of the Haegler Ranch basin. The Haegler Ranch Drainage Basin covers approximately 17 square miles located in the central portion of El Paso County. The Haegler Ranch Drainage Basin is tributary to Ellicott Consolidated Drainage Basin unnamed tributary, which is tributary to Black Squirrel Creek.

In general, the Haegler Ranch Drainage Basin flows from north to south and the nearest drainageway is located to the north west of the site. None of the Haegler Ranch drainageway floodplains are

located on-site, and there will therefore be no impacts due to the proposed development. As described in the Haegler Ranch DBPS, the existing 24" CMP crossing US 24 that directs flows onto the site is called facility number 707. The proposed development will route the US 24 culvert flows to the Judge Orr Road ditch adhering to the previous drainage report. The proposed development does not intend to change peak flows in the existing drainageways. Excerpts of the Haegler Ranch DBPS are shown in Appendix D.

EXISTING DRAINAGE CONDITIONS

Existing Sub-basin Drainage

The site was previously studied within the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" dated July 2019 by Associated Design Professionals, Inc. (hereby referred to as the "2019 ADP Report"). The 2019 ADP Report was for the development of the Judge Orr Road RV Park & Storage Development located to the east of Range Flower Way. As part of that development, an existing 30" HDPE storm sewer was constructed to capture off-site flows and route them to the east past the Judge Orr Road RV Park & Storage site. The 2019 ADP Report planned for a future pond (Pond 1) to be constructed as part of the Judge Orr Road Commercial Park site development and tie into the existing storm sewer. The 2019 ADP Report also planned to send the off-site flow crossing US 24 via the 24" CMP to the triple 36" X 30" HERCP along the Judge Orr Road roadside ditch. See Appendix D for applicable excerpts of the 2019 ADP Report.

The existing basin delineation for Judge Orr Road Commercial Park as shown on the map within Appendix E is as follows:

Off-site Basin OS1 is approximately 7.81 acres with a 7% impervious and is comprised of the southeast half of US 24 and undeveloped area to the north of the project site within lot 1 of the Sun Prairie Subdivision Filing 1. The basin boundaries conform with the basin delineation shown in the 2019 ADP Report. Runoff will follow the historic path overland from the north to the southeast where it will enter Basin EXA at DPO1 ($Q_5=2.9$ cfs, $Q_{100}=15.1$ cfs). The basin flows will be conveyed along an existing drainage swale south to the combination at DP1.1 within Basin EXA.

Off-site Basin OS2 is approximately 0.97 acres with a 21% impervious and is comprised of the southeast half of US 24 and undeveloped area to the northwest of the project site. Runoff will follow the historic path overland from the crown of US 24 flowing northwest to the southeast where it will enter Basin EXA at DPO2 ($Q_5=1.2$ cfs, $Q_{100}=4.0$ cfs). The basin flows will sheet flow overland within Basin EXA and combine at DP1.1.

Existing Basin EXA is approximately 18.9 acres with a 2% impervious and in the existing condition is comprised of undeveloped land, existing drainage swale, existing 30" HDPE and FES, and existing storm sewer. Historically runoff flows from the northwest to the southeast to DP1 ($Q_5=3.8$ cfs, $Q_{100}=25.6$ cfs). Flows from DPO1 and DPO2 will combine with DP1 at DP1.1 ($Q_5=6.6$ cfs,

$Q_{100}=38.8$ cfs). Flows then continue flowing off-site to the east within the existing 30" HDPE storm sewer.

Off-site Basin OS3 is approximately 27.2 acres and is comprised of the northwest half of US 24 and undeveloped open range area to the northwest of the project site. The basin boundaries conform with the basin delineation shown in the 2019 ADP Report. Runoff will follow the historic path overland from the crown of US 24 flowing northwest to the southeast where it will enter Basin EXB via an existing 24" CMP culvert at DPO3 ($Q_5=19.0$ cfs, $Q_{100}=63.6$ cfs). The basin flows will sheet flow overland within Basin EXB and combine at existing triple 36" X 30" HERCP culverts at DP2.1.

Off-site Basin OS4 is approximately 3.67 acres with a 34% impervious and is comprised of the southeast half of US 24, the north half of Judge Orr Road and undeveloped land. Runoff will follow the historic path flowing from the crown of the roadway to the roadside swale where it will enter Basin EXB at DPO4 ($Q_5=3.9$ cfs, $Q_{100}=10.4$ cfs). The basin flows will sheet flow overland within Basin EXB and combine at existing triple 36" X 30" HERCP culverts at DP2.1.

Existing Basin EXB is approximately 22.5 acres with a 2% impervious and in the existing condition is comprised of undeveloped land, existing dirt road, and existing single-family home. Historically runoff flows from the northwest to the southeast to DP2 ($Q_5=3.5$ cfs, $Q_{100}=23.2$ cfs). Flows from DPO3 and DPO4 will combine with DP2 at DP2.1 ($Q_5=20.7$ cfs, $Q_{100}=79.2$ cfs). Flows then continue flowing off-site to the east along Judge Orr Road swale.

A summary of existing basin parameters is presented in Appendix B.

It appears Sagefield is a private road, therefore it would be a 60' access easement or tract and not ROW.

DRAINAGE CONDITIONS

Stability of swale depends on swale slope and lining. Refer to table 10-4 in the EPC DCMv1 Section III Ch 10.2 for specific allowable velocities.

Proposed Drainage Conveyance

In general, developed flows are collected in proposed EPC Type A curb and gutter (C&G), storm sewer, and swales which convey water to inlets. A proposed urban local roadway (Sagefield Drive) with 60' right-of-ways are used throughout the site and are per the typical El Paso County section. Proposed swales will be designed to ensure they are stable and have required capacity to satisfy criteria. A swale is considered stable with a velocity of 5 ft/s or less. If velocities exceed 5 ft/s, swales shall be protected by buried soil riprap to limit potential erosion. To ensure capacity, swales will have a minimum of 1 ft. of freeboard over the water surface for flows anticipated in a 100-year storm event. The swales shall comply with Table 6-1 of the EPC DCM Volume 1. More detailed analysis shall be provided in the future Final Drainage Report.

Proposed Sub-basin Drainage

The proposed basin delineation for Judge Orr Road Commercial Park as shown on the map within Appendix E is as follows:

Off-site basin OS2a is approximately 0.58 acres with a 22% impervious and is comprised of the southeast half of US 24 and undeveloped area to the northwest of the project site. Runoff ($Q_5=0.6$ cfs, $Q_{100}=1.9$ cfs) will follow the historic path overland from the crown of US 24 flowing northwest to the southeast where it will enter Basin A1 at DPO2a. The basin flows will combine at DP1.1 within Basin A1.

Basin A1 is approximately 2.45 acres with a 80% impervious and is comprised of proposed industrial Lot 8. Runoff ($Q_5=6.4$ cfs, $Q_{100}=12.8$ cfs) from this basin will flow to the southeast to DP1 and combine with DPO2a at DP1.1 ($Q_5=6.6$ cfs, $Q_{100}=13.8$ cfs). DP1.1 flows represent the total combined developed Lot 8 flow. Future development will capture these flows and tie into the proposed storm sewer stub. Flows then combine at the DP2.2 manhole.

Off-site basin OS2b is approximately 0.64 acres with a 17% impervious and is comprised of the southeast half of US 24 and undeveloped area to the northwest of the project site. Runoff ($Q_5=0.6$ cfs, $Q_{100}=2.0$ cfs) will follow the historic path overland from the crown of US 24 flowing northwest to the southeast where it will enter Basin A2 at DPO2b. The basin flows will combine at DP2.1 within Basin A2.

Basin A2 is approximately 2.85 acres with a 80% impervious and is comprised of proposed industrial Lot 9. Runoff ($Q_5=7.9$ cfs, $Q_{100}=15.7$ cfs) from this basin will flow to the southeast to DP2 and combine with DPO2b at DP2.1 ($Q_5=8.5$ cfs, $Q_{100}=18.0$ cfs). DP2.1 flows represent the total combined developed Lot 9 flow. Future development will capture these flows and tie into the proposed storm sewer stub. DP2.1 and DP1.1 flows combine at the DP2.2 ($Q_5=14.1$ cfs, $Q_{100}=29.6$ cfs) manhole. DP2.2 flows then combine at the DP4.2 manhole.

Off-site basin OS1 is approximately 7.81 acres with a 7% impervious and is comprised of the southeast half of US 24 and undeveloped area to the north of the project site within lot 1 of the Sun Prairie Subdivision Filing 1. The basin boundaries conform with the basin delineation shown in the 2019 ADP Report. Runoff ($Q_5=2.9$ cfs, $Q_{100}=15.1$ cfs) will follow the historic path overland from the north to the southeast where it will be captured at the proposed Type C inlet at DPO1. This inlet was sized to capture all proposed flows in both the minor and major storm. The basin flows will combine at the DP3.1 manhole within Basin A3.

Basin A3 is approximately 3.88 acres with a 80% impervious and is comprised of proposed industrial Lot 10. Runoff ($Q_5=9.7$ cfs, $Q_{100}=19.4$ cfs) from this basin will flow to the southeast to DP3. DP3 is the developed Lot 10 flow. Future development will capture these flows and tie into the proposed storm sewer stub. DP3 flows combine with DPO1 at DP3.1 ($Q_5=9.8$ cfs, $Q_{100}=28.7$ cfs). Flows then combine at the DP4.1 Type R inlet.

Basin A4 is approximately 0.59 acres with a 90% impervious and is comprised of the north half of Sagefield Drive. Runoff ($Q_5=2.0$ cfs, $Q_{100}=3.8$ cfs) from this basin will flow northeast along the EPC Type A C&G to the 5' Type R inlet (sump) at DP4. This inlet was sized to capture all flows in the

minor and major storm. DP4 flows combine with DP3.1 at DP4.1 ($Q_5=11.2$ cfs, $Q_{100}=31.3$ cfs). Flows then combine at the DP4.2 manhole.

Basin A5 is approximately 0.58 acres with a 92% impervious and is comprised of the south half of Sagefield Drive. Runoff ($Q_5=2.1$ cfs, $Q_{100}=3.8$ cfs) from this basin will flow northeast along the EPC Type A C&G to the 5' Type R inlet (sump) at DP5. This inlet was sized to capture all flows in the minor and major storm. DP5 flows combine with DP4.2 at DP5.1 ($Q_5=22.8$ cfs, $Q_{100}=55.4$ cfs). Flows are then pipe to Pond 1 and combine at the outlet structure DP15.1.

Basin A6 is approximately 0.66 acres with a 95% impervious and is comprised of proposed commercial Lot 5. Runoff ($Q_5=2.7$ cfs, $Q_{100}=4.9$ cfs) from this basin will flow overland south into Pond 1 at DP6. Flows then combine at the outlet structure DP15.1.

Basin B1 is approximately 2.51 acres with a 95% impervious and is comprised of proposed commercial Lot 7. Runoff ($Q_5=9.6$ cfs, $Q_{100}=17.5$ cfs) from this basin will flow overland southeast to the DP7 swale and combine at DP8.1.

Basin B2 is approximately 2.51 acres with a 95% impervious and is comprised of proposed commercial Lot 6. Runoff ($Q_5=9.5$ cfs, $Q_{100}=17.3$ cfs) from this basin will flow overland northeast to the DP8 swale and combine with DP7 at DP8.1 ($Q_5=18.9$ cfs, $Q_{100}=34.6$ cfs). Flows then combine at DP9.1.

Basin B3 is approximately 3.50 acres with a 95% impervious and is comprised of proposed commercial Lots 4 and 5. Runoff ($Q_5=14.5$ cfs, $Q_{100}=26.4$ cfs) from this basin will flow overland north and south to DP9. DP9 and DP8.1 flows combine with the DP9.1 ($Q_5=32.1$ cfs, $Q_{100}=58.7$ cfs) swale. DP9.1 flows to a proposed FES and culvert which inflow to Pond 1 and combine at the outlet structure DP15.1.

Basin C1 is approximately 2.34 acres with a 95% impervious and is comprised of proposed commercial Lot 2. Runoff ($Q_5=9.2$ cfs, $Q_{100}=16.8$ cfs) from this basin will flow overland northeast to storm sewer stub at DP10. DP10 is the developed Lot 2 flow. Future development will capture these flows and tie into the proposed storm sewer stub. DP10 flows then combine at the DP12.2 manhole.

Basin C2 is approximately 2.32 acres with a 95% impervious and is comprised of proposed commercial Lot 3. Runoff ($Q_5=9.3$ cfs, $Q_{100}=17.0$ cfs) from this basin will flow overland north to DP11. DP11 is the developed Lot 3 flow. Future development will capture these flows and tie into the proposed storm sewer stub. DP11 flows then combine with DP12 at Type R inlet DP12.1.

Basin C3 is approximately 0.66 acres with a 91% impervious and is comprised of the south half of Sagefield Drive. Runoff ($Q_5=2.3$ cfs, $Q_{100}=4.1$ cfs) from this basin will flow southeast along the EPC Type A C&G to the 5' Type R inlet (sump) at DP12. This inlet was sized to capture all flows in the

minor and major storm. DP12 flows combine with DP11 at DP12.1 ($Q_5=9.9$ cfs, $Q_{100}=18.1$ cfs). Flows then combine at the DP12.2 manhole.

Basin C4 is approximately 0.58 acres with a 90% impervious and is comprised of the north half of Sagefield Drive. Runoff ($Q_5=2.0$ cfs, $Q_{100}=3.8$ cfs) from this basin will flow southeast along the EPC Type A C&G to the 5' Type R inlet (sump) at DP13. This inlet was sized to capture all flows in the minor and major storm. DP13 flows combine with DP12.2 at DP13.1 ($Q_5=19.6$ cfs, $Q_{100}=35.9$ cfs). Flows are then pipe to Pond 1 and combine at the outlet structure DP15.1.

Basin C5 is approximately 0.49 acres with a 95% impervious and is comprised of proposed commercial Lot 4. Runoff ($Q_5=2.0$ cfs, $Q_{100}=3.6$ cfs) from this basin will flow overland north into Pond 1 at DP14. Flows then combine at the outlet structure DP15.1.

Basin D is approximately 1.57 acres with a 59% impervious and is comprised of Tract C and proposed Pond 1. Runoff ($Q_5=4.6$ cfs, $Q_{100}=9.7$ cfs) from this basin will flow from all sides to Pond 1 and combine at the outlet structure DP15.1 ($Q_5=63.0$ cfs, $Q_{100}=129.5$ cfs). The Pond 1 outlet structure will control the release of the flows and discharge to the existing 30" HDPE storm sewer at DP15.2 ($Q_5=1.0$ cfs, $Q_{100}=22.4$ cfs) and continue flowing off-site to the south and then east.

Off-site basin OS3 is approximately 27.2 acres is comprised of the northwest half of US 24 and undeveloped area to the northwest of the project site. The basin boundaries conform with the basin delineation shown in the 2019 ADP Report. Runoff ($Q_5=18.9$ cfs, $Q_{100}=63.5$ cfs) from this basin will follow the historic path overland from the northwest to the southeast where it will enter Basin E1 via an existing 24" CMP culvert at DPO3. A proposed DPO3 swale conveys the flow along the existing avigation easement to the Judge Orr Road ditch. The design conforms with the 2019 ADP Report. The basin flows will combine at proposed triple 36" RCP culverts at DP17.1.

Off-site basin OS4 is approximately 3.48 acres with a 34% impervious and is comprised of the southeast half of US 24, the north half of Judge Orr Road and undeveloped land. Runoff ($Q_5=3.7$ cfs, $Q_{100}=9.7$ cfs) from this basin will follow the historic path flowing from the roadway to the Judge Orr Road roadside swale where it will combine at proposed triple 36" RCP culverts at DP17.1.

Will it be a tract if it will not be built on?

Basin E1 is approximately 11.7 acres with a 2% impervious and is comprised of proposed undeveloped Lot 1 and an existing avigation easement. Runoff ($Q_5=2.4$ cfs, $Q_{100}=16.0$ cfs) from this basin will sheet flow overland to the southeast to DP16 and combine at DP17.1.

Basin E2 is approximately 0.87 acres with a 70% impervious and is comprised of proposed south access of Sagefield Drive and part of commercial Lots 3 and. Runoff ($Q_5=2.7$ cfs, $Q_{100}=5.5$ cfs) from this basin will flow offsite to the east to DP17 and combine with DP16 at DP17.1 ($Q_5=24.8$ cfs, $Q_{100}=87.6$ cfs). DP17.1 flows represent the total combined flow captured by the proposed triple 36" RCP culverts. Flows then continue flowing off-site to the east along Judge Orr Road swale.

A summary of proposed basin parameters is presented in Appendix B.

Comparison of Flows

There are two locations where the existing and proposed flows leave the site:

- Flows leave the eastern side of the site within the existing 30" HDPE storm sewer located at the existing DP1.1 and proposed DP15.2. Existing DP1.1 flows ($Q_5=6.6$ cfs, $Q_{100}=38.8$ cfs) are greater in both the minor and major storm than the proposed DP15.2 flows ($Q_5=1.0$ cfs, $Q_{100}=57.3$ cfs). In the 2019 ADP Report, the flows entering the 30" HDPE storm sewer are $Q_5=0.1$ cfs and $Q_{100}=57.3$ cfs at DPD1. The proposed development limits flow traveling off-site at this location to below predevelopment conditions and does not negatively impact the existing storm sewer infrastructure or downstream properties.
- Flows leave the southeastern side of the site along the Judge Orr Road roadside swale to the existing triple 36" X 30" HERCP culverts located at the existing DP2.1 and proposed triple 36" RCP culverts at proposed DP17.1. Existing DP2.1 flows ($Q_5=20.7$ cfs, $Q_{100}=79.2$ cfs) are greater in both the minor and major storm than the proposed DP17.1 flows ($Q_5=24.8$ cfs, $Q_{100}=87.6$ cfs). In the 2019 ADP Report, the flows entering the triple 36" X 30" HERCP culverts are $Q_5=24.8$ cfs and $Q_{100}=94.8$ cfs at DP5. The proposed development limits flow traveling off-site at this location to below predevelopment conditions and does not negatively impact the existing storm sewer infrastructure or downstream properties.

The proposed developed flows leave the site at less than or equal to the flow rates that were used to design the downstream infrastructure as described within the 2019 ADP Report.

Therefore, there is no negative impact anticipated to downstream properties.

DRAINAGE FACILITY DESIGN

General Concept

The proposed stormwater conveyance system was designed to convey the developed Judge Orr Commercial Park flows to the full-spectrum EDB via EPC Type A C&G, inlets, storm sewer, culverts, and swales. The proposed full-spectrum EDB will be designed to release flows at less than historic to minimize adverse impacts downstream. Due to this, there are no drainage problems anticipated downstream of the Judge Orr Commercial Park development. The EDB will outfall to existing storm sewer and flows east to Judge Orr Road RV Park & Storage and ultimately to the Haegler Ranch drainageway.

Specific Details

The full-spectrum EDB will have proposed forebays at inflow points, concrete trickle channel, and outlet structure. The proposed pond forebays and weir contain the required percentage of the Water Quality Capture Volume (WQCV). The forebays weir will release 2% or 3% of the undetained peak 100-year inflow (depending on impervious acres per USDCM) into the full-spectrum EDB to the

Will require a PCM Identifier (i.e. Pond 1, Pond A, etc.) for project pond will be constructed under.

proposed concrete trickle channel. The trickle channel will direct flows into the proposed full-spectrum EDB outlet structure, which will detain water per times specified by criteria. The WQCV will be released within 40 hours and the EURV will be released within 72 hours.

Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume (WQCV) and implementing source controls.

Step 1: Reducing Runoff Volumes – The development of the project site is proposed as industrial and commercial lots (2.5-acre min.). The future developments shall incorporate lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Portions of the proposed flow in general follows the historic path over pervious surfaces into existing drainage paths. These practices will also allow for increased infiltration and reduce runoff volume.

Step 2: Stabilize Drainageways – Judge Orr Commercial Park utilizes storm sewer throughout the project site. The storm sewer networks direct the on-site development flows to proposed Pond 1. Pond 1 releases flow into the existing storm sewer infrastructure and ultimately into the Haegler Ranch drainageway.

Step 3: Provide WQCV – Runoff from this development is treated through capture and slow release of the WQCV in the permanent full-spectrum EDB that is designed per current El Paso County drainage criteria. Some areas meet the requirements of Section 1.7.B.7 for land disturbance to undeveloped land to remain undeveloped.

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full-spectrum water quality and detention will be provided for all of the development site not meeting exclusions present in the ECM - Stormwater Quality Policy and Procedures Section 1.7.1.B. Basin E1 falls under the Section 1.7.1.B.7 of the ECM Stormwater Quality and Policy Procedure for land disturbance to undeveloped land to remain undeveloped. Only a portion of this basin is disturbed with the proposed DPO3 swale and grading tie-ins to the existing Judge Orr Road ditch. Basin E2 is under the 1-acre limit and is the only on-site basin to be released off-site without any WQ treatment. This exclusion is under Section 1.7.1.C.1.A of the ECM Stormwater Quality Policy and Procedure for portions of the site where it is not practicable to capture the runoff. The proposed roadways and basins not listed above will be treated within the proposed full-spectrum EDB. Outlet structure release rates will be limited to less than historic rates to minimize adverse impacts to downstream stormwater facilities.

See Table 2 below for the water quality treatment summary table indicating which basins are treated and which are excluded.

Revise reference for
ECM Appendix I that
was updated May 2026.
Typical comment.

Table 2 - Water quality treatment summary table.

PBMP Summary Table		
Basins	Tributary Area (acres)	PBMP
A1-A6	11.0	POND 1
B1-B3	8.52	POND 1
C1-C5	6.39	POND 1
D	1.57	POND 1
E1	11.7	EXCLUDED*
E2	0.87	EXCLUDED**
*EXCLUDED BASED ON LAND DIST. TO UNDEVELOPED LAND TO REMAIN UNDEVELOPED PER ECM APP. I.7.1.B.7 **UNTREATED AND UNDETAINED AREA (<1 ACRE)		

Step 4: Implement Source Controls - A site specific stormwater quality and erosion control plan and narrative shall be prepared in conjunction with the Final Drainage Report. Site specific temporary source control BMPs as well as permanent BMP's will be detailed in this plan and narrative to protect receiving waters.

Proposed Full-Spectrum EDBs

Water quality is provided for the site by the full-spectrum detention and water quality EDBs. Table 3 below shows the basin parameters for the pond. Refer to Appendix C for the MHFD-Detention design sheets that include the tributary basin parameters as well as the stage-storage table. The outlet structure shall be fully designed with the Final Drainage Report and includes an orifice plate, overflow grate, and restrictor plate to release stormwater at the appropriate rates. The WQCV will be released within 40 hours, the EURV will be released within 72 hours, and the minor and major flows will be released at or below the pre-development flow rate. A preliminary outlet structure design is provided in Appendix C. Table 4 below gives the designed results for Pond 1.

Table 3 - Watershed design parameters for EDB.

Name	Watershed Area	Percent Impervious	Watershed Slope
Pond 1	37.0 ac	68.5%	0.015 ft/ft

Use same Pond name

Table 4- Full-spectrum EDB design.

Name	Required Volume (ac-ft)	Provided Volume (ac-ft)	WQCV (ac-ft)	EURV (ac-ft)	5-year Release (cfs)	100-year Release (cfs)
Pond A	4.7	4.9	0.8	3.2	1.0	22.4

For Pond 1, a broad-crested weir lined with buried soil riprap is provided as an emergency spillway along the eastern embankment of the pond. Should the spillway become active, emergency flows would travel to Range Flower Way and flow south.

Erosion Control Plan

We respectfully request that the Final Erosion Control Plan and associated Cost Estimate to be submitted in conjunction with the construction drawings and plat prior to obtaining a grading permit.

Operation & Maintenance

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. All proposed drainage structures within any platted County R.O.W. (roadside ditches and local road culverts) will be owned and maintained by El Paso County. All proposed drainage structures within easements or tracts (full-spectrum water quality ponds, drainageway culverts and drainageway improvements) will be owned and maintained by the property owner unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Inspection access for El Paso County will be provided through maintenance easements

Drainage and Bridge Fees

The proposed site lies within the Haegler Ranch Drainage Basin. The drainage and basin fees will be assessed in conjunction with the construction drawings and plat prior to obtaining a grading permit.

Construction Cost Opinion

A construction cost opinion for the drainage infrastructure will be provided in conjunction with the construction drawings and plat prior to obtaining a grading permit.

SUMMARY

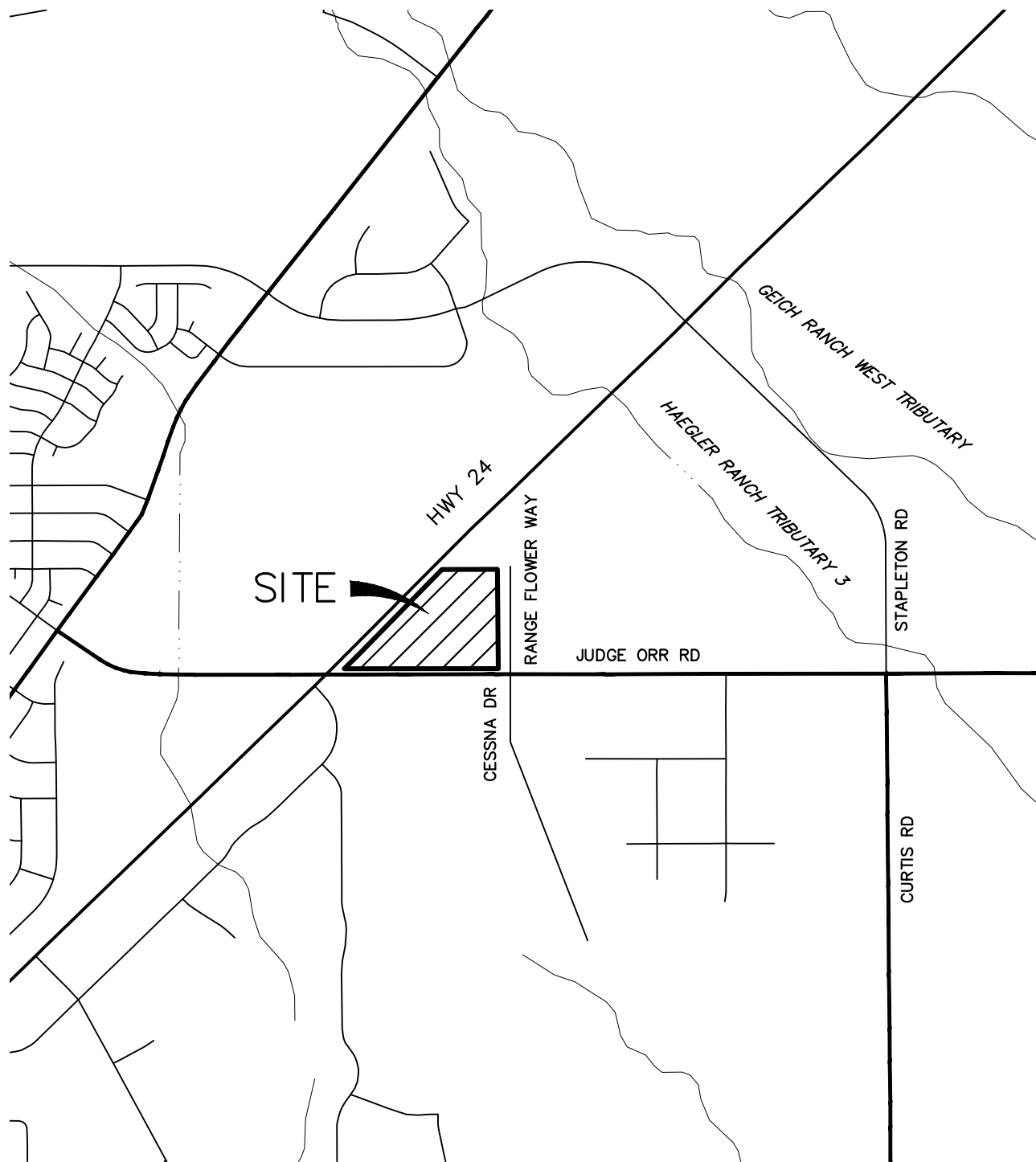
The Preliminary Drainage Report for Judge Orr Road Commercial Park identifies on-site and off-site drainage patterns, storm sewer, inlet locations, areas tributary to the site, and safely routes developed storm water to adequate outfall facilities. The proposed Judge Orr Road Commercial Park development will not adversely affect the off-site major drainageways or surrounding development. This report meets the latest El Paso County Drainage Criteria requirements for this site.

REFERENCES:

1. Engineering Criteria Manual, El Paso County, October 14, 2020.
2. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.
3. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.
4. Haegler Ranch Basin Drainage Basin Planning Study, URS Corporation, May 2009.
5. Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development, Associated Design Professionals, Inc., July 2019.

