EPC STORMWATER REVIEW COMMENTS IN ORANGE BOXES WITH BLACK TEXT

NOTED, THANK YOU

Early Grading Permit - Final Drainage Report

Overlook at Homestead Subdivision Filing No. 1 El Paso County, Colorado

Prepared for:
PT Overlook LLC
1864 Woodmoor Drive, Suite 100
Monument, CO 80132

Prepared by:
Kimley-Horn and Associates, Inc.
2 North Nevada Avenue, Suite 900
Colorado Springs, Colorado 80903
(719) 453-0180
Contact: Kevin Kofford, P.E.

NOTED. PCD NUMBER ADDED TO COVER SHEET

Project #: 196239003
PCD Filing No.: EGP241
Prepared: January 24, 2024

Kimley-Horn

CERTIFICATION

SIGNATURES AND STAMPS TO BE ADDED UPON SUBMITTAL FOR APPROVAL.

DESIGN ENGINEER'S STATEMENT

The attached drainage plan and report were prepared unc… are correct to the best of my knowledge and belief. Said… according to the criteria established by the County for dr… 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 preparation of this report.

Sign and stamp

SIGNATURE (Affix Seal): ______________________________
Kevin Kofford, P.E. Date

OWNER/DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all of the requirements specified in this Drainage Report and Plan.

PT Overlook LLC
Name of Developer

Owner sign and date

____
Authorized Signature Date

Joe DesJardin
Printed Name

Director of Entitlements
Title

1864 Woodmoor Drive Suite 100, Monument, CO 80132
Address

EL PASO COUNTY

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

______________________________ ______________________
Joshua Palmer, P.E. Date
County Engineer/ ECM Administrator

Conditions:

TABLE OF CONTENTS

INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to provide the hydrologic and to document the drainage design methodology in support of the proposed Overlook at Homestead Subdivision Filing No. 1("the Project") on behalf of PT Overlook LLC. The finalized hydraulic design and associated calculations for the early grading stage of this project will be provided with the Final Drainage Report. The Project is located within the jurisdictional limits of El Paso County ("the County"). Therefore, the hydrologic and hydraulic design is based on the County's criteria which is described in further detail with

Hydraulic analysis for currently proposed storm pipes shall be provided within this FDR.

LOCATION

The Project Site located east of … so County, Colorado including parcels 4122000005, 4100000255, 4100000256. More specifically, the site is a Portion of Section 22 and a Portion of Section 27, Township 11 South, Range 64 West of the 6th PM, County of El Paso, State of Colorado. North of the project site is agricultural and rural residential land, to the east is Homestead Ranch Park owned and maintained by El Paso County, and to the south and west is Homestead Ranch subdivisions. Filing No.1 consists of 36, five acre lots and is located just south … the Apex Ranch Subdivision and the large butte. A … **Appendix** of this report.

NOTED, TEXT REMOVED AND HYDRAULIC ANALYSIS ADDED TO REPORT.

The Site is currently owned by PT Overlook LLC and w…

DESCRIPTION OF PROPERTY

The entire Overlook project is approximately 350.8 acres consisting of mostly vacant, undeveloped land with native vegetation and a rural single-family residential home situated in the northwest corner of the Site and is classified as Agricultural Grazing Land to be subdivided into 62 total lots. Filing No. 1 consists of approximately 202.72 acres which will be subdivided into 36 5-acre parcels. Vegetation within the site is characterized primarily by prairie grasses along with some area of scrub brush and trees. The Site does not currently provide water quality or detention for the Project area.

The existing topography consists of slopes ranging from 1% to 33% with an existing butte covering much of the northern portion of the Site. Filing No. 1 includes a roadway and temporary cul-de-sac on the top of the existing butte, but the majority of the site is located south of the butte. Flows in the existing conditions run off site into one of four major drainage basins. Filing No. 1 only discharges into the Upper Black Squirrel Cree and La Vega Ranch drainage basins, to the south. Detailed descriptions of the existing major drainage basins can be found later in the report.

According to NRCS soil mapping data, USCS Type B soils are the primary soil type within the site. Type 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. Soils mapping information has been provided in the **Appendix**.

The Filing No. 1 development of this site will consist of 36, five acre residential lots with roadway improvements, roadway grading, three full spectrum detention ponds, roadside ditches, culverts, and drainage swales.

FLOODPLAIN STATEMENT

The Site is located outside the 100-year floodplain and within Zone X (an area of minimal flood hazard) as noted on the FEMA FIRM Map No. 08041C0350G revised on December 7, 2018 (See **Appendix**).

DRAINAGE BASINS

MAJOR BASIN DESCRIPTIONS

The Project Site is tributary to four major drainage basins in the El Paso County Drainage Basin Map. Bijou Creek, East Kiowa Creek, Upper Black Squirrel, and La Vega Ranch Drainage Basins. These drainage basins are located in the north central portion of El Paso County. The northeast portion of the site is tributary to Bijou Creek Drainage Basin, the northwest portion of the site is tributary to East Kiowa Creek Drainage Basin, the southwest portion of the site is tributary to Upper Black Squirrel Drainage Basin, and the southeast portion of the site is tributary to La Vega Ranch Drainage Basin. Filing No. 1 only discharges into the Upper Black Squirrel Creek and La Vega Ranch Drainage Basins, to the south. In an effort to simplify basin nomenclature, the following naming conventions have been used for both existing and proposed drainage sub-basins labeling. Proposed Basins have been designed in effort to keep runoff within the same existing basins, as to not transfer runoff between basins.

A - Upper Black Squirrel Drainage Basin (CHBS2000)
B - La Vega Ranch Drainage Basin (CHBR0400)
C - East Kiowa ... 00)
D - Bijou Creek ...

Noted, statement removed to avoid confusion

El Paso County ... provided in the **Appendix**. A summary of flows in existing and pr... ...ded to the **Appendix**.

COMPLIANCE WITH PREVIOUS FINAL DRAINAGE REPORT

A portion of the proposed Project Site falls within the existing approv... ...t for Apex Ranch Estates" by Terra Nova Engineering, Inc. approval ... . Flows from these basins will be at or below history values. These flo... ...e calculation for the existing detention facility for Filing No. 1. Excerpts fr... ...d FDR have been provided in the **Appendix**.

NOTED, B2 INCLUDED

proposed conditions for the PRELIM plan is not the same as proposed for the EGP FDR

A Preliminary Drainage Report was submitted to the County as part of the SP238 Application for the Preliminary Plat. The existing and proposed hydrology for this Final Drainage Report are consistent with the hydrology presented in the Preliminary Drainage Report.

EXISTING SUB-BASIN DESCRIPTIONS

Please include B2

Historically the runoff from the Site drains into one of two major drainage basins for Filing No. 1 as described above. Slopes vary from 2-33% throughout the site with various natural features. The Site has been divided into 8 onsite basins A1-A2, B1, B3, and B3A, and 2 offsite basins OS-A1 and OS-A2. The offsite basins are located west of the Site and generally flow west towards to existing stormwater infrastructure. Descriptions of each individual sub-basin can be found below.

Sub-Basin A1
This on-site sub-basin consists of an area of 19.92 acres, located in the southwest corner of the Site. Drainage flows o[illegible] it is captured by an existing culvert at DP 1 [illegible] ousness for this sub-basin is 8%. Runoff duri[illegible] 8.41 cfs respectively. Refer to the **Appendix** [illegible]

Please provide a brief discussion of how the existing runoff flow interacts with the existing natural channels shown on the proposed drainage map.

Sub-Basin A2
This on-site sub-basin consists of an area of 61.50 acres, located in the southwest corner of the Site. Drainage flows overland from the northeast to the southwest where it flows offsite at DP 2 [illegible] ed imperviousness for this sub-basin is 1%. [illegible] 3.00 cfs and 87.58 cfs respectively. Refer to [illegible] Map.

Hydraulic analysis of channels has been added to appendix. Discussion added including reference to appendix. Channels now shown on existing drainage map.

[illegible] acres, located in the south-central portion of the Site. Drainage flows overland from the north to the south where it flows offsite at DP 3 into Reata subdivision south of the Site. The weighted imperviousness for this sub-basin is 0%. Runoff during the 5-year and 100-year events are 9.87 cfs and 72.48 cfs respectively. Refer to the **Appendix** for the Existing Conditions Drainage Map.

Sub-Basin B2
This on-site sub-basin consists of an area of 42.42 acres, located in the south-central portion of the Site. Drainage flows overland from the north to the south where it flows offsite at DP 4 into Reata subdivision south of the Site. The weighted imperviousness for this sub-basin is 0%. Runoff during the 5-year and 100-year events are 9.41 cfs and 69.09 cfs respectively. Refer to the **Appendix** for the Existing Conditions Drainage Map.

Sub-Basin B3
This on-site sub-basin consists of an area of 25.42 acres, located in the southeast portion of the Site. Drainage flows overland from the north to the south where it flows offsite at DP 5 into Reata subdivision south of the Site. The weighted imperviousness for this sub-basin is 0%. Runoff during the 5-year and 100-year events are 5.91 cfs and 43.40 cfs respectively. Refer to the **Appendix** for the Existing Conditions Drainage Map.

Sub-Basin B3A
This on-site sub-basin consists of an area of 24.23 acres, located in the southeast corner of the Site. Drainage flows overland from the north to the south where it flows offsite at DP 5A into Reata subdivision south of the Site. The weighted imperviousness for this sub-basin is 0%. Runoff during the 5-year and 100-year events are 5.99 cfs and 43.98 cfs respectively. Refer to the **Appendix** for the Existing Conditions Drainage Map.

Sub-Basin OS-A1
The off-site sub-basin consists of an area of 4.06 acres, located in the western central portion of the drainage study area. Drainage flows overland from the northeast to southwest where it is captured by an existing drainage culvert at DP 14 and directed west of Elbert Road. The weighted imperviousness for this sub-basin is 19%. Runoff during the 5-year and 100-year events are 3.76 cfs and 12.49 cfs respectively. Refer to the **Appendix** for the Existing Conditions Drainage Map.

Sub-Basin OS-A2
The off-site sub-basin consists of an area of 4.45 acres, located in the central portion of the drainage study area. Drainage flows overland from the north to south where it enters sub-basin

Clarifying text added

A2 at DP 15 and follows the patterns described in sub-basin A2. The weighted imperviousness for this sub-basin is 19%. Runoff during the 5-year and 100-year events are 3.76 cfs and 12.49 cfs respectively. Refer to the **Appendix** for the Existing Conditions Drainage Map.

Add clarifying text that in the early grading condition these three EDBs will be TSBs and they will not be fully constructed until final plat and final design.

PROPOSED SUB-BASIN DESCRIPTIONS

For the proposed condition, stormwater will generally maintain historic flow patterns. The proposed roadways will alter some of the existing flow paths. The roadway ditches will capture runoff from the roadways and direct flows via proposed culverts back to the existing flow paths, which will ultimately follow historic patterns or be capture by o... ...ed storm water ponds. The proposed Site has been divided into 10 on... ..., B6-B8, ... Descriptions of each ... ...be found ... ...eveloped and no char... ...sins are ... ...or Apex Ranch Estates ... ...g, dated ... ...d detention basin, on th... ...x Ranch ... ...ed and sized to provide water quality for the entire basins ... Drainage Report. This area includes all the proposed roadway extensions through the ROW preservation within the Apex Ranch Estates Subdivision. This project does not rely on the water quality or detention volumes provided by the existing detention basin within Apex Ranch Estates.

Discussion regarding culvert design added to text.

Discussion regarding channels and erosion protection has been added to report. TRM now called out on channel analysis.

The three proposed full spectrum extended detention basins will be designed to release developed flows from Filing No. 1 at less than or equal to historic rates for this project before ... ...l spectrum extended detention basins will be ... ...emp... ...provided ... ...e de... ...emporary ... ...n se...

Please provide a brief discussion of how the proposed runoff flow interacts with the existing natural channels shown on the proposed drainage map. Note that if the proposed storm water flows are increased, please explain how these channels can handle the proposed flows.

Please provide discussion all proposed pipes, and inlets within this project.

...acres, located in the southwest corner of the ... ...o the southwest where it is captured by an existing culvert at DP 1 and outfalls west of Elbert Rd. There are no proposed improvements in sub-basin A1. The weighted imperviousness for this sub-basin is 15%. Runoff during the 5-year and 100-year events are 10.41 cfs and 41.24 cfs respectively. Due to the slight increase in sub-basin imperviousness, the 100-yr runoff increases from 38.41 to 41.24 cfs. The additional runoff ... ...ugh the nearly 1500 ft long, 50 ft wide existing drainage ... Flows from this basin will be collected in roadside ditches ... ...ert Road. The runoff from this basin will not impact the Reata ... ...or increase in flows is not anticipated to impact the capacity ... ...ppendix** for the Proposed Conditions Drainage Map.

The change in imperviousness represents future development. As this EG FDR requires hydraulic analysis of culverts, TSBs, ditches, & natural channels it is important we properly size storm water infrastructure based on the proposed conditions.

Explain in the narrative how WQ is being addressed for all basins including exclusions.

...area of 58.27 acres, located in the southwest corner of the ... ...sin include proposed roads, roadside ditches, culverts, and ... ...on basin A2. Drainage flows overland from the northeast to ... ...roposed roadside ditches, is conveyed through proposed ... captured by propose private full spectrum detention basin A2 at DP 2. The weighted imperviousness for this sub-basin is 12%. R... ...d 100-year events are 20.99 cfs and 92.96 cfs respectively. Due to ... ...increases ... ...ss than his... ...in will exit ...

Explanation of WQ is provided in four step process section of report.

As there is no development occuring within this basin, the impervious % should be the same as existing. It appears that each of these basins is taking into account the future development to occur on site but only the rough grading should be accounted for at this stage. Update the drainage plan also.

Discussion regarding the pond outfall for Ponds A2, B1, & B8 has been included in text.

Explain how discharge from TSB and ponds will be controlled since they are now concentrated flows into the southern subdivision

south of th ted natural drainage channels a ock pond withi uth of the Site. The minor incre ted by the prop ion basin A2 and released a les r to the **Appen** ditions Drainage Map.

Sub-Basin B1

This on-site sub-basin consists of an area of 40.74 acres, located in the south-central portion of the Site. Improvements within this sub-basin include proposed roads, roadside ditches, culverts, and proposed private full spectrum detention basin B1. Drainage flows overland from the north to the south where it flows into proposed roadside ditches, is conveyed through proposed stormwater culverts, and is ultimately captured by propose private full spectrum detention basin B1 at DP 3. The weighted imperviousness for this sub-basin is 10%. Runoff during the 5-year and 100-year events are 16.77 cfs and 80.40 cfs respectively. Due to the increase in sub-basin imperviousness, the 100-yr runoff for DP 3 is anticipated to increases from 72.48 cfs to 80.40 cfs. The additional runoff will be collected and released at less than historic rates via a proposed private full spectrum detention basin. Flows from this basin will exit into the Reata subdivision south of the Site via existing, vegetated natural drainage channels and outfall to an existing stock pond within the adjacent property south of the Site. The minor increase in flows will be mitigated by the proposed full spectrum detention basin B1 and released a less than historic rates. Refer to the **Appendix** for the Proposed Conditions Drainage Map.

Sub-Basin B2

This on-site sub-basin consists of an area of 16.00 acres, located in the south-central portion of the Site. Drainage flows overland from the north to the south where it flows offsite at DP 4. Improvements within this sub-basin include proposed public roads. This sub-basin includes an approx. 14,351 sq ft improved area of roadway that will not be receiving water quality treatment. A detailed discussion regarding water quality treatment has been included in Step-2 of the Four Step Process. The weighted imperviousness for this sub-basin is 9%. Runoff during the 5-year and 100-year events are 7.82 cfs and 38.64 cfs respectively. It is anticipated in a 100-yr storm event the total runoff for DP 4 will reduce from 69.09 cfs to 38.64 cfs, as the proposed roadway will cut off much of the upstream portion of the existing drainage basin and route those flows to a proposed full spectrum detention basin. As such there are no anticipated downstream impacts. Refer to the **Appendix** for the Proposed Conditions Drainage Map.

Sub-Basin B3

This on-site sub-basin consists of an area of 19.11 acres, located in the southeastern portion of the Site. Drainage flows overland from the northwest to southeast where it flows off site at DP 5. There are no proposed public improvements within this sub-basin, but single-family homes will be constructed and excluded the large lot exclusion I.7.1.B.5 and discussed in step 2 of the four-step process. The weighted imperviousness for this sub-basin is 7%. Runoff during the 5-year and 100-year events are 7.83 cfs and 42.71 cfs respectively. In the proposed conditions, it is anticipated in a 100-yr storm event the total runoff for DP 5A (DP 5 in proposed conditions) will reduce from 43.98 to 42.71, as such there are no anticipated downstream impacts. Refer to the **Appendix** for the Proposed Conditions Drainage Map.