APPENDIX A

FIGURES AND EXHIBITS



2000 1000 0 2000



ORIGINAL SCALE: 1" = 2000'

VICINITY MAP
JUDGE ORR ROAD COMMERCIAL PARK
JOB NO. 25315.00
05/28/2025
SHEET 1 OF 1



J&R ENGINEERING

A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 38.9571°, Longitude: -104.5723°
Elevation: 6873 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.239 (0.191-0.301)	0.291 (0.232-0.367)	0.381 (0.303-0.482)	0.461 (0.364-0.585)	0.577 (0.444-0.764)	0.672 (0.504-0.899)	0.771 (0.559-1.06)	0.877 (0.609-1.23)	1.02 (0.684-1.48)	1.14 (0.741-1.66)
10-min	0.349 (0.279-0.440)	0.426 (0.340-0.537)	0.558 (0.444-0.705)	0.674 (0.534-0.856)	0.845 (0.650-1.12)	0.984 (0.738-1.32)	1.13 (0.818-1.55)	1.28 (0.892-1.81)	1.50 (1.00-2.16)	1.67 (1.08-2.44)
15-min	0.426 (0.341-0.537)	0.519 (0.415-0.655)	0.681 (0.542-0.860)	0.822 (0.651-1.04)	1.03 (0.792-1.36)	1.20 (0.899-1.61)	1.38 (0.998-1.89)	1.57 (1.09-2.20)	1.83 (1.22-2.64)	2.04 (1.32-2.97)
30-min	0.610 (0.487-0.768)	0.743 (0.593-0.936)	0.972 (0.774-1.23)	1.17 (0.929-1.49)	1.47 (1.13-1.94)	1.71 (1.28-2.28)	1.96 (1.42-2.68)	2.22 (1.54-3.13)	2.60 (1.73-3.74)	2.89 (1.87-4.21)
60-min	0.781 (0.624-0.984)	0.938 (0.749-1.18)	1.22 (0.969-1.54)	1.47 (1.16-1.87)	1.85 (1.43-2.47)	2.17 (1.63-2.92)	2.51 (1.82-3.46)	2.88 (2.01-4.07)	3.41 (2.28-4.93)	3.83 (2.48-5.58)
2-hr	0.952 (0.767-1.19)	1.13 (0.912-1.42)	1.46 (1.17-1.83)	1.77 (1.41-2.23)	2.24 (1.75-2.97)	2.64 (2.00-3.53)	3.07 (2.25-4.20)	3.54 (2.49-4.98)	4.22 (2.85-6.08)	4.77 (3.12-6.91)
3-hr	1.04 (0.845-1.30)	1.23 (0.993-1.53)	1.58 (1.27-1.96)	1.91 (1.53-2.39)	2.43 (1.91-3.22)	2.88 (2.20-3.85)	3.38 (2.49-4.62)	3.92 (2.78-5.50)	4.72 (3.21-6.78)	5.37 (3.53-7.75)
6-hr	1.21 (0.986-1.49)	1.41 (1.15-1.74)	1.79 (1.45-2.21)	2.17 (1.75-2.69)	2.77 (2.20-3.66)	3.30 (2.55-4.39)	3.89 (2.90-5.30)	4.56 (3.25-6.36)	5.52 (3.79-7.90)	6.32 (4.19-9.06)
12-hr	1.39 (1.14-1.70)	1.62 (1.33-1.98)	2.06 (1.69-2.53)	2.49 (2.03-3.07)	3.17 (2.54-4.14)	3.76 (2.93-4.96)	4.42 (3.32-5.97)	5.16 (3.71-7.14)	6.22 (4.30-8.83)	7.11 (4.75-10.1)
24-hr	1.60 (1.33-1.94)	1.88 (1.56-2.28)	2.39 (1.97-2.90)	2.87 (2.36-3.51)	3.62 (2.91-4.67)	4.26 (3.33-5.55)	4.96 (3.75-6.62)	5.73 (4.16-7.86)	6.84 (4.77-9.63)	7.76 (5.23-11.0)
2-day	1.86 (1.55-2.23)	2.18 (1.82-2.62)	2.77 (2.30-3.34)	3.31 (2.74-4.01)	4.12 (3.34-5.25)	4.81 (3.79-6.20)	5.55 (4.22-7.33)	6.35 (4.64-8.62)	7.49 (5.26-10.4)	8.42 (5.73-11.8)
3-day	2.03 (1.71-2.43)	2.39 (2.01-2.86)	3.03 (2.53-3.64)	3.61 (3.00-4.35)	4.48 (3.63-5.66)	5.20 (4.11-6.66)	5.98 (4.57-7.84)	6.82 (5.00-9.20)	8.00 (5.64-11.1)	8.96 (6.13-12.5)
4-day	2.19 (1.84-2.60)	2.56 (2.16-3.06)	3.23 (2.71-3.86)	3.83 (3.20-4.60)	4.74 (3.86-5.97)	5.49 (4.36-7.00)	6.30 (4.83-8.23)	7.16 (5.27-9.63)	8.39 (5.94-11.6)	9.38 (6.45-13.1)
7-day	2.59 (2.20-3.06)	2.99 (2.53-3.54)	3.70 (3.12-4.39)	4.34 (3.64-5.18)	5.30 (4.34-6.63)	6.10 (4.88-7.72)	6.96 (5.37-9.04)	7.88 (5.84-10.5)	9.19 (6.55-12.6)	10.2 (7.09-14.2)
10-day	2.94 (2.50-3.46)	3.38 (2.87-3.98)	4.14 (3.51-4.90)	4.83 (4.07-5.73)	5.85 (4.81-7.26)	6.70 (5.37-8.42)	7.59 (5.88-9.81)	8.56 (6.36-11.4)	9.91 (7.10-13.6)	11.0 (7.65-15.2)
20-day	3.92 (3.36-4.57)	4.52 (3.88-5.28)	5.53 (4.73-6.48)	6.40 (5.44-7.53)	7.64 (6.30-9.33)	8.62 (6.95-10.7)	9.63 (7.51-12.3)	10.7 (8.00-14.0)	12.1 (8.74-16.4)	13.3 (9.30-18.2)
30-day	4.71 (4.06-5.47)	5.45 (4.70-6.33)	6.66 (5.72-7.76)	7.67 (6.55-8.98)	9.06 (7.49-11.0)	10.1 (8.20-12.5)	11.2 (8.78-14.2)	12.3 (9.27-16.1)	13.8 (9.99-18.6)	14.9 (10.5-20.4)
45-day	5.70 (4.94-6.58)	6.58 (5.70-7.60)	8.00 (6.91-9.27)	9.16 (7.86-10.7)	10.7 (8.88-12.9)	11.9 (9.64-14.5)	13.0 (10.2-16.4)	14.2 (10.7-18.4)	15.7 (11.4-20.9)	16.8 (11.9-22.8)
60-day	6.53 (5.68-7.51)	7.51 (6.53-8.65)	9.08 (7.86-10.5)	10.3 (8.90-12.0)	12.0 (9.95-14.3)	13.2 (10.7-16.0)	14.4 (11.3-18.0)	15.6 (11.8-20.0)	17.0 (12.4-22.6)	18.1 (12.9-24.6)

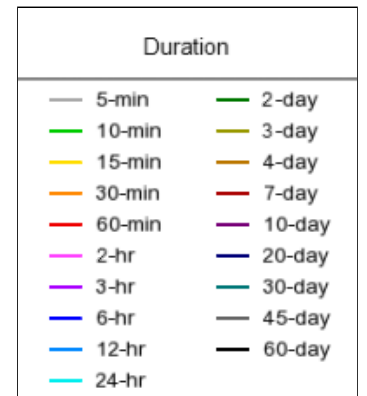
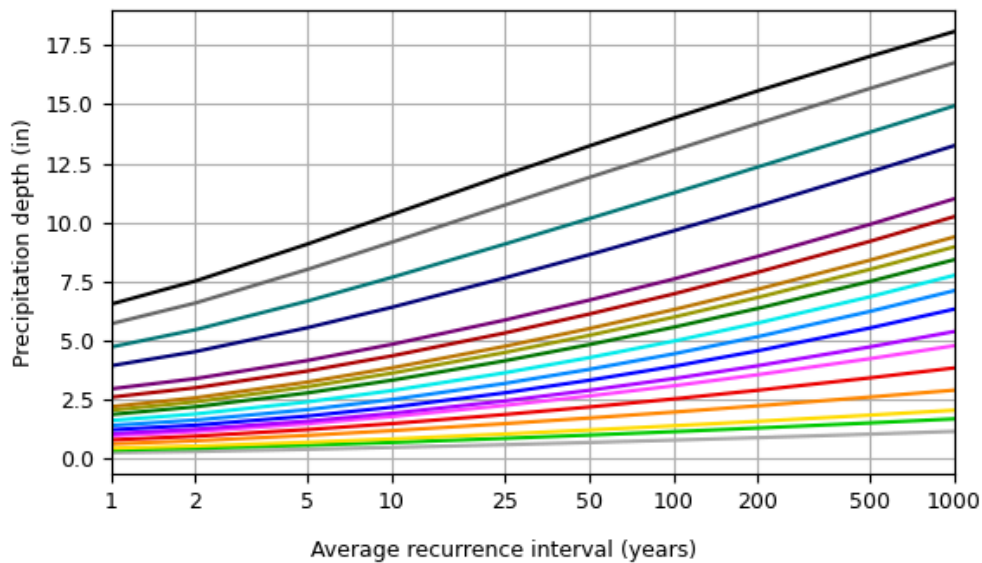
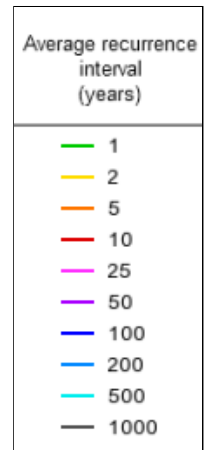
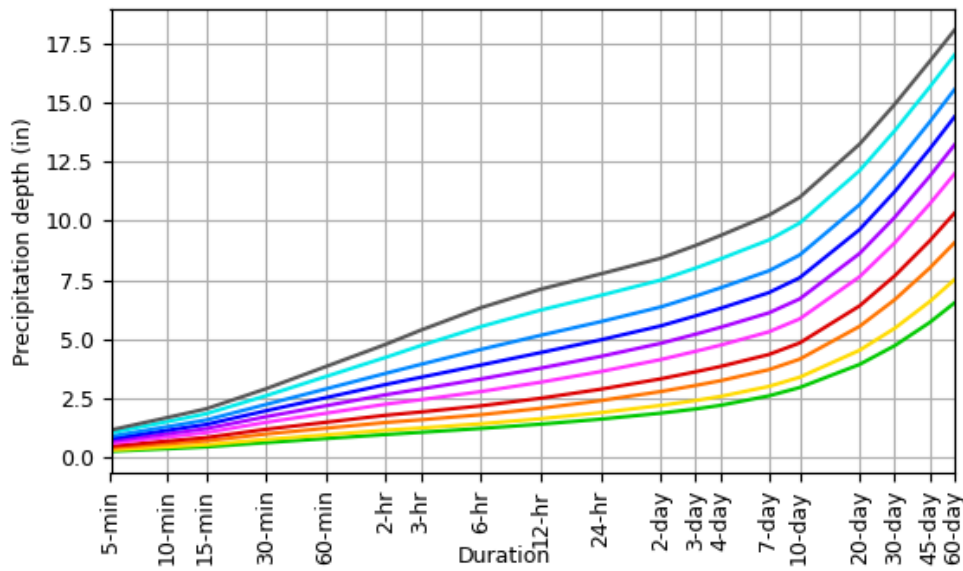
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 38.9571°, Longitude: -104.5723°



[Back to Top](#)

Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

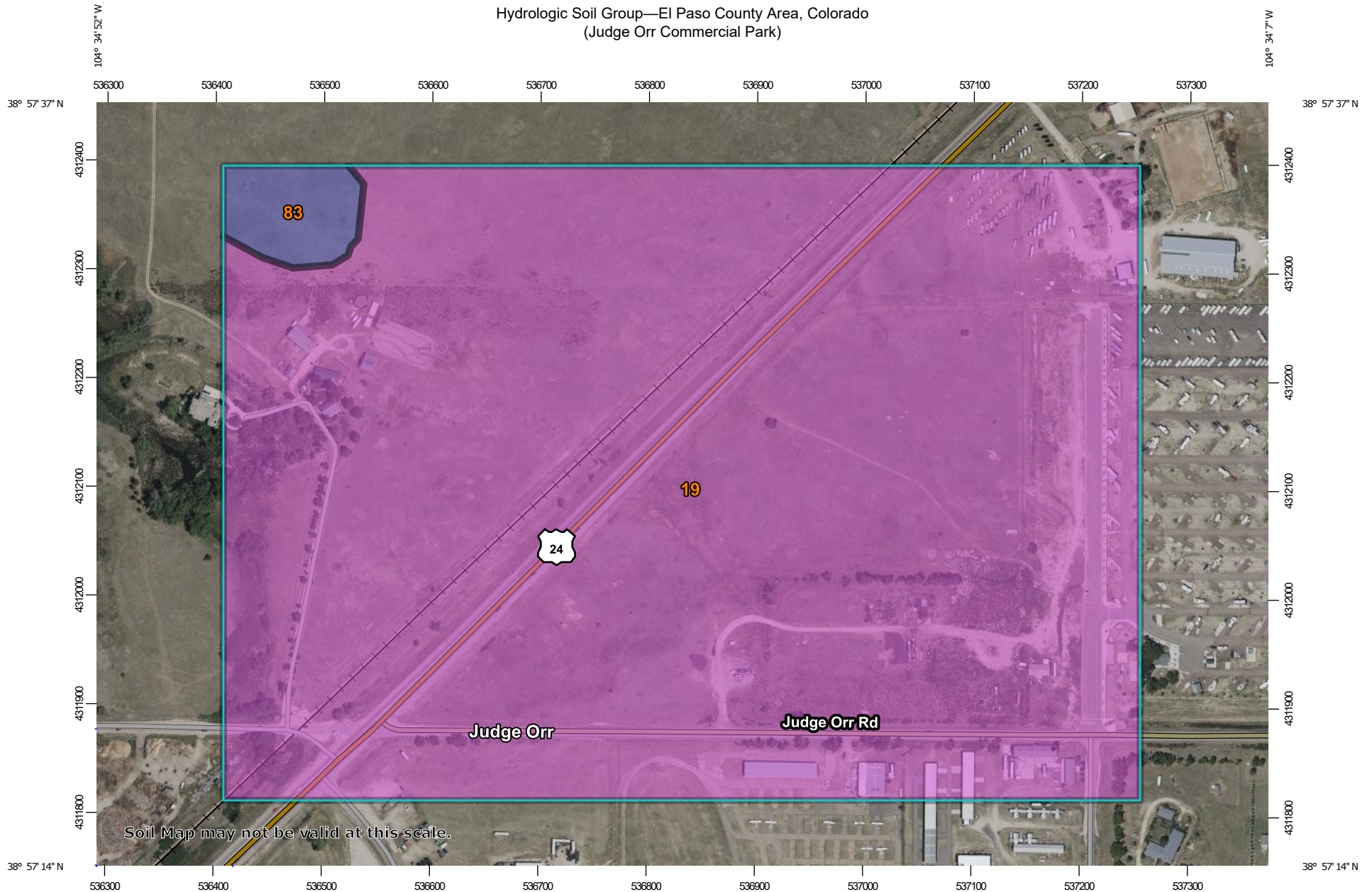


[Back to Top](#)

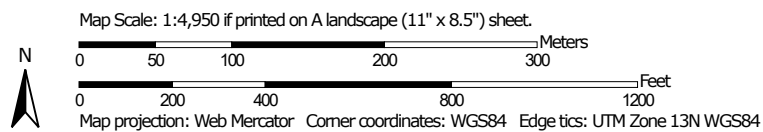
[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

Hydrologic Soil Group—El Paso County Area, Colorado (Judge Orr Commercial Park)



Soil Map may not be valid at this scale.



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

4/28/2025
Page 1 of 4

Hydrologic Soil Group—El Paso County Area, Colorado
(Judge Orr Commercial Park)

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 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Jul 23, 2024—Aug 4, 2024

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
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	120.0	97.8%
83	Stapleton sandy loam, 3 to 8 percent slopes	B	2.6	2.2%
Totals for Area of Interest			122.6	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

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

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

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

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

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

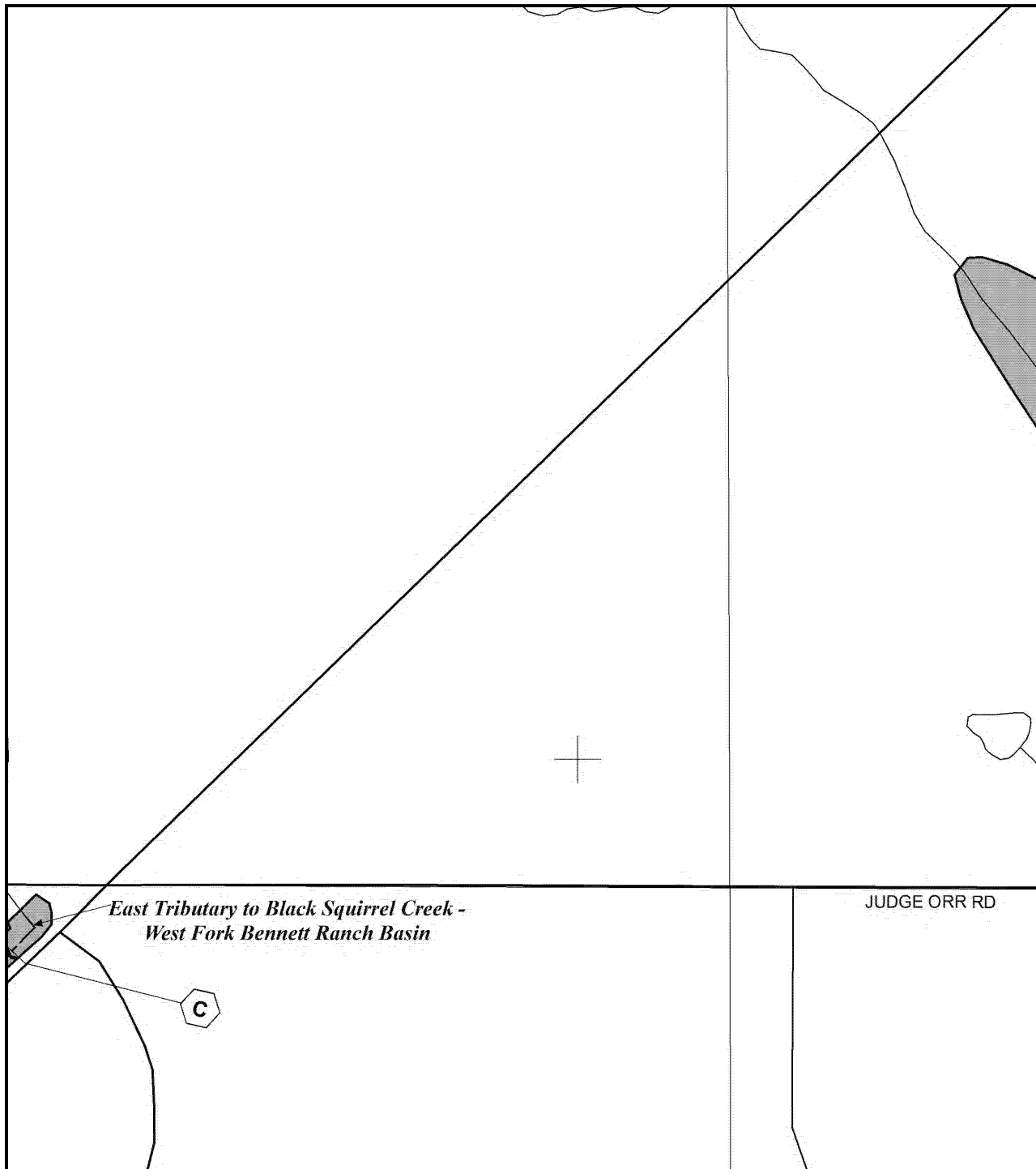
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



MAP SCALE 1" = 500'

250 0 500 1000
FEET

50 0 150 300
MET



PANEL 0554G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 554 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0554	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER
08041C0554G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at <https://msc.fema.gov>.

APPENDIX B

HYDROLOGIC CALCULATIONS

EXISTING COMPOSITE % IMPERVIOUS/C VALUE CALCULATIONS

Subdivision: Judge Orr Road Commercial Park

Location: El Paso County

Project Name: Judge Orr Road Commercial Park

Project No.: 25315.00

Calculated By: _____

Checked By: _____

Date: 5/28/25

Basin ID	Total Area (ac)	Hardscape (100% Impervious)				Roofs (90% Impervious)				Undeveloped (2% Impervious)				Basin Total Weighted C		Basins Total Weighted % Imp.
		C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	
EXA	18.9	0.90	0.96	0.00	0.0%	0.73	0.8	0.00	0.0%	0.09	0.4	18.9	2.0%	0.09	0.36	2.0%
EXB	21.2	0.90	0.96	0.00	0.0%	0.73	0.8	0.00	0.0%	0.09	0.4	21.2	2.0%	0.09	0.36	2.0%
OS1	7.81	0.90	0.96	0.36	4.6%	0.73	0.8	0.0	0.0%	0.09	0.4	7.5	1.9%	0.13	0.39	6.5%
OS2	0.97	0.90	0.96	0.19	19.6%	0.73	0.8	0.0	0.0%	0.09	0.4	0.8	1.6%	0.25	0.48	21.2%
OS3	27.2	0.90	0.96	-	-	0.73	0.8	-	-	0.09	0.4	-	-	0.30	0.60	-
OS4	3.67	0.90	0.96	1.21	33.0%	0.73	0.8	0.0	0.0%	0.09	0.4	2.5	1.3%	0.36	0.56	34.3%
Total On-Site	40.1															2.0%
Total Off-Site	39.7															-
Notes: Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019																

EXISTING STANDARD FORM SF-2

TIME OF CONCENTRATION

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By:
Checked By:
Date: 5/28/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
EXA	18.9	A	2%	0.09	0.36	300	3.0%	22.0	740	1.8%	7.0	0.9	13.1	35.1	1040.0	35.6	35.1
EXB	21.2	A	2%	0.09	0.36	300	1.5%	27.6	1660	2.0%	7.0	1.0	27.9	55.6	1960.0	46.7	46.7
OS1	7.81	A	7%	0.13	0.39	-	-	-	-	-	-	-	-	-	-	-	21.6
OS2	0.97	A	21%	0.25	0.48	70	23.0%	4.6	0	0.0%	15.0	0.0	0.0	4.6	70.0	22.4	5.0
OS3	27.2	A	-	0.30	0.60	-	-	-	-	-	-	-	-	-	-	-	33.4
OS4	3.67	A	34%	0.36	0.56	85	2.0%	9.8	2015	4.0%	15.0	3.0	11.2	21.0	2100.0	32.3	21.0

NOTES: Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

$$t_c = t_i + t_t$$

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S_o^{0.33}}$$

Equation 6-3

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60KV_s} = \frac{L_t}{60V_s}$$

Equation 6-4

Where:

t_t = channelized flow time (travel time, min)

L_t = waterway length (ft)

S_o = waterway slope (ft/ft)

V_s = travel time velocity (ft/sec) = K√S_o

K = NRCS conveyance factor (see Table 6-2).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

Where:

t_i = overland (initial) flow time (minutes)

C_s = runoff coefficient for 5-year frequency (from Table 6-4)

L_t = length of overland flow (ft)

S_o = average slope along the overland flow path (ft/ft).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.

L_t = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Equation 6-5

EXISTING STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 5-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By:
Checked By:
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q_c (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q_c (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_c (min)	
	O1	OS1	7.81	0.13	21.6	0.99	2.98	2.9															Off-site flows onto the site on the north side at DPO1 Combines flow at existing FES at DP1.1
	O2	OS2	0.97	0.25	5.0	0.24	5.17	1.2															Off-site US 24 roadway flows onto the site on the north west side at DPO2 Combines flow at existing FES at DP1.1
	1	EXA	18.9	0.09	35.1	1.70	2.25	3.8															Sheet flows overland to the south west side to DP1 Combines flow at existing FES at DP1.1
	1.1								35.1	2.93	2.25	6.6											Combined flows of DPO1, DPO2, and DP1 Flows within existing 30" HDPE storm sewer south and then offsite to the east
	O3	OS3	27.2	0.30	33.4	8.16	2.32	19.0															Off-site flows onto the site via an existing 24" CMP culvert at DPO3 Combines flow at existing triple 36" X 30" HERCP culverts at DP2.1
	O4	OS4	3.67	0.36	21.0	1.31	3.01	3.9															Off-site US 24 and Judge Orr roadway flows onto the site on the south east and south side at DPO4 Combines flow at existing triple 36" X 30" HERCP culverts at DP2.1
	2	EXB	21.2	0.09	46.7	1.91	1.82	3.5															Sheet flows overland to the south west side to DP2 Combines flow at existing triple 36" X 30" HERCP culverts at DP2.1
	2.1								46.7	11.38	1.82	20.7											Combined flows of DPO3, DPO4, and DP2 at existing triple 36" X 30" HERCP culverts Continues flowing to the east off-site along Judge Orr Road swale

Notes:
Street and Pipe C*A values are determined by Q_c/I using the catchment's intensity value.
Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

EXISTING STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 100-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	I (in/hr)	Q _i (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q _i (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _c (min)	
	O1	OS1	7.81	0.39	21.6	3.03	5.00	15.1															Off-site flows onto the site on the north side at DPO1 Combines flow at existing FES at DP1.1
	O2	OS2	0.97	0.48	5.0	0.46	8.68	4.0															Off-site US 24 roadway flows onto the site on the north west side at DPO2 Combines flow at existing FES at DP1.1
	1	EXA	18.9	0.36	35.1	6.80	3.77	25.6															Sheet flows overland to the south west side to DP1 Combines flow at existing FES at DP1.1
	1.1								35.1	10.29	3.77	38.8											Combined flows of DPO1, DPO2, and DP1 Flows within existing 30" HDPE storm sewer south and then offsite to the east
	O3	OS3	27.2	0.60	33.4	16.33	3.90	63.6															Off-site flows onto the site via an existing 24" CMP culvert at DPO3 Combines flow at existing triple 36" X 30" HERCP culverts at DP2.1
	O4	OS4	3.67	0.56	21.0	2.05	5.06	10.4															Off-site US 24 and Judge Orr roadway flows onto the site on the south east and south side at DPO4 Combines flow at existing triple 36" X 30" HERCP culverts at DP2.1
	2	EXB	21.2	0.36	46.7	7.63	3.05	23.2															Sheet flows overland to the south west side to DP2 Combines flow at existing triple 36" X 30" HERCP culverts at DP2.1
	2.1								46.7	26.01	3.05	79.2											Combined flows of DPO3, DPO4, and DP2 at existing triple 36" X 30" HERCP culverts Continues flowing to the east off-site along Judge Orr Road swale

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

PROPOSED COMPOSITE % IMPERVIOUS/C VALUE CALCULATIONS

Subdivision: Judge Orr Road Commercial Park

Location: El Paso County

Project Name: Judge Orr Road Commercial Park

Project No.: 25315.00

Calculated By: _____

Checked By: _____

Date: 5/28/25

Basin ID	Total Area (ac)	Hardscape/Water (100% Impervious)				Business (Commercial Areas) (95% Impervious)				Industrial (Light Areas) (80% Impervious)				Undeveloped (2% Impervious)				Basin Total Weighted C		Basins Total Weighted % Imp.
		C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	
A1	2.45	0.90	0.96	0.00	0.0%	0.81	0.88	0.00	0.0%	0.59	0.70	2.45	80.0%	0.09	0.36	0.00	0.0%	0.59	0.70	80.0%
A2	2.85	0.90	0.96	0.00	0.0%	0.81	0.88	0.00	0.0%	0.59	0.70	2.85	80.0%	0.09	0.36	0.00	0.0%	0.59	0.70	80.0%
A3	3.88	0.90	0.96	0.00	0.0%	0.81	0.88	0.00	0.0%	0.59	0.70	3.88	80.0%	0.09	0.36	0.00	0.0%	0.59	0.70	80.0%
A4	0.59	0.90	0.96	0.53	89.8%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.06	0.2%	0.82	0.90	90.0%
A5	0.58	0.90	0.96	0.53	91.4%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.05	0.2%	0.83	0.91	91.6%
A6	0.66	0.90	0.96	0.00	0.0%	0.81	0.88	0.66	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
B1	2.51	0.90	0.96	0.00	0.0%	0.81	0.88	2.51	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
B2	2.51	0.90	0.96	0.00	0.0%	0.81	0.88	2.51	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
B3	3.50	0.90	0.96	0.00	0.0%	0.81	0.88	3.50	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
C1	2.34	0.90	0.96	0.00	0.0%	0.81	0.88	2.34	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
C2	2.32	0.90	0.96	0.00	0.0%	0.81	0.88	2.32	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
C3	0.66	0.90	0.96	0.60	90.9%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.06	0.2%	0.83	0.91	91.1%
C4	0.58	0.90	0.96	0.52	89.7%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.06	0.2%	0.82	0.90	89.9%
C5	0.49	0.90	0.96	0.00	0.0%	0.81	0.88	0.49	95.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	95.0%
D	1.57	0.90	0.96	0.92	58.6%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.65	0.8%	0.56	0.71	59.4%
E1	11.7	0.90	0.96	0.00	0.0%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	11.70	2.0%	0.09	0.36	2.0%
E2	0.87	0.90	0.96	0.25	28.7%	0.81	0.88	0.37	40.4%	0.59	0.70	0.00	0.0%	0.09	0.36	0.25	0.6%	0.63	0.75	69.7%

Basin ID	Total Area (ac)	Hardscape/Water (100% Impervious)				Business (Commercial Areas) (95% Impervious)				Industrial (Light Areas) (80% Impervious)				Undeveloped (2% Impervious)				Basin Total Weighted C		Basins Total Weighted % Imp.
		C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	
																		C ₅	C ₁₀₀	
OS1	7.81	0.90	0.96	0.36	4.6%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	7.45	1.9%	0.13	0.39	6.5%
OS2a	0.58	0.90	0.96	0.12	20.7%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.46	1.6%	0.26	0.48	22.3%
OS2b	0.64	0.90	0.96	0.10	15.6%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.54	1.7%	0.22	0.45	17.3%
OS3	27.2	0.90	0.96	-	-	0.81	0.88	-	-	0.59	0.70	-	-	0.09	0.36	-	-	0.30	0.60	-
OS4	3.48	0.90	0.96	1.12	32.2%	0.81	0.88	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	2.36	1.4%	0.35	0.55	33.5%
Total Pond 1	36.5																			68.0%
Total On-Site	40.1																			62.2%
Total Off-Site	39.7																			-
Notes: Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019																				

PROPOSED STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By:
Checked By:
Date: 5/28/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
A1	2.45	A	80%	0.59	0.70	100	2.8%	6.6	320	3.0%	20.0	3.5	1.5	8.1	420.0	13.9	8.1
A2	2.85	A	80%	0.59	0.70	100	3.6%	6.0	200	3.3%	20.0	3.6	0.9	7.0	300.0	13.3	7.0
A3	3.88	A	80%	0.59	0.70	100	3.3%	6.2	590	2.6%	20.0	3.2	3.0	9.3	690.0	15.4	9.3
A4	0.59	A	90%	0.82	0.90	20	2.0%	1.8	910	1.0%	20.0	2.0	7.6	9.4	930.0	17.7	9.4
A5	0.58	A	92%	0.83	0.91	20	2.0%	1.7	880	1.0%	20.0	2.0	7.3	9.1	900.0	17.2	9.1
A6	0.66	A	95%	0.81	0.88	100	1.0%	5.2	20	1.0%	20.0	2.0	0.2	5.4	120.0	10.0	5.4
B1	2.51	A	95%	0.81	0.88	100	1.5%	4.6	320	1.5%	20.0	2.4	2.2	6.8	420.0	11.8	6.8
B2	2.51	A	95%	0.81	0.88	100	1.5%	4.6	360	1.5%	20.0	2.4	2.4	7.0	460.0	12.0	7.0
B3	3.50	A	95%	0.81	0.88	100	1.5%	4.6	100	1.8%	20.0	2.7	0.6	5.2	200.0	10.4	5.2
C1	2.34	A	95%	0.81	0.88	100	2.0%	4.2	340	2.0%	20.0	2.8	2.0	6.2	440.0	11.6	6.2
C2	2.32	A	95%	0.81	0.88	100	2.0%	4.2	270	2.0%	20.0	2.8	1.6	5.8	370.0	11.3	5.8
C3	0.66	A	91%	0.83	0.91	20	2.0%	1.8	1020	1.0%	20.0	2.0	8.5	10.3	1040.0	18.3	10.3
C4	0.58	A	90%	0.82	0.90	20	2.0%	1.8	910	1.2%	20.0	2.2	6.9	8.7	930.0	17.1	8.7
C5	0.49	A	95%	0.81	0.88	100	1.0%	5.2	60	1.0%	20.0	2.0	0.5	5.7	160.0	10.3	5.7
D	1.57	A	59%	0.56	0.71	45	25.0%	2.2	200	0.5%	20.0	1.4	2.4	4.6	245.0	18.6	5.0
E1	11.70	A	2%	0.09	0.36	300	2.0%	25.1	1600	3.4%	15.0	2.8	9.6	34.8	1900.0	41.2	34.8
E2	0.87	A	70%	0.63	0.75	20	2.0%	3.0	470	2.0%	20.0	2.8	2.8	5.8	490.0	17.1	5.8

PROPOSED STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
OS1	7.81	A	7%	0.13	0.39	-	-	-	-	-	-	-	-	-	-	-	21.6
OS2a	0.58	A	22%	0.26	0.48	70	2.0%	10.1	0	0.0%	15.0	0.0	0.0	10.1	70.0	22.2	10.1
OS2b	0.64	A	17%	0.22	0.45	70	2.0%	10.6	0	0.0%	15.0	0.0	0.0	10.6	70.0	23.1	10.6
OS3	27.2	A	-	0.30	0.60	-	-	-	-	-	-	-	-	-	-	-	33.4
OS4	3.48	A	34%	0.35	0.55	85	2.0%	9.9	2015	4.0%	15.0	3.0	11.2	21.1	2100.0	32.6	21.1

Notes: Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

$$t_c = t_i + t_t$$

Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Equation 6-4

Where:

t_t = channelized flow time (travel time, min)

L_t = waterway length (ft)

S_o = waterway slope (ft/ft)

V_t = travel time velocity (ft/sec) = K√S_o

K = NRCS conveyance factor (see Table 6-2).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S_o^{0.33}}$$

Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)

C_s = runoff coefficient for 5-year frequency (from Table 6-4)

L = length of overland flow (ft)

S_o = average slope along the overland flow path (ft/ft).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.

L_t = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Equation 6-5

PROPOSED STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 5-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	O2A	OS2a	0.58	0.26	10.1	0.15	4.11	0.6															Off-site US 24 roadway flows onto the site on the north west side at DPO2a Combines flow at 24" storm stub at DP1.1
	1	A1	2.45	0.59	8.1	1.45	4.45	6.4															Sheet flows overland to the south east side to DP1 Combines flow at 24" storm stub at DP1.1
	1.1								10.1	1.60	4.11	6.6											Combined flows of DPO2a and DP1 Flows are piped within the storm sewer to the combination manhole at DP2.2
	O2B	OS2b	0.64	0.22	10.6	0.14	4.04	0.6															Off-site US 24 roadway flows onto the site on the north west side at DPO2b Combines flow at 24" storm stub at DP2.1
	2	A2	2.85	0.59	7.0	1.68	4.67	7.9															Sheet flows overland to the south east side to DP2 Combines flow at 24" storm stub at DP2.1
	2.1								7.0	1.82	4.67	8.5											Combined flows of DPO2b and DP2 Flows are piped within the storm sewer to the combination manhole at DP2.2
	2.2								10.1	3.42	4.11	14.1											Combined flows of DP1.1 and DP2.1 Flows are piped within the storm sewer to the combination manhole at DP4.2
	O1	OS1	7.81	0.13	21.6	0.99	2.97	2.9															Off-site flows onto the site on the north side captured by Type C inlet at DPO1 Combines flow at manhole at DP3.1
	3	A3	3.88	0.59	9.3	2.29	4.24	9.7															Sheet flows overland to the south east side to DP3 Combines flow at manhole at DP3.1
	3.1								21.6	3.28	2.97	9.8											Combined flows of DPO1 and DP3 storm sewer stub Flows are piped within the storm sewer to the Type R inlet at DP4.1
	4	A4	0.59	0.82	9.4	0.48	4.22	2.0															Proposed Sagefield Drive flow captured by Type R inlet at DP4 Combines flow within Type R inlet at DP4.1
	4.1								21.6	3.76	2.97	11.2											Combined flows of DP3.1 and DP4 Flows are piped within the storm sewer to the combination manhole at DP4.2
	4.2								21.6	7.18	2.97	21.4											Combined flows of DP2.2 and DP4.1 Flows are piped within the storm sewer to the combination inlet at DP5.1
	5	A5	0.58	0.83	9.1	0.48	4.28	2.1															Proposed Sagefield Drive flow captured by Type R inlet at DP5 Combines flow within Type R inlet at DP5.1
	5.1								21.6	7.66	2.97	22.8											Combines flows of DP4.2 and DP5 Flows are piped within the storm sewer to combine in the pond at DP15.1
	6	A6	0.66	0.81	5.4	0.53	5.05	2.7															Sheets flows overland to the south at DP6 Combines flow within proposed Pond 1 at DP15.1

PROPOSED STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 5-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C* A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C* A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C* A (ac)	Slope (%)	Q _{pipe} (cfs)	C* A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	7	B1	2.51	0.81	6.8	2.03	4.72	9.6															Sheet flows overland to the south east to DP7 swale Combines flow in proposed swale at DP8.1
	8	B2	2.51	0.81	7.0	2.03	4.66	9.5															Sheet flows overland to the north east at DP8 swale Combines flow in proposed swale at DP8.1
	8.1								7.0	4.06	4.66	18.9											Combined flows of DP7 and DP8 swales Flows along swale to combination at proposed FES at DP9.1
	9	B3	3.50	0.81	5.2	2.84	5.11	14.5															Sheet flows overland to the north and south at DP9 swale Combines flow in proposed swale at DP9.1
	9.1								7.0	6.90	4.66	32.1											Combined flows of DP8.1 and DP9 swales at proposed FES at DP9.1 Flows are piped within the storm sewer to combine in Pond 1 at DP15.1
	10	C1	2.34	0.81	6.2	1.90	4.85	9.2															Sheet flows overland to the north and east to the storm sewer stub at DP10 Combines flow at manhole at DP12.2
	11	C2	2.32	0.81	5.8	1.88	4.96	9.3															Sheet flows overland to the north to the storm sewer stub at DP11 Combines flow within Type R inlet and DP12.1
	12	C3	0.66	0.83	10.3	0.55	4.09	2.3															Proposed Sagefield Drive flow captured by Type R inlet at DP12 Combines flow within Type R inlet at DP12.1
	12.1								10.3	2.43	4.09	9.9											Combined flows of DP11 and DP12 Flows are piped within the storm sewer to the combination manhole at DP12.2
	12.2								10.3	4.33	4.09	17.7											Combined flows of DP10 and DP12.1 Flows are piped within the storm sewer to the combination inlet at DP13.1
	13	C4	0.58	0.82	8.7	0.47	4.33	2.0															Proposed Sagefield Drive flow captured by Type R inlet at DP13 Combines flow within Type R inlet at DP13.1
	13.1								10.3	4.80	4.09	19.6											Combines flows of DP12.2 and DP13 Flows are piped within the storm sewer to combine in Pond at DP15.1
	14	C5	0.49	0.81	5.7	0.40	4.96	2.0															Sheets flows overland to the north at DP14 Combines flow within proposed Pond 1 at DP15.1
	15	D	1.57	0.56	5.0	0.89	5.17	4.6															Runoff from sheet flows from all sides to Pond 1 at DP15 Treated within Pond 1 at DP15.1
	15.1								21.6	21.18	2.97	63.0											Combines total Pond 1 inflow of DP5.1, DP6, DP9.1, DP13.1, DP14, and DP15 Treated within Pond 1 and controlled release at DP15.2
	15.2								-	-	-	1.0											Controlled outlet structure release of Pond 1 flows Flows within existing 30" HDPE storm sewer after leaving Pond 1

PROPOSED STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 5-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By:
Checked By:
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	
	O3	OS3	27.2	0.30	33.4	8.16	2.32	18.9														Off-site flows onto the site via an existing 24" CMP culvert at DPO3 Conveyed via proposed DPO3 swale to the existing triple 36" X 30" HERCP culverts at DP17.1
	O4	OS4	3.48	0.35	21.1	1.22	3.01	3.7														Off-site US 24 and Judge Orr roadway flows onto the site on the south east and south side at DPO4 Combines flow at existing triple 36" X 30" HERCP culverts at DP17.1
	16	E1	11.7	0.09	34.8	1.05	2.26	2.4														Sheet flow overland to the south east at DP16 Combines flow at existing triple 36" X 30" HERCP culverts at DP17.1
	17	E2	0.87	0.63	5.8	0.55	4.95	2.7														Flows to the east and south at DP17 Combines flow at existing triple 36" X 30" HERCP culverts at DP17.1
	17.1								34.8	10.98	2.26	24.8										Combined flows of DPO3, DPO4, DP16, and DP17 at existing triple 36" X 30" HERCP culverts Continues flowing to the east off-site along Judge Orr Road swale

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019
Values in BLUE from the MHFD Detention spreadsheets. See Appendix C.

PROPOSED STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 100-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME				REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	O2A	OS2a	0.58	0.48	10.1	0.28	6.90	1.9															Off-site US 24 roadway flows onto the site on the north west side at DPO2a Combines flow at 24" storm stub at DP1.1
	1	A1	2.45	0.70	8.1	1.72	7.47	12.8															Sheet flows overland to the south east side to DP1 Combines flow at 24" storm stub at DP1.1
	1.1								10.1	2.00	6.90	13.8											Combined flows of DPO2a and DP1 Flows are piped within the storm sewer to the combination manhole at DP2.2
	O2B	OS2b	0.64	0.45	10.6	0.29	6.78	2.0															Off-site US 24 roadway flows onto the site on the north west side at DPO2b Combines flow at 24" storm stub at DP2.1
	2	A2	2.85	0.70	7.0	2.00	7.85	15.7															Sheet flows overland to the south east side to DP2 Combines flow at 24" storm stub at DP2.1
	2.1								7.0	2.29	7.85	18.0											Combined flows of DPO2b and DP2 Flows are piped within the storm sewer to the combination manhole at DP2.2
	2.2								10.1	4.29	6.90	29.6											Combined flows of DP1.1 and DP2.1 Flows are piped within the storm sewer to the combination manhole at DP4.2
	O1	OS1	7.81	0.39	21.6	3.03	4.99	15.1															Off-site flows onto the site on the north side captured by Type C inlet at DPO1 Combines flow at manhole at DP3.1
	3	A3	3.88	0.70	9.3	2.72	7.13	19.4															Sheet flows overland to the south east side to DP3 Combines flow at manhole at DP3.1
	3.1								21.6	5.75	4.99	28.7											Combined flows of DPO1 and DP3 storm sewer stub Flows are piped within the storm sewer to the Type R inlet at DP4.1
	4	A4	0.59	0.90	9.4	0.53	7.09	3.8															Proposed Sagefield Drive flow captured by Type R inlet at DP4 Combines flow within Type R inlet at DP4.1
	4.1								21.6	6.28	4.99	31.3											Combined flows of DP3.1 and DP4 Flows are piped within the storm sewer to the combination manhole at DP4.2
	4.2								21.6	10.57	4.99	52.8											Combined flows of DP2.2 and DP4.1 Flows are piped within the storm sewer to the combination inlet at DP5.1
	5	A5	0.58	0.91	9.1	0.53	7.18	3.8															Proposed Sagefield Drive flow captured by Type R inlet at DP5 Combines flow within Type R inlet at DP5.1
	5.1								21.6	11.10	4.99	55.4											Combines flows of DP4.2 and DP5 Flows are piped within the storm sewer to combine in the pond at DP15.1
	6	A6	0.66	0.88	5.4	0.58	8.48	4.9															Sheets flows overland to the south at DP6 Combines flow within proposed Pond 1 at DP15.1

PROPOSED STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 100-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME				REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	7	B1	2.51	0.88	6.8	2.21	7.92	17.5															Sheet flows overland to the south east to DP7 swale Combines flow in proposed swale at DP8.1
	8	B2	2.51	0.88	7.0	2.21	7.82	17.3															Sheet flows overland to the north east at DP8 swale Combines flow in proposed swale at DP8.1
	8.1								7.0	4.42	7.82	34.6											Combined flows of DP7 and DP8 swales Flows along swale to combination at proposed FES at DP9.1
	9	B3	3.50	0.88	5.2	3.08	8.58	26.4															Sheet flows overland to the north and south at DP9 swale Combines flow in proposed swale at DP9.1
	9.1								7.0	7.50	7.82	58.7											Combined flows of DP8.1 and DP9 swales at proposed FES at DP9.1 Flows are piped within the storm sewer to combine in Pond 1 at DP15.1
	10	C1	2.34	0.88	6.2	2.06	8.15	16.8															Sheet flows overland to the north and east to the storm sewer stub at DP10 Combines flow at manhole at DP12.2
	11	C2	2.32	0.88	5.8	2.04	8.32	17.0															Sheet flows overland to the north to the storm sewer stub at DP11 Combines flow within Type R inlet and DP12.1
	12	C3	0.66	0.91	10.3	0.60	6.87	4.1															Proposed Sagefield Drive flow captured by Type R inlet at DP12 Combines flow within Type R inlet at DP12.1
	12.1								10.3	2.64	6.87	18.1											Combined flows of DP11 and DP12 Flows are piped within the storm sewer to the combination manhole at DP12.2
	12.2								10.3	4.70	6.87	32.3											Combined flows of DP10 and DP12.1 Flows are piped within the storm sewer to the combination inlet at DP13.1
	13	C4	0.58	0.90	8.7	0.52	7.27	3.8															Proposed Sagefield Drive flow captured by Type R inlet at DP13 Combines flow within Type R inlet at DP13.1
	13.1								10.3	5.22	6.87	35.9											Combined flows of DP12.2 and DP13 Flows are piped within the storm sewer to combine in Pond at DP15.1
	14	C5	0.49	0.88	5.7	0.43	8.33	3.6															Sheet flows overland to the north at DP14 Combines flow within proposed Pond 1 at DP15.1
	15	D	1.57	0.71	5.0	1.12	8.68	9.7															Runoff from sheet flows from all sides to Pond 1 at DP15 Treated within Pond 1 at DP15.1
	15.1								21.6	25.95	4.99	129.5											Combines total Pond 1 inflow of DP5.1, DP6, DP9.1, DP13.1, DP14, and DP15 Treated within Pond 1 and controlled release at DP15.2
	15.2								-	-	-	22.4											Controlled outlet structure release of Pond 1 flows Flows within existing 30" HDPE storm sewer after leaving Pond 1

PROPOSED STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Judge Orr Road Commercial Park
Location: El Paso County
Design Storm: 100-Year

Project Name: Judge Orr Road Commercial Park
Project No.: 25315.00
Calculated By: _____
Checked By: _____
Date: 5/28/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME				REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	O3	OS3	27.2	0.60	33.4	16.32	3.89	63.5															Off-site flows onto the site via an existing 24" CMP culvert at DPO3 Conveyed via proposed DPO3 swale to the existing triple 36" X 30" HERCP culverts at DP17.1
	O4	OS4	3.48	0.55	21.1	1.92	5.05	9.7															Off-site US 24 and Judge Orr roadway flows onto the site on the south east and south side at DPO4 Combines flow at existing triple 36" X 30" HERCP culverts at DP17.1
	16	E1	11.7	0.36	34.8	4.21	3.79	16.0															Sheet flow overland to the south east at DP16 Combines flow at existing triple 36" X 30" HERCP culverts at DP17.1
	17	E2	0.87	0.75	5.8	0.66	8.31	5.5															Flows to the east and south at DP17 Combines flow at existing triple 36" X 30" HERCP culverts at DP17.1
	17.1								34.8	23.11	3.79	87.6											Combined flows of DPO3, DPO4, DP16, and DP17 at existing triple 36" X 30" HERCP culverts Continues flowing to the east off-site along Judge Orr Road swale

Notes:

Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

Values in BLUE from the MHFD Detention spreadsheets. See Appendix C.

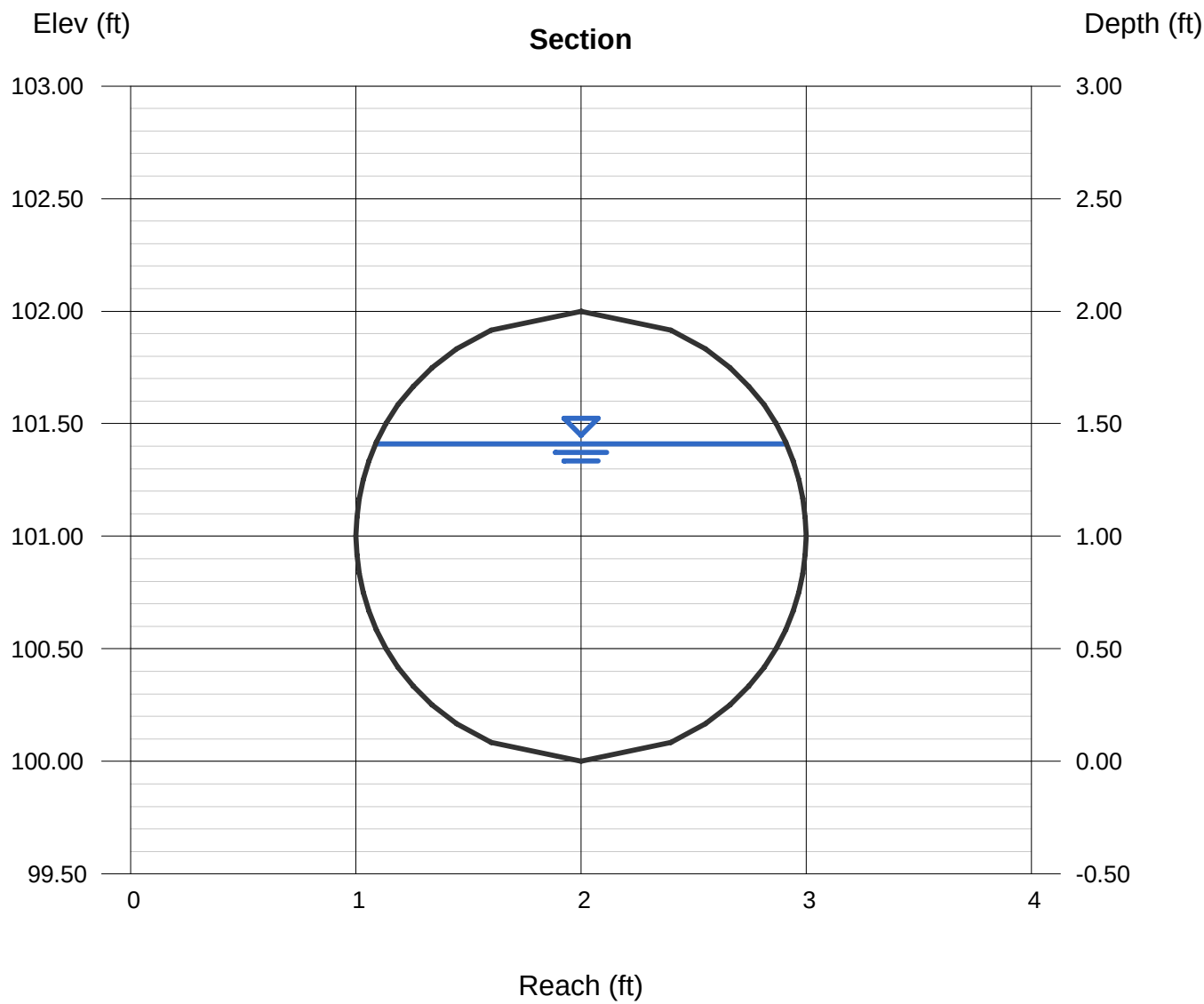
APPENDIX C

HYDRAULIC CALCULATIONS

Channel Report

DP1.1 Preliminary Pipe

Circular		Highlighted	
Diameter (ft)	= 2.00	Depth (ft)	= 1.41
		Q (cfs)	= 13.8
		Area (sqft)	= 2.37
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 5.70
Slope (%)	= 0.50	Wetted Perim (ft)	= 3.99
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.32
		Top Width (ft)	= 1.82
		EGL (ft)	= 1.91
Calculations			
Compute by:	Known Q		
Known Q (cfs)	= 13.50		