Sub-Basin B6

This on-site sub-basin consists of an area of 53.31 acres, located in the central portion of the Site. Improvements within this sub-basin include proposed roads, roadside ditches, and culverts. Drainage flows overland from the northeast to the southwest where it flows into proposed roadside ditches, is conveyed through a proposed stormwater culvert at DP 8, and into sub-basin B8. From there, flows will follow path as described in sub-basin B8 where it will ultimately be captured in proposed full spectrum detention basin B8. The weighted imperviousness for this sub-basin is

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ring the 5-year and 100-year events are 22.55 cfs and 106.95 cfs respectively. **pendix** for the Proposed Conditions Drainage Map.

Please revise the proposed private full spectrum extended detention to a temporary pond throughout the entire FDR, unless you are planning to install the full spectrum ponds at this stage.

-basin co... in the southern portion of the
ows overla... s off site at DP 9. There are no
vements w... viousness for this sub-basin is
ng the 5-y... nd 6.17 cfs respectively. Refer
k for the Pr...

Sub-Basin B8

This on-site sub-basin consists of an area of 9.52 acres, located in the southern portion of the Site. Drainage flows overland from the north to south where it is captured by proposed private full spectrum extended detention basin B8 at DP 10. It should be noted that sub-basin B8 accepts flows from sub-basin B6 at DP 8. Refer to sub-basin B6 for information regarding the proposed flows from sub-basin B6. Aside from the proposed extended detention basin there are no proposed improvements within this sub-basin. The weighted imperviousness for this sub-basin is 7%. Runoff during the 5-year and 100-year events are 4.22 cfs and 23.05 cfs respectively. In addition to the increase of imperviousness, sub-basin B8 is also accepting flows from sub-basin B6 to the north. The combination of these factors results in a proposed increase of flows at DP 10 (DP 5 in existing conditions) from 43.40 cfs to 130.00 cfs. The additional runoff will be collected and released at less than historic rates via a proposed private full spectrum detention basin. Flows from this basin will exit into the Reata subdivision south of the Site via existing, vegetated natural drainage channel and outfall to an existing established vegetated area within the adjacent property south of the Site. The minor increase in flows will be mitigated by the proposed full spectrum detention basin B8 and released a less than historic rates. Refer to the **Appendix** for the Proposed Conditions Drainage Map.

Increase from 43.40 cfs to 130 cfs is not a minor increase. Please ensure that the proposed temporary sediment pond B8 has capacity to handle the proposed runoffs.

Sub-Basin OS-A1

The off-site sub-basin consists of an area of 4.0... tral portion of the drainage study area. Drainage flows overla... st where it is captured by an existing drainage culvert at DP 18... The weighted ... is 25%. Runof... ents are 4.12 ... er to the **Appendix** for the Proposed Conditions Drainage Map.

Noted, TSB sizing has been included in appendix of CSWMP

...f an area of 4.45 acres, located in the central portion of the drainage study area. Drainage flows overland from the north to south where it enters sub-basin A2 at DP 19 and follows the patterns described in sub-basin A2. The weighted imperviousness for this sub-basin is 7%. Runoff during the 5-year and 100-year events are 2.10 cfs and 11.46 cfs respectively. Refer to the **Appendix** for the Proposed Conditions Drainage Map.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The proposed storm facilities are designed to be in compliance with El Paso County "Drainage Criteria Manual (DCM)" dated October 2018 ("the MANUAL"), El Paso County "Engineering Criteria Manual" ("the Engineering Manual"), Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014 ("the Colorado Springs MANUAL"), and Mile High Flood District (MHFD), Urban Drainage and Flood Control District

Drainage Criteria Manuals (UDFCDCM), (Volumes 1, 2 and 3), prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

Site drainage is not significantly impacted by such constraints as utilities or existing development.

A Preliminary Drainage Report was completed for the overall Overlook Subdivision (SP238). This Final Drainage Report uses the Preliminary Drainage Report to assist with the drainage design for Filing No. 1.

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per chapter 6 of the CRITERIA. Table 6-2 of the CRITERIA is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the CRITERIA by calculating weighted impervious values for each specific site basin as outlined and shown in the Preliminary Drainage Report.

HYDRAULIC CRITERIA

Applicable design methods were utilized to analyze the proposed ponds, culverts, and existing drainage channels which includes the use of the UD-Detention spreadsheet, rational calculations spreadsheet, and FlowMaster, and UD-Culvert.

Proposed Drainage features on-site have been analyzed and sized for the following design storm events:

- Major Storm: 100-year Storm Event

Three temporary sediment basins are proposed in order to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. The temporary sediment basins will contain perforated outlet pipes with a release time of approximately 72 hours. The table below outlines the sediment basin sizing, which was based on MHFD temporary sediment basin sizing calculations

Temporary Sediment Basin ID	Tributary Basin Area (Acres)	TSB Volume (Ac-ft)
TSB A2	58.3	3.42
TSB B1	40.7	2.23
TSB B8	62.8	3.48

The existing natural drainage channels and proposed roadside ditches are designed to carry flows to the temporary sediment basins. The natural channels have varying bottom widths, slopes, and side slopes. The Project intends on using existing natural drainage channels to convey flow where appropriate. Natural channels through Filing No. 1 have been labeled and identified on the Proposed Drainage Map. Channel calculations and summary table have been provided in the **Appendix.** It is not anticipated channel upgrades or improvements will be required for this project. Proposed drainage easements have been proposed on the Early Grading Plans in locations where the natural channels convey flow a substantial amount of flow between properties.

Roadside ditches are provided along the proposed roadways to route flows to the proposed culverts. The roadside ditches are sized to convey the major event flow. The roadside ditched have been designed to have an average depth of 3 feet, a v-ditch, a left-side slope of 3:1, and a right-side slope of 4:1. No channels were determined to have velocities above the allowable permissible velocities for grass lines channels. Roadside ditch calculations and summary table has been provided in the **Appendix**.

Culverts were sized to convey flows from the ditches and channels, underneath the sites paved roads. The proposed culverts range from 18" to 36" and have been designed to convey the 100-year storm event. Culvert calculations and summary table has been provided in the **Appendix**.

THE FOUR STEP PROCESS

The Project was designed in accordance with the four-step process to minimize adverse impacts of urbanization, as outlined in the El Paso County Engineering Manual for BMP selection as noted below:

Step 1. **Employ Runoff Reduction Practices** – The project is proposing a low-density residential development that will be designed to minimize the impact to the current existing terrain. Per Section I.7.1B of Appendix I of the ECM, the single-family residences fall under the large lot e[illegible]ervious area is less than 10% of the area. Homes are typically p[illegible]ot and provide long distances for infiltration across natural terrai[illegible]ved roadways will increase the Site's impervious area; howeve[illegible]hannels will be constructed to slow down the runoff velocity and reduce runoff peaks. The three proposed detention ponds will be used to capture stormwater, provide water quality treatment, and maintain flows discharging off site at or below historic levels.

Noted, clarifying text added.

Clarify that 3 TSBs specifically will treat the areas not excluded with the large lot exclusions or the 20% exclusion.

Step 2. Provide a Water Quality Capture Volume – Permanent water quality measures and detention facilities will be necessary for the Project. Temporary water quality and erosion control measures will be provided during construction to prevent sediment laden water from discharging from the Site. Water quality measures are being used for all stormwater that contacts roadways. Per ECM Appendix I Section I.7.B.5: Large Lot Single Family exclusion, most of the proposed site will be excluded from water quality, lot imperviousness shall be limited to 10 percent or less. Per ECM Appendix I Section 1.7.C.1.a., 20% of the development site or less than 1 acre can be excluded from providing water quality. As mentioned, 0.99 acres (43,197 sq ft) of impervious area will not be able to be treated which is less than 20% of the overall site.

Step 3 Stabilize Drainageways– Stabilizing proposed roadside ditches, and channels by designing them with slopes that control the flow rates. Placement of riprap upstream and downstream of culverts to help reduce erosion of the roadside ditches. Existing drainage ways will be graded to reduce the velocity of the water to minimize erosion. The existing natural channels have been analyzed for width and velocity for the 100-yr storm event. Easements are proposed to accommodate the full width of the major storm event.

Step 4. Implement Site Specific and Other Source Control BMPs – The erosion control construction BMPs of the Project were designed to reduce contamination. Source control BMPs include the use of vehicle tracking control, culvert protection, stockpile management, and stabilized staging areas.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed drainage patterns will match historic patterns. To maintain historic flows, three full spectrum detention ponds are being proposed and will capture and control the flows from the proposed development into a serious of channels and culverts. The Temporary Sediment Basins described in this report TSB A2, B1, B8 will be converted into the extended detention basins as part of the Final Drainage Report to be processed with the Final Plat application.

DRAINAGE FEES

FEES

The project is within the Upper Black Squirrel Drainage Basin (CHBS2000), La Vega Ranch Drainage Basin (CHBR0400), East Kiowa Creek Drainage Basin (KIKI0400), and Bijou Creek Drainage Basin (BIBI0200) all four of which are not part of the El Paso County Drainage Basin Fee Program. As such, no drainage fees are due with this Project.

SUMMARY

This report has been prepared in accordance with El Paso County stormwater criteria. It outlines the Site design for the 5-year and 100-year storm events drainage system. The drainage design presented within this report conforms to the criteria presented in the MANUAL Additionally, as the proposed pond release rates are to be designed less than historic rates, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments.

REFERENCES

1. Final Drainage Re[illegible]ring, Inc. dated September 3, 200[illegible]
2. El Paso County “[illegible]ctober 31, 2018
3. Natural Resource[illegible]e 21, 2023.
4. Urban Drainage and Flood Control District Drainage Criteria Manuals (UDFCDCM), (Volumes 1, 2 and 3), prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.
5. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0350G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

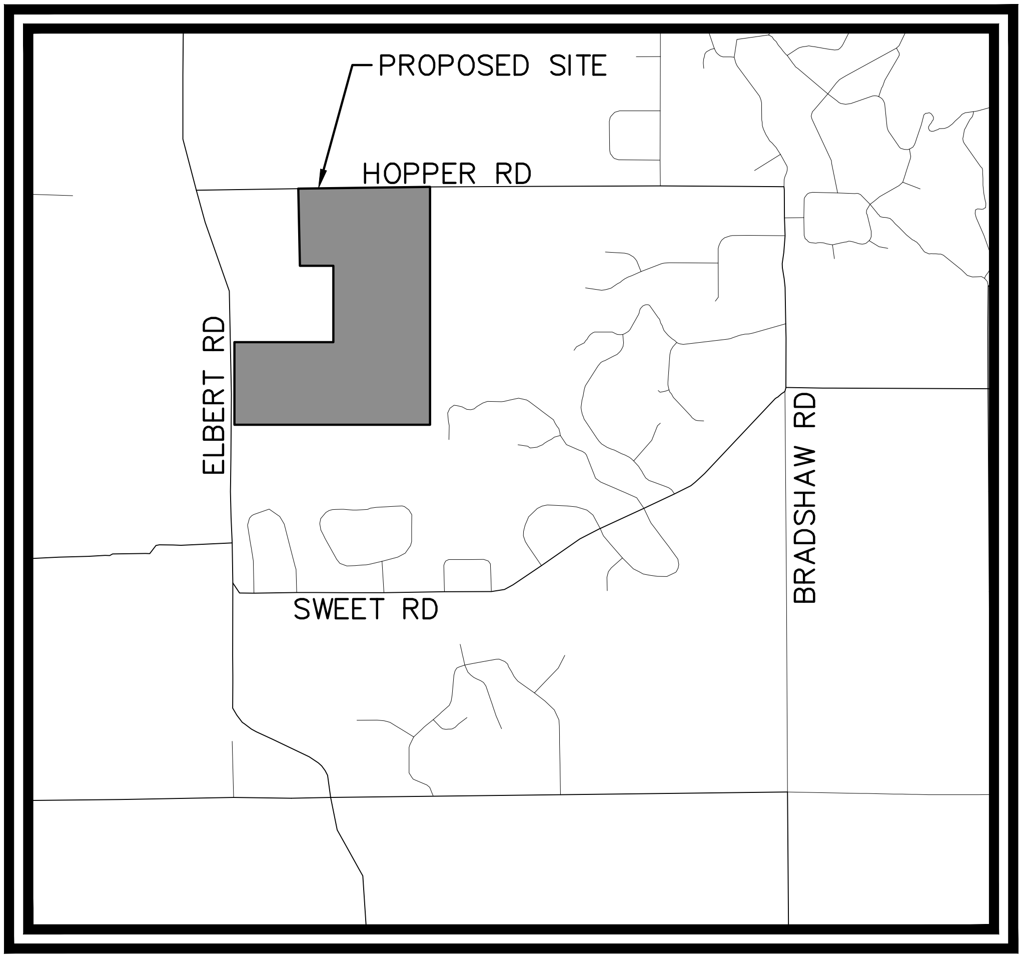
Proposed pond replaced with temporary sediment basins. Detailed design has been included in appendix.

Clarify, is this in the final condition? In the interim Early Grading condition the flows would likely be close to historic due to the lack of increase in impervious area. The TSBs associated with early grading do not have supporting calculations to support release rates. Tailor this summary to focus on early grading and clarify when statements apply to conformance in the final condition with the full spectrum detention that will eventually be constructed

Kimley»Horn

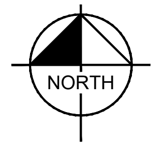
APPENDIX

APPENDIX A: VICINITY MAP



VICINITY MAP

SCALE: 1":5000'



APPENDIX B: FEMA MAP & SOILS REPORT

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

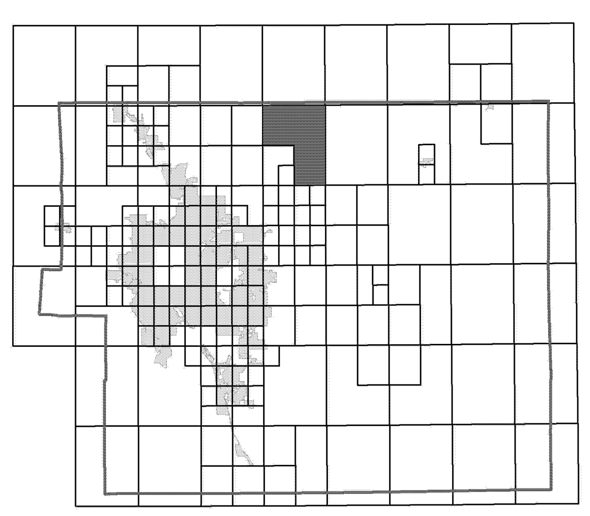
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

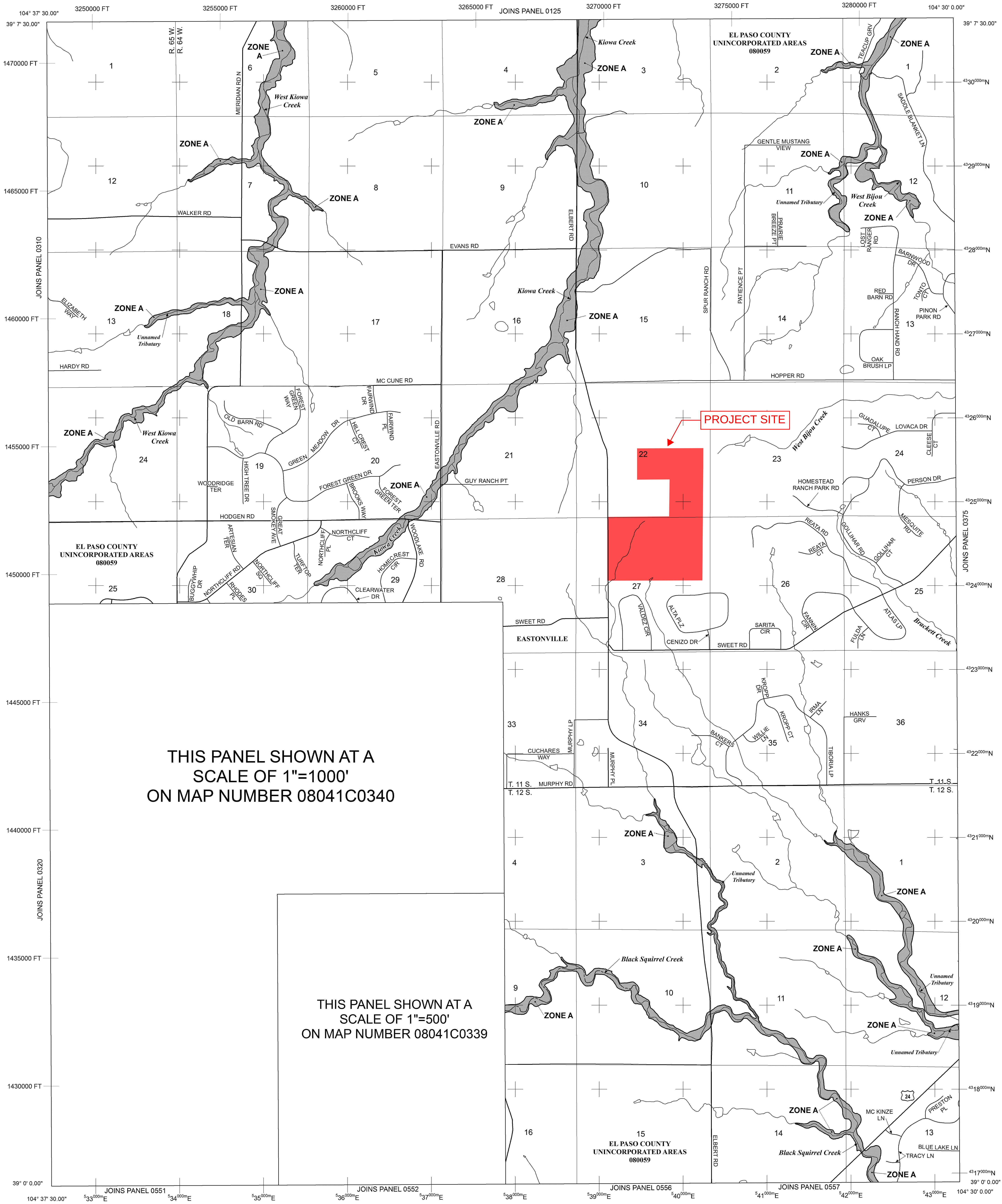
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A —— A	Cross section line
23 - - - - 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0350G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 350 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