Channel Report

DP2.1 Preliminary Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 100.00

Slope (%) = 0.50

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 15.50

Highlighted

Depth (ft) = 1.59

Q (cfs) = 18.0

Area (sqft) = 2.68

Velocity (ft/s) = 5.78

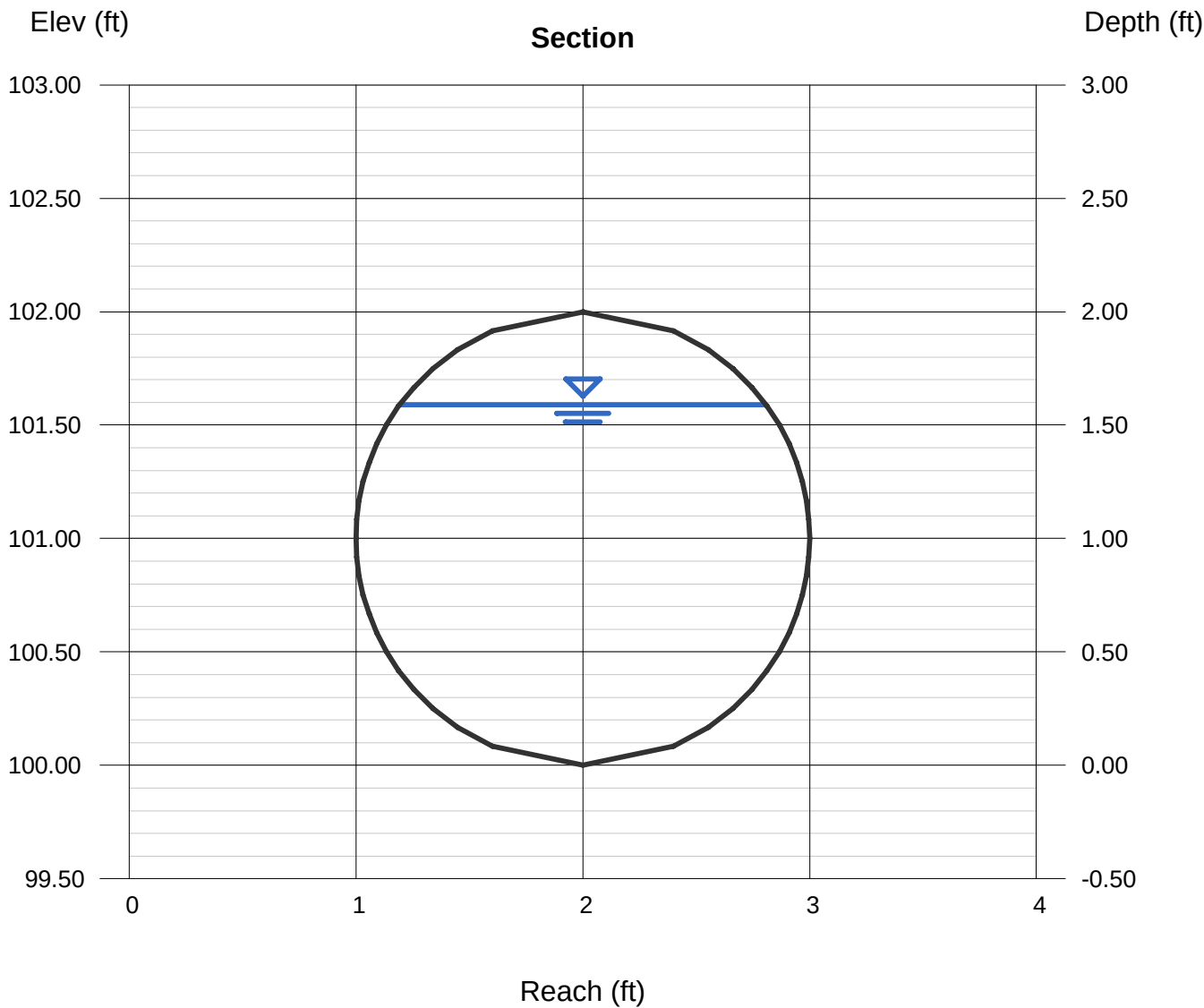
Wetted Perim (ft) = 4.41

Crit Depth, Yc (ft) = 1.42

Top Width (ft) = 1.61

EGL (ft) = 2.11

Flow at DP2.1
is 18 cfs



Channel Report

DP2.2 Preliminary Pipe

Circular

Diameter (ft) = 2.50

Invert Elev (ft) = 100.00

Slope (%) = 0.50

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 28.60

Flow at DP 2.2
is 29.6 cfs

Highlighted

Depth (ft) = 2.02

Q (cfs) = 29.6

Area (sqft) = 4.25

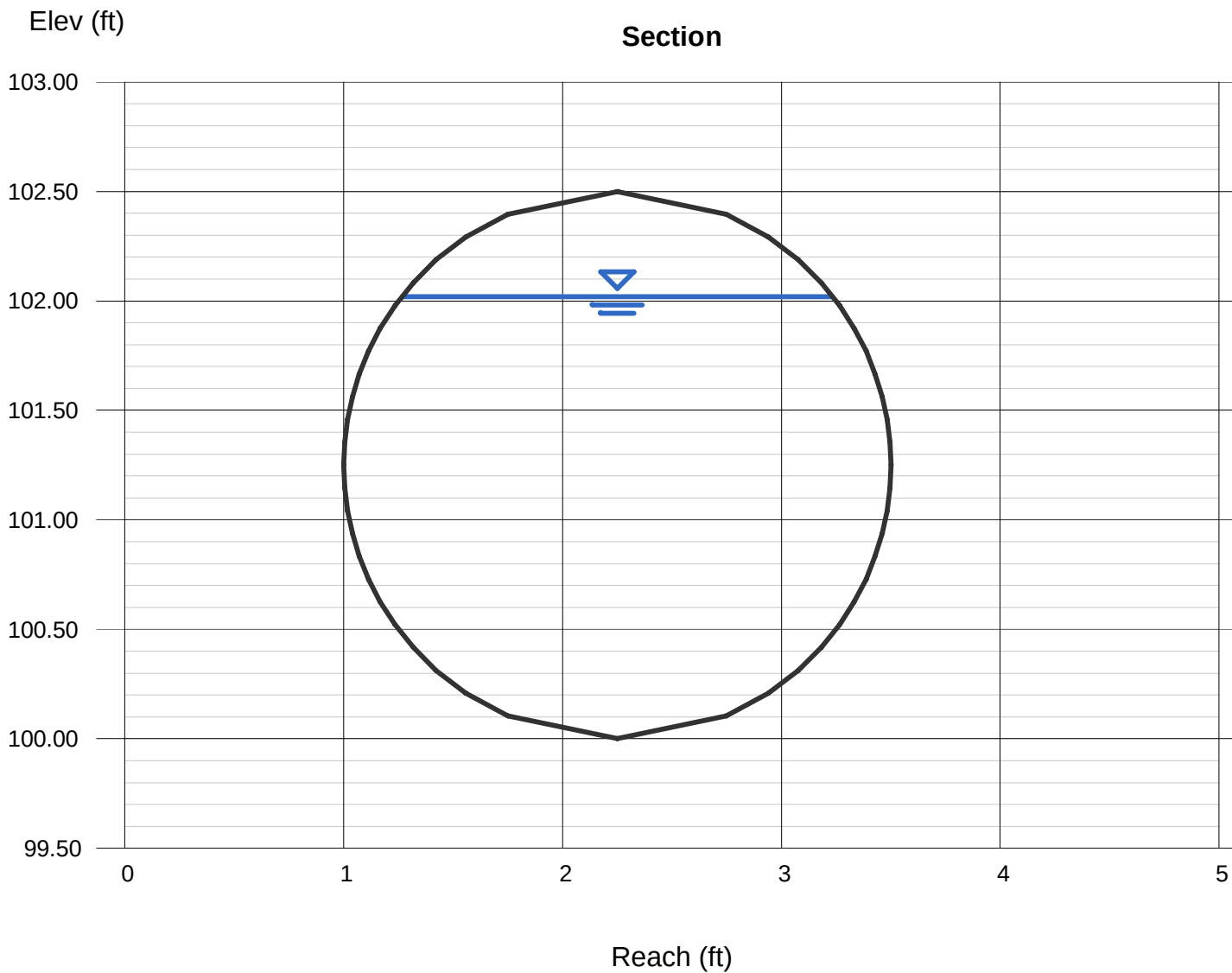
Velocity (ft/s) = 6.73

Wetted Perim (ft) = 5.59

Crit Depth, Yc (ft) = 1.83

Top Width (ft) = 1.97

EGL (ft) = 2.72



Channel Report

DP3 Preliminary Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 100.00

Slope (%) = 0.70

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 20.00

Highlighted

Depth (ft) = 1.77

Q (cfs) = 19.4

Area (sqft) = 2.94

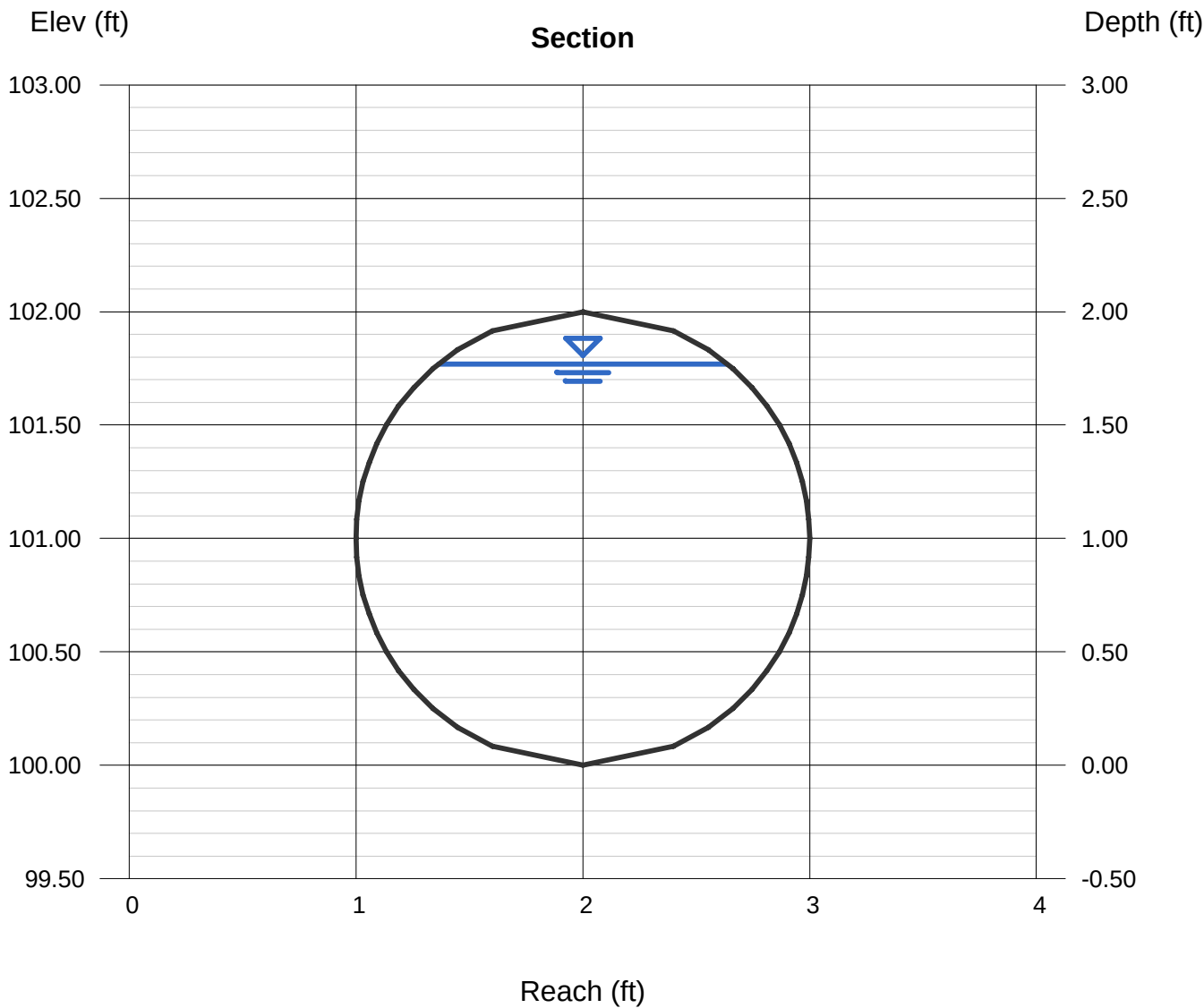
Velocity (ft/s) = 6.80

Wetted Perim (ft) = 4.90

Crit Depth, Yc (ft) = 1.61

Top Width (ft) = 1.28

EGL (ft) = 2.49



Channel Report

DP3.1 Preliminary Pipe

Circular

Diameter (ft) = 2.50

Invert Elev (ft) = 100.00

Slope (%) = 0.50

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 29.00

Highlighted

Depth (ft) = 2.05

Q (cfs) = 28.7

Area (sqft) = 4.32

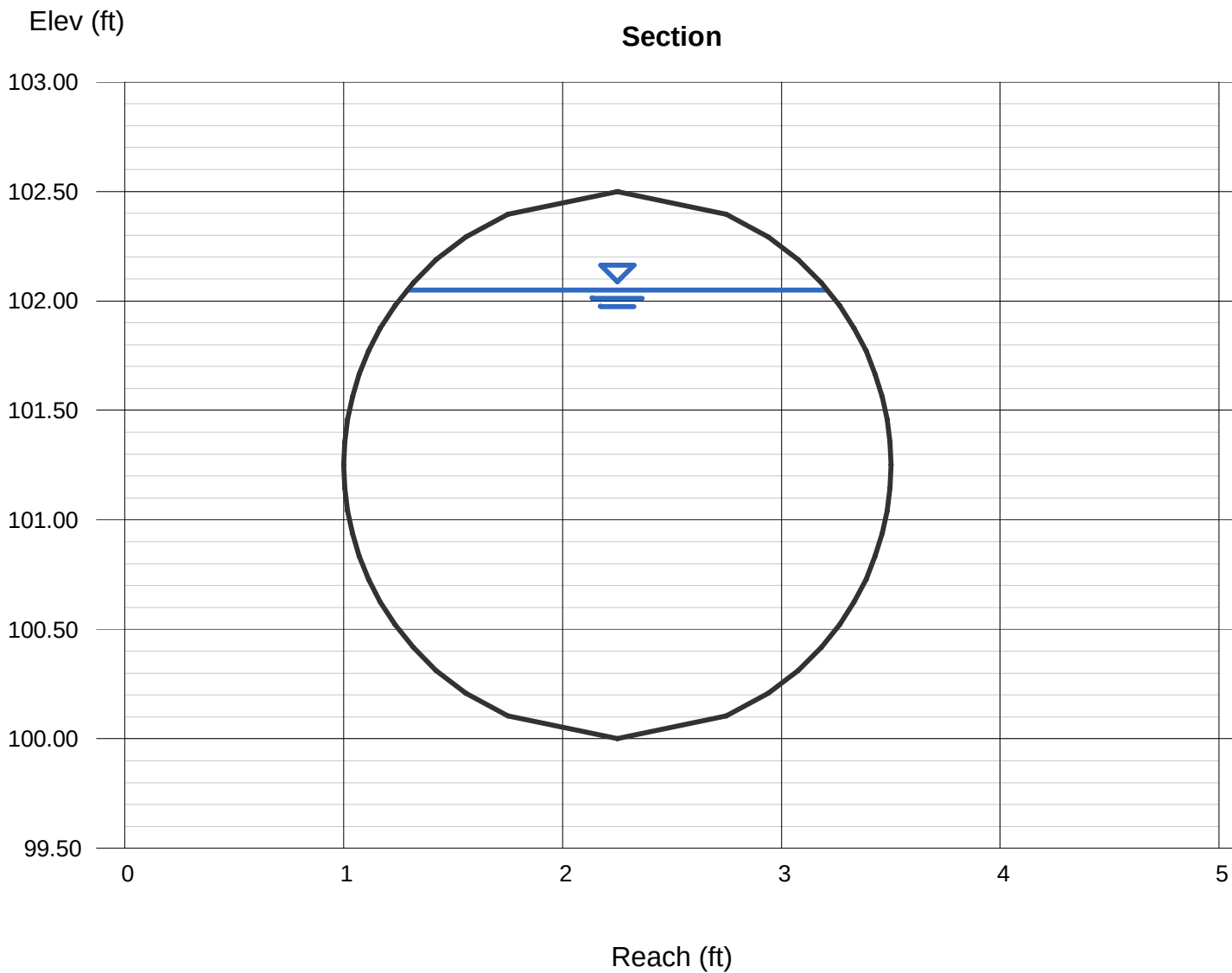
Velocity (ft/s) = 6.72

Wetted Perim (ft) = 5.68

Crit Depth, Yc (ft) = 1.84

Top Width (ft) = 1.91

EGL (ft) = 2.75



Channel Report

DP4.1 Preliminary Pipe

Circular

Diameter (ft) = 2.50

Invert Elev (ft) = 100.00

Slope (%) = 0.60

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 32.00

Highlighted

Depth (ft) = 2.07

Q (cfs) = 31.3

Area (sqft) = 4.35

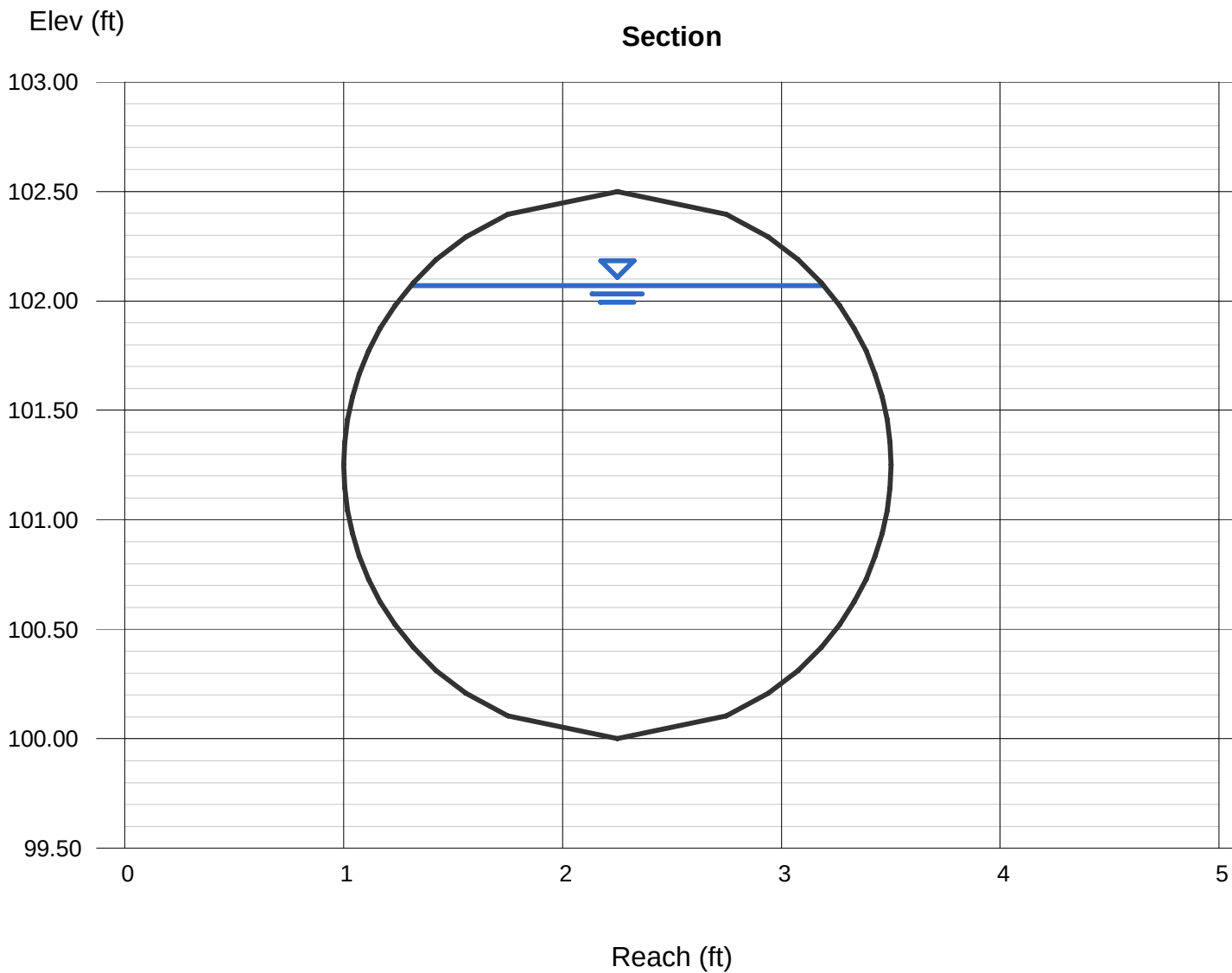
Velocity (ft/s) = 7.35

Wetted Perim (ft) = 5.73

Crit Depth, Yc (ft) = 1.93

Top Width (ft) = 1.88

EGL (ft) = 2.91



Channel Report

DP4.2 Preliminary Pipe

Circular

Diameter (ft) = 3.00

Invert Elev (ft) = 100.00

Slope (%) = 0.60

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 52.70

Highlighted

Depth (ft) = 2.52

Q (cfs) = 52.8

Area (sqft) = 6.34

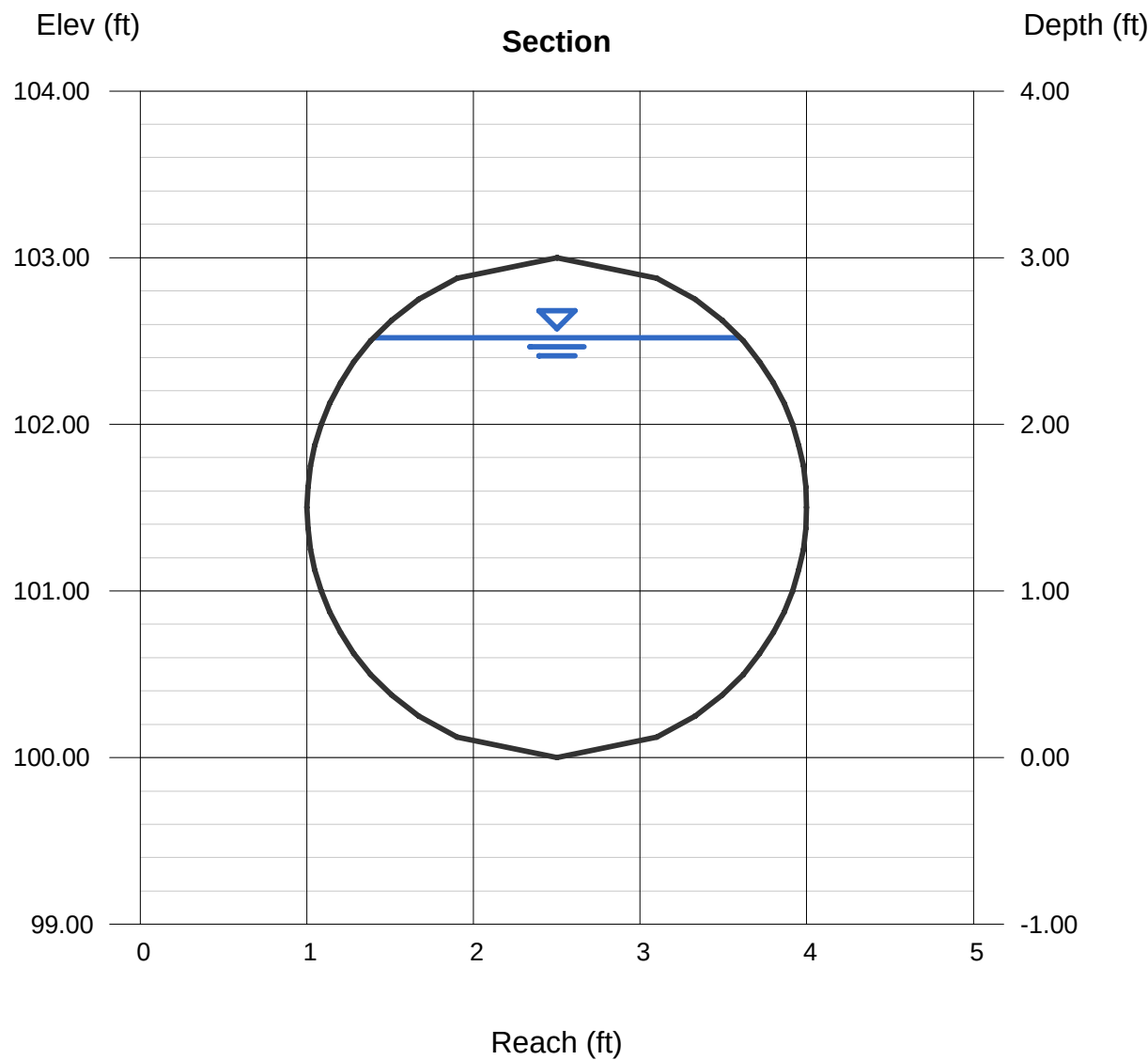
Velocity (ft/s) = 8.31

Wetted Perim (ft) = 6.96

Crit Depth, Yc (ft) = 2.36

Top Width (ft) = 2.20

EGL (ft) = 3.59



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, May 21 2025

A cross-section diagram of a circular pipe. The horizontal axis is labeled "Reach (ft)" and ranges from 0 to 5. The left vertical axis is labeled "Elev (ft)" and ranges from 99.00 to 104.00. The right vertical axis is labeled "Depth (ft)" and ranges from -1.00 to 4.00. The pipe is represented by a black circle with a center at approximately (2.5, 101.5). A blue horizontal line represents the water level, located at an elevation of approximately 102.6. A blue inverted triangle symbol is positioned above the water level line, indicating the water surface. The diagram shows the pipe is partially filled with water.

Channel Report

DP10 Preliminary Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 100.00

Slope (%) = 0.65

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 19.00

Highlighted

Depth (ft) = 1.73

Q (cfs) = 16.8

Area (sqft) = 2.89

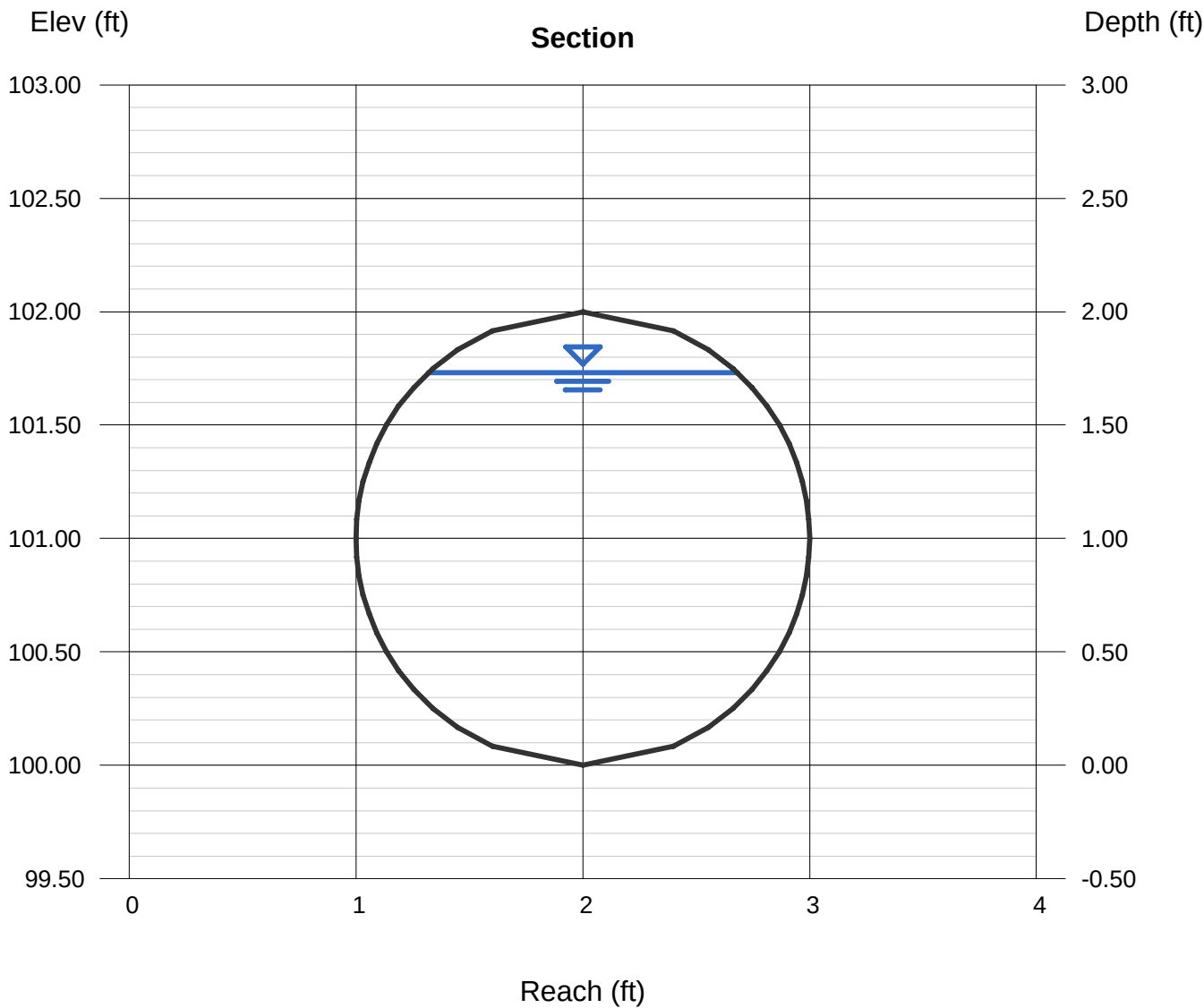
Velocity (ft/s) = 6.58

Wetted Perim (ft) = 4.78

Crit Depth, Yc (ft) = 1.57

Top Width (ft) = 1.37

EGL (ft) = 2.40



Channel Report

DP11 Preliminary Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 100.00

Slope (%) = 0.50

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 17.00

Highlighted

Depth (ft) = 1.79

Q (cfs) = 17.0

Area (sqft) = 2.97

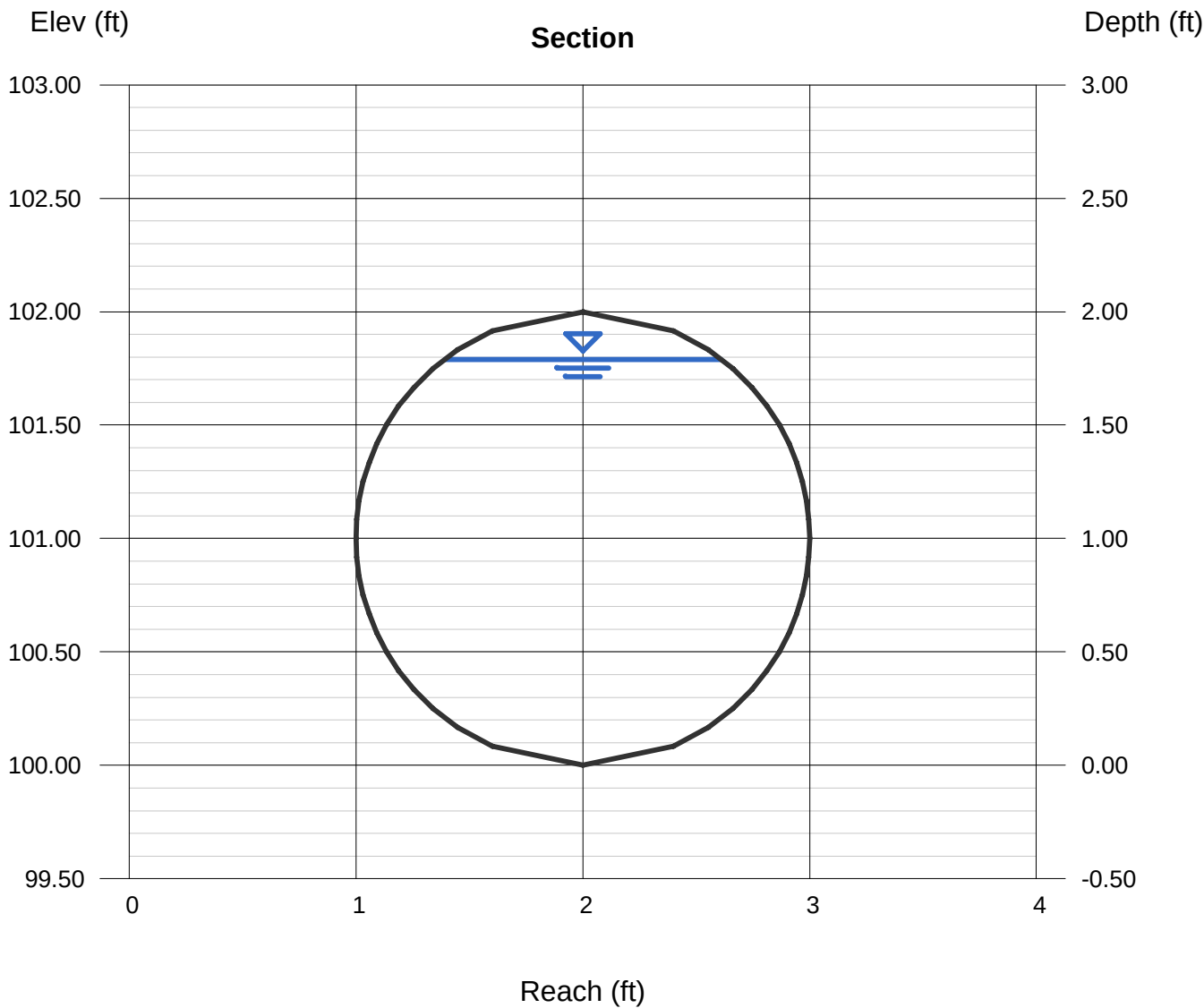
Velocity (ft/s) = 5.73

Wetted Perim (ft) = 4.97

Crit Depth, Yc (ft) = 1.49

Top Width (ft) = 1.22

EGL (ft) = 2.30



Channel Report

DP12.1 Preliminary Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 100.00

Slope (%) = 0.60

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 18.00

Highlighted

Depth (ft) = 1.70

Q (cfs) = 18.1

Area (sqft) = 2.85

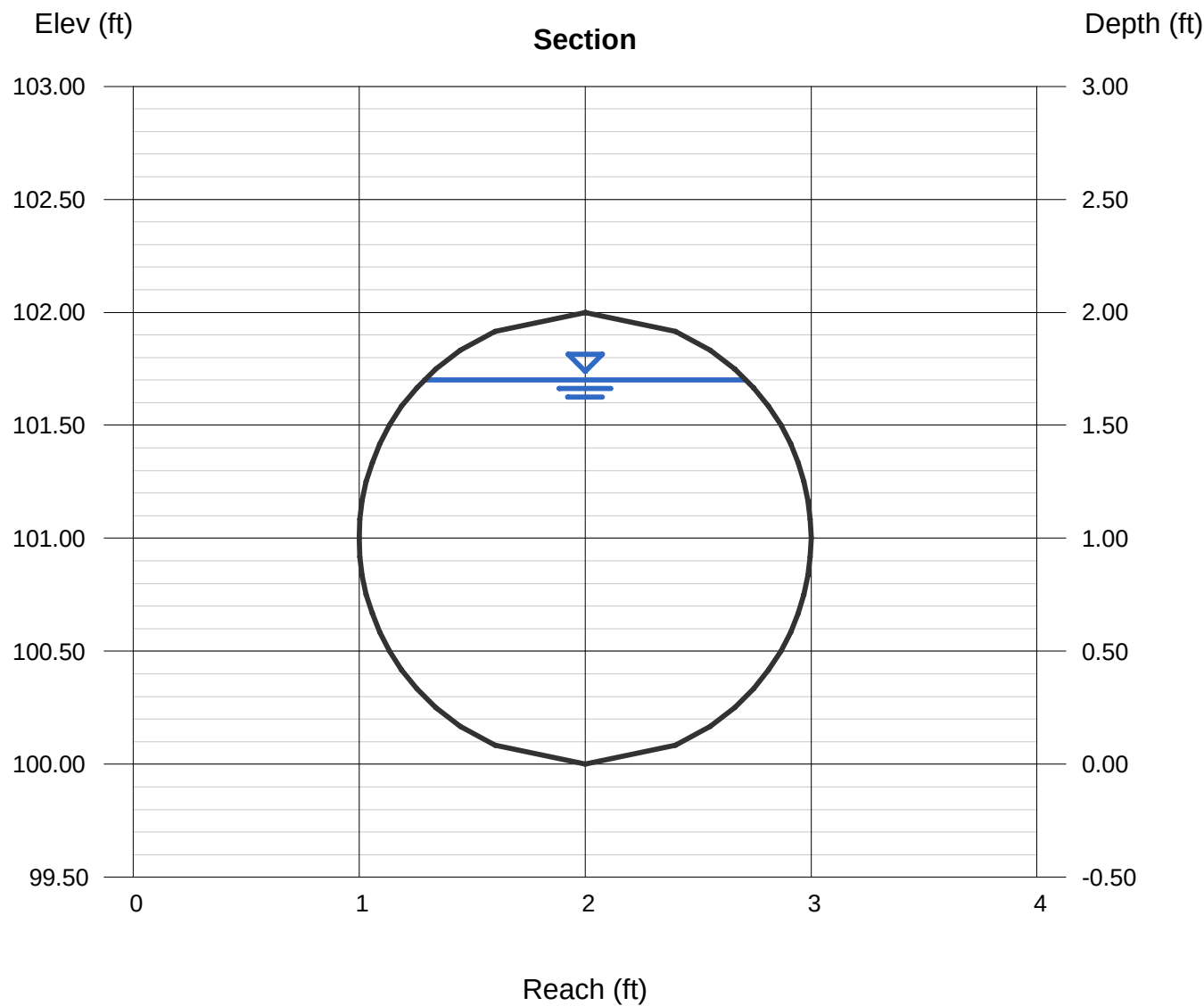
Velocity (ft/s) = 6.32

Wetted Perim (ft) = 4.70

Crit Depth, Yc (ft) = 1.53

Top Width (ft) = 1.42

EGL (ft) = 2.32



Channel Report

DP12.2 Preliminary Pipe

Circular

Diameter (ft) = 2.50

Invert Elev (ft) = 100.00

Slope (%) = 0.70

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 34.50

Highlighted

Depth (ft) = 2.06

Q (cfs) = 32.3

Area (sqft) = 4.33

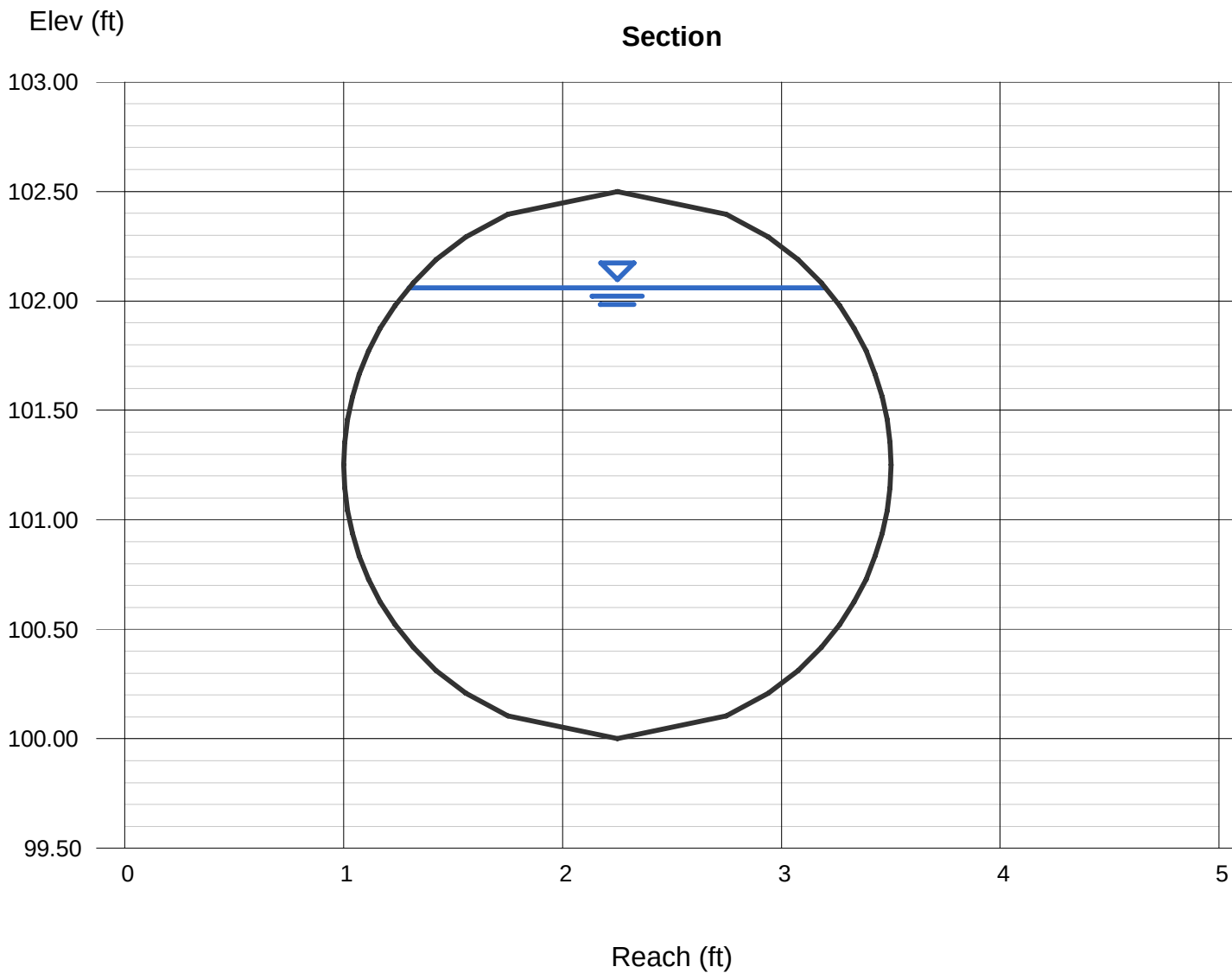
Velocity (ft/s) = 7.96

Wetted Perim (ft) = 5.70

Crit Depth, Yc (ft) = 2.00

Top Width (ft) = 1.90

EGL (ft) = 3.04



Channel Report

DP13.1 Preliminary Pipe

Circular

Diameter (ft) = 3.00

Invert Elev (ft) = 100.00

Slope (%) = 0.50

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 37.50

Highlighted

Depth (ft) = 2.03

Q (cfs) = 35.9

Area (sqft) = 5.10

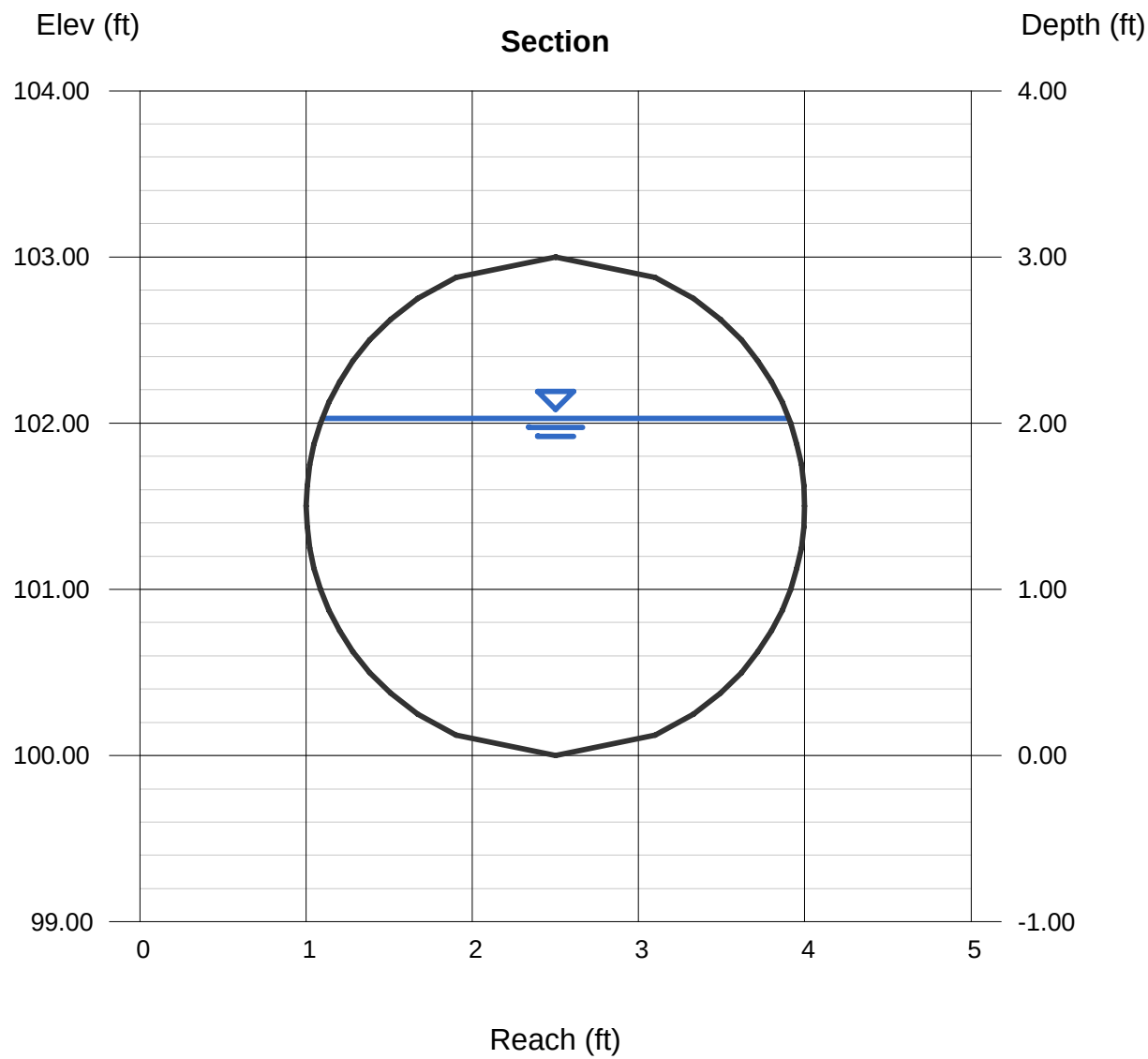
Velocity (ft/s) = 7.35

Wetted Perim (ft) = 5.80

Crit Depth, Yc (ft) = 2.00

Top Width (ft) = 2.80

EGL (ft) = 2.87



Channel Report

DPO1 Preliminary Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 100.00

Slope (%) = 0.50

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 15.50

Highlighted

Depth (ft) = 1.59

Q (cfs) = 15.1

Area (sqft) = 2.68

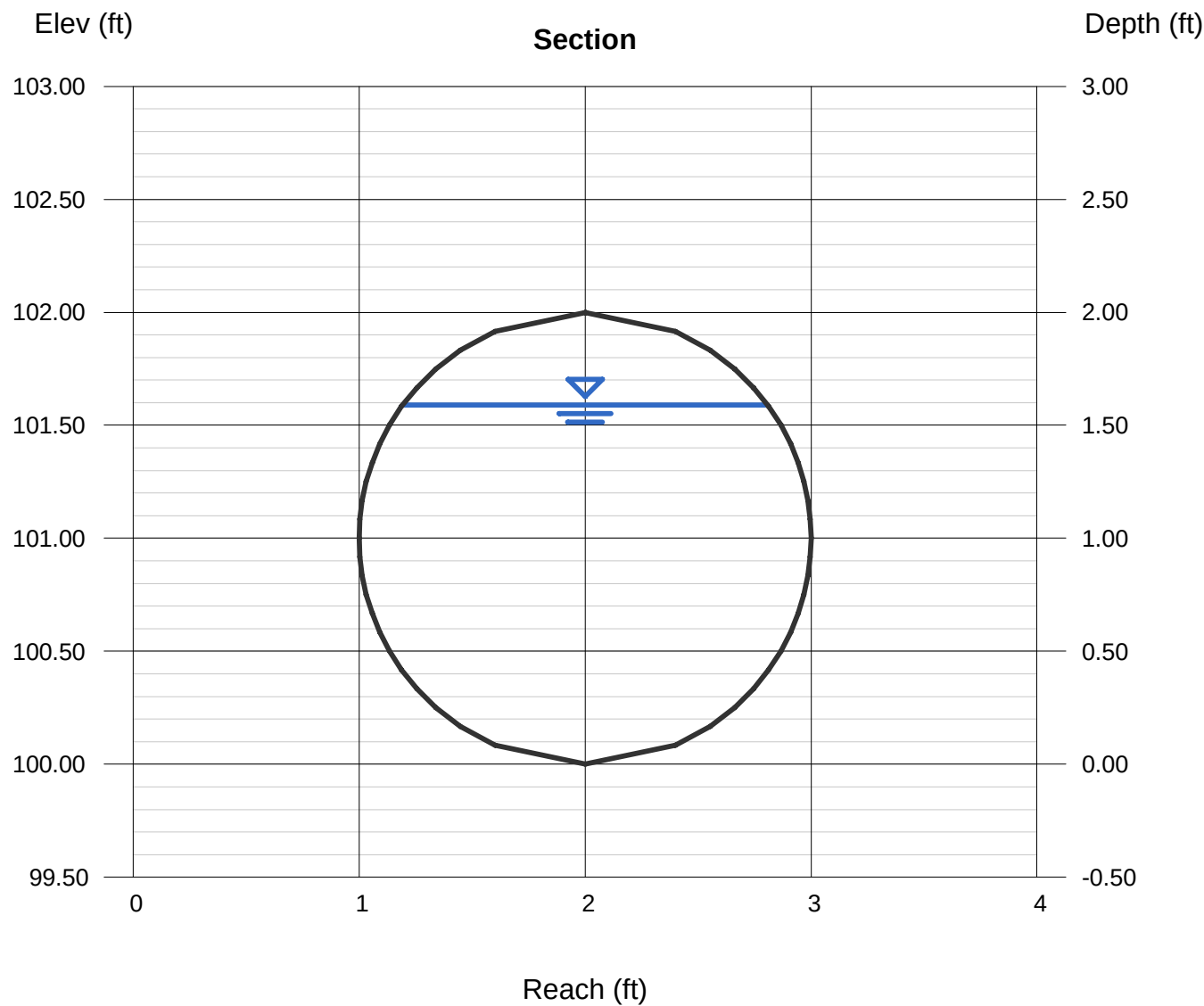
Velocity (ft/s) = 5.78

Wetted Perim (ft) = 4.41

Crit Depth, Yc (ft) = 1.42

Top Width (ft) = 1.61

EGL (ft) = 2.11



Channel Report

DP7 Swale

Triangular

Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00

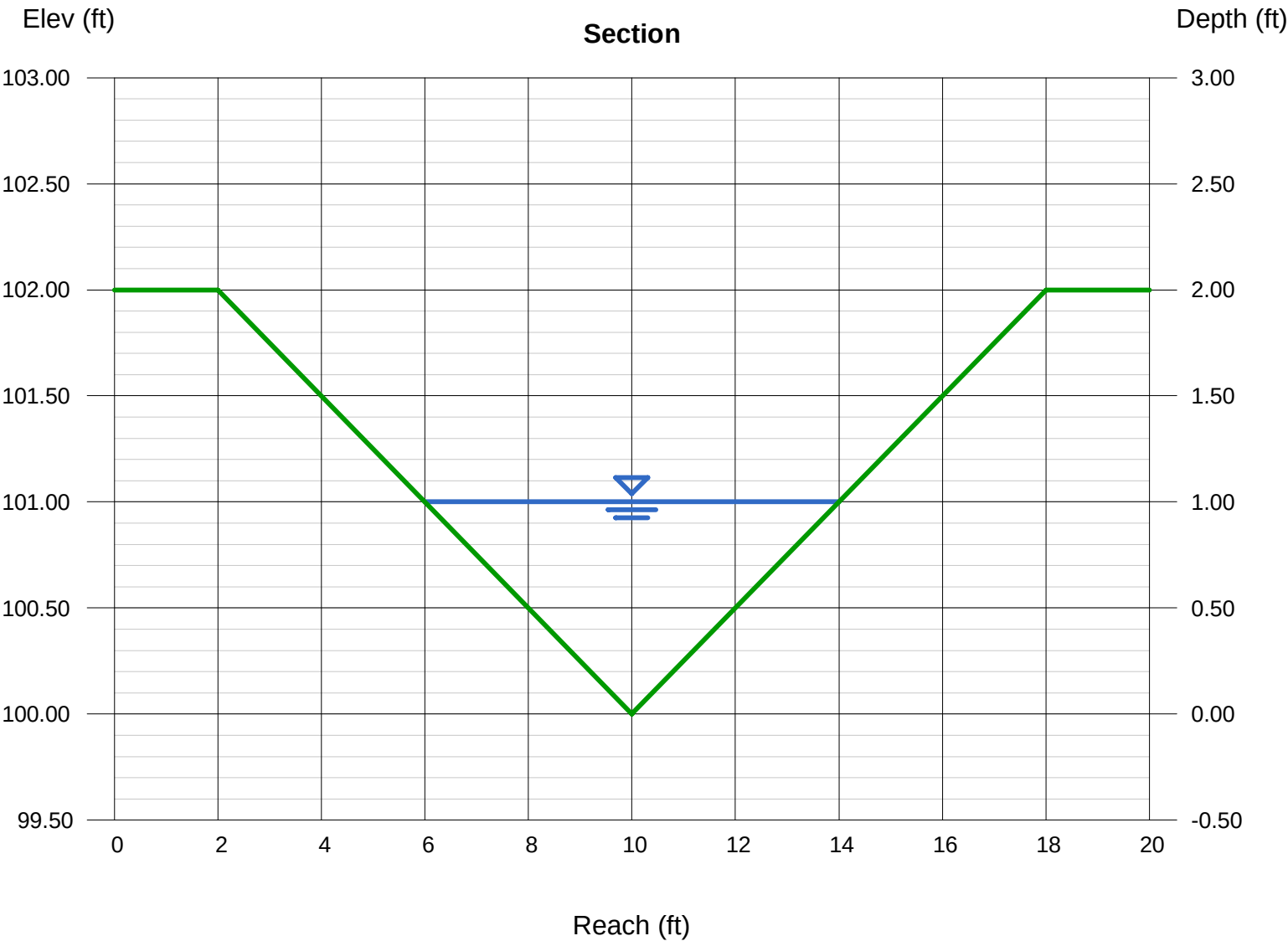
Invert Elev (ft) = 100.00
Slope (%) = 1.50
N-Value = 0.025

Calculations

Compute by: Known Q
Known Q (cfs) = 17.50

Highlighted

Depth (ft) = 1.00
Q (cfs) = 17.5
Area (sqft) = 4.00
Velocity (ft/s) = 4.38
Wetted Perim (ft) = 8.25
Crit Depth, Yc (ft) = 1.04
Top Width (ft) = 8.00
EGL (ft) = 1.30



Channel Report

DP8 Swale

Triangular

Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00

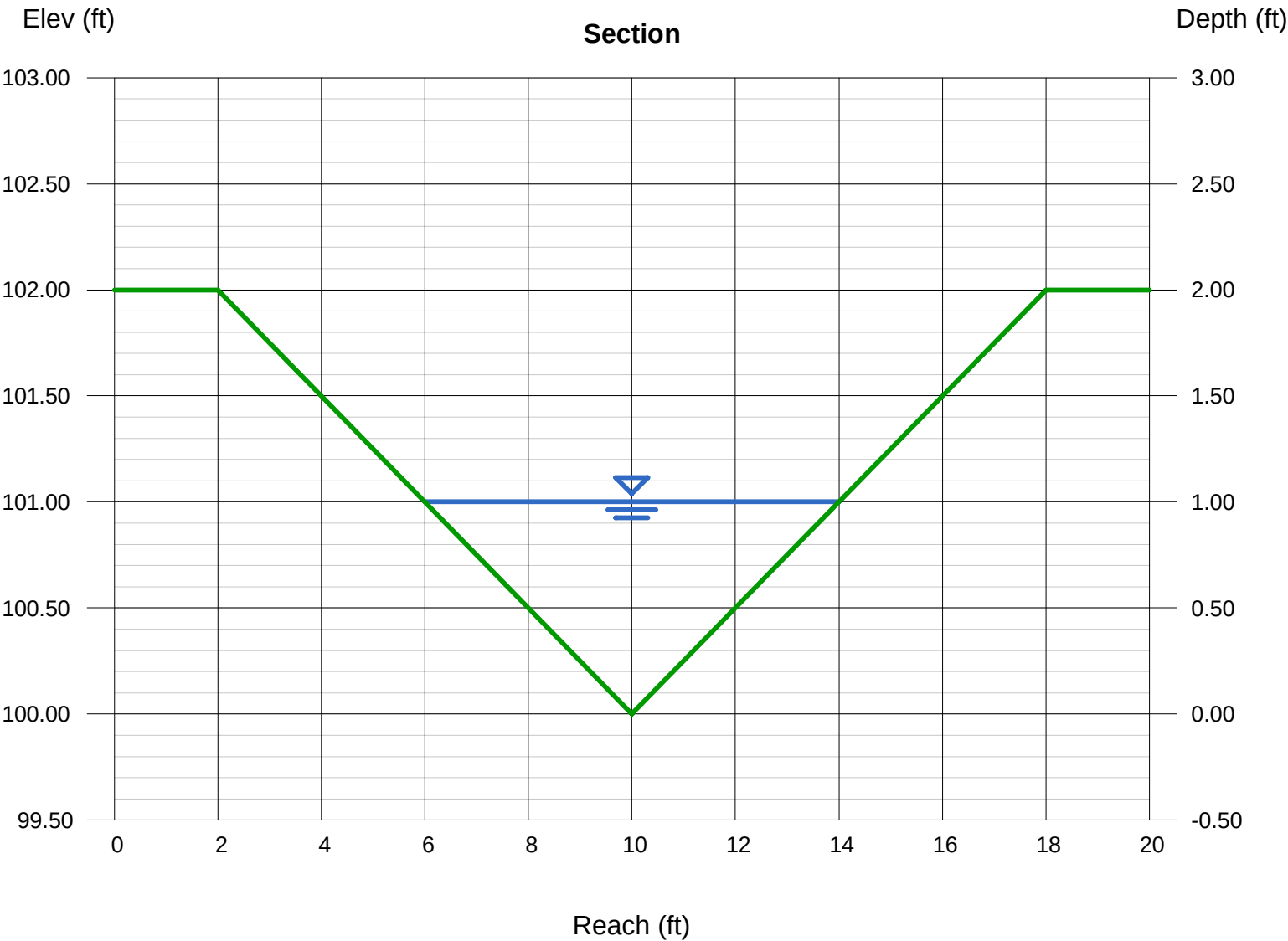
Invert Elev (ft) = 100.00
Slope (%) = 1.50
N-Value = 0.025

Calculations

Compute by: Known Q
Known Q (cfs) = 17.50

Highlighted

Depth (ft) = 1.00
Q (cfs) = 17.3
Area (sqft) = 4.00
Velocity (ft/s) = 4.38
Wetted Perim (ft) = 8.25
Crit Depth, Yc (ft) = 1.04
Top Width (ft) = 8.00
EGL (ft) = 1.30



Channel Report

DP9.1 Swale

Triangular

Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.75

Invert Elev (ft) = 100.00
Slope (%) = 1.00
N-Value = 0.025

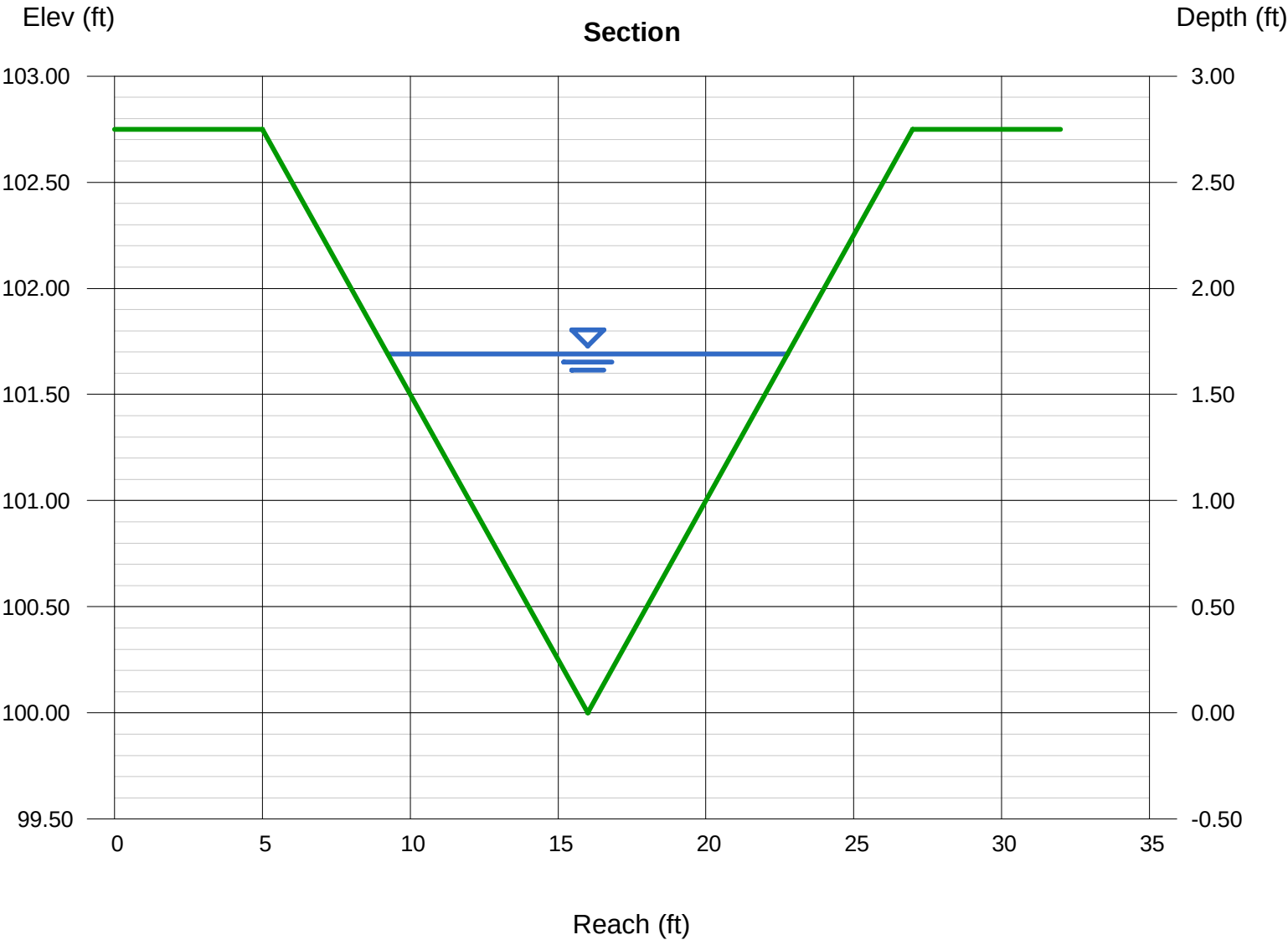
Calculations

Compute by: Known Q
Known Q (cfs) = 59.00

Highlighted

Depth (ft) = 1.69
Q (cfs) = 58.7
Area (sqft) = 11.42
Velocity (ft/s) = 5.16
Wetted Perim (ft) = 13.94
Crit Depth, Yc (ft) = 1.69
Top Width (ft) = 13.52
EGL (ft) = 2.10

Note velocity is high. Lining may be needed, but this can be determined at FDR. Just add a footnote here stating that.



Channel Report

DPO3 Swale

Trapezoidal

Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.25
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.025

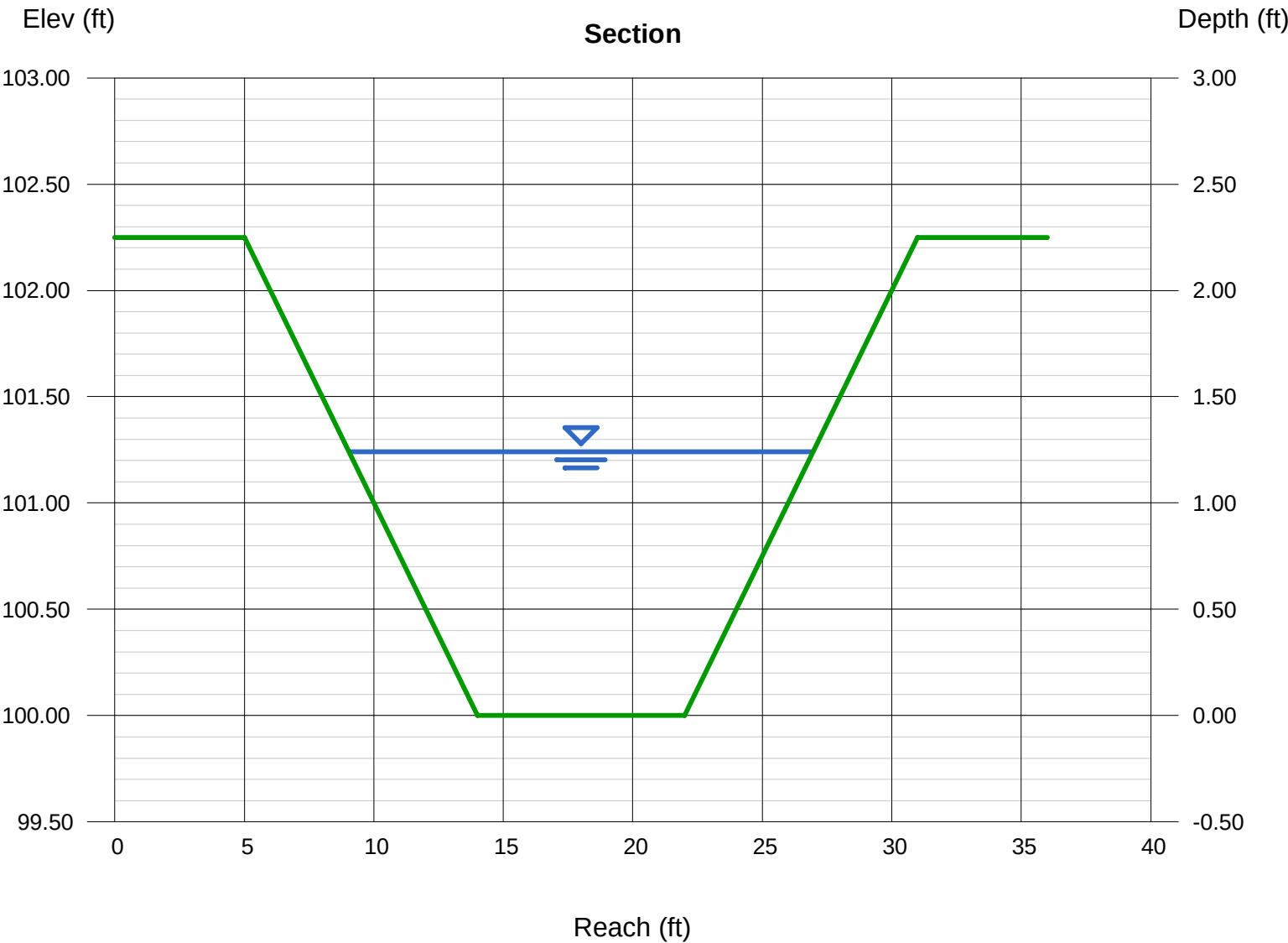
Highlighted

Depth (ft)	= 1.24
Q (cfs)	= 63.5
Area (sqft)	= 16.07
Velocity (ft/s)	= 3.86
Wetted Perim (ft)	= 18.23
Crit Depth, Yc (ft)	= 1.03
Top Width (ft)	= 17.92
EGL (ft)	= 1.47

Calculations

Compute by:	Known Q
Known Q (cfs)	= 62.00

Flow at O3
is 63.5 cfs



Channel Report

DPO1 Swale

Triangular

Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00

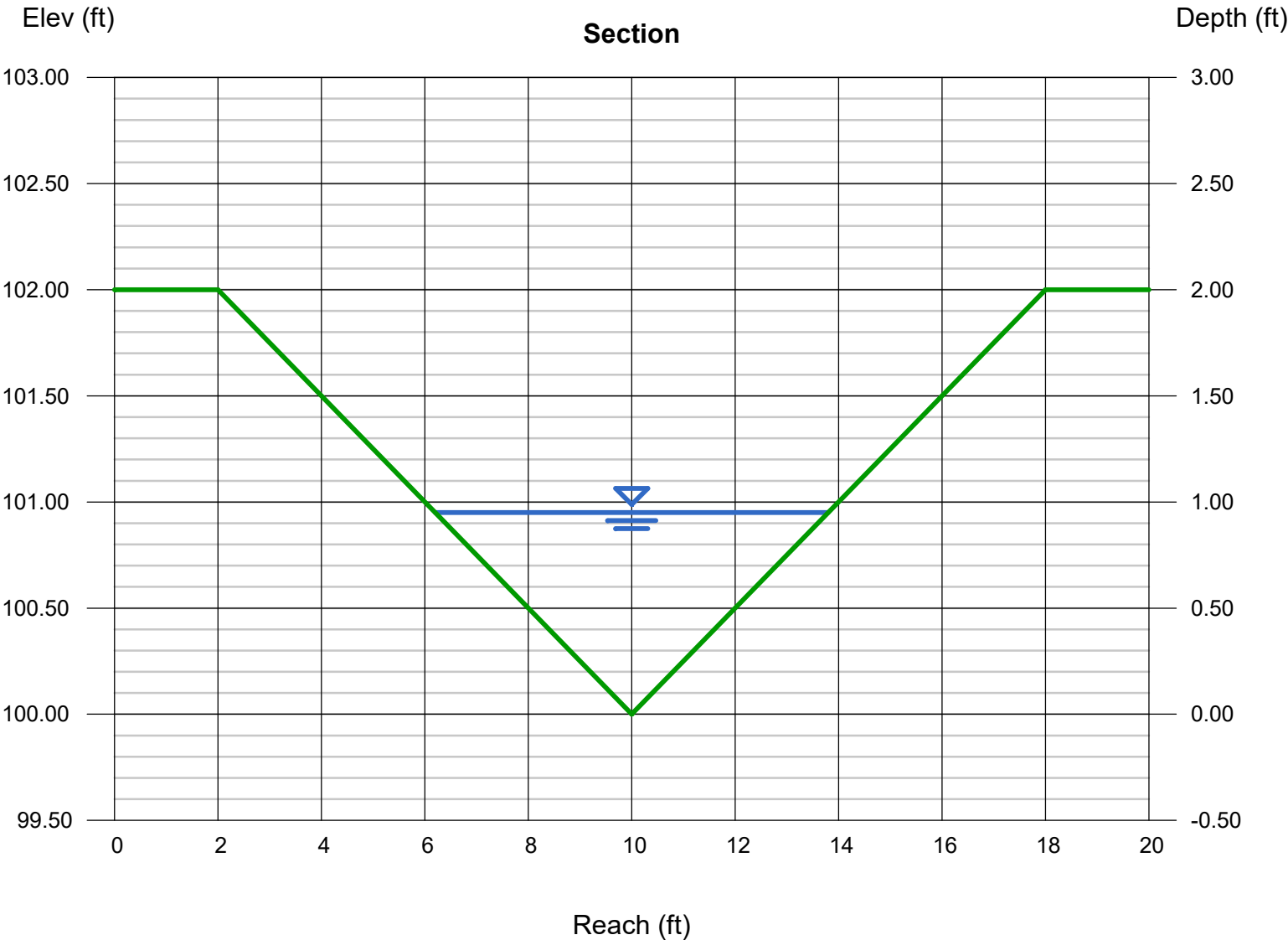
Invert Elev (ft) = 100.00
Slope (%) = 1.50
N-Value = 0.025

Calculations

Compute by: Known Q
Known Q (cfs) = 15.50

Highlighted

Depth (ft) = 0.95
Q (cfs) = 15.1
Area (sqft) = 3.61
Velocity (ft/s) = 4.29
Wetted Perim (ft) = 7.83
Crit Depth, Yc (ft) = 0.99
Top Width (ft) = 7.60
EGL (ft) = 1.24



INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP4	DP5	DP12
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	2.0	2.1	2.3
Major Q_{Known} (cfs)	3.8	3.8	4.1

Bypass (Carry-Over) Flow from Upstream [Inlets must be organized from upstream \(left\) to downstream \(right\) in order for bypass flows to be linked.](#)

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.0	2.1	2.3
Major Total Design Peak Flow, Q (cfs)	3.8	3.8	4.1
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP13	DPO1
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA
Hydraulic Condition	In Sump	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type C

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	2.0	2.9
Major Q_{Known} (cfs)	3.8	15.1

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

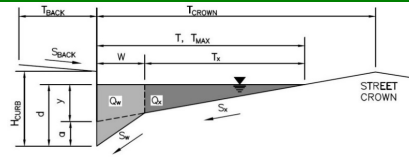
Minor Total Design Peak Flow, Q (cfs)	2.0	2.9
Major Total Design Peak Flow, Q (cfs)	3.8	15.1
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	0.0

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Judge Orr Road Commercial Park

Inlet ID: DP4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	7.5	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.014	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	17.5	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.016	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	12.5	17.5	ft
d_{MAX}	6.0	7.8	inches
	☐	☐	