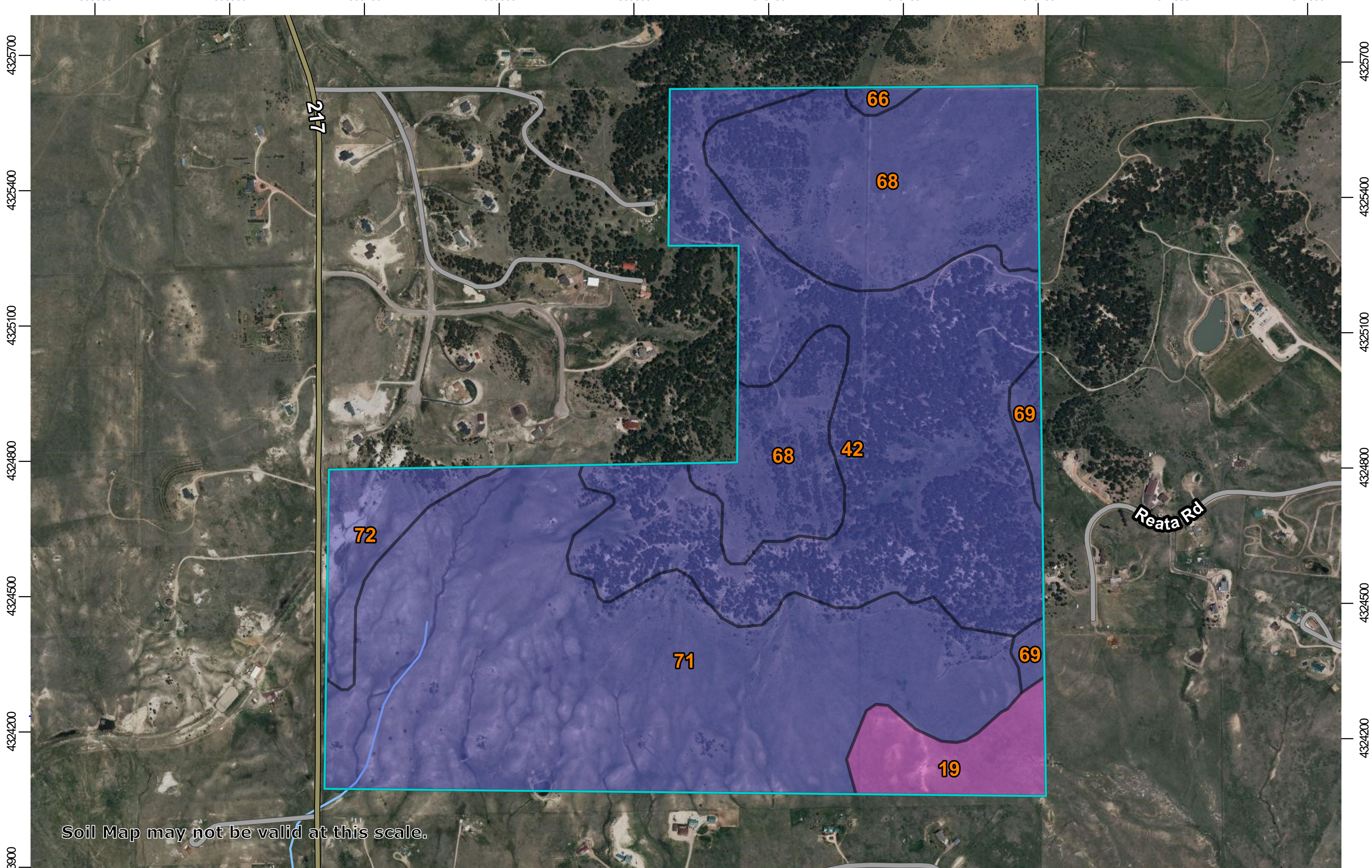
COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0350	G

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
08041C0350G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



104° 33' 19" W 104° 31' 17" W

Map Scale: 1:13,300 if printed on A landscape (11" x 8.5") sheet.

N

0 150 300 600 900 Meters

0 500 1000 2000 3000 Feet

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

MAP LEGEND

Area of Interest (AOI)
Area of Interest (AOI)

Soils

Soil Rating Polygons
A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines
A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points
A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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	18.1	4.1%
42	Kettle-Rock outcrop complex	B	135.4	30.8%
66	Peyton sandy loam, 1 to 5 percent slopes	B	1.7	0.4%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	91.1	20.7%
69	Peyton-Pring complex, 8 to 15 percent slopes	B	5.6	1.3%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	171.8	39.0%
72	Pring coarse sandy loam, 8 to 15 percent slopes	B	16.2	3.7%
Totals for Area of Interest			**440.0**	**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

APPENDIX C: HYDROLOGY

Kimley»Horn

STANDARD FORM SF-1
RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION
EXISTING CONDITIONS

PROJECT NAME: Overlook
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

DATE: 1/24/2024

SOIL: B

LAND USE:	RESIDENTIAL (>5AC) AREA	PASTURE/MEADOW (SOIL GROUP A/B) AREA	PAVEMENT AREA	AREA
2-YEAR COEFF.	0.05	0.02	0.89	
5-YEAR COEFF.	0.12	0.08	0.90	
10-YEAR COEFF.	0.20	0.15	0.92	
100-YEAR COEFF.	0.39	0.35	0.96	
IMPERVIOUS %	7%	0%	100%	

DESIGN BASIN	DESIGN POINT	RESIDENTIAL (>5AC) AREA (AC)	PASTURE/MEADOW (SOIL GROUP A/B) AREA (AC)	PAVEMENT AREA (AC)	AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
FDR Basins											
A1	1		18.28	1.64		**19.92**	0.09	0.15	0.21	0.40	8%
A2	2		60.84	0.66		**61.50**	0.03	0.09	0.16	0.36	1%
B1	3		45.75			**45.75**	0.02	0.08	0.15	0.35	0%
B2	4		42.42			**42.42**	0.02	0.08	0.15	0.35	0%
B3	5		25.42			**25.42**	0.02	0.08	0.15	0.35	0%
B3A	5A		24.23			**24.23**	0.02	0.08	0.15	0.35	0%
OS-A1	14		3.29	0.77		**4.06**	0.19	0.24	0.30	0.47	19%
OS-A2	15	4.45				**4.45**	0.05	0.12	0.20	0.39	7%
TOTAL - OVERALL		**4.45**	**220.23**	**3.07**	**0.00**	**227.75**	0.03	0.09	0.16	0.36	1%
		2%	**97%**	**1%**	**0%**	**100%**					

Note: Land use coefficients sourced from City of Colorado Springs Drainage Criteria Manual, Volume 1, Table 6-6.

Kimley»Horn

STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: Overlook
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

EXISTING CONDITIONS

DATE: 1/24/2024

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)					FINAL Tc
DESIGN BASIN (1)	AREA Ac (2)	C5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	VEL fps (11)	T_t Min. (12)	COMP. tc (13)	TOTAL LENGTH (14)	TOTAL SLOPE (15)	TOTAL IMP. (16)	Tc Min. (17)	Min.
FDR Basins																
A1	19.92	0.15	300	18.0%	11.5	2,066	5.7%	2.5	0.6	57.7	69.2	2366	7.3%	8%	23.1	23.1
A2	61.50	0.09	300	18.0%	12.3	3,677	5.7%	2.5	0.6	102.7	114.9	3977	6.6%	1%	32.1	32.1
B1	45.75	0.08	300	25.0%	11.1	2,577	6.5%	2.5	0.6	67.4	78.5	2877	8.4%		26.0	26.0
B2	42.42	0.08	300	6.9%	17.0	2,347	10.3%	2.5	0.8	48.8	65.8	2647	9.9%		24.7	24.7
B3	25.42	0.08	300	23.0%	11.4	1,968	9.9%	2.5	0.8	41.7	53.1	2268	11.6%		22.6	22.6
B3A	24.23	0.08	300	20.0%	11.9	1,500	10.0%	2.5	0.8	31.6	43.6	1800	11.7%		20.0	20.0
OS-A1	4.06	0.24	300	5.0%	16.1	161	5.0%	2.5	0.6	4.8	20.9	461	5.0%	19%	12.6	12.6
OS-A2	4.45	0.12	250	10.0%	13.2			2.5			13.2	250	10.0%	7%	11.4	11.4

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}} \qquad t_c = \frac{L}{180} + 10 \qquad V = C_v S_w^{0.5}$$

Note: Conveyance coefficient from Table 6-7 of DCM

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 2 YEAR EVENT

PROJECT NAME: Overlook

EXISTING CONDITIONS

DATE: 1/24/2024

PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
STORM LINE	DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t_c(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	t_t (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	A1	19.92	0.09	23.14	1.83	2.30	4.19													
	2	A2	61.50	0.03	32.09	1.80	1.91	3.44													
	3	B1	45.75	0.02	25.98	0.92	2.16	1.98													
	4	B2	42.42	0.02	24.71	0.85	2.22	1.88													
	5	B3	25.42	0.02	22.60	0.51	2.32	1.18													
	5A	B3A	24.23	0.02	20.00	0.48	2.47	1.20													
	14	OS-A1	4.06	0.19	12.56	0.75	3.02	2.27													
	15	OS-A2	4.45	0.05	11.39	0.22	3.14	0.70													

Note: Rainfall intensity from Figure 6-5 IDF Equations

$$I_2 = -1.19 \ln(t_{c,min}) + 6.035$$

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: Overlook

EXISTING CONDITIONS

DATE: 1/24/2024

PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		1	A1	19.92	0.15	23.14	2.94	2.87	8.43													
		2	A2	61.50	0.09	32.09	5.46	2.38	13.00													
		3	B1	45.75	0.08	25.98	3.66	2.70	9.87													
		4	B2	42.42	0.08	24.71	3.39	2.77	9.41													
		5	B3	25.42	0.08	22.60	2.03	2.91	5.91													
		5A	B3A	24.23	0.08	20.00	1.94	3.09	5.99													
		14	OS-A1	4.06	0.24	12.56	0.96	3.79	3.62													
		15	OS-A2	4.45	0.12	11.39	0.53	3.93	2.10													

Note: Rainfall intensity from Figure 6-5 IDF Equations $I_5 = -1.5 \ln(t_{c,min}) + 7.583$

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: Overlook
EXISTING CONDITIONS
DATE: 1/24/2024
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t_c(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		1	A1	19.92	0.40	23.14	7.97	4.82	38.41													
		2	A2	61.50	0.36	32.09	21.93	3.99	87.58													
		3	B1	45.75	0.35	25.98	16.01	4.53	72.48													
		4	B2	42.42	0.35	24.71	14.85	4.65	69.09													
		5	B3	25.42	0.35	22.60	8.90	4.88	43.40													
		5A	B3A	24.23	0.35	20.00	8.48	5.19	43.98													
		14	OS-A1	4.06	0.47	12.56	1.89	6.36	12.02													
		15	OS-A2	4.45	0.39	11.39	1.74	6.60	11.46													

Note: Rainfall intensity from Figure 6-5 IDF Equations $I_{100} = -2.52 \ln(t_{c,min}) + 12.735$

Kimley»Horn

PROJECT NAME: Overlook 1/24/2024
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

EXISTING CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS			% IMPERVIOUS
			Q2	Q5	Q100	
FDR Basins						
1	A1	19.92	4.19	8.43	38.41	8%
2	A2	61.50	3.44	13.00	87.58	1%
3	B1	45.75	1.98	9.87	72.48	0%
4	B2	42.42	1.88	9.41	69.09	0%
5	B3	25.42	1.18	5.91	43.40	0%
5A	B3A	24.23	1.20	5.99	43.98	0%
14	OS-A1	4.06	2.27	3.62	12.02	19%
15	OS-A2	4.45	0.70	2.10	11.46	7%
ON-SITE BASIN TOTAL						
BASIN A TOTAL		81.42	7.63	21.43	125.99	3%
BASIN B TOTAL		137.82	6.24	31.18	228.94	0%
ON-SITE TOTAL		**219.24**	**13.87**	**52.61**	**354.92**	**1%**
OFF-SITE BASIN TOTAL						
OFF-SITE BASIN A		8.51	2.97	5.72	23.48	13%
OFF-SITE TOTAL		**8.51**	**2.97**	**5.72**	**23.48**	**13%**
SITE TOTAL		**227.75**	**16.84**	**58.33**	**378.41**	**1%**

Kimley»Horn

STANDARD FORM SF-1

RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROPOSED CONDITIONS

PROJECT NAME: Overlook
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

DATE: 1/24/2024

SOIL: B

LAND USE:	RESIDENTIAL (>5AC) AREA	PASTURE/MEADOW (SOIL GROUP A/B) AREA	PAVEMENT AREA	AREA
2-YEAR COEFF.	0.05	0.02	0.89	
5-YEAR COEFF.	0.12	0.08	0.90	
10-YEAR COEFF.	0.20	0.15	0.92	
100-YEAR COEFF.	0.39	0.35	0.96	
IMPERVIOUS %	7%	0%	100%	

DESIGN BASIN	DESIGN POINT	RESIDENTIAL (>5AC) AREA (AC)	PASTURE/MEADOW (SOIL GROUP A/B) AREA (AC)	PAVEMENT AREA (AC)	AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
FDR Basins											
A1	1	17.91		1.64		**19.55**	0.12	0.19	0.26	0.44	15%
A2	2	55.40		2.87		**58.27**	0.09	0.16	0.24	0.42	12%
B1	3	39.58		1.16		**40.74**	0.07	0.14	0.22	0.41	10%
B2	4	15.66		0.34		**16.00**	0.07	0.14	0.22	0.40	9%
B3	5	19.11				**19.11**	0.05	0.12	0.20	0.39	7%
B6	8	51.65		1.66		**53.31**	0.08	0.14	0.22	0.41	10%
B7	9	2.46				**2.46**	0.05	0.12	0.20	0.39	7%
B8	10	9.52				**9.52**	0.05	0.12	0.20	0.39	7%
OS-A1	18	3.29		0.77		**4.06**	0.21	0.27	0.34	0.50	25%
OS-A2	19	4.45				**4.45**	0.05	0.12	0.20	0.39	7%
TOTAL - OVERALL		**219.03**	**0.00**	**8.44**	**0.00**	**227.47**	0.08	0.15	0.23	0.41	10%
		96%	**0%**	**4%**	**0%**	**100%**					

Note: Land use coefficients sourced from City of Colorado Springs Drainage Criteria Manual, Volume 1, Table 6-6.