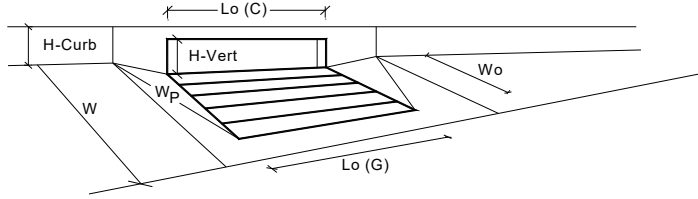
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



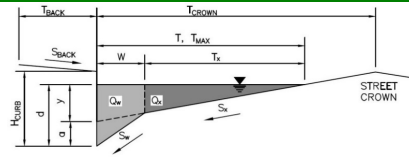
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.8	inches
Grate Information			MINOR	MAJOR	☒ Override Depths
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.33	0.48	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
		Q _s =	5.4	9.0	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _{PEAK REQUIRED} =	2.0	3.8	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Judge Orr Road Commercial Park

Inlet ID: DP5

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$$\begin{aligned} T_{\text{BACK}} &= 7.5 \text{ ft} \\ S_{\text{BACK}} &= 0.020 \text{ ft/ft} \\ n_{\text{BACK}} &= 0.014 \end{aligned}$$

$$\begin{aligned} H_{\text{CURB}} &= 6.00 \text{ inches} \\ T_{\text{CROWN}} &= 17.5 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_x &= 0.020 \text{ ft/ft} \\ S_w &= 0.083 \text{ ft/ft} \\ S_o &= 0.000 \text{ ft/ft} \\ n_{\text{STREET}} &= 0.016 \end{aligned}$$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	12.5	17.5	ft
d_{MAX}	6.0	7.8	inches
	☐	☐	

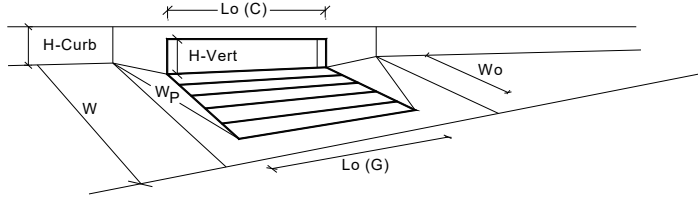
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$$Q_{\text{allow}} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ \text{SUMP} & \text{SUMP} \end{matrix} \text{ cfs}$$

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



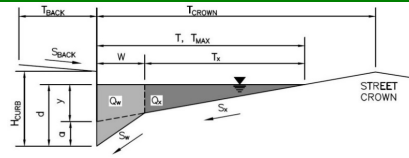
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.8	inches
Grate Information			MINOR	MAJOR	☒ Override Depths
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.33	0.48	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _s =	5.4	9.0	cfs
		Q _{PEAK REQUIRED} =	2.1	3.8	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Judge Orr Road Commercial Park

Inlet ID: DP12

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$$\begin{aligned} T_{\text{BACK}} &= 7.5 \text{ ft} \\ S_{\text{BACK}} &= 0.020 \text{ ft/ft} \\ n_{\text{BACK}} &= 0.014 \end{aligned}$$

$$\begin{aligned} H_{\text{CURB}} &= 6.00 \text{ inches} \\ T_{\text{CROWN}} &= 17.5 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_x &= 0.020 \text{ ft/ft} \\ S_w &= 0.083 \text{ ft/ft} \\ S_o &= 0.000 \text{ ft/ft} \\ n_{\text{STREET}} &= 0.016 \end{aligned}$$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	12.5	17.5	ft
d_{MAX}	6.0	7.8	inches

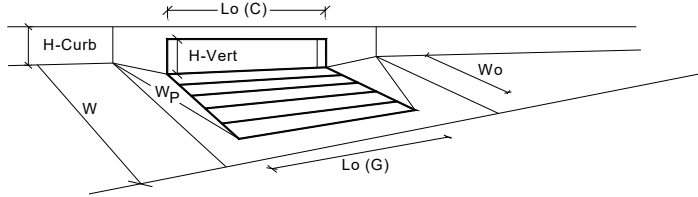
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



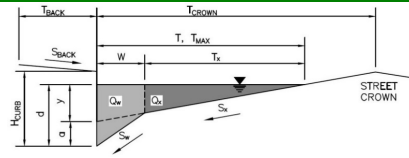
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.8	inches
Grate Information		MINOR		MAJOR	
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
Curb Opening Information		MINOR		MAJOR	
Length of a Unit Curb Opening		L _o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR		MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.33	0.48	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q _s =	5.4	9.0	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _{PEAK REQUIRED} =	2.3	4.1	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Judge Orr Road Commercial Park

Inlet ID: DP13

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	7.5	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.014	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	17.5	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	12.5	17.5	ft
$d_{MAX} =$	6.0	7.8	inches
	☐	☐	

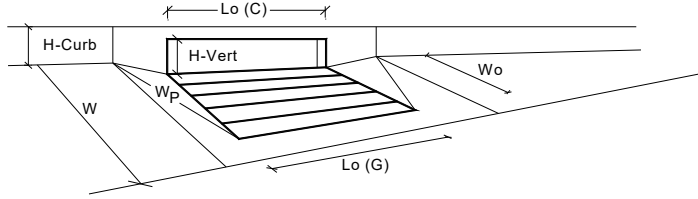
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

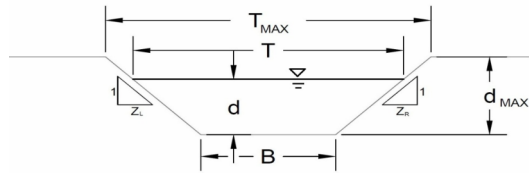
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type = CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.8	inches
Grate Information		MINOR		MAJOR	
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
Curb Opening Information		MINOR		MAJOR	
Length of a Unit Curb Opening		L _o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR		MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.33	0.48	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q _s =	5.4	9.0	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _{PEAK REQUIRED} =	2.0	3.8	cfs

AREA INLET IN A SWALE

Judge Orr Road Commercial Park
DPO1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

n =	0.025	
S_0 =	0.0100	ft/ft
B =	0.00	ft
Z1 =	4.00	ft/ft
Z2 =	4.00	ft/ft

Choose One:

- ☐ Non-Cohesive
☒ Cohesive
☐ Paved

Maximum Allowable Top Width of Channel for Minor & Major Storm

Maximum Allowable Water Depth in Channel for Minor & Major Storm

	Minor Storm	Major Storm	
T_{MAX} =	8.00	16.00	ft
d_{MAX} =	1.00	2.00	ft

Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	14.7	93.5	cfs
d_{allow} =	1.00	2.00	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

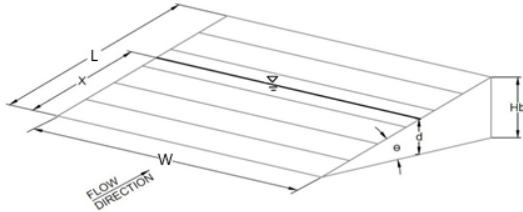
Q_o =	2.9	15.1	cfs
d =	0.54	1.01	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

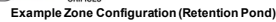
AREA INLET IN A SWALE

Judge Orr Road Commercial Park
DPO1

Inlet Design Information (Input)	
Type of Inlet	CDOT Type C
Inlet Type =	CDOT Type C
Angle of Inclined Grate (must be ≤ 30 degrees)	$\theta = 0.00$ degrees
Width of Grate	$W = 3.00$ ft
Length of Grate	$L = 3.00$ ft
Open Area Ratio	$A_{\text{RATIO}} = 0.70$
Height of Inclined Grate	$H_B = 0.00$ ft
Clogging Factor	$C_f = 0.50$
Grate Discharge Coefficient	$C_d = 0.96$
Orifice Coefficient	$C_o = 0.64$
Weir Coefficient	$C_w = 2.05$
	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	$d = 0.54$ MINOR
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a = 7.4$ cfs
Bypassed Flow	$Q_b = 0.0$ cfs
Capture Percentage = Q_a/Q_o	$C\% = 100$ %

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

MHFD-Detention, Version 4.06 (July 2022)

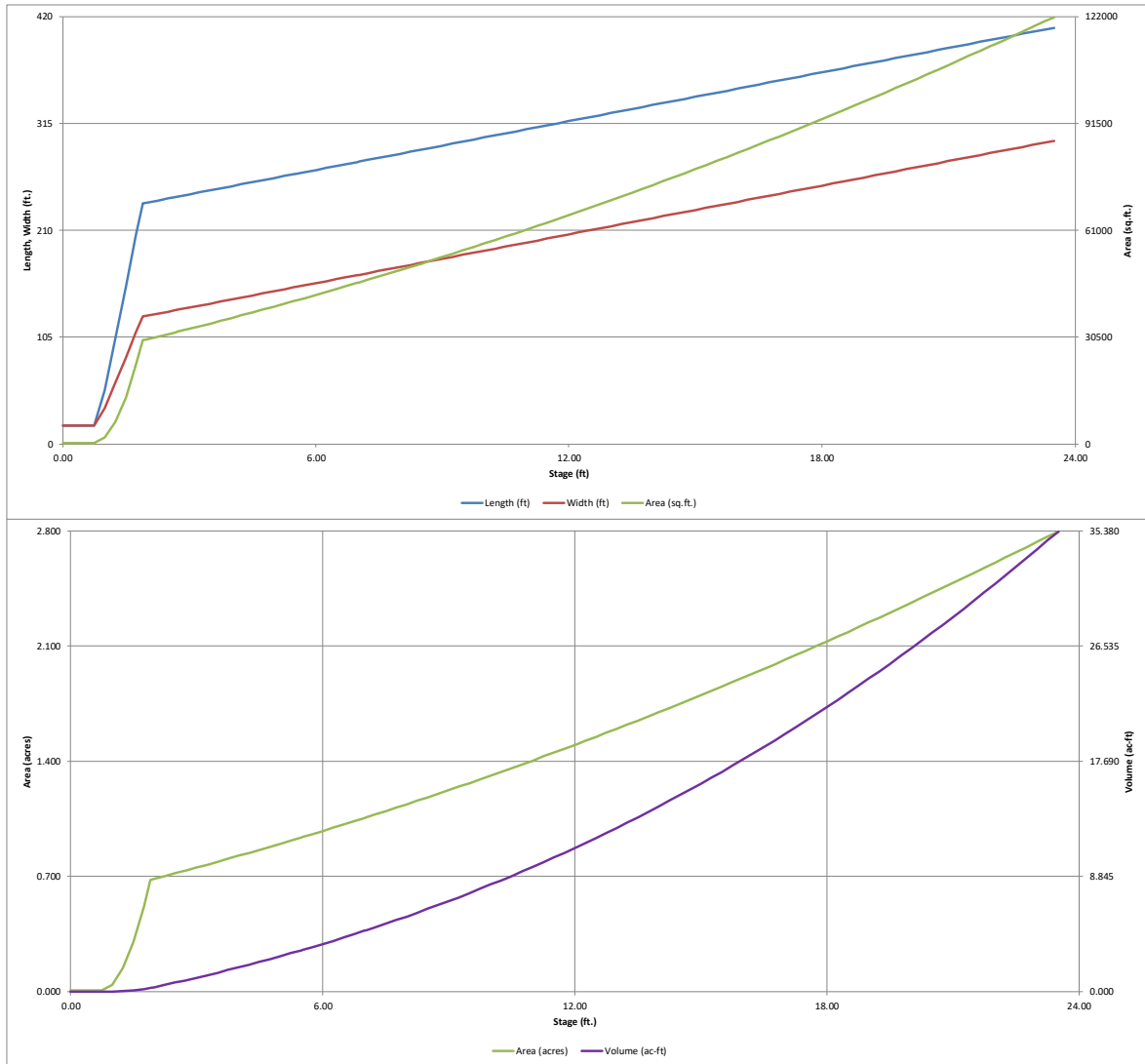
Basin ID: Pond 1

Preliminary comments on MHFD calculations do not need to be addressed. Full comments can be provided if pond design is submitted, but this is not required.

6855.75

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

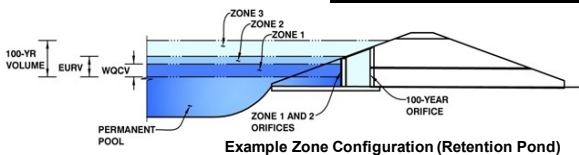


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Judge Orr Road Commercial Park

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.68	0.828	Orifice Plate
Zone 2 (EURV)	5.52	2.364	Circular Orifice
Zone 3 (100-year)	7.02	1.490	Weir&Pipe (Restrict)
Total (all zones)		4.682	

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

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

Calculated Parameters for Underdrain

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

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

Calculated Parameters for Plate

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.840E-02	ft ²
Depth at top of Zone using Orifice Plate =	2.68	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.70	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.65	sq. inches (diameter = 1-13/16 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	0.89	1.79					
Orifice Area (sq. inches)	2.65	2.65	2.65					

	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)

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected		Zone 2 Circular	Not Selected
Invert of Vertical Orifice =	2.68	N/A	ft (relative to basin bottom at Stage = 0 ft)	0.09	N/A
Depth at top of Zone using Vertical Orifice =	5.52	N/A	ft (relative to basin bottom at Stage = 0 ft)	0.17	N/A
Vertical Orifice Diameter =	4.06	N/A	inches		

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

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, H _o =	5.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	5.75	N/A
Overflow Weir Front Edge Length =	4.00	N/A	feet	4.00	N/A
Overflow Weir Gate Slope =	0.00	N/A	H:V	6.90	N/A
Horiz. Length of Weir Sides =	4.00	N/A	feet	12.66	N/A
Overflow Gate Type =	Close Mesh Gate	N/A		6.33	N/A
Debris Clogging % =	50%	N/A	%		

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	1.83	N/A
Outlet Pipe Diameter =	30.00	N/A	inches	0.58	N/A
Restrictor Plate Height Above Pipe Invert =	12.00		inches	1.37	N/A
					radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =	7.25	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth =	0.72	feet
Spillway Crest Length =	55.00	feet	Stage at Top of Freeboard =	8.97	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.22	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.90	acre-ft

Routed Hydrograph Results

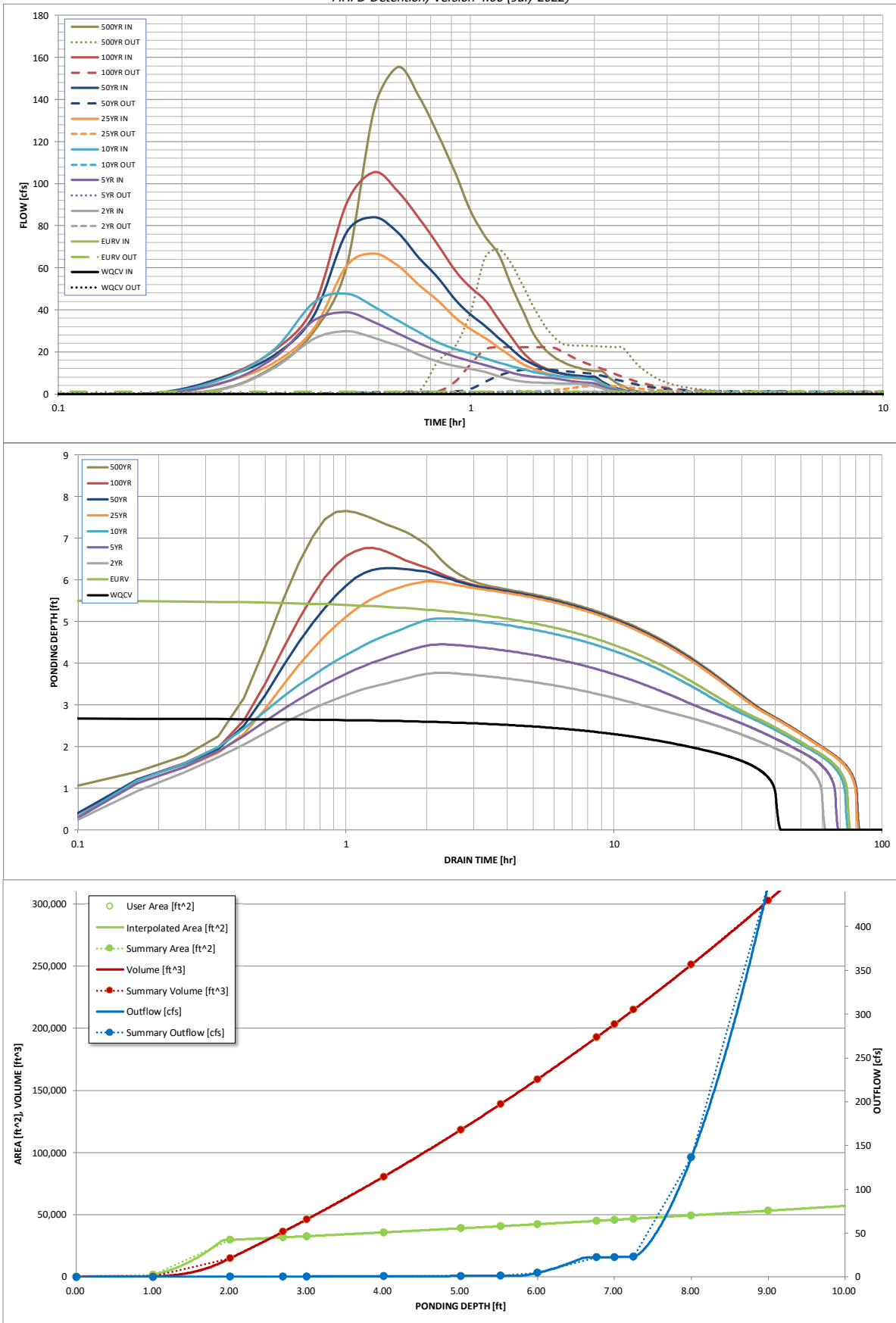
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.94	1.22	1.47	1.85	2.17	2.51	3.41
One-Hour Rainfall Depth (in) =	N/A	N/A	0.94	1.22	1.47	1.85	2.17	2.51	3.41
CUHP Runoff Volume (acre-ft) =	0.828	3.192	1.790	2.392	2.968	3.930	4.837	5.896	8.660
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.790	2.392	2.968	3.930	4.837	5.896	8.660
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.3	0.5	2.8	11.2	21.5	47.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.08	0.30	0.58	1.29
Peak Inflow Q (cfs) =	N/A	N/A	29.9	38.9	47.8	66.8	84.2	105.6	155.4
Peak Outflow Q (cfs) =	0.3	1.3	0.9	1.0	1.2	4.1	11.8	22.4	68.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	4.0	2.6	1.5	1.1	1.0	1.4
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.8	1.7	1.8
Max Velocity through Gate 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	68	56	62	67	72	70	68	64
Time to Drain 99% of Inflow Volume (hours) =	40	72	59	65	71	77	77	76	74
Maximum Ponding Depth (ft) =	2.69	5.52	3.77	4.46	5.08	5.97	6.28	6.77	7.66
Area at Maximum Ponding Depth (acres) =	0.73	0.94	0.81	0.86	0.90	0.97	1.00	1.04	1.11
Maximum Volume Stored (acre-ft) =	0.835	3.194	1.667	2.233	2.788	3.624	3.929	4.418	5.383

Ratio Peak Outflow to Predevelopment Q: Ratio should be less than or equal to 1 for minor (5-yr) and major (100-yr) design storms. See Chapter 4.1 of DCM volume 2 (and also Chap 2 of MHFD DCM vol. 3).

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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

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	0.29	0.03	2.53
	0:15:00	0.00	0.00	2.41	5.20	7.16	5.61	7.75	8.03	13.05
	0:20:00	0.00	0.00	12.35	17.23	21.22	14.96	18.52	20.69	29.66
	0:25:00	0.00	0.00	26.29	34.93	43.66	31.11	37.24	41.56	60.83
	0:30:00	0.00	0.00	29.90	38.94	47.80	61.11	77.02	90.90	135.71
	0:35:00	0.00	0.00	26.63	34.19	41.55	66.75	84.16	105.63	155.43
	0:40:00	0.00	0.00	22.94	28.92	34.96	60.98	76.63	96.23	141.48
	0:45:00	0.00	0.00	18.75	24.21	29.47	51.77	64.79	83.65	123.50
	0:50:00	0.00	0.00	15.47	20.57	24.59	44.52	55.42	71.07	105.31
	0:55:00	0.00	0.00	13.44	17.85	21.55	36.44	44.95	58.72	86.92
	1:00:00	0.00	0.00	11.94	15.77	19.25	30.96	37.90	50.70	75.16
	1:05:00	0.00	0.00	10.54	13.84	17.05	26.76	32.53	44.80	66.63
	1:10:00	0.00	0.00	8.59	12.09	15.04	22.21	26.83	35.66	52.58
	1:15:00	0.00	0.00	7.01	10.31	13.48	18.22	21.81	27.74	40.44
	1:20:00	0.00	0.00	6.11	9.05	12.06	14.46	17.11	20.26	29.19
	1:25:00	0.00	0.00	5.64	8.34	10.62	12.16	14.32	15.51	22.18
	1:30:00	0.00	0.00	5.37	7.91	9.60	10.32	12.12	12.70	17.95
	1:35:00	0.00	0.00	5.23	7.61	8.89	9.12	10.69	10.98	15.36
	1:40:00	0.00	0.00	5.12	6.84	8.39	8.29	9.72	9.81	13.57
	1:45:00	0.00	0.00	5.04	6.21	8.06	7.77	9.11	9.03	12.40
	1:50:00	0.00	0.00	4.98	5.77	7.82	7.40	8.67	8.48	11.55
	1:55:00	0.00	0.00	4.31	5.45	7.43	7.15	8.38	8.13	11.04
	2:00:00	0.00	0.00	3.76	5.05	6.71	7.00	8.21	8.01	10.87
	2:05:00	0.00	0.00	2.73	3.68	4.85	5.12	5.99	5.86	7.94
	2:10:00	0.00	0.00	1.90	2.56	3.38	3.56	4.16	4.09	5.54
	2:15:00	0.00	0.00	1.31	1.76	2.35	2.47	2.89	2.86	3.87
	2:20:00	0.00	0.00	0.89	1.18	1.60	1.69	1.97	1.95	2.63
	2:25:00	0.00	0.00	0.58	0.77	1.06	1.12	1.30	1.28	1.73
	2:30:00	0.00	0.00	0.37	0.51	0.70	0.75	0.88	0.86	1.16
	2:35:00	0.00	0.00	0.21	0.31	0.41	0.46	0.53	0.52	0.70
	2:40:00	0.00	0.00	0.09	0.16	0.21	0.24	0.28	0.27	0.35
	2:45:00	0.00	0.00	0.03	0.06	0.07	0.09	0.10	0.10	0.12
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	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

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

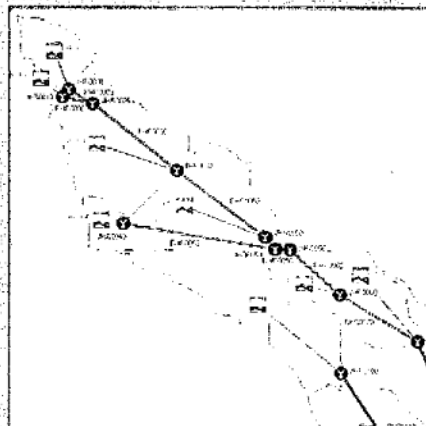
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage	Area	Area	Volume	Volume	Total
-------	------	------	--------	--------	-------

[illegible]

APPENDIX D

REFERENCE MATERIALS



Hewley Ranch Basin

Drainage Basin Planning Study

May 2009



URS

1.0 EXECUTIVE SUMMARY

1.1. Purpose and Scope

The purpose of the drainage Basin Planning Study (DBPS) is to identify a stormwater management plan for the existing and future stormwater and infrastructure needs within the Haegler Ranch Drainage Basin (Haegler Ranch). The scope of work for this DBPS includes:

- Obtain existing relevant data and general information from participating entities.
- Obtain current information for land use and future growth in Haegler Ranch.
- Gather information about right-of-way, known drainage problems, and proposed stormwater projects.
- Utilize the County policies, criteria, and applicable information wherever possible.
- Perform hydrologic and hydraulic analyses within Haegler Ranch at 2-, 5-, 10-, and 100-year intervals.
- Identify existing and potential stormwater and/or flooding problems.
- Develop improvement alternatives to reduce existing and potential flooding problems.
- Recommend and prepare a preliminary design for a selected alternative plan.
- Conduct an economic analysis of the preferred alternative.
- Develop drainage and bridge fees for Haegler Ranch.
- Prepare a written report discussing all items examined in the DBPS.

1.2. Location and Description

The Haegler Ranch Drainage Basin (Haegler Ranch) encompasses 16.6 square miles in unincorporated El Paso County, Colorado, and is a tributary to Black Squirrel Creek (see Figure 1-1). Haegler Ranch Basin is located in Sections 29, 32 and 33 of Township 12 South Range 64 West and sections 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 22, 23, and 24 of Township 13 South, Range, 64 West and sections 18, 19, 20, 28, 29, 30, 31, 32, 33, and 34 of Township 13 South, Range 63 West and sections 2, 3, and 4 of Township 14 South, Range 63 West. Topography in the basin is rolling rangeland with poor vegetative cover associated with semi-arid climates. The Haegler Ranch consists of indistinct ephemeral streams that flow after storms for a short period of time, and the main stem of Haegler Ranch consists of dry natural grass swales with some poor quality riparian zones and small wetlands in the floodplains. The natural drainageways are generally shallow and wide, and flow paths are not well defined in many areas.

1.3. Land Use

As of July 2005, approximately 14 percent of the basin was developed. Much of this existing development consists of 2- to 5-acre lots and larger agricultural parcels south of US Hwy 24. Due to growth in the basin, land use is expected to change in the future with new low and medium density residential developments. Higher density residential developments such as Meridian Ranch, Santa Fe Springs, and Four Way Ranch are underway in the northwestern portions of the Haegler Ranch Basin. Meridian Ranch is in the north and Santa Fe Springs is in the central portion of the watershed. The area of Meridian Ranch within Haegler Ranch has high-density land uses of commercial and business,

residential lots of 0.25 acres, and new paved roads with curb and gutter. Santa Fe Springs has a larger area in Haegler Ranch and a wider range of land uses including high density development such as commercial and business, residential lots of 0.125 acres, residential lots of 0.25 acres, schools, and new paved roads with curb and gutter as well as low density development such as residential large lots with 2% imperviousness, parks, and open space.

Future developed condition hydrology was modeled using proposed 2030 land uses from Colorado Springs Utilities Land Use Coverages (CSU 2005). The developed condition land uses are reasonably consistent with the Falcon Small Area Master Plan dated August 2008.

1.4. Hydrologic Analysis

As part of this study, hydrologic analyses for existing and future land use conditions were computed for the Haegler Ranch for 2-, 5-, 10-, and 100-year recurrence interval events using the USACE Hydrologic Engineering Center – Hydrologic Modeling System Version 2.2.2 (HEC-HMS). During the analyses, a portion of the original Haegler Ranch as delineated by the County map was found to be part of the Geick Ranch Drainage Basin at Judge Orr Road, due to the lack of a roadway culvert at the crossing. This area is excluded from the Haegler Ranch DBPS and is included as part of the Geick Ranch DBPS, per the County. Resulting flow rates and volumes are compared at key locations throughout the Haegler Ranch for both existing and future models. Generally, the largest flow and volume increases due to future development occur in the middle portion of the basin, assuming no detention. Since the future land use scenario does not include development in the lower portion of the watershed, potential increases in peak flows are attenuated and less at the mouth of the basin. The results indicate the most profound increases in peak flows due to development are in the more frequent, 2- and 5-year events.

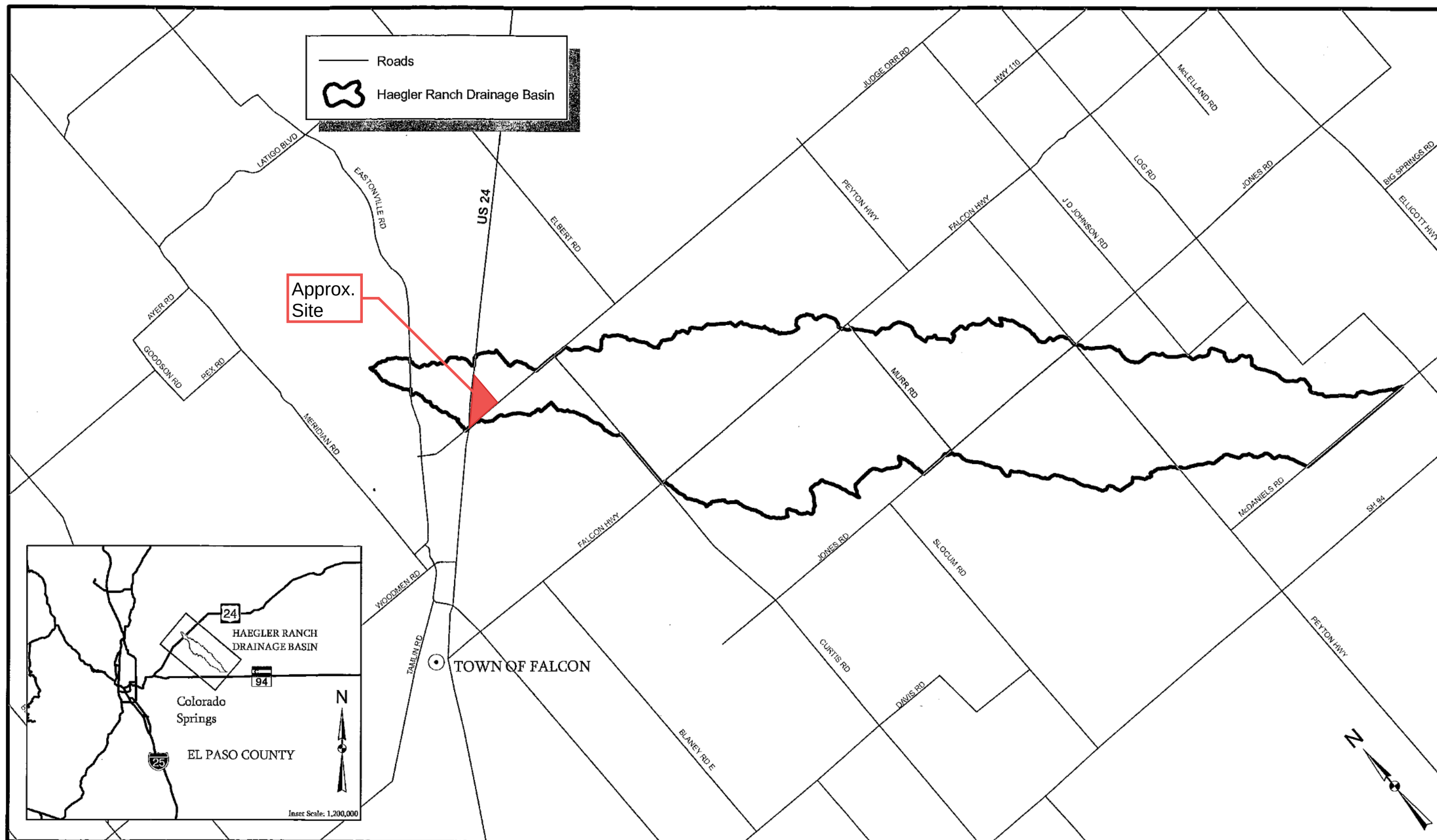
1.5. Hydraulic Analysis

Hydraulic analyses for existing conditions were then conducted for 8 channels within the Haegler Ranch Drainage Basin for the 2-, 5-, 10-, and 100-year recurrence interval floods using the USACE Hydrologic Engineering Center-River Analysis System Version 3.1.3 (HEC-RAS). The hydraulic analysis of Haegler Ranch main stem was performed by dividing the basin into several reaches covering approximately 31 miles from the headwaters near Eastonville Road to its confluence with the unnamed tributary of Geick Ranch Drainage Basin. As part of the field investigation, the size, type, and condition of bridges, culverts, channels, inlets, and pipes were recorded for the existing drainage facilities in the basin.

Using the results of the HEC-RAS modeling, floodplains for the 100-year existing condition flows were delineated. The approximate floodplain and profiles were used to assess where hydraulic inadequacies exist along the major drainageways. The approximate floodplain information was used primarily for the identification of flood prone areas along the major drainageways and to aid in the evaluation of alternative plans. The approximate floodplain data in this DBPS does not replace the information presented in the City of Colorado Springs and El Paso County Flood Insurance studies (FEMA 1999).

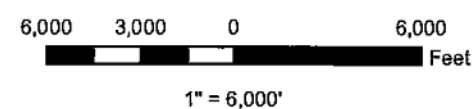
1.6. Flooding Problems

Results of the hydraulics analysis show that, of the 22 road crossings in the Haegler Ranch, only 2 crossings can safely pass the existing 100-year flow and 20 road crossings are overtopped. The floodplain areas include approximately 80 residential properties and additional structures.



URS

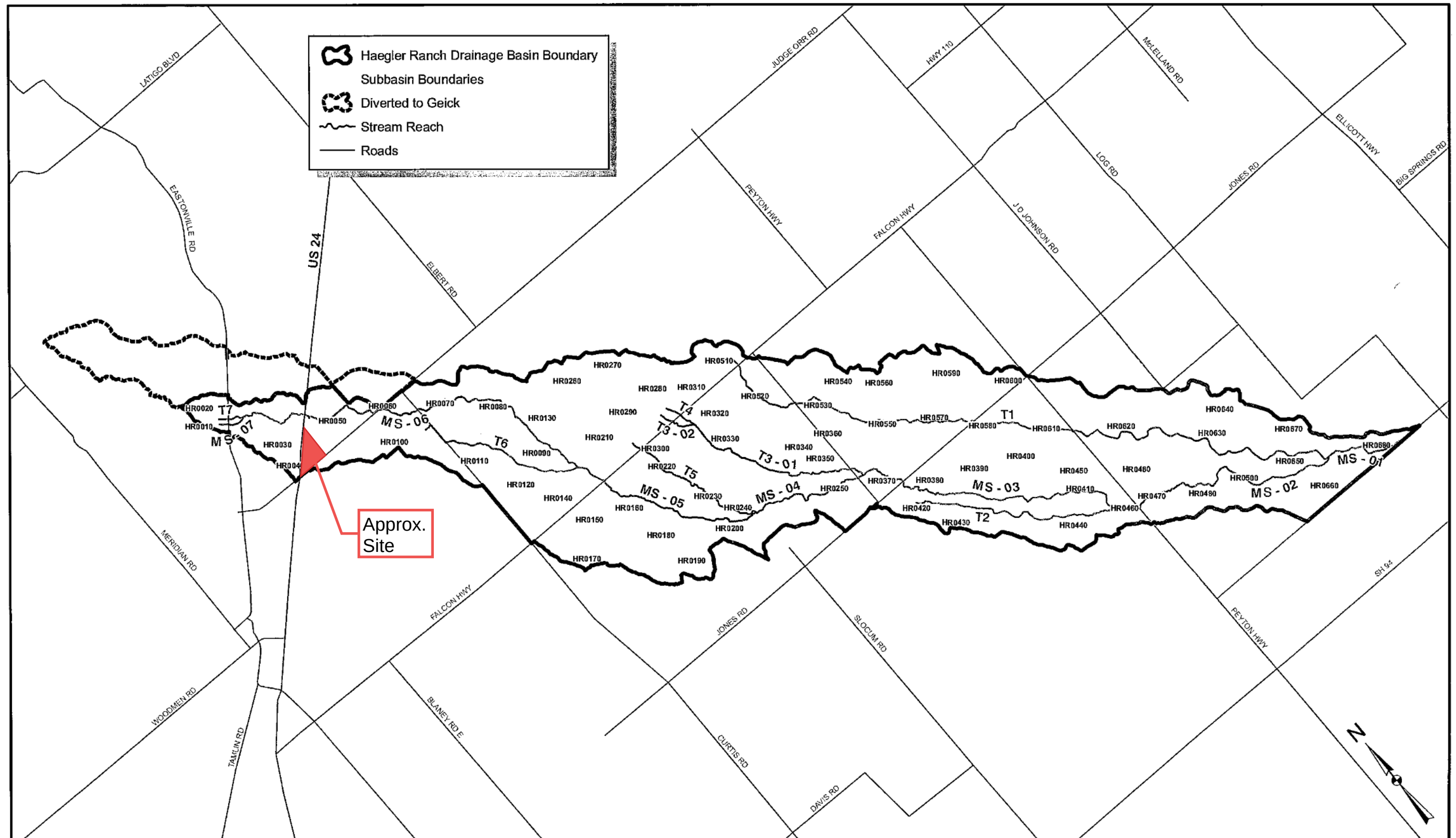
9980 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001



DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN

**VICINITY MAP
FIGURE 1-1**



URS

9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001



5,000 2,500 0 5,000
Feet
1" = 5,000'

DATE: 09/08

HAEGLER RANCH DRAINAGE BASIN

SUBBASIN DELINEATION

FIGURE 4-1

Table 5-3 Existing Hydraulic Deficiencies

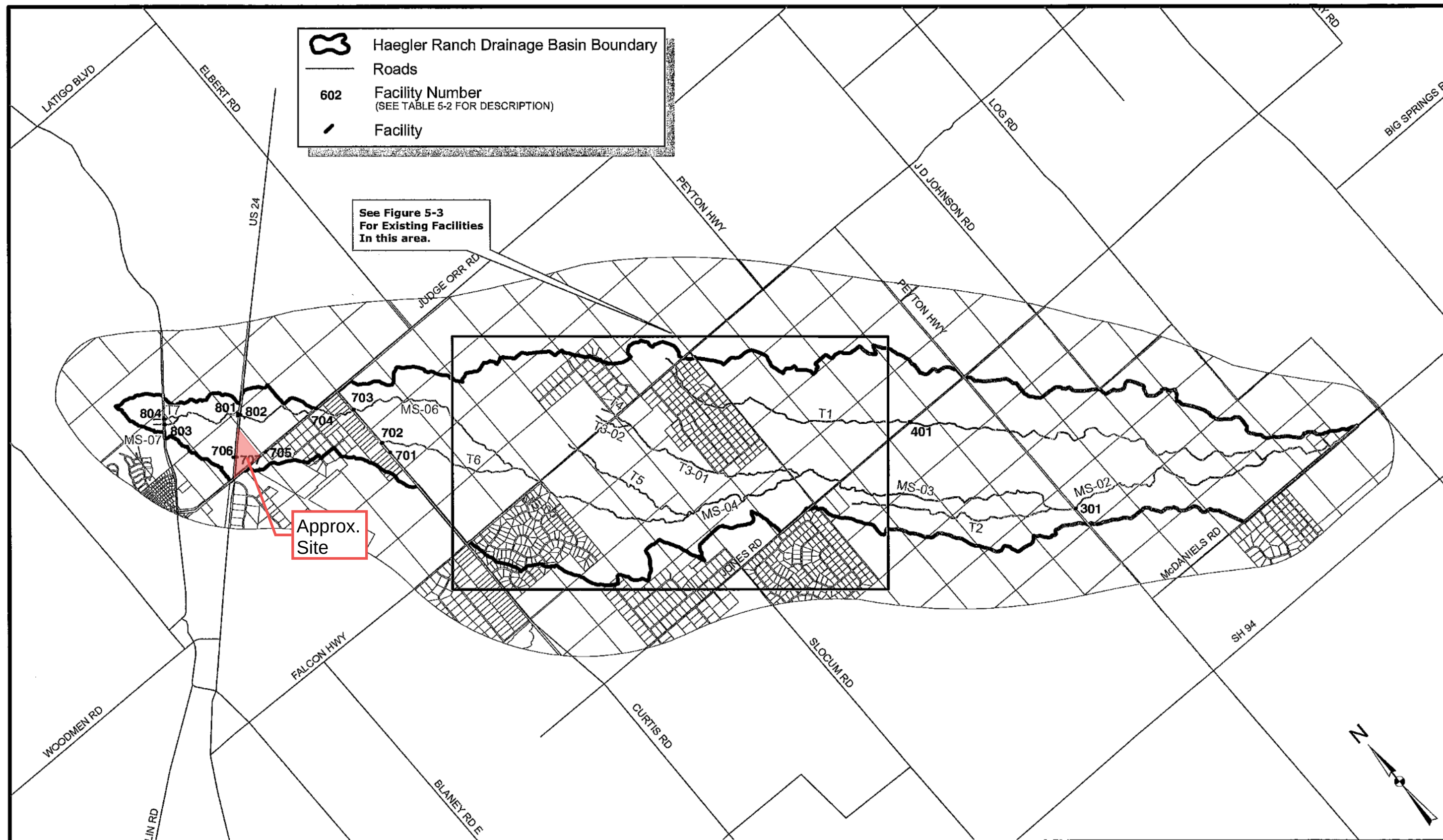
Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency
633	Sagecreek Road	N/A	24" CMP	N/A	N/A
634	Sagecreek Road	N/A	24" CMP	N/A	N/A
701	Curtis Road	N/A	18" CMP	N/A	N/A
702	Curtis Road	Tributary 6 (T6)	36" CMP	120	Overtops
703	Curtis Road	Main Stem (MS-06)	24" CMP	590	Overtops
704	Judge Orr Road	Main Stem (MS-06)	Blocked Culvert	540	Overtops
705	Judge Orr Road	N/A	18" CMP	N/A	N/A
706	US 24	N/A	20" Steel Pipe	N/A	N/A
707	US 24	N/A	24" CMP	N/A	N/A
801	Pedestrian Bridge	Main Stem (MS-06)	Bridge	350	Meets Capacity
802	US24	Main Stem (MS-06)	2-66" CMPs	350	Meets Capacity
803	Eastonville Road	Main Stem (MS-07)	27"X21" CMP	25	Overtops
804	Eastonville Road	Tributary 7 (T7)	18" CMP	99	Overtops

Note: 69 Structures were cataloged and located. N/A indicates that the structure was not analyzed because it was not on one of the main channels.

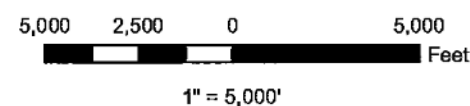
5.14. Results

Hydraulic conditions from the hydraulic model results are summarized in Table 5-4. This includes channel velocity, flow depth, and top width for existing conditions at key locations. Water surface profiles for Haegler Ranch Drainage Basin for the 100-year recurrence interval flood for the existing conditions are presented in Figure 5-4 the HEC-RAS model for Haegler Ranch Drainage Basin for the existing conditions is provided in Appendix B.

The approximate 100-year floodplain as seen in Figure 5-4 varies from a contained floodplain with in a defined channel to a wide floodplain with shallow flooding. Three areas were designated as flooding: 1) the approximate 100-year floodplain as delineated by HEC-RAS, 2) split flow flooding that was estimated from HEC-RAS elevation upstream and contours, and 3) shallow areas connected to the floodplain with less than 1 foot of flooding.



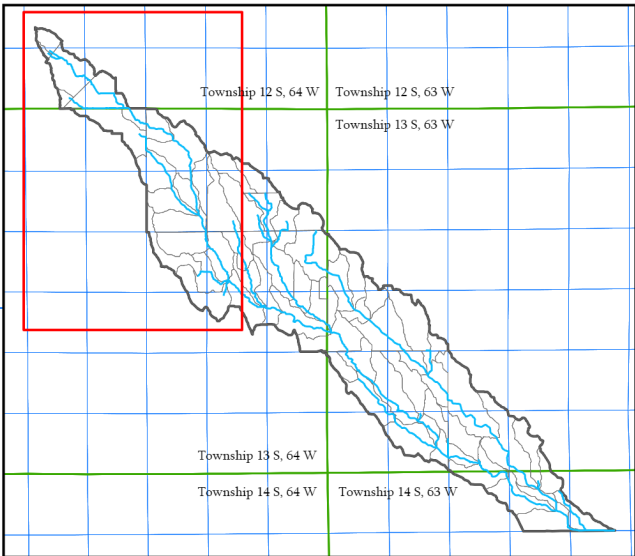
URS
 9960 Federal Dr.
 Suite 300
 Colorado Springs, CO 80921
 719.531.0001



DATE: 09/08

HAEGLER RANCH DRAINAGE BASIN
FACILITY INVENTORY A
FIGURE 5-2

FIGURE 4-4 SHEET 1



- JUNCTIONS
- JHR0025 - JUNCTION IDENTIFIERS
- HR0010 - SUBBASIN IDENTIFIERS
- REACHES
- POTENTIAL WETLANDS
- HAEGLER RANCH BASIN BOUNDARY
- SUBBASIN BOUNDARIES

Approx.
Site



0 2,500 5,000 Feet
1:12,000 1" = 1,000 ft.

SUBBASINS

NAME	2 YR FLOWS (cfs)		100 YR FLOWS (cfs)		SUBBASIN AREA (sq. mi)
	Existing	Future	Existing	Future	
HR0010	3.1	11	25	52	0.022
HR0020	11	100	99	320	0.108
HR0030	9.0	13	260	300	0.393
HR0040	0.36	0.36	26	26	0.045
HR0050	2.7	4.3	170	200	0.377
HR0060	2.0	3.5	54	66	0.101
HR0070	5.4	210	99	580	0.180
HR0080	2.5	190	87	970	0.482
HR0090	0.95	11	44	160	0.154
HR0100	4.3	5.8	120	140	0.394
HR0110	1.9	72	84	420	0.310
HR0120	2.0	4.0	73	150	0.226
HR0130	0.27	15	29	180	0.185
HR0140	3.5	6.4	110	140	0.283
HR0150	21	21	210	210	0.290
HR0160	6.6	6.6	96	96	0.267
HR0170	15	17	130	150	0.241
HR0180	6.4	6.4	85	85	0.194
HR0190	19	19	190	190	0.340
HR0200	6.3	6.8	140	150	0.272
HR0210	13	24	150	240	0.359
HR0220	6.3	6.6	85	90	0.168
HR0260	0.88	36	60	240	0.186
HR0290	20	57	180	460	0.340

JUNCTIONS

NAME	2 YR FLOWS (cfs)		100 YR FLOWS (cfs)		DRAINAGE AREA (sq. mi)
	Existing	Future	Existing	Future	
JHR0025	14	110	120	370	0.130
JHR0030	21	120	350	630	0.523
JHR0056	24	120	540	830	0.945
JHR0060	25	120	590	890	1.046
JHR0070	28	210	660	930	1.226
JHR0080	29	340	720	1500	1.708
JHR0110	6.1	72	200	440	0.704
JHR0125	37	410	980	2100	2.792
JHR0145	39	420	1100	2400	3.260
JHR0150	42	440	1100	2600	3.550
JHR0160	44	440	1200	2600	3.817
JHR0185	50	450	1400	2700	4.252
JHR0190	65	470	1400	2900	4.592

URS

HAEGLER RANCH DRAINAGE BASIN
EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

PRELIMINARY/FINAL DRAINAGE REPORT

FOR

JUDGE ORR ROAD RV PARK & STORAGE DEVELOPMENT

Prepared For:

**Prairie Stone, LLC
9476 Dakota Dunes Lane
Peyton, CO 80831-4138**

Prepared By:

**Associated Design Professionals, Inc.
3520 Austin Bluffs Parkway
Colorado Springs, CO 80918
719.266-5212**

**ADP Project No.160301
July 17, 2019**

PCD Project #PPR-16-040



**PRELIMINARY/FINAL DRAINAGE REPORT
JUDGE ORR ROAD RV PARK & STORAGE DEVELOPMENT**

GENERAL

The Judge Orr Road RV Park & Storage project consists of 35.0 acres located along Judge Orr Road just east of US 24 and approximately two miles northeast of Falcon, Colorado. The project is located within the previously approved Meadowlake Commons Master Plan area. The site is further described as being located in central El Paso County within the Southwest Quarter of Section 33, Township 12 South, Range 64 West of the 6th Principal Meridian, El Paso County, Colorado.

The proposed development lies within the Haegler Ranch Drainage Basin Planning Study area, prepared by URS Corporation in 2007. It is also included in the Meadowlake Commons MDDP, prepared by Springs Engineering in 2008. For this report, the existing flows for this project utilize the findings of the Meadowlake Commons MDDP.

SOILS

The Soil Conservation Service (NRCS) soil survey for El Paso County has identified the soil type in this study area as follows:

Map Symbol No.	Soil Name	Hydrologic Soil Group
19	Columbine Gravelly Sandy Loam	A

FLOODPLAIN STATEMENT

A small portion of the site is located within a Zone A floodplain as determined by FEMA on the Flood Insurance Rate Map (FIRM) Panel 08041C0575G, dated December 7, 2018.

METHOD OF COMPUTATION

The methodology used for this report is in accordance with the *City/County Drainage Criteria Manual*. The Rational Method for computation of runoff was used for local basin design.

$$Q = cia$$

Where	Q	=	Maximum rate of runoff in cubic feet per second
	c	=	Runoff coefficient representing drainage area characteristics
	i	=	Average rainfall intensity, in inches per hour, for the duration required for the runoff to become established
	a	=	Drainage basin size in acres

The overall drainage for the area including off-site flows was calculated using the US Army Corp of Engineers Hydrologic Engineering Center – Hydrologic Modeling System, Version 3.1.0 (HEC-HMS). The Soil Conservation Service (SCS) (since renamed National Resources Conservation Service - NRCS) curve number method was selected for calculating the runoff volumes from the drainage basins per the DCM. Runoff rates for the five-year minor storm and 100-year major design storm were calculated.

Times of concentration were estimated using the SCS procedures described in the DCM based upon the hydrologic soil type, the natural conditions found in the basins and the runoff curve numbers (CN) chart from Table 5-4 of the DCM.

The 100-year, 24-hour storm precipitation selected from the NOAA isopleth map in Figure 5-4e from the DCM was 4.6 inches. The ten-year, 24-hour storm precipitation selected from the rainfall depth-duration relationship chart in Figure 5-6 from the DCM was 3.1 inches. The five-year, 24-hour storm precipitation was derived from Figure 5-6 of the *City/County Drainage Criteria Manual*. The calculated rainfall amount was 2.6 inches. These numbers, along with SCS information, were used as input.

WATER QUALITY/DETENTION CONCEPTS

In accordance with current NPDES requirements, stormwater quality BMPs will be incorporated into the development of this project. Water quality facilities will be included in all proposed full spectrum detention facilities.

EXISTING DRAINAGE CONDITIONS

The existing site is only minimally developed with some gravel roads and two existing structures. The site is covered with Rangeland grasses and generally drains to the southeast at an average slope of three percent. An existing channel and a Zone A floodplain exist within the far northeastern corner of the project area. An existing, broad swale bisects the site and travels through an abandoned stock pond prior to exiting the site. All flows from Judge Orr Road are intercepted by a roadside ditch which continues past the site to the east.

There are currently two culvert crossings running under US 24. One crossing is a 24-inch CMP culvert located approximately 1,000 feet northeast of the US 24/Judge Orr Road intersection. This pipe is estimated to accommodate flows of 12.9 cfs for the five-year storm and 54.1 cfs for the 100-year storm. The second crossing consists of twin 54-inch CMP culverts. These pipes are located approximately 2,900 ft northeast of the intersection. The twin culverts carry offsite flows of 44.2 cfs for the five-year storm and 192.7 cfs for the 100-year storm and enter the project in the northeast corner, enter the existing channel located in the far northeast corner of the site and cross the property north of the project site.

The existing area located northwest of the parcel is designated as Sub-Basin OS1. This sub-basin drains existing pasture land and produces flows of 3.3 cfs for the 5-year storm and 15.2 cfs for the 100-year storm. These flows are intercepted by an existing ditch which carries the flows south along the property line to a low point from Sub-Basin OS2.

Sub-Basin OS2 drains the area just west of the parcel. This area is currently vacant and produces flows of 4.0 cfs and 28.0 cfs respectively. These flows combine with the flows from Sub-Basin OS1 at DP1 for total flows of 6.4 cfs for the 5-year storm and 39.0 cfs for the 100-year storm. These flows travel east through a broad swale located in Sub-Basin A2 and into an existing stock pond within Sub-Basin A2

Sub-Basin A1 drains the northeastern portion of the site. It is currently vacant and covered with rangeland grasses. This sub-basin produces flows of 2.2 cfs for the 5-year storm and 16.5 cfs for the 100-year storm. These flows leave the site in a southeasterly direction approximately 600 ft north of the main channel. These flows eventually join the main channel about 500 ft east of the site.

Sub-Basin A2 drains the major portion of the site and contains the stock pond and farm residence. The site also contains an existing stock pond which has been breached and is covered with rangeland grasses. This sub-basin produces flows of 3.1 cfs and 24.0 cfs respectively. These flows combine with the flows from DP1 at DP2 to produce total flows of 7.9 cfs for the 5-

year storm and 52.1 cfs for the 100-year storm. These flows leave the site in the southeast area of the site.

Sub-Basin OS3 drains an area west of SH24 and drains to the east into Sub-Basin OS4 through a 24" CMP. This area is currently zoned A-35 and is primarily open range. This sub-basin produces flows of 17.8 cfs and 62.0 cfs respectively.

Sub-Basin OS4 drains an area west of the parcel. The area is vacant and covered with rangeland grasses. It slopes to the southeast and flows east along Judge Orr Road. It produces flows of 8.2 cfs and 36.7 cfs respectively. These flows combine with the flows from OS3 at DP3 to produce flows of 24.8 cfs for the 5-year storm and 94.8 cfs for the 100-year storm.

Sub-Basin A3 drains the southern area of the site and is mostly vacant with a barn and some gravel drives located in the western portion of the site. It produces flows of 1.1 cfs and 5.3 cfs respectively and drains into the roadside ditch. OS5 drains the area between the property line and the center line of Judge Orr Road. This area produces flows of 1.3 and 3.3 respectively, and combines with the flows from A3 at DP4 within the Judge Orr roadside ditch to produce total flows of 2.0 cfs for the 5-year storm and 7.6 cfs for the 100-year storm. These flows combine with the flows from DP3 at DP4 to produce total flows of 23.3 cfs for the 5-year storm and 89.0 cfs for the 100-year storm within the roadside ditch. These flows leave the site in a northeasterly direction and join with the main channel about 300 ft east of the property. These flows eventually combine with the flows from DP2 and Sub-Basin A1 at DP6 to produce total flows in the main channel of 33.3 cfs for the 5-year storm and 156.2 cfs for the 100-year storm.

Sub-Basin B drains a small portion of the site in the northern corner. It produces flows of 0.2 cfs for the 5-year storm and 1.6 cfs for the 100-year storm.

The estimated runoff amounts produced for the project under existing conditions are shown in Table 1 below.

TABLE 1 – EXISTING CONDITIONS		
Sub-Basin	Q ₅ CFS	Q ₁₀₀ CFS
OS1	3.3	15.3
OS2	4.0	28.0
OS3	17.8	62.0
OS4	8.2	36.7
OS5	1.3	3.3
A1	2.2	16.5
A2	3.1	24.0
A3	1.1	5.3
B	0.2	1.6
DP1 (OS1 + OS2)	6.4	39.0
DP2 (DP1 + A2)	7.9	52.1
DP3 (OS3 + OS4)	24.8	94.8
DP4 (DP3+OS5 + A3)	23.3	89.0
DP5 (DP2 + DP4 + A1)	33.3	156.2

DEVELOPED DRAINAGE CONDITIONS

The development of the site will include an RV storage area in the northern portion of the site with RV pads located in the southern portion of the site. The northern area will be covered by 4 inches of loose gravel. The southern area will have 120 gravel RV pad sites with asphalt roads connecting the sites and vegetated areas between the pads.

Flows amounts from the area west of SH 24 will remain the same as delineated in the existing conditions portion of the report. Currently these flows travel east in a swale toward the RV development. In the future these flows will be intercepted by a storm sewer and routed directly into the Judge Orr Road ditch as delineated on the Developed Conditions Map.

Existing historic flows from the property to the west will be transported through the site by way of a 30" HDPE storm sewer. The proposed 30" HDPE storm sewer will be located near the west property line to facilitate the connection from a future detention facility once the property to the west has been developed. The overflow spillway will also be directed to the 30" storm sewer along the west property line. This design has been coordinated with the current property owner, as has the proposed swale within the west property. OS1 and OS2 will flow down the existing swale on the west property and into a 4' wide swale which outlets at the same location as detention Pond 2. In the future a new detention pond will replace the swale and will tie directly into the 30" private HDPE storm sewer, with the portion of the storm sewer which will run under the future Right of Way constructed with RCP. This storm sewer will direct the flows around the RV storage site and outlet onto the adjacent property to the east adjacent to the Pond 2 outlet and will be maintained by the owner of the west property. The storm sewer will be placed within a drainage easement in the future when the property is platted. A conceptual 4.6 acre foot pond (Pond 1) was calculated for the future neighborhood commercial site with an estimated outflow of 0.1 cfs for the 5-year storm and 50.7 cfs for the 100-year storm, however the current flows are 6.4 cfs and 39.0 cfs respectively.

Sub-Basin A1 will drain the northern part of the site. This area will be used for RV storage and will be covered by 4 inches of loose gravel. This area will produce flows of 12.3 cfs and 26.0 cfs for the five- and 100-year storms. A 12" berm will keep the flows within the sub-basin. The flows will travel along the berm, cross the drive in a concrete pan and flow into a ditch which will take the flows into Pond 2.

Sub-Basin A2A drains the area between the west property line and the RV storage from the north boundary line to a high point in Range Flower Way. This area will contain the future public road. It will produce flows of 5.7 cfs and 12.0 cfs respectively and will flow into Sub-Basin A3 through a 24" RCP storm sewer.

Sub-basin A3 drains the central area of the site between the gravel parking area to the north and the storm sewer to the south. Flows from this RV park area will sheet flow toward a proposed swale. It will produce of 6.9 cfs and 18.0 cfs respectively. These flows will combine with the flows from Sub-Basin A2A at DP2 to produce flows of 11.2 cfs and 27.1 cfs respectively which will be intercepted by a Type D inlet and a 24" private HDPE storm sewer and transported into Pond 2.

Sub-Basin A4 drains the western and southern part of the developed parcel. This area will be developed as an RV park with private streets and gravel parking areas for RV's. The RV Park area will have asphalt roads with natural grass areas between the parking pads. Flows will travel to the southeast and be intercepted by a main road and transported into the detention basin. It will produce flows of 11.8 cfs and 30.0 cfs respectively.

The total flows into Pond 2 at DP3 will be 29.6 cfs and 70.0cfs for the five- and 100-year storms. The proposed 2.53 AF detention basin will release these flows through an outlet structure with a 36 inch RCP pipe at a rate of 0.5 cfs for the 5-year storm and 33.7 cfs for the 100-year storm.

Sub-Basin A2B drains the lower portion of Range Flower Way. This area will contain the future public road. It will produce flows of 2.4 cfs and 4.8 cfs respectively. These flows will be directed into the Judge Orr Road ditch and into Sub-Basin A5.

Sub-Basin A5 drains the western and southernmost area of the site. This area contains a proposed cinder trail and 75 ft future Judge Orr Road right-of-way. This area will produce flows of 0.4 cfs and 2.9 cfs respectively. Sub-Basin OS5 drains the area between the property line and the centerline of Judge Orr Road. This area produces flows of 1.0 cfs and 2.6 cfs respectively and combines with the flows from A5 and DP5 at DP6 to produce total flows in this area of 22.8 cfs for the 5-year storm and 87.5 cfs for the 100-year storm. These flows will combine with the detained flows at DP7 to produce total flows of 28.9 cfs for the 5-year storm and 150.6 cfs for the 100-year storm.

Sub-Basin B in the northeastern portion of the site will contain a landscaped area and produce flows of 0.2 cfs for the 5-year storm and 1.6 cfs for the 100-year storm.

Table 2 shows the estimated runoff which will be produced for the project under developed conditions.