Kimley»Horn

STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: **Overlook**
PROJECT NUMBER: **196239003**
CALCULATED BY: **GKS**
CHECKED BY: **KRK**

PROPOSED CONDITIONS

DATE: 1/24/2024

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)					FINAL Tc
DESIGN BASIN (1)	AREA Ac (2)	C5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	VEL fps (11)	T_t Min. (12)	COMP. tc (13)	TOTAL LENGTH (14)	TOTAL SLOPE (15)	TOTAL IMP. (16)	Tc Min. (17)	Min.
FDR Basins																
A1	19.55	0.19	300	18.0%	11.1	2,066	5.0%	2.5	0.6	61.6	72.7	2366	6.6%	15%	23.1	23.1
A2	58.27	0.16	300	18.0%	11.4	4,100	4.0%	2.5	0.5	136.7	148.1	4400	5.0%	12%	34.4	34.4
B1	40.74	0.14	300	8.0%	15.2	2,000	4.5%	2.5	0.5	62.9	78.1	2300	5.0%	10%	22.8	22.8
B2	16.00	0.14	300	7.0%	16.0	500	6.0%	2.5	0.6	13.6	29.6	800	6.4%	9%	14.4	14.4
B3	19.11	0.12	300	21.0%	11.3	800	8.0%	2.5	0.7	18.9	30.1	1100	11.5%	7%	16.1	16.1
B6	53.31	0.14	300	22.0%	10.8	1,900	3.0%	2.5	0.4	73.1	84.0	2200	5.6%	10%	22.2	22.2
B7	2.46	0.12	300	6.0%	17.1	100	6.0%	2.2	0.5	3.1	20.2	400	6.0%	7%	12.2	12.2
B8	9.52	0.12	300	6.0%	17.1	300	10.0%	2.5	0.8	6.3	23.5	600	8.0%	7%	13.3	13.3
OS-A1	4.06	0.27	300	5.0%	15.5	161	5.0%	2.5	0.6	4.8	20.3	461	5.0%	25%	12.6	12.6
OS-A2	4.45	0.12	250	10.0%	13.2			2.5			13.2	250	10.0%	7%	11.4	11.4

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}} \qquad t_c = \frac{L}{180} + 10 \qquad V = C_v S_w^{0.5}$$

Note: Conveyance coefficient from Table 6-7 of DCM

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 2 YEAR EVENT

PROJECT NAME: Overlook
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

PROPOSED CONDITIONS

DATE: 1/24/2024

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		1	A1	19.55	0.12	23.14	2.36	2.30	5.41													
		2	A2	58.27	0.09	34.44	5.32	1.82	9.71													
		3	B1	40.74	0.07	22.78	3.01	2.32	6.97													
		4	B2	16.00	0.07	14.44	1.09	2.86	3.10													
		5	B3	19.11	0.05	16.11	0.96	2.73	2.61													
		8	B6	53.31	0.08	22.22	4.06	2.34	9.52													
		9	B7	2.46	0.05	12.22	0.12	3.06	0.38													
		10	B8	9.52	0.05	13.33	0.48	2.95	1.41													
		18	OS-A1	4.06	0.21	12.56	0.85	3.02	2.57													
		19	OS-A2	4.45	0.05	11.39	0.22	3.14	0.70													

Note: Rainfall intensity from Figure 6-5 IDF Equations

$$I_2 = -1.19 \ln(t_{c,min}) + 6.035$$

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: Overlook

PROPOSED CONDITIONS

DATE: 1/24/2024

PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
STORM LINE	DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	A1	19.55	0.19	23.14	3.63	2.87	10.41													
	2	A2	58.27	0.16	34.44	9.23	2.27	20.99													
	3	B1	40.74	0.14	22.78	5.79	2.89	16.77													
	4	B2	16.00	0.14	14.44	2.19	3.58	7.82													
	5	B3	19.11	0.12	16.11	2.29	3.41	7.83													
	8	B6	53.31	0.14	22.22	7.69	2.93	22.55													
	9	B7	2.46	0.12	12.22	0.30	3.83	1.13													
	10	B8	9.52	0.12	13.33	1.14	3.70	4.22													
	18	OS-A1	4.06	0.27	12.56	1.09	3.79	4.12													
	19	OS-A2	4.45	0.12	11.39	0.53	3.93	2.10													

Note: Rainfall intensity from Figure 6-5 IDF Equations

$$I_5 = -1.5\ln(t_{c,min}) + 7.583$$

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: Overlook
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

PROPOSED CONDITIONS

DATE: 1/24/2024

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t_c(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		1	A1	19.55	0.44	23.14	8.56	4.82	41.24													
		2	A2	58.27	0.42	34.44	24.36	3.82	92.96													
		3	B1	40.74	0.41	22.78	16.55	4.86	80.40													
		4	B2	16.00	0.40	14.44	6.43	6.01	38.64													
		5	B3	19.11	0.39	16.11	7.45	5.73	42.71													
		8	B6	53.31	0.41	22.22	21.74	4.92	106.95													
		9	B7	2.46	0.39	12.22	0.96	6.43	6.17													
		10	B8	9.52	0.39	13.33	3.71	6.21	23.05													
		18	OS-A1	4.06	0.50	12.56	2.02	6.36	12.86													
		19	OS-A2	4.45	0.39	11.39	1.74	6.60	11.46													

Note: Rainfall intensity from Figure 6-5 IDF Equations $I_{100} = -2.52\ln(t_{c,min}) + 12.735$

Kimley»Horn

PROJECT NAME: Overlook 1/24/2024
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY						
DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS			% IMPERVIOUS
			Q2	Q5	Q100	
PDR Basins						
1	A1	19.55	5.41	10.41	41.24	15%
2	A2	58.27	9.71	20.99	92.96	12%
3	B1	40.74	6.97	16.77	80.40	10%
4	B2	16.00	3.10	7.82	38.64	9%
5	B3	19.11	2.61	7.83	42.71	7%
8	B6	53.31	9.52	22.55	106.95	10%
9	B7	2.46	0.38	1.13	6.17	7%
10	B8	9.52	1.41	4.22	23.05	7%
18	OS-A1	4.06	2.57	4.12	12.86	25%
19	OS-A2	4.45	0.70	2.10	11.46	7%
ON-SITE BASIN TOTAL						
BASIN A TOTAL		77.82	15.12	31.40	134.20	12%
BASIN B TOTAL		141.14	23.98	60.32	297.91	9%
ON-SITE TOTAL		**218.96**	**23.98**	**60.32**	**297.91**	**10%**
OFF-SITE BASIN TOTAL						
OFF-SITE BASIN A		8.51	3.27	6.22	24.32	15%
OFF-SITE TOTAL		**8.51**	**3.27**	**6.22**	**24.32**	**15%**
SITE TOTAL		**227.47**	**27.25**	**66.54**	**322.23**	**10%**

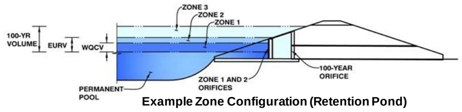
APPENDIX D: HYDRUALICS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Overlook A2 WQCV

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	2.87	acres
Watershed Length =	1,000	ft
Watershed Length to Centroid =	500	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	100.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	

VOLUME USED IN POND SIZING

er providing required inputs above including 1-hour rainfall ths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban H graph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.120	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.324	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.281	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.360	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.424	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.487	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.550	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.619	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.777	acre-feet		inches
Approximate 2-yr Detention Volume =	0.263	acre-feet		
Approximate 5-yr Detention Volume =	0.340	acre-feet		
Approximate 10-yr Detention Volume =	0.412	acre-feet		
Approximate 25-yr Detention Volume =	0.442	acre-feet		
Approximate 50-yr Detention Volume =	0.458	acre-feet		
Approximate 100-yr Detention Volume =	0.470	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.120	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.205	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.146	acre-feet
Total Detention Basin Volume =	0.470	acre-feet
Initial Surcharge Volume (ISV) =	16	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		

Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

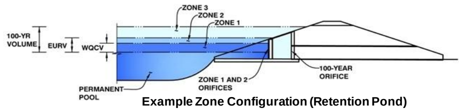
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Overlook A2 Prelim Pond Sizing

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB		
Watershed Area =	58.27	acres	
Watershed Length =	3,500	ft	
Watershed Length to Centroid =	1,750	ft	
Watershed Slope =	0.100	ft/ft	Steep Slope > 0.06 ft/ft
Watershed Imperviousness =	12.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	Denver - Capitol Building		

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.120	acre-feet	0.120	acre-feet
Excess Urban Runoff Volume (EURV) =	0.667	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.873	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.836	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.787	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.448	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.593	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.228	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	10.226	acre-feet		inches
Approximate 2-yr Detention Volume =	0.434	acre-feet		
Approximate 5-yr Detention Volume =	0.670	acre-feet		
Approximate 10-yr Detention Volume =	1.290	acre-feet		
Approximate 25-yr Detention Volume =	1.747	acre-feet		
Approximate 50-yr Detention Volume =	1.835	acre-feet		
Approximate 100-yr Detention Volume =	2.346	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.120	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.547	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.679	acre-feet
Total Detention Basin Volume =	2.346	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increement = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	23,106	0.530		
	--	1.00	--	--	--	25,662	0.589	24,384	0.560
	--	2.00	--	--	--	28,319	0.650	51,375	1.179
	--	3.00	--	--	--	31,076	0.713	81,072	1.861
	--	4.00	--	--	--	33,934	0.779	113,577	2.607
	--	5.00	--	--	--	36,892	0.847	148,990	3.420
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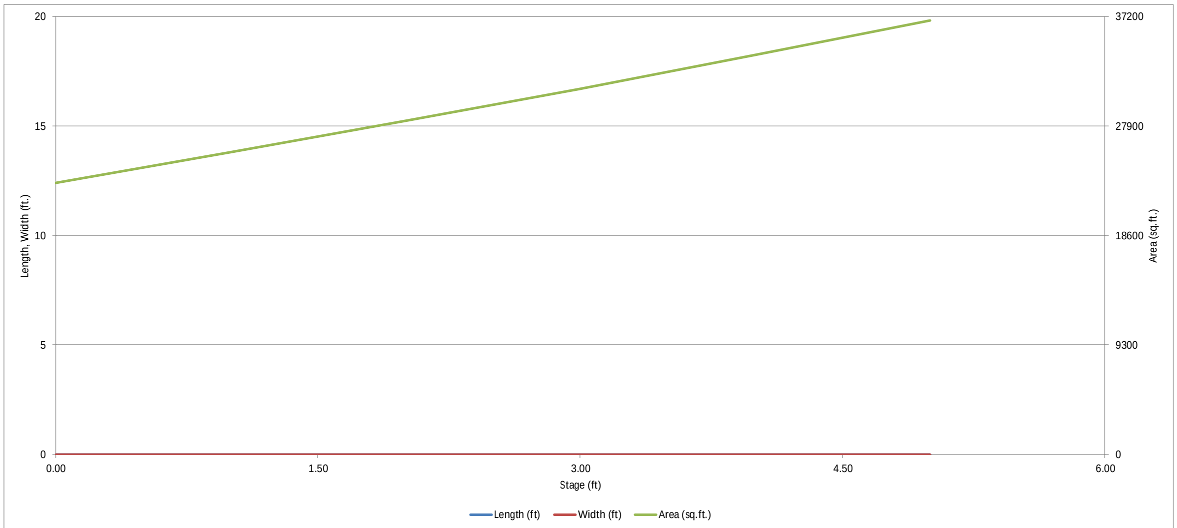
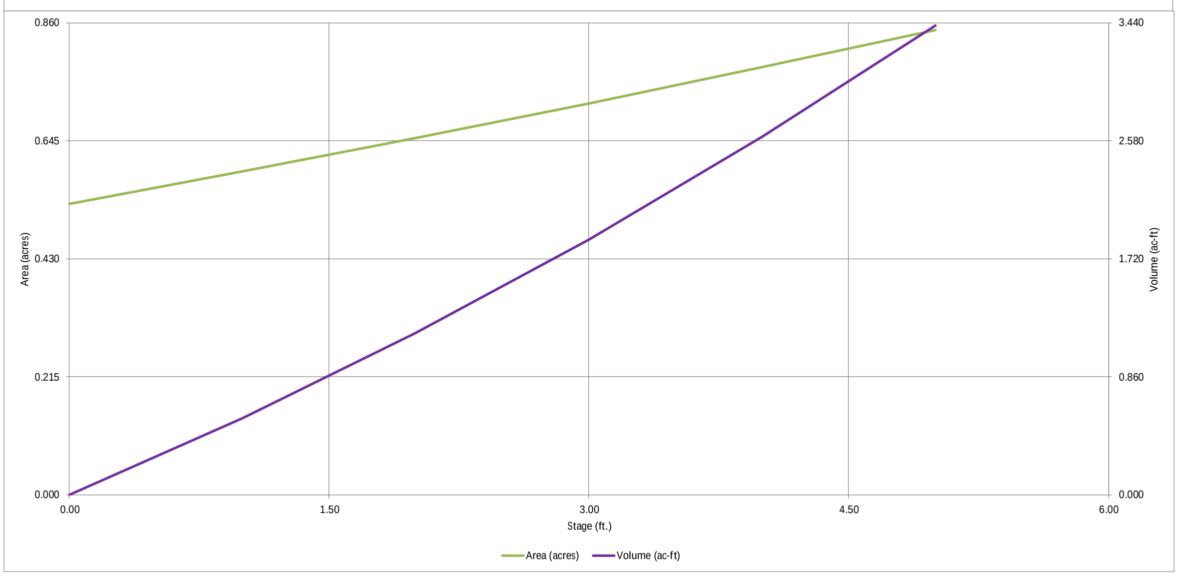
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



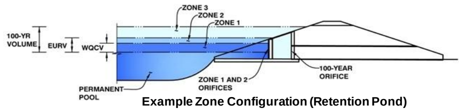


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Overlook B1 WQCV

Basin ID:



Example Zone Configuration (Retention Pond)

Depth Increement = | ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	1.16	acres
Watershed Length =	500	ft
Watershed Length to Centroid =	250	ft
Watershed Slope =	0.100	ft/ft
Watershed Imperviousness =	100.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	

Steep Slope > 0.06 ft/ft

VOLUME USED IN POND SIZING

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.048	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.131	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =		acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =		acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =		acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =		acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =		acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =		acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =		acre-feet		inches
Approximate 2-yr Detention Volume =		acre-feet		
Approximate 5-yr Detention Volume =		acre-feet		
Approximate 10-yr Detention Volume =		acre-feet		
Approximate 25-yr Detention Volume =		acre-feet		
Approximate 50-yr Detention Volume =		acre-feet		
Approximate 100-yr Detention Volume =		acre-feet		

Define Zones and Basin Geometry

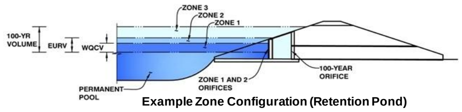
Select Zone 1 Storage Volume (Required) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	6	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Overlook B1 Prelim Pond Sizing

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB			
Watershed Area =	40.74	acres		
Watershed Length =	3,000	ft		
Watershed Length to Centroid =	1,500	ft		
Watershed Slope =	0.045	ft/ft		
Watershed Imperviousness =	10.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.048	acre-feet	0.048	acre-feet
Excess Urban Runoff Volume (EURV) =	0.383	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.544	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.202	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.858	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.027	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.825	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.973	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	7.066	acre-feet		inches
Approximate 2-yr Detention Volume =	0.244	acre-feet		
Approximate 5-yr Detention Volume =	0.383	acre-feet		
Approximate 10-yr Detention Volume =	0.796	acre-feet		
Approximate 25-yr Detention Volume =	1.112	acre-feet		
Approximate 50-yr Detention Volume =	1.163	acre-feet		
Approximate 100-yr Detention Volume =	1.503	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.048	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.335	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.120	acre-feet
Total Detention Basin Volume =	1.503	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	14,485	0.333		
	--	1.00	--	--	--	16,343	0.375	15,414	0.354
	--	2.00	--	--	--	18,301	0.420	32,736	0.752
	--	3.00	--	--	--	20,359	0.467	52,066	1.195
	--	4.00	--	--	--	22,519	0.517	73,505	1.687
	--	5.00	--	--	--	24,778	0.569	97,153	2.230
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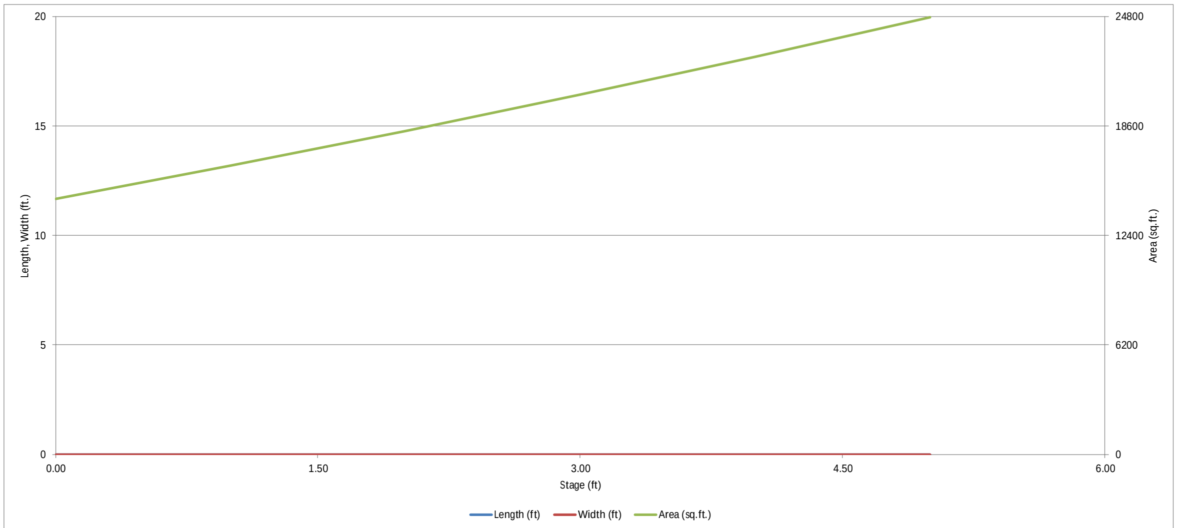
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10
5
0
Length, Width (ft.)
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18600
12400
6200
0
Area (sq.ft.)
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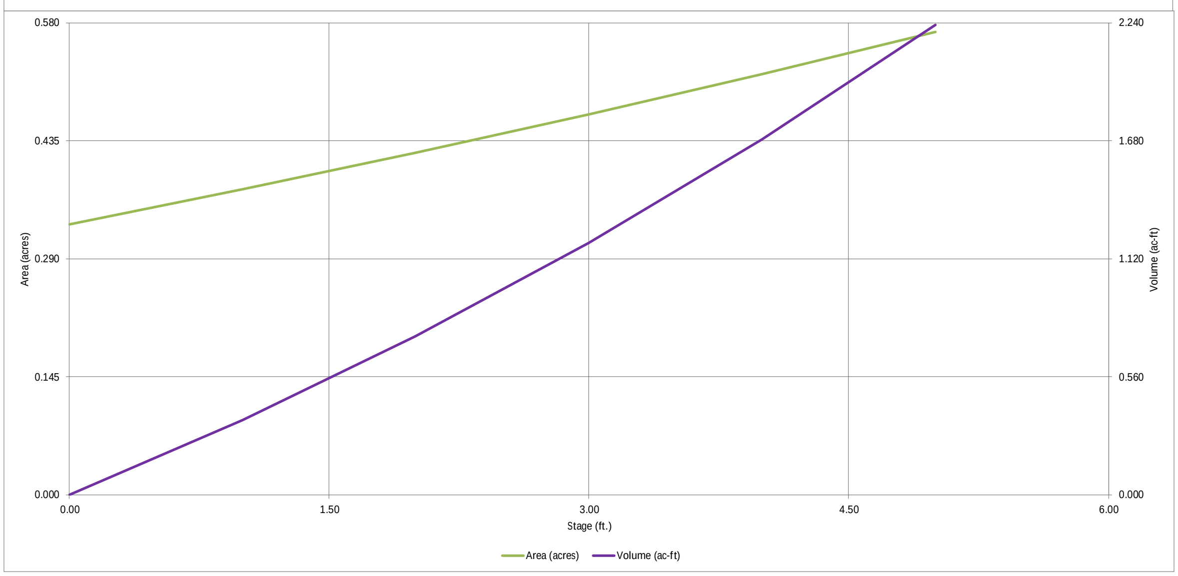
1.50
3.00
4.50
6.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

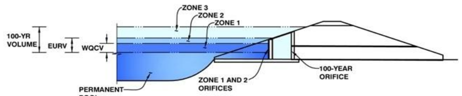

0.580
0.435
0.290
0.145
0.000
Area (acres)
2.240
1.680
1.120
0.560
0.000
Volume (ac-ft)
0.00
1.50
3.00
4.50
6.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Overlook B8 WQCV

Basin ID:



Example Zone Configuration (Retention Pond)

VOLUME USED IN POND SIZING

Watershed Information

Selected BMP Type =	EDB		Note: L / W Ratio > 8
Watershed Area =	1.66	acres	L / W Ratio = 13.83
Watershed Length =	1,000	ft	
Watershed Length to Centroid =	500	ft	
Watershed Slope =	0.035	ft/ft	
Watershed Imperviousness =	100.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	Denver - Capitol Building		

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.069	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.188	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =		acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =		acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =		acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =		acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =		acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =		acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =		acre-feet		inches
Approximate 2-yr Detention Volume =		acre-feet		
Approximate 5-yr Detention Volume =		acre-feet		
Approximate 10-yr Detention Volume =		acre-feet		
Approximate 25-yr Detention Volume =		acre-feet		
Approximate 50-yr Detention Volume =		acre-feet		
Approximate 100-yr Detention Volume =		acre-feet		

Define Zones and Basin Geometry

Select Zone 1 Storage Volume (Required) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	9	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		

Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

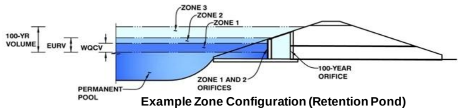
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Overlook B8 Preliminary Pond Sizing

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB			
Watershed Area =	62.83	acres		
Watershed Length =	4,000	ft		
Watershed Length to Centroid =	2,000	ft		
Watershed Slope =	0.050	ft/ft		
Watershed Imperviousness =	9.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.069	acre-feet	0.069	acre-feet
Excess Urban Runoff Volume (EURV) =	0.527	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.793	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.795	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.801	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.614	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.843	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.619	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	10.846	acre-feet		inches
Approximate 2-yr Detention Volume =	0.333	acre-feet		
Approximate 5-yr Detention Volume =	0.527	acre-feet		
Approximate 10-yr Detention Volume =	1.146	acre-feet		
Approximate 25-yr Detention Volume =	1.628	acre-feet		
Approximate 50-yr Detention Volume =	1.697	acre-feet		
Approximate 100-yr Detention Volume =	2.207	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.069	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.458	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.680	acre-feet
Total Detention Basin Volume =	2.207	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increement = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	13,730	0.315		
	--	1.00	--	--	--	17,427	0.400	15,578	0.358
	--	2.00	--	--	--	21,230	0.487	34,907	0.801
	--	3.00	--	--	--	25,133	0.577	58,088	1.334
	--	4.00	--	--	--	29,138	0.669	85,224	1.956
	--	5.00	--	--	--	33,243	0.763	116,414	2.673
	--	6.00	--	--	--	37,448	0.860	151,759	3.484
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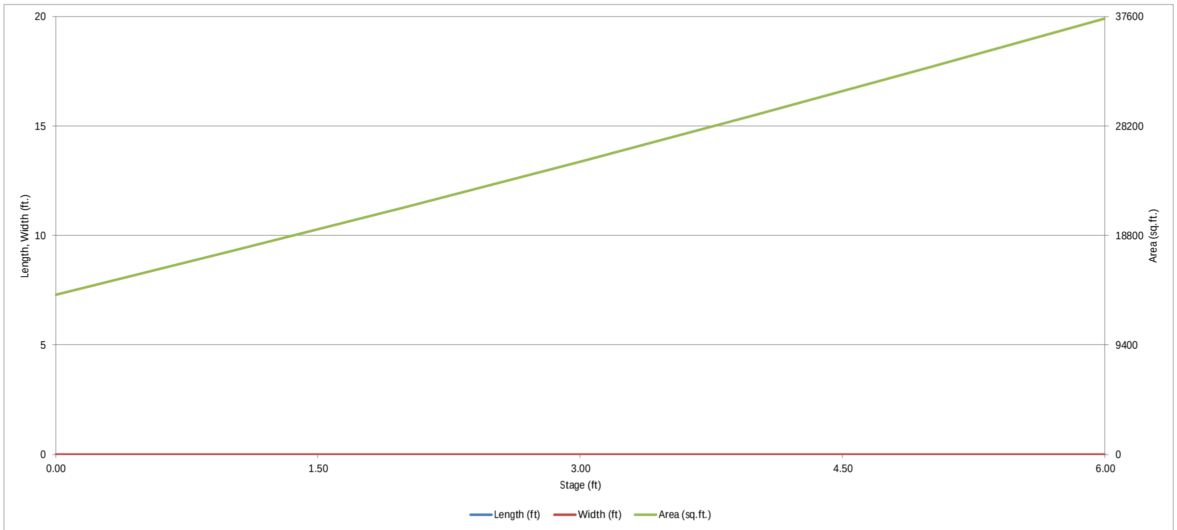
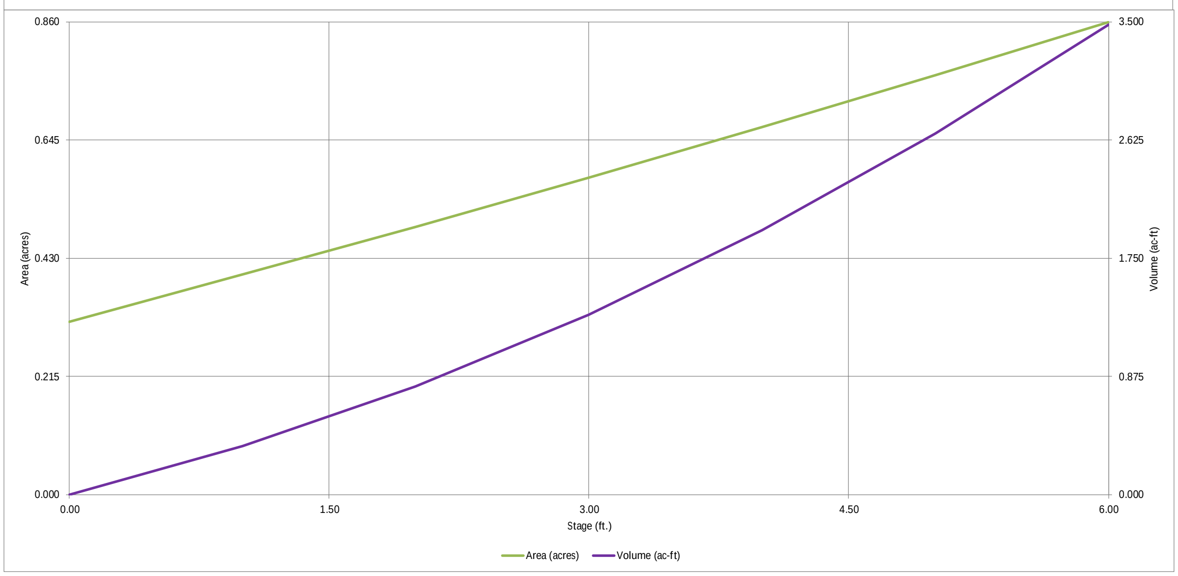
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





Natural Channels Flow Summary							
Channel ID	Contributing Basins	Tributary Area (ac)	Basin Area (ac)	Basin 100-yr Flow (cfs)	Channel 100-yr Flow (cfs)	Velocity (ft/s)	Normal Depth (ft)
A1-1	A1	19.55	19.55	41.24	41.24	2.62	0.48
A2-1	A2, OS-A2	32.76 (A2) + 3.25 (OS-A2)	58.72 (A2) + 4.45 (OS-A2)	92.96 (A2) + 11.46 (OS-A2)	60.42	3.82	0.59
A2-2	A2	9.06	58.27	92.96	14.45	2.48	0.18
A2-3	A2	11.45	58.27	92.96	18.27	3.09	0.40
A2-4	A2	1.70	58.27	92.96	2.71	1.49	0.02
A2-5	A2, B1	7.75 (A2) + 3.44 (B1)	58.72 (A2) + 40.74 (B1)	92.96 (A2) + 80.40 (B1)	19.06	2.17	0.30
A2-6	A2, B1	2.46 (A2) + 3.44 (B1)	58.72 (A2) + 40.74 (B1)	92.96 (A2) + 80.40 (B1)	10.72	1.86	0.18
B1-1	B1	10.19	40.74	80.40	20.11	2.71	0.28
B1-2	B1	14.29	40.74	80.40	28.20	3.76	0.24
B1-3	B1	13.43	40.74	80.40	26.50	3.46	0.47
B1-4	B1	4.03	40.74	80.40	7.95	2.52	0.02
B1-5	B1	2.54	40.74	80.40	5.01	1.68	0.11
B1-6	B1	2.72	40.74	80.40	5.37	1.84	0.17
B2-1	B2	4.92	16.00	38.64	11.88	2.69	0.25
B2-2	B2	9.77	16.00	38.64	23.59	3.54	0.29
B6-1	B6	11.58	53.31	106.95	23.23	6.67	0.29
B7-1	B7	2.25	2.46	6.17	5.64	1.91	0.23
B8-1	B8, B6	3.32 (B8) + 53.31 (B6)	9.52 (B8) + 53.31 (B6)	23.05 (B8) + 106.95 (B6)	114.99	5.39	0.63

Please provide erosion protection for the channel B6-1 as velocity is above the standard velocity in DCM V1, chapter 10, table 10-4. Please verify all channels and identify erosion protection needed.

Noted, erosion protection now noted in table

Worksheet for A1-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.015 ft/ft
Discharge	41.24 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	41.00
0+35	36.00
0+64	36.00
1+00	41.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 41.00)	(0+35, 36.00)	0.040
(0+35, 36.00)	(0+64, 36.00)	0.040
(0+64, 36.00)	(1+00, 41.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

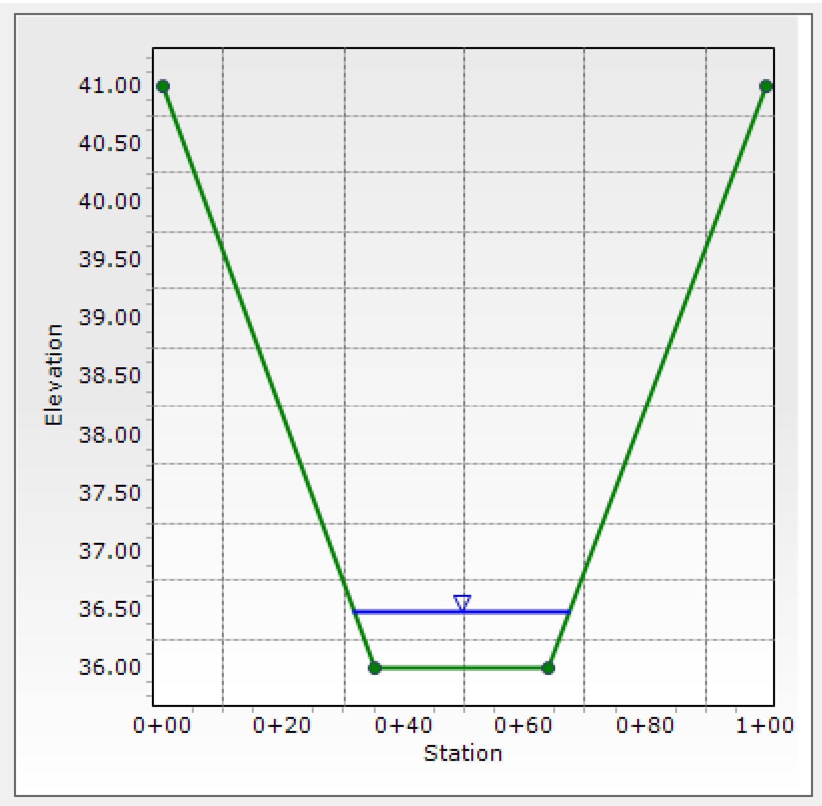
Normal Depth	5.8 in
Roughness Coefficient	0.040
Elevation	36.48 ft
Elevation Range	36.0 to 41.0 ft
Flow Area	15.7 ft²
Wetted Perimeter	36.0 ft
Hydraulic Radius	5.3 in
Top Width	35.89 ft
Normal Depth	5.8 in
Critical Depth	4.6 in
Critical Slope	0.033 ft/ft
Velocity	2.62 ft/s
Velocity Head	0.11 ft
Specific Energy	0.59 ft
Froude Number	0.698

Worksheet for A1-1

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	5.8 in
Critical Depth	4.6 in
Channel Slope	0.015 ft/ft
Critical Slope	0.033 ft/ft



Worksheet for A2-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.028 ft/ft
Discharge	60.42 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	47.00
0+66	42.00
0+87	42.00
1+25	47.75

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 47.00)	(0+66, 42.00)	0.040
(0+66, 42.00)	(0+87, 42.00)	0.040
(0+87, 42.00)	(1+25, 47.75)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

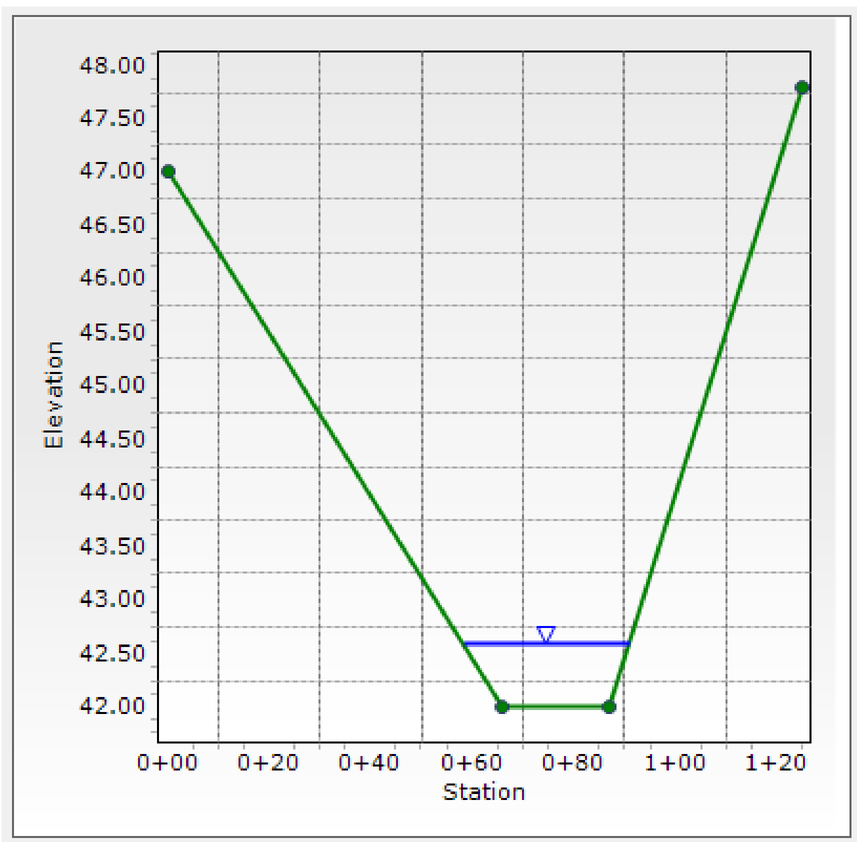
Normal Depth	7.1 in
Roughness Coefficient	0.040
Elevation	42.59 ft
Elevation Range	42.0 to 47.8 ft
Flow Area	15.8 ft²
Wetted Perimeter	32.7 ft
Hydraulic Radius	5.8 in
Top Width	32.67 ft
Normal Depth	7.1 in
Critical Depth	6.9 in
Critical Slope	0.030 ft/ft
Velocity	3.82 ft/s
Velocity Head	0.23 ft
Specific Energy	0.82 ft
Froude Number	0.969

Worksheet for A2-1

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	7.1 in
Critical Depth	6.9 in
Channel Slope	0.028 ft/ft
Critical Slope	0.030 ft/ft



Worksheet for A2-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.046 ft/ft
Discharge	14.45 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	23.00
0+43	16.00
0+72	16.00
1+25	20.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 23.00)	(0+43, 16.00)	0.040
(0+43, 16.00)	(0+72, 16.00)	0.040
(0+72, 16.00)	(1+25, 20.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

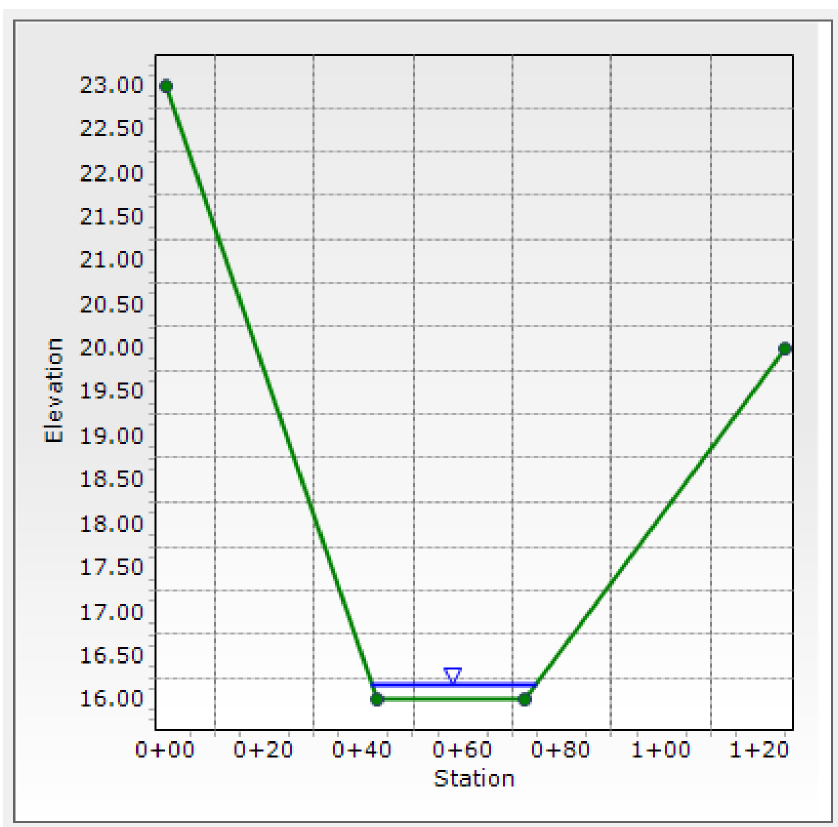
Normal Depth	2.2 in
Roughness Coefficient	0.040
Elevation	16.18 ft
Elevation Range	16.0 to 23.0 ft
Flow Area	5.8 ft²
Wetted Perimeter	33.3 ft
Hydraulic Radius	2.1 in
Top Width	33.30 ft
Normal Depth	2.2 in
Critical Depth	2.3 in
Critical Slope	0.041 ft/ft
Velocity	2.48 ft/s
Velocity Head	0.10 ft
Specific Energy	0.28 ft
Froude Number	1.048

Worksheet for A2-2

Results	
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.2 in
Critical Depth	2.3 in
Channel Slope	0.046 ft/ft
Critical Slope	0.041 ft/ft



Worksheet for A2-3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.030 ft/ft
Discharge	18.27 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.00
0+51	4.00
0+63	4.00
0+98	9.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.00)	(0+51, 4.00)	0.040
(0+51, 4.00)	(0+63, 4.00)	0.040
(0+63, 4.00)	(0+98, 9.00)	0.040

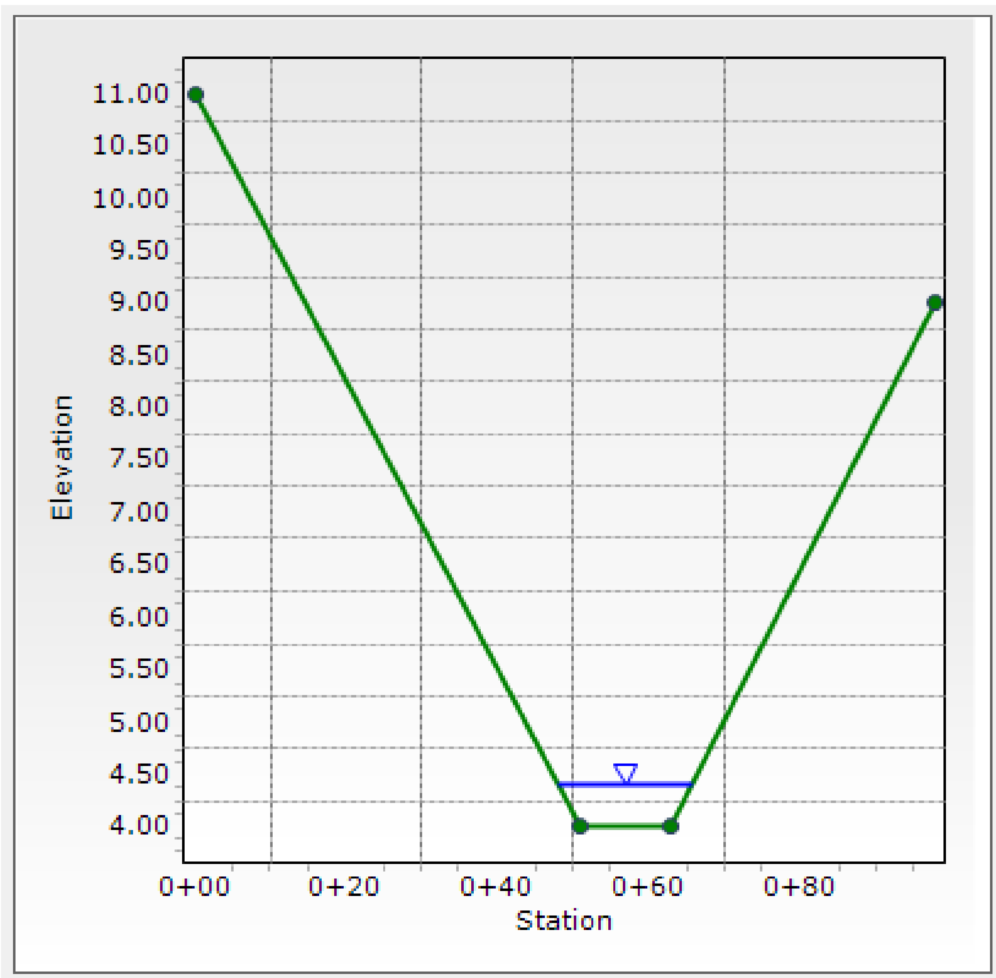
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	4.8 in
Roughness Coefficient	0.040
Elevation	4.40 ft
Elevation Range	4.0 to 11.0 ft
Flow Area	5.9 ft^2
Wetted Perimeter	17.7 ft
Hydraulic Radius	4.0 in
Top Width	17.69 ft
Normal Depth	4.8 in
Critical Depth	4.6 in
Critical Slope	0.034 ft/ft
Velocity	3.09 ft/s
Velocity Head	0.15 ft
Specific Energy	0.55 ft
Froude Number	0.942
Flow Type	Subcritical

Worksheet for A2-3

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.8 in
Critical Depth	4.6 in
Channel Slope	0.030 ft/ft
Critical Slope	0.034 ft/ft



Worksheet for A2-4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.029 ft/ft
Discharge	2.71 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+15	14.00
0+32	12.75
0+47	12.50
0+98	18.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+15, 14.00)	(0+32, 12.75)	0.040
(0+32, 12.75)	(0+47, 12.50)	0.040
(0+47, 12.50)	(0+98, 18.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

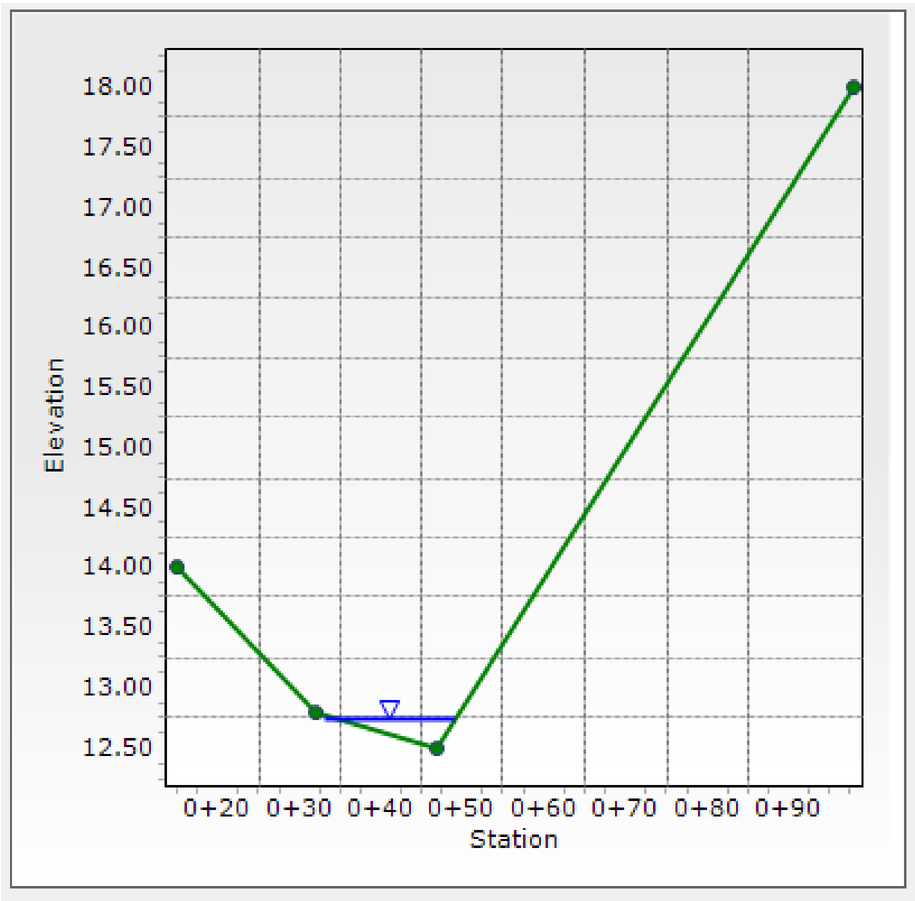
Normal Depth	2.7 in
Roughness Coefficient	0.040
Elevation	12.73 ft
Elevation Range	12.5 to 18.0 ft
Flow Area	1.8 ft²
Wetted Perimeter	15.9 ft
Hydraulic Radius	1.4 in
Top Width	15.86 ft
Normal Depth	2.7 in
Critical Depth	2.5 in
Critical Slope	0.050 ft/ft
Velocity	1.49 ft/s
Velocity Head	0.03 ft
Specific Energy	0.26 ft
Froude Number	0.778

Worksheet for A2-4

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.7 in
Critical Depth	2.5 in
Channel Slope	0.029 ft/ft
Critical Slope	0.050 ft/ft



Worksheet for A2-5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.020 ft/ft
Discharge	19.06 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	15.00
0+43	12.00
0+68	12.00
1+25	16.75

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 15.00)	(0+43, 12.00)	0.040
(0+43, 12.00)	(0+68, 12.00)	0.040
(0+68, 12.00)	(1+25, 16.75)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

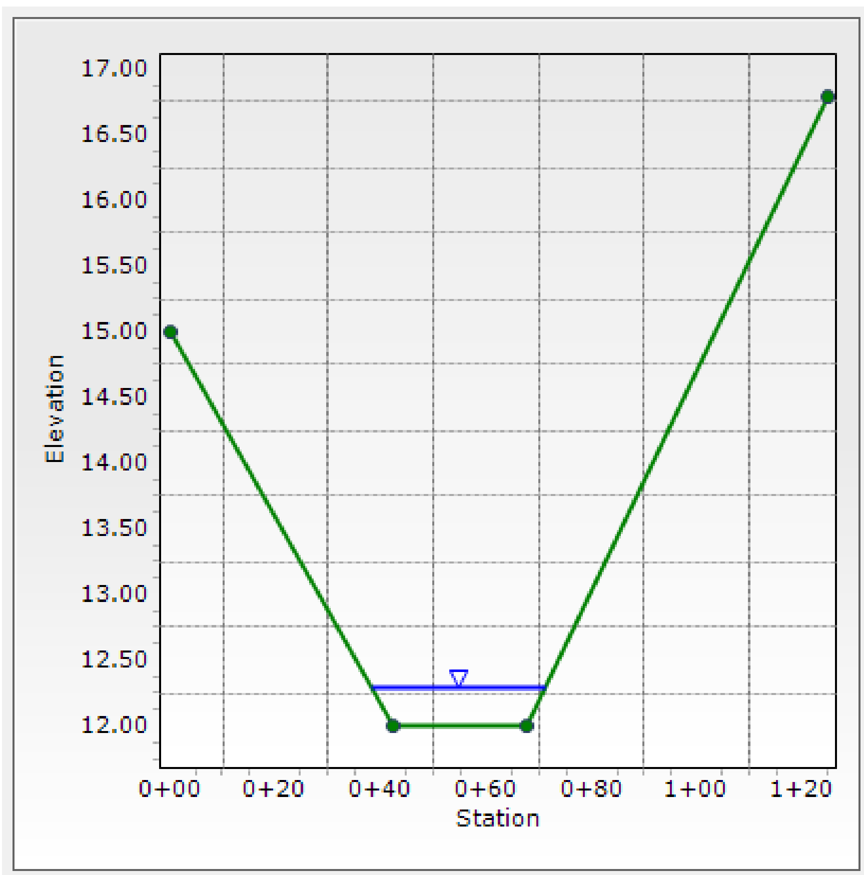
Normal Depth	3.6 in
Roughness Coefficient	0.040
Elevation	12.30 ft
Elevation Range	12.0 to 16.8 ft
Flow Area	8.8 ft²
Wetted Perimeter	33.2 ft
Hydraulic Radius	3.2 in
Top Width	33.18 ft
Normal Depth	3.6 in
Critical Depth	3.0 in
Critical Slope	0.038 ft/ft
Velocity	2.17 ft/s
Velocity Head	0.07 ft
Specific Energy	0.37 ft
Froude Number	0.742

Worksheet for A2-5

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.6 in
Critical Depth	3.0 in
Channel Slope	0.020 ft/ft
Critical Slope	0.038 ft/ft



Worksheet for A2-6

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.027	ft/ft
Discharge	10.72	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	30.00
0+31	28.00
0+59	28.00
0+94	30.25

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 30.00)	(0+31, 28.00)	0.040
(0+31, 28.00)	(0+59, 28.00)	0.040
(0+59, 28.00)	(0+94, 30.25)	0.040

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

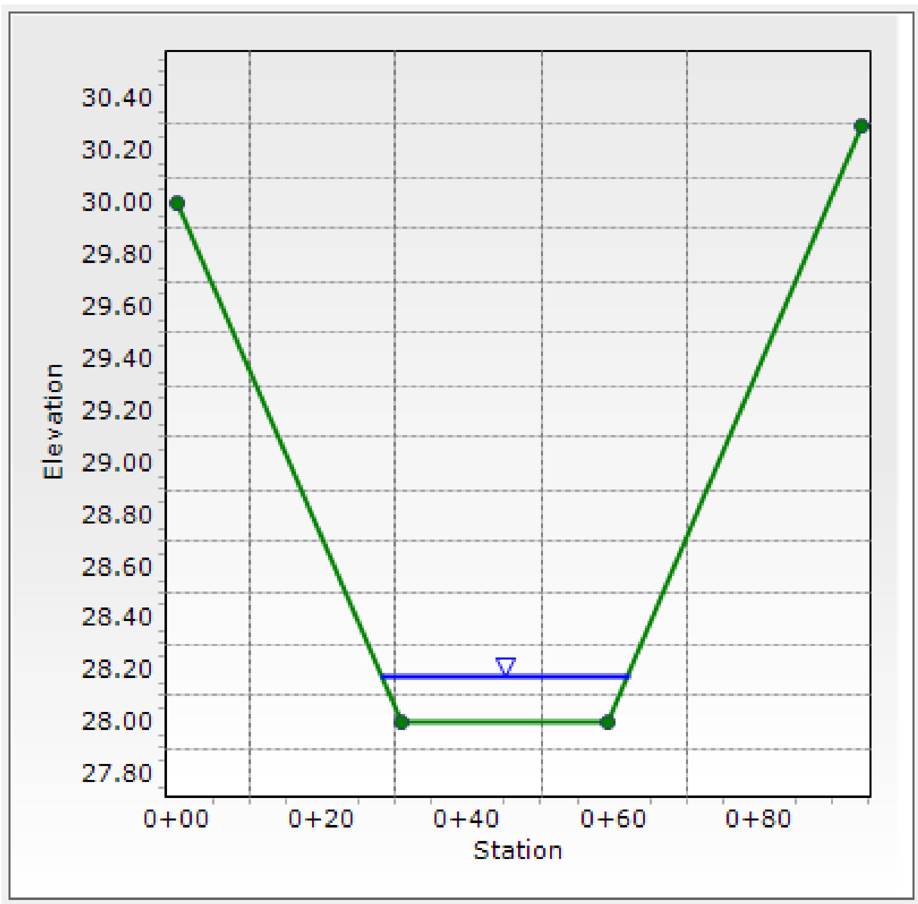
Results		
Normal Depth	2.2	in
Roughness Coefficient	0.040	
Elevation	28.18	ft
Elevation Range	28.0 to 30.3 ft	
Flow Area	5.8	ft²
Wetted Perimeter	34.2	ft
Hydraulic Radius	2.0	in
Top Width	34.16	ft
Normal Depth	2.2	in
Critical Depth	1.9	in
Critical Slope	0.044	ft/ft
Velocity	1.86	ft/s
Velocity Head	0.05	ft
Specific Energy	0.24	ft
Froude Number	0.800	

Worksheet for A2-6

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.2 in
Critical Depth	1.9 in
Channel Slope	0.027 ft/ft
Critical Slope	0.044 ft/ft



Worksheet for B1-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.034 ft/ft
Discharge	20.11 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	26.00
0+54	20.00
0+76	20.00
1+25	22.75

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 26.00)	(0+54, 20.00)	0.040
(0+54, 20.00)	(0+76, 20.00)	0.040
(0+76, 20.00)	(1+25, 22.75)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

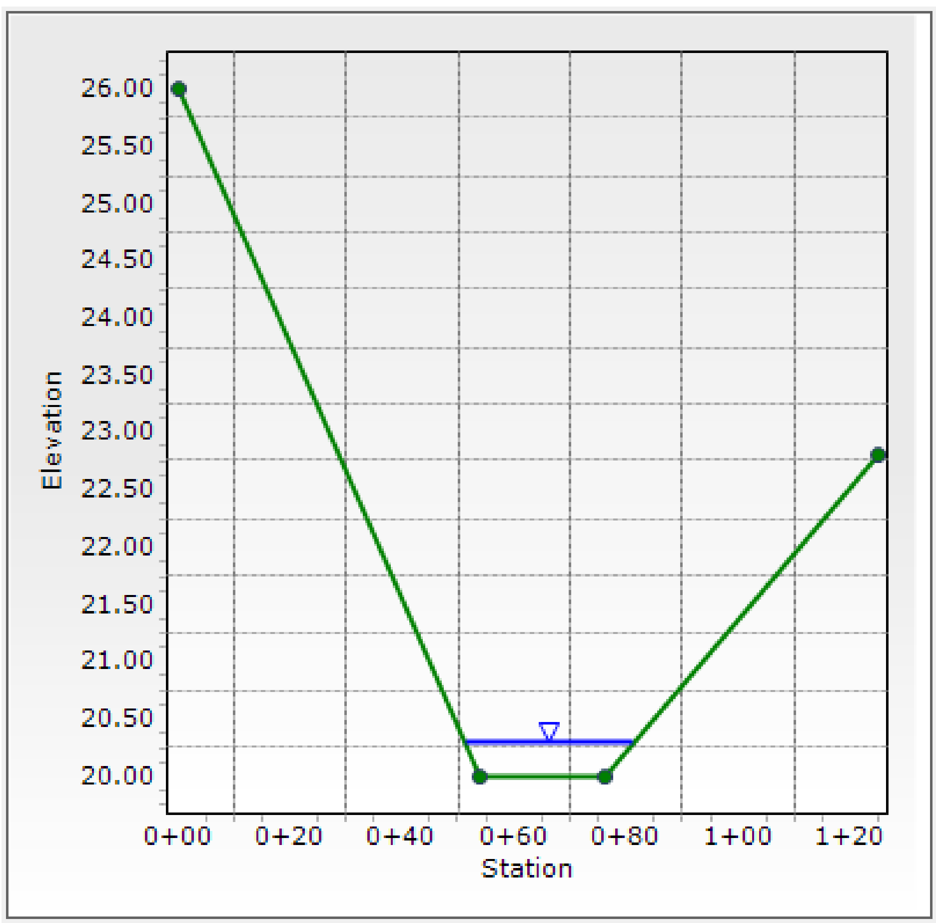
Normal Depth	3.4 in
Roughness Coefficient	0.040
Elevation	20.29 ft
Elevation Range	20.0 to 26.0 ft
Flow Area	7.4 ft²
Wetted Perimeter	29.7 ft
Hydraulic Radius	3.0 in
Top Width	29.69 ft
Normal Depth	3.4 in
Critical Depth	3.3 in
Critical Slope	0.037 ft/ft
Velocity	2.71 ft/s
Velocity Head	0.11 ft
Specific Energy	0.40 ft
Froude Number	0.958

Worksheet for B1-1

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.4 in
Critical Depth	3.3 in
Channel Slope	0.034 ft/ft
Critical Slope	0.037 ft/ft



Worksheet for B1-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.075 ft/ft
Discharge	28.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	3.00
0+31	0.00
0+60	0.00
1+00	4.84

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 3.00)	(0+31, 0.00)	0.040
(0+31, 0.00)	(0+60, 0.00)	0.040
(0+60, 0.00)	(1+00, 4.84)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.9 in
Roughness Coefficient	0.040
Elevation	0.24 ft
Elevation Range	0.0 to 4.8 ft
Flow Area	7.5 ft²
Wetted Perimeter	33.4 ft
Hydraulic Radius	2.7 in
Top Width	33.34 ft
Normal Depth	2.9 in
Critical Depth	3.6 in
Critical Slope	0.036 ft/ft
Velocity	3.76 ft/s
Velocity Head	0.22 ft
Specific Energy	0.46 ft
Froude Number	1.396
Flow Type	Supercritical

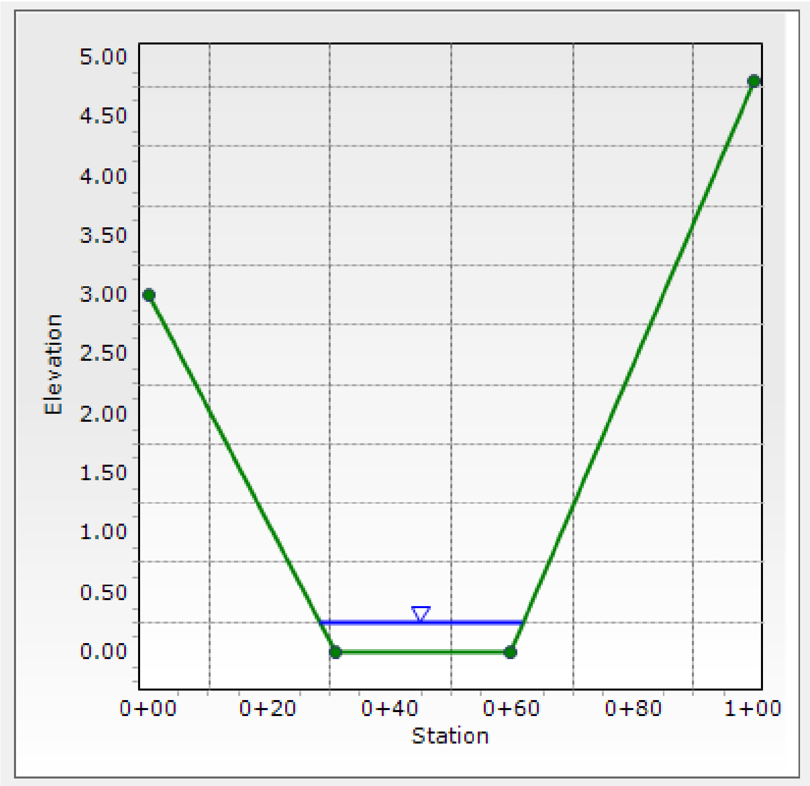
Worksheet for B1-2

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.9 in
Critical Depth	3.6 in
Channel Slope	0.075 ft/ft
Critical Slope	0.036 ft/ft



Worksheet for B1-3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.033 ft/ft
Discharge	26.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	19.00
0+45	14.00
0+56	14.00
0+98	18.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 19.00)	(0+45, 14.00)	0.040
(0+45, 14.00)	(0+56, 14.00)	0.040
(0+56, 14.00)	(0+98, 18.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

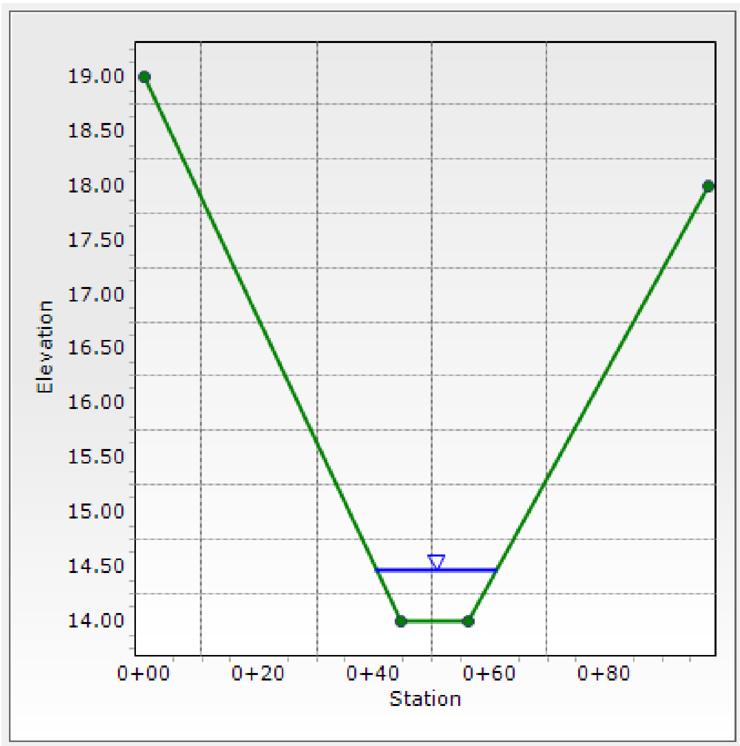
Normal Depth	5.6 in
Roughness Coefficient	0.040
Elevation	14.47 ft
Elevation Range	14.0 to 19.0 ft
Flow Area	7.7 ft²
Wetted Perimeter	20.9 ft
Hydraulic Radius	4.4 in
Top Width	20.85 ft
Normal Depth	5.6 in
Critical Depth	5.7 in
Critical Slope	0.033 ft/ft
Velocity	3.46 ft/s
Velocity Head	0.19 ft
Specific Energy	0.66 ft
Froude Number	1.005

Worksheet for B1-3

Results	
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.6 in
Critical Depth	5.7 in
Channel Slope	0.033 ft/ft
Critical Slope	0.033 ft/ft



Worksheet for B1-4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.063 ft/ft
Discharge	7.95 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	34.00
0+26	30.00
0+47	30.00
0+75	35.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 34.00)	(0+26, 30.00)	0.040
(0+26, 30.00)	(0+47, 30.00)	0.040
(0+47, 30.00)	(0+75, 35.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.8 in
Roughness Coefficient	0.040
Elevation	30.15 ft
Elevation Range	30.0 to 35.0 ft
Flow Area	3.2 ft²
Wetted Perimeter	22.5 ft
Hydraulic Radius	1.7 in
Top Width	22.52 ft
Normal Depth	1.8 in
Critical Depth	2.0 in
Critical Slope	0.043 ft/ft
Velocity	2.52 ft/s
Velocity Head	0.10 ft
Specific Energy	0.24 ft
Froude Number	1.185

Worksheet for B1-4

Results

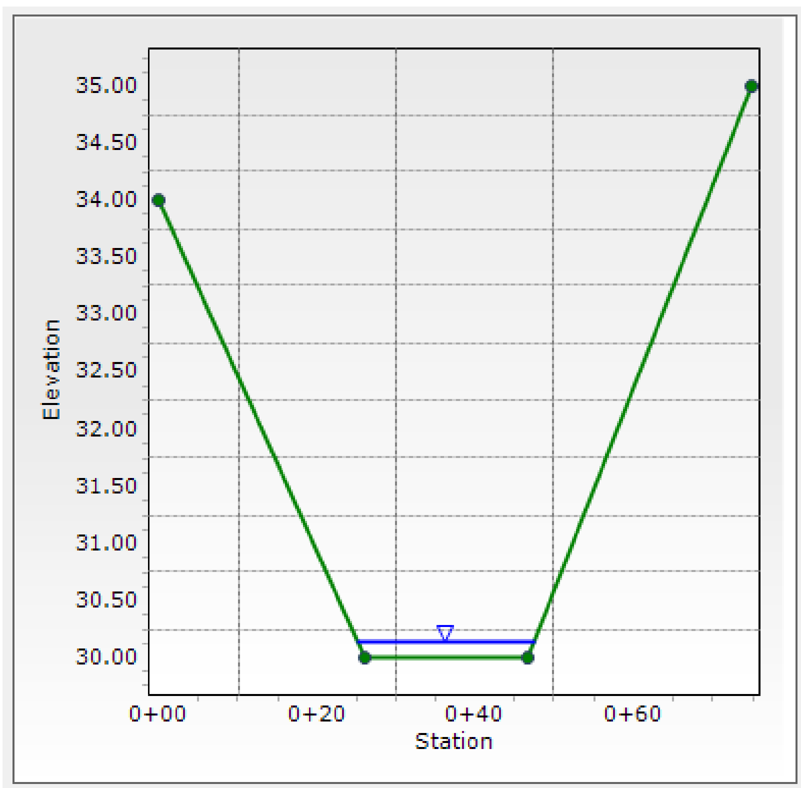
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.8 in
Critical Depth	2.0 in
Channel Slope	0.063 ft/ft
Critical Slope	0.043 ft/ft



Worksheet for B1-5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.039 ft/ft
Discharge	5.01 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	35.00
0+29	32.00
0+54	32.00
0+73	35.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 35.00)	(0+29, 32.00)	0.040
(0+29, 32.00)	(0+54, 32.00)	0.040
(0+54, 32.00)	(0+73, 35.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

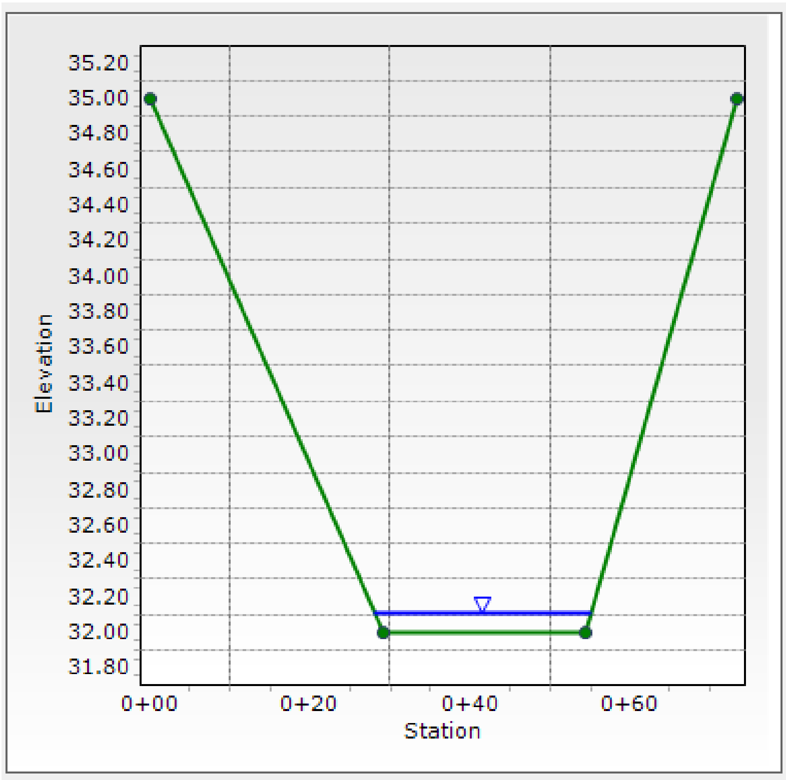
Normal Depth	1.4 in
Roughness Coefficient	0.040
Elevation	32.11 ft
Elevation Range	32.0 to 35.0 ft
Flow Area	3.0 ft²
Wetted Perimeter	27.1 ft
Hydraulic Radius	1.3 in
Top Width	27.07 ft
Normal Depth	1.4 in
Critical Depth	1.3 in
Critical Slope	0.050 ft/ft
Velocity	1.68 ft/s
Velocity Head	0.04 ft
Specific Energy	0.16 ft
Froude Number	0.894

Worksheet for B1-5

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.4 in
Critical Depth	1.3 in
Channel Slope	0.039 ft/ft
Critical Slope	0.050 ft/ft



Worksheet for B1-6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.030 ft/ft
Discharge	5.37 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	22.00
0+35	18.00
0+51	18.00
0+92	23.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 22.00)	(0+35, 18.00)	0.040
(0+35, 18.00)	(0+51, 18.00)	0.040
(0+51, 18.00)	(0+92, 23.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

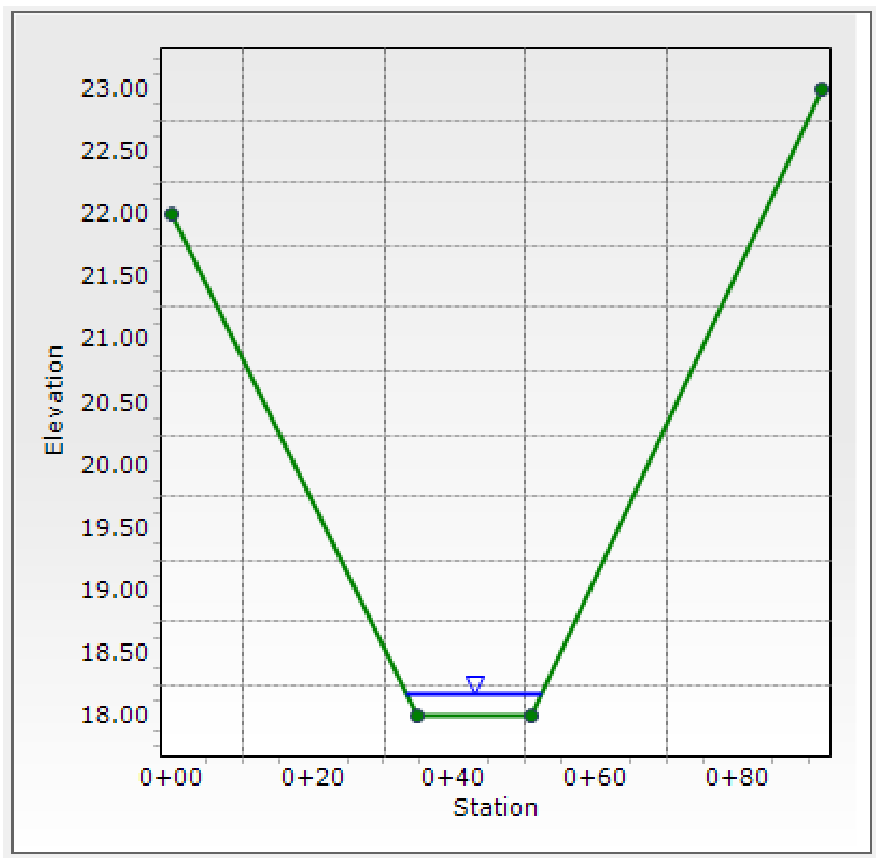
Normal Depth	2.0 in
Roughness Coefficient	0.040
Elevation	18.17 ft
Elevation Range	18.0 to 23.0 ft
Flow Area	2.9 ft²
Wetted Perimeter	19.1 ft
Hydraulic Radius	1.8 in
Top Width	19.04 ft
Normal Depth	2.0 in
Critical Depth	1.8 in
Critical Slope	0.045 ft/ft
Velocity	1.84 ft/s
Velocity Head	0.05 ft
Specific Energy	0.22 ft
Froude Number	0.829

Worksheet for B1-6

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.0 in
Critical Depth	1.8 in
Channel Slope	0.030 ft/ft
Critical Slope	0.045 ft/ft



Worksheet for B2-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.037 ft/ft
Discharge	11.88 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	5.00
0+42	0.00
0+58	0.00
0+75	4.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5.00)	(0+42, 0.00)	0.040
(0+42, 0.00)	(0+58, 0.00)	0.040
(0+58, 0.00)	(0+75, 4.50)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

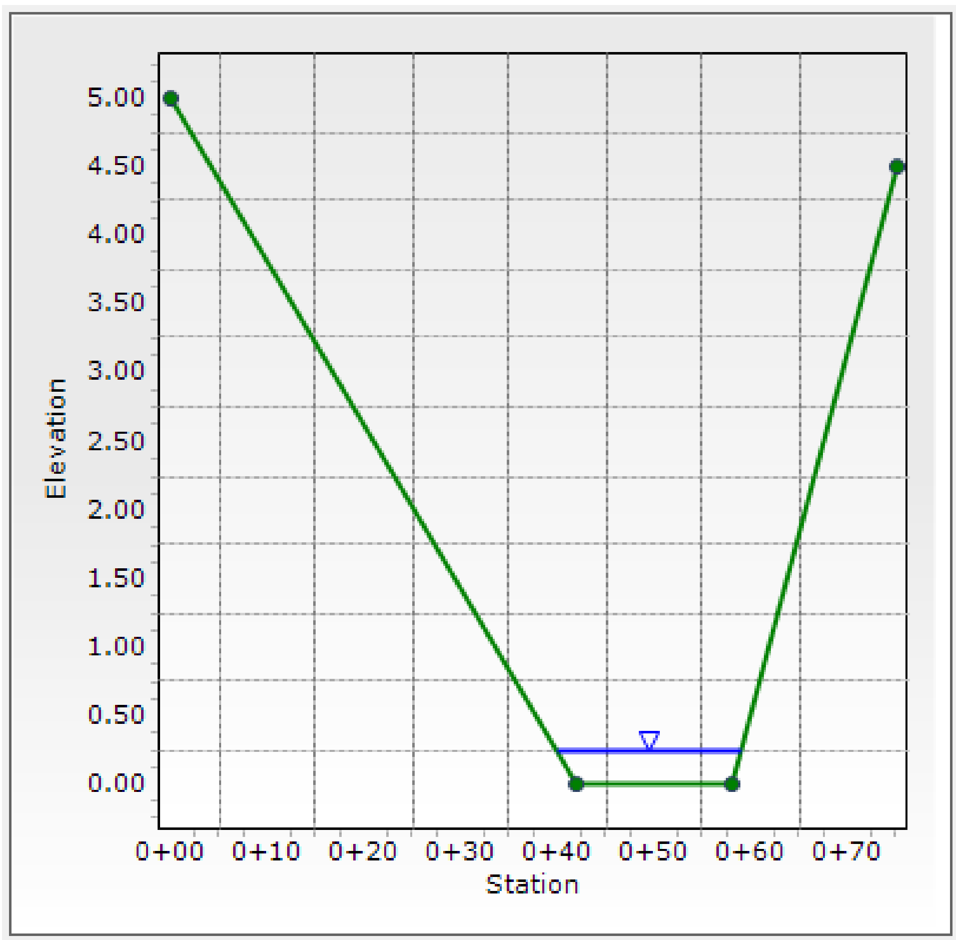
Results

Normal Depth	3.0 in
Roughness Coefficient	0.040
Elevation	0.25 ft
Elevation Range	0.0 to 5.0 ft
Flow Area	4.4 ft²
Wetted Perimeter	19.1 ft
Hydraulic Radius	2.8 in
Top Width	19.07 ft
Normal Depth	3.0 in
Critical Depth	3.0 in
Critical Slope	0.038 ft/ft
Velocity	2.69 ft/s
Velocity Head	0.11 ft
Specific Energy	0.36 ft
Froude Number	0.984
Flow Type	Subcritical

Worksheet for B2-1

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.0 in
Critical Depth	3.0 in
Channel Slope	0.037 ft/ft
Critical Slope	0.038 ft/ft



Worksheet for B2-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.054 ft/ft
Discharge	23.59 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	13.00
0+38	8.00
0+59	8.00
0+96	13.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 13.00)	(0+38, 8.00)	0.040
(0+38, 8.00)	(0+59, 8.00)	0.040
(0+59, 8.00)	(0+96, 13.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

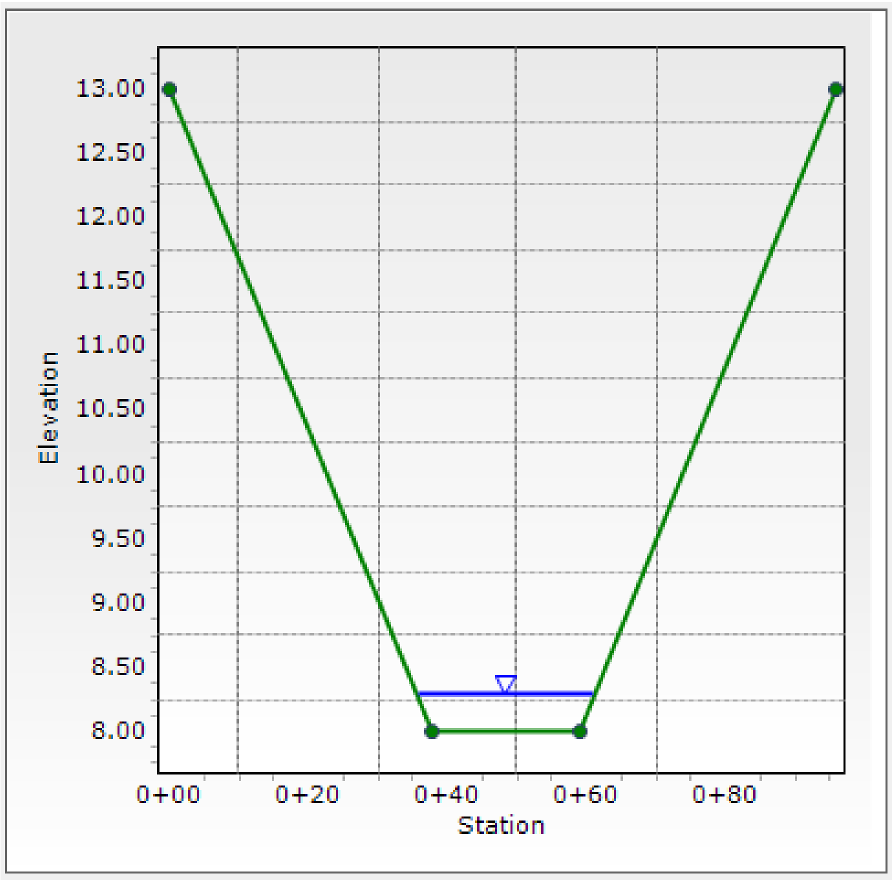
Results

Normal Depth	3.5 in
Roughness Coefficient	0.040
Elevation	8.29 ft
Elevation Range	8.0 to 13.0 ft
Flow Area	6.7 ft²
Wetted Perimeter	25.4 ft
Hydraulic Radius	3.2 in
Top Width	25.31 ft
Normal Depth	3.5 in
Critical Depth	3.9 in
Critical Slope	0.035 ft/ft
Velocity	3.54 ft/s
Velocity Head	0.19 ft
Specific Energy	0.48 ft
Froude Number	1.217
Flow Type	Supercritical

Worksheet for B2-2

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.5 in
Critical Depth	3.9 in
Channel Slope	0.054 ft/ft
Critical Slope	0.035 ft/ft



Worksheet for B8-1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.050 ft/ft
Discharge	114.99 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	202.00
0+52	198.00
0+79	198.00
1+06	201.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 202.00)	(0+52, 198.00)	0.040
(0+52, 198.00)	(0+79, 198.00)	0.040
(0+79, 198.00)	(1+06, 201.00)	0.040

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

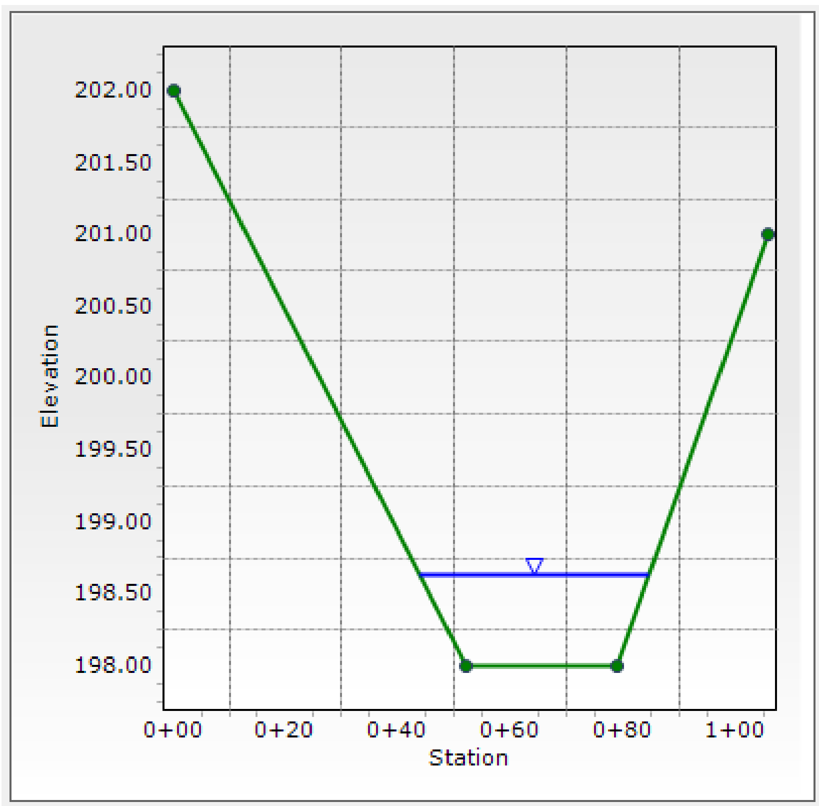
Results	
Normal Depth	7.6 in
Roughness Coefficient	0.040
Elevation	198.63 ft
Elevation Range	198.0 to 202.0 ft
Flow Area	21.4 ft²
Wetted Perimeter	40.9 ft
Hydraulic Radius	6.3 in
Top Width	40.85 ft
Normal Depth	7.6 in
Critical Depth	8.9 in
Critical Slope	0.028 ft/ft
Velocity	5.39 ft/s
Velocity Head	0.45 ft
Specific Energy	1.08 ft
Froude Number	1.313

Worksheet