TABLE 2 – PHASE I DEVELOPED CONDITIONS		
Sub-Basin	Q₅CFS	Q₁₀₀ CFS
OS1	3.3	15.3
OS2	7.2	54.9
OS3	17.8	62.0
OS4	3.7	10.1
OS5	1.0	2.6
A1	12.3	26.0
A2A	5.7	12.0
A2B	2.4	4.8
A3	6.9	18.0
A4	11.8	30.0
A5	0.4	2.9
B	0.2	1.6
DP1 (OS1+OS2)	9.7	66.4
DPD1 (Existing DP1)	6.4	39.0
DP2 (A2A+A3)	11.2	27.1
DP3 (DP2+A1+A4)	29.6	70.0
DPD2 (Detained DP2)	0.5	33.7
DP4(DPD2+DPD1)	6.5	67.4
DP5 (OS3+OS4 Existing)	24.8	94.8
DP6 (A2B+A5+OS5+DP5)	22.8	87.5
DP7 (DP5+DP6)	28.9	150.6

JUDGE ORR ROAD RV PARK & STORAGE DEVELOPMENT

C FACTOR CALCULATION SHEET

RUNOFF COEFFICIENT

TYPE A/B SOILS

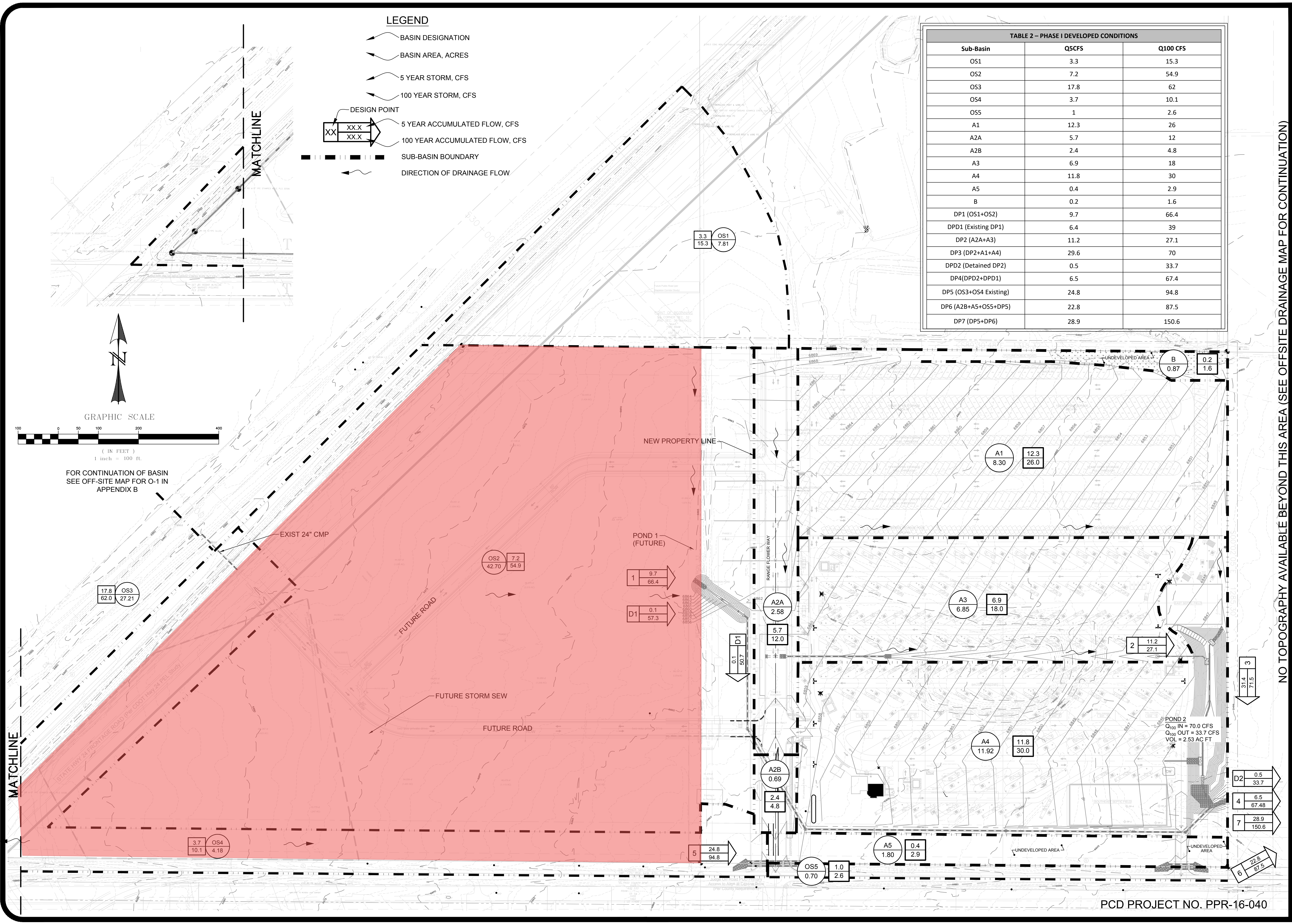
LAND USE	5 YR	100 YR	IMPERV. %
UNDEV	0.08	0.35	0
LOOSE GRAVEL	0.59	0.7	80
GRAVEL ROADS	0.59	0.7	80
GRAVEL RV PARKING PAD	0.59	0.7	80
PAVED ROADS/BUILDINGS	0.9	0.96	100

Historic Conditions

AREA	TOTAL AREA (acre)	SURFACE CONDITION AREAS				CALCULATED C	
		GRASSED SURFACE	LOOSE GRAVEL	GRAVEL ROADS	BUILDINGS OR PAVED ROADS	5 YR	100 YR
DESIG.							
A1	11.75	11.75	0.00	0.00	0.00	0.08	0.35
A2	20.75	20.60	0.00	0.10	0.05	0.08	0.35
A3	4.36	3.91	0.00	0.35	0.10	0.14	0.39
	36.86	36.26	0.00	0.45	0.15	0.09	0.36
% Impervious		0%	80%	80%	100%		
Imp x A		0	0	0.36	0.15		
Total I x A	0.51						
Total Imp	0.51/36.86 = 1.4%						
B	0.87	0.87	0.00	0.00	0.00	0.08	0.35
OS1	7.81	7.19	0.00	0.00	0.62	0.15	0.40
OS2	36.41	35.96	0.00	0.00	0.45	0.09	0.36
OS3	27.21	From Heagler DBPS				0.30	0.60
OS4	13.73	12.37	0.00	0.00	1.36	0.16	0.41
OS5	0.71	0.42	0.00	0.00	0.29	0.41	0.60

[illegible]

M:\LAND PROJECTS\2016\160301-Judge Orr Road RV Park\DWG\160301-Developed Conditions.dwg Jim.Cill West, 07/17/19 6:19 PM



DESIGNED BY
MAB

PROJECT ENGINEER
MAB

DATE:
8/20/18

JOB NO.
160301

CAD FILE NO.
160301-Developed Conditions

DRAWN BY
HUG

SCALE:
1" = 100'

VERT.
N/A

PREPARED BY:

3520 Austin Bluffs Parkway
Suite 102
Colorado Springs, CO 80918
(719) 266-5212
fax: (719) 266-5341

JUDGE ORR ROAD RV PARK & STORAGE

COLORADO SPRINGS, COLORADO

DRAINAGE - DEV OVERALL CONDITIONS

SHEET

2 of 3

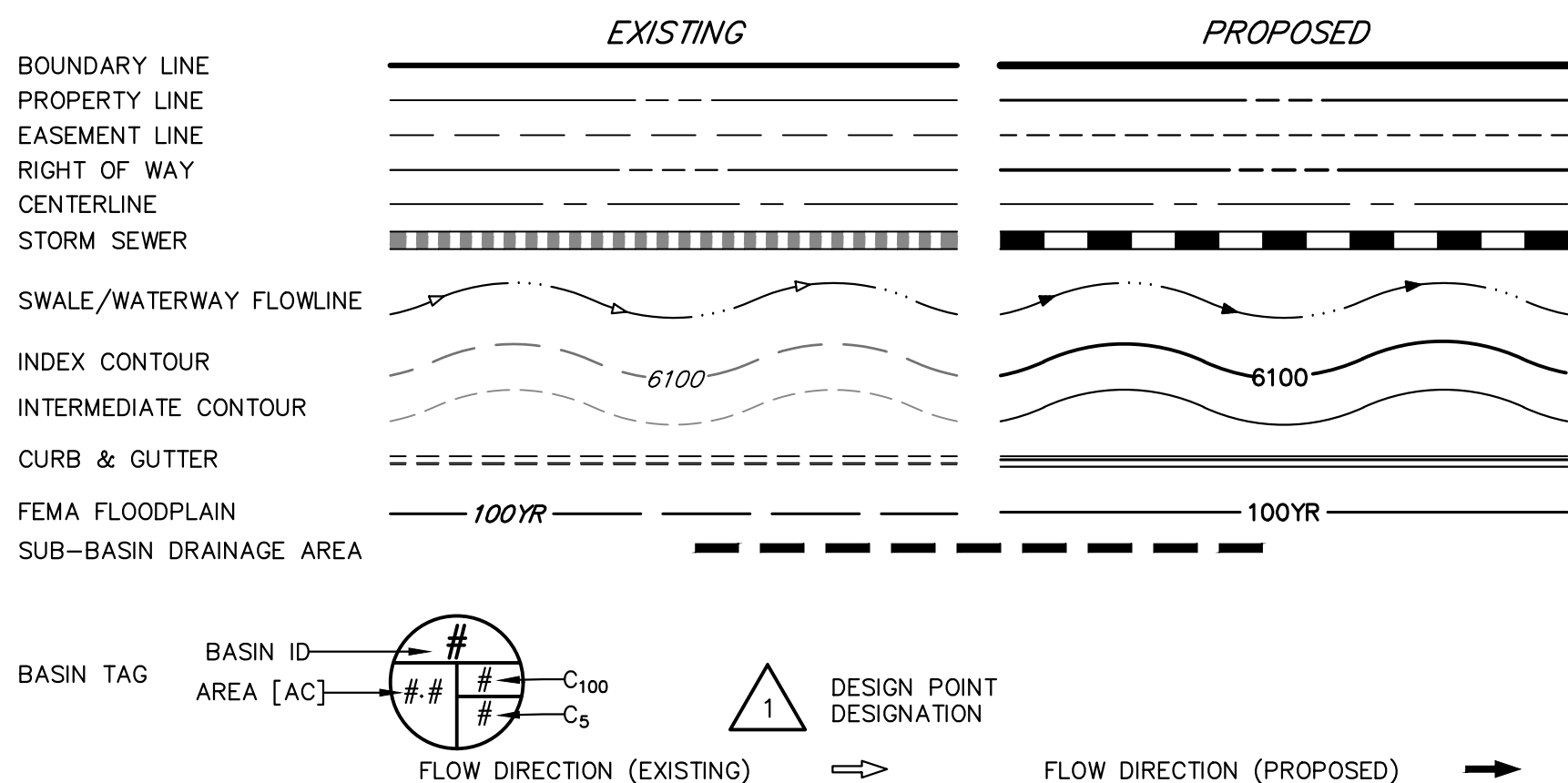
APPENDIX E
DRAINAGE MAPS

JUDGE ORR ROAD COMMERCIAL PARK

EL PASO COUNTY, CO

EXISTING DRAINAGE MAP

LAYER LINETYPE LEGEND



OFF-SITE BASIN BOUNDARIES CONFORM WITH THE BASIN DELINEATION SHOWN IN THE "PRELIMINARY/FINAL DRAINAGE REPORT FOR JUDGE ORR ROAD RV PARK AND STORAGE DEVELOPMENT" BY ASSOCIATED DESIGN PROFESSIONALS, INC. (TYP.)

OFF-SITE BASIN BOUNDARIES CONFORM WITH THE BASIN DELINEATION SHOWN IN THE "PRELIMINARY/FINAL DRAINAGE REPORT FOR JUDGE ORR ROAD RV PARK AND STORAGE DEVELOPMENT" BY ASSOCIATED DESIGN PROFESSIONALS, INC. (TYP.)

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
EXA	18.9	2%	0.09	0.36	35.1	3.8	25.6
EXB	21.2	2%	0.09	0.36	46.7	3.5	23.4
OS1	7.81	7%	0.13	0.39	21.6	2.9	15.1
OS2	0.97	21%	0.25	0.48	5.0	1.2	4.0
OS3	27.2	-	0.30	0.60	33.4	19.0	63.6
OS4	3.67	34%	0.36	0.56	21.0	3.9	10.4

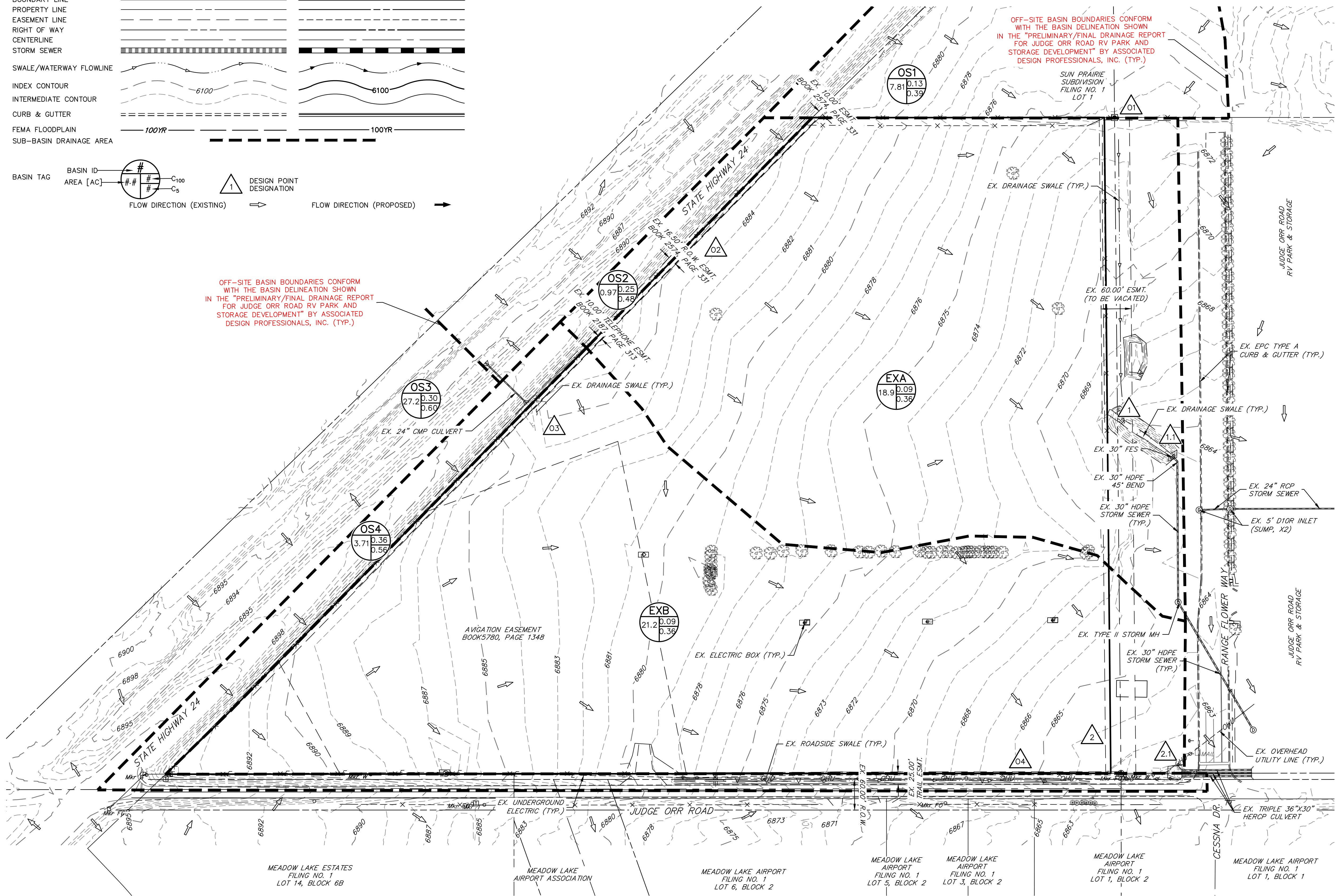
Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

Flows do not match with flows shown in ADP report.

DESIGN POINT SUMMARY TABLE

DP#	Q _s	Q ₁₀₀
01	2.9	15.1
02	1.2	4.0
1	3.8	25.6
1.1	6.6	38.8
03	19.0	63.6
04	3.9	10.4
2	3.5	23.2
2.1	20.7	79.2

Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019



100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EXISTING DRAINAGE MAP
JUDGE ORR ROAD COMMERCIAL PARK
JOB NO. 25315.00
05/28/2025
SHEET 1 OF 1

J-R ENGINEERING
A Westrian Company

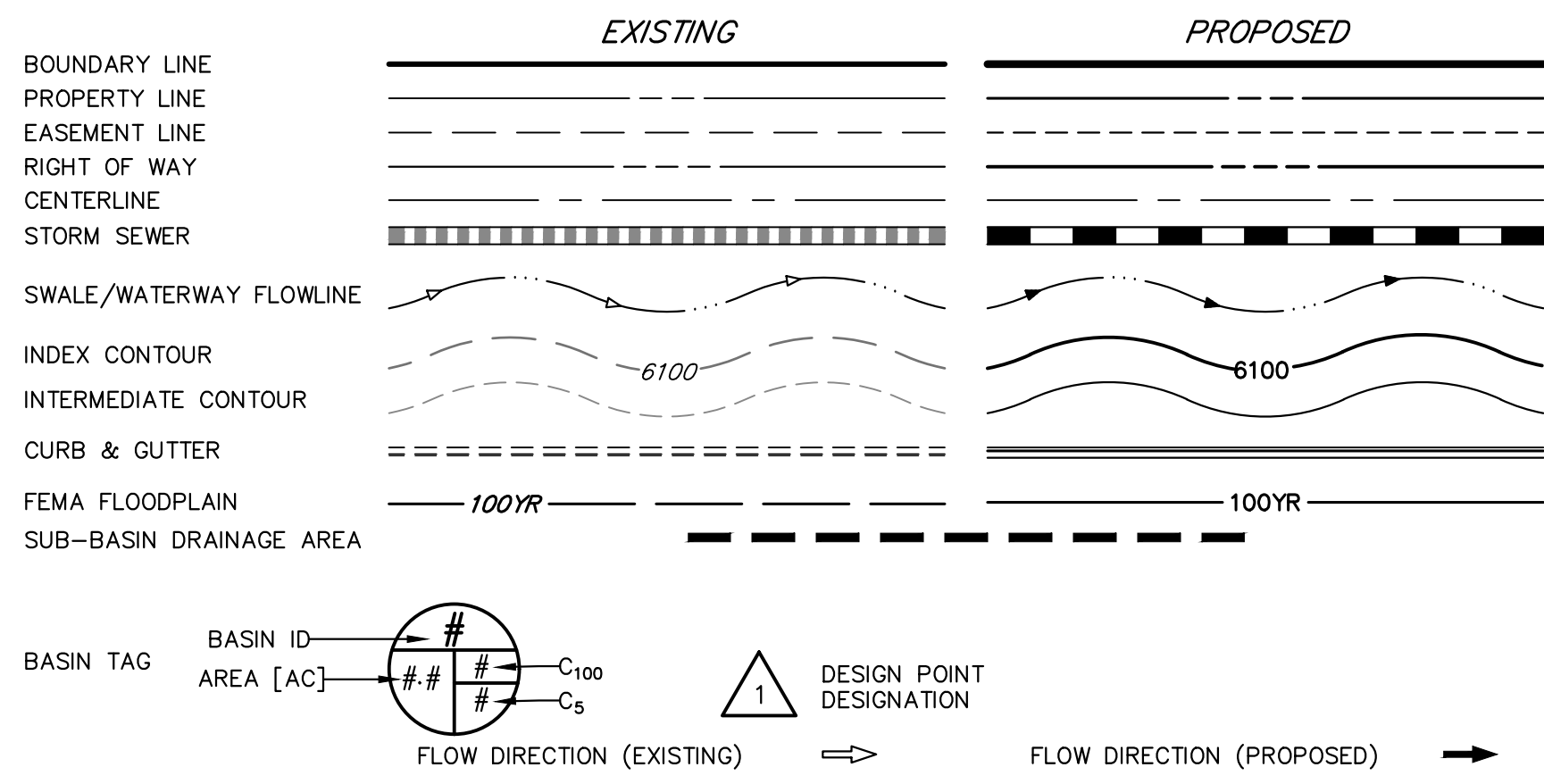
Centennial 303-740-9993 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

JUDGE ORR ROAD COMMERCIAL PARK

EL PASO COUNTY, CO

PROPOSED DRAINAGE MAP

LAYER LINETYPE LEGEND



OFF-SITE BASIN BOUNDARIES CONFORM WITH THE BASIN DELINEATION SHOWN IN THE "PRELIMINARY/FINAL DRAINAGE REPORT FOR JUDGE ORR ROAD RV PARK AND STORAGE DEVELOPMENT" BY ASSOCIATED DESIGN PROFESSIONALS, INC. (TYP.)

OFF-SITE BASIN BOUNDARIES CONFORM WITH THE BASIN DELINEATION SHOWN IN THE "PRELIMINARY/FINAL DRAINAGE REPORT FOR JUDGE ORR ROAD RV PARK AND STORAGE DEVELOPMENT" BY ASSOCIATED DESIGN PROFESSIONALS, INC. (TYP.)

BASIN SUMMARY TABLE									
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)		
A1	2.45	80%	0.59	0.70	8.1	6.4	12.8		
A2	2.85	80%	0.59	0.70	7.0	7.9	15.7		
A3	3.88	80%	0.59	0.70	9.3	9.7	19.4		
A4	0.59	90%	0.82	0.90	9.4	2.0	3.8		
A5	0.58	92%	0.83	0.91	9.1	2.1	3.8		
A6	0.66	95%	0.81	0.88	5.4	2.7	4.9		
B1	2.51	95%	0.81	0.88	6.8	9.6	17.5		
B2	2.51	95%	0.81	0.88	7.0	9.5	17.3		
B3	3.50	95%	0.81	0.88	5.2	14.5	26.4		
C1	2.34	95%	0.81	0.88	6.2	9.2	16.8		
C2	2.32	95%	0.81	0.88	5.8	9.3	17.0		
C3	0.66	91%	0.83	0.91	10.3	2.3	4.1		
C4	0.58	90%	0.82	0.90	8.7	2.0	3.8		
C5	0.49	95%	0.81	0.88	5.7	2.0	3.6		
D	1.57	59%	0.56	0.71	5.0	4.6	9.7		
E1	11.70	2%	0.09	0.36	34.8	2.4	16.0		
E2	0.87	70%	0.63	0.75	5.8	2.7	5.5		
OS1	7.81	7%	0.13	0.39	21.6	2.9	15.1		
OS2a	0.58	22%	0.26	0.48	10.1	0.6	1.9		
OS2b	0.64	17%	0.22	0.45	10.6	0.6	2.0		
OS3	27.2	-	0.30	0.60	33.4	18.9	63.5		
OS4	3.48	34%	0.35	0.55	21.1	3.7	9.7		

Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

Flows do not match with flows shown in ADP report

DESIGN POINT SUMMARY TABLE

DP#	Q _s	Q ₁₀₀
O2A	0.6	1.9
1	6.4	12.8
1.1	6.6	13.8
O2B	0.6	2.0
2	7.9	15.7
2.1	8.5	18.0
2.2	14.1	29.6
O1	2.9	15.1
3	9.7	19.4
3.1	9.8	28.7
4	2.0	3.8
4.1	11.2	31.3
4.2	21.4	52.8
5	2.1	3.8
5.1	22.8	55.4
6	2.7	4.9
7	9.6	17.5
8	9.5	17.3
8.1	18.9	34.6
9	14.5	26.4
9.1	32.1	58.7
10	9.2	16.8
11	9.3	17.0
12	2.3	4.1
12.1	9.9	18.1
12.2	17.7	32.3
13	2.0	3.8
13.1	19.6	35.9
14	2.0	3.6
15	4.6	9.7
15.1	63.0	129.5
15.2	1.0	22.4
O3	18.9	63.5
O4	3.7	9.7
16	2.4	16.0
17	2.7	5.5
17.1	24.8	87.6

Values in RED from the "Preliminary/Final Drainage Report for Judge Orr Road RV Park & Storage Development" by Associated Design Professionals Inc. dated July 2019

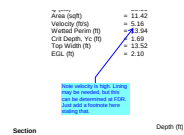
PROPOSED DRAINAGE MAP
JUDGE ORR ROAD COMMERCIAL PARK
JOB NO. 25315.00
05/28/2025
SHEET 1 OF 1



Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

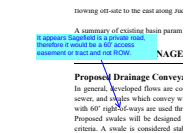
V1_Drainage Report - Preliminary.pdf Markup Summary

Callout (7)



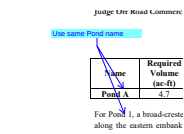
Subject: Callout
Page Label: 59
Author: CDurham
Date: 7/2/2026 1:01:49 PM
Status:
Color:
Layer:
Space:

Note velocity is high. Lining may be needed, but this can be determined at FDR. Just add a footnote here stating that.



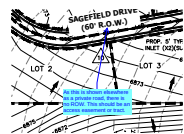
Subject: Callout
Page Label: 7
Author: CDurham
Date: 7/2/2026 1:20:27 PM
Status:
Color:
Layer:
Space:

It appears Sagefield is a private road, therefore it would be a 60' access easement or tract and not ROW.



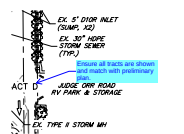
Subject: Callout
Page Label: 14
Author: CDurham
Date: 7/2/2026 1:26:28 PM
Status:
Color:
Layer:
Space:

Use same Pond name



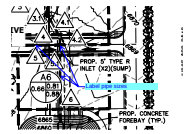
Subject: Callout
Page Label: [1] PR-DR01
Author: CDurham
Date: 7/2/2026 1:58:19 PM
Status:
Color:
Layer:
Space:

As this is shown elsewhere as a private road, there is no ROW. This should be an access easement or tract.



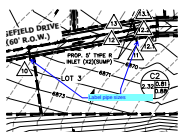
Subject: Callout
Page Label: [1] PR-DR01
Author: CDurham
Date: 7/2/2026 1:58:48 PM
Status:
Color:
Layer:
Space:

Ensure all tracts are shown and match with preliminary plan.



Subject: Callout
Page Label: [1] PR-DR01
Author: CDurham
Date: 7/2/2026 2:00:43 PM
Status:
Color:
Layer:
Space:

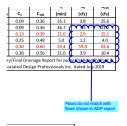
Label pipe sizes



Subject: Callout
Page Label: [1] PR-DR01
Author: CDurham
Date: 7/2/2026 2:01:32 PM
Status:
Color: 
Layer:
Space:

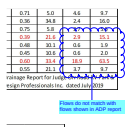
Label pipe sizes

Cloud+ (2)



Subject: Cloud+
Page Label: [1] 24x36 Title Landscape
Author: CDurham
Date: 7/2/2026 1:56:32 PM
Status:
Color: 
Layer:
Space:

Flows do not match with flows shown in ADP report.



Subject: Cloud+
Page Label: [1] PR-DR01
Author: CDurham
Date: 7/2/2026 1:57:31 PM
Status:
Color: 
Layer:
Space:

Flows do not match with flows shown in ADP report

Group (1)



Subject: Group
Page Label: 12
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:17:13 PM
Status:
Color: 
Layer:
Space:

1.7.1.B.

Highlight (3)

$$\begin{aligned} &= 11.42 \\ &= 5.16 \\ &= 13.94 \end{aligned}$$

Subject: Highlight
Page Label: 59
Author: CDurham
Date: 7/2/2026 1:01:03 PM
Status:
Color: 
Layer:
Space:

5.16

nd **A**

Subject: Highlight
Page Label: 14
Author: CDurham
Date: 7/2/2026 1:26:07 PM
Status:
Color: 
Layer:
Space:

A

nd 1, a 1

.1 - - - - -

Subject: Highlight
Page Label: 14
Author: CDurham
Date: 7/2/2026 1:26:08 PM
Status:
Color: 
Layer:
Space:

SW - Highlight (4)

PROPOSED DRAINAGE CONDITIONS
Proposed Drainage Conditions
In general, drainage flows are collected at proposed DCP Type A curb and gutter
outlets and are directed to existing stormwater drains. To prevent sheet flow conditions,
drainage outlets will be designed to ensure they are fully and have required
outlet. **As shown on attached map, the proposed drainage conditions** are shown
relative to the proposed curb and gutter. To ensure that the proposed drainage
conditions are fully and have required outlet, the proposed drainage conditions
shall be provided in the final Drainage Report.
Proposed Sub-base Drainage
The proposed sub-base drainage for the Road Commercial Park is shown on
Appendix C of the plan.

Subject: SW - Highlight
Page Label: 7
Author: EPC Stormwater- Zachary
Date: 6/30/2026 4:59:34 PM
Status:
Color: 
Layer:
Space:

A swale is considered stable with a velocity of 5 ft/s or less.

is approxi
ed Lot 1 an
sheet flow c

Subject: SW - Highlight
Page Label: 10
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:04:57 PM
Status:
Color: 
Layer:
Space:

Lot 1

Haegler Ranch dragaway.

Specific Details
The full-spectrum EDB will
outlet structure. The propose
Quality Capture Volume (W
100-year inflow (depending

Subject: SW - Highlight
Page Label: 11
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:09:58 PM
Status:
Color: 
Layer:
Space:

full-spectrum EDB

ON LAND DIST. TO
ND TO REMAIN
:CM APP. I.7.1.B.7
INDETAINED AREA
RE)

Subject: SW - Highlight
Page Label: 13
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:17:55 PM
Status:
Color: 
Layer:
Space:

APP. I.7.1.B.7

SW - Textbox (2)

: XXXXX


Subject: SW - Textbox
Page Label: 1
Author: EPC Stormwater- Zachary
Date: 6/30/2026 4:44:44 PM
Status:
Color: 
Layer:
Space:

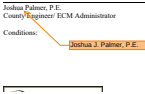
SP264

Preliminary comments on MHFD calculations do not need to be addressed. Full comments can be provided if pond design is submitted, but this is not required.

Subject: SW - Textbox
Page Label: 64
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:28:39 PM
Status:
Color: ■
Layer:
Space:

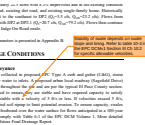
Preliminary comments on MHFD calculations do not need to be addressed. Full comments can be provided if pond design is submitted, but this is not required.

SW - Textbox with Arrow (5)



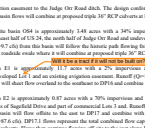
Subject: SW - Textbox with Arrow
Page Label: 2
Author: EPC Stormwater- Zachary
Date: 6/30/2026 4:44:29 PM
Status:
Color: ■
Layer:
Space:

Joshua J. Palmer, P.E.



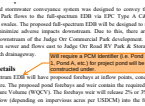
Subject: SW - Textbox with Arrow
Page Label: 7
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:02:02 PM
Status:
Color: ■
Layer:
Space:

Stability of swale depends on swale slope and lining. Refer to table 10-4 in the EPC DCMv1 Section III Ch 10.2 for specific allowable velocities.



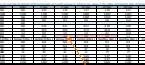
Subject: SW - Textbox with Arrow
Page Label: 10
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:05:25 PM
Status:
Color: ■
Layer:
Space:

Will it be a tract if it will not be built on?



Subject: SW - Textbox with Arrow
Page Label: 11
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:11:08 PM
Status:
Color: ■
Layer:
Space:

Will require a PCM Identifier (i.e. Pond 1, Pond A, etc.) for project pond will be constructed under.



Subject: SW - Textbox with Arrow
Page Label: 66
Author: EPC Stormwater- Zachary
Date: 6/30/2026 5:27:18 PM
Status:
Color: ■
Layer:
Space:

Ratio Peak Outflow to Predevelopment Q: Ratio should be less than or equal to 1 for minor (5-yr) and major (100-yr) design storms. See Chapter 4.1 of DCM volume 2 (and also Chap 2 of MHFD DCM vol. 3).

Text Box (4)

= 15.50 Flow at DP2.1 is 18 cfs	Subject: Text Box Page Label: 44 Author: CDurham Date: 7/2/2026 12:53:50 PM Status: Color: Layer: Space:	Flow at DP2.1 is 18 cfs
= 28.60 Flow at DP 2.2 is 29.6 cfs	Subject: Text Box Page Label: 45 Author: CDurham Date: 7/2/2026 12:54:46 PM Status: Color: Layer: Space:	Flow at DP 2.2 is 29.6 cfs
= 63.50 Flow at O3 is 63.5 cfs	Subject: Text Box Page Label: 60 Author: CDurham Date: 7/2/2026 1:02:20 PM Status: Color: Layer: Space:	Flow at O3 is 63.5 cfs
water quality for the proposed pond. Required not designed per USDCM and CSES/EPDCM shall (10.5) will be used in the Final Drainage : swales per criteria. The hydraulic design and sport. Note that the existing culverts will be analyzed also, if they are to remain. SUB-BASINS asin. The "Haefer Ranch Basin Drainage Basin	Subject: Text Box Page Label: 5 Author: CDurham Date: 7/2/2026 1:14:03 PM Status: Color: Layer: Space:	Note that the existing culverts will be analyzed also, if they are to remain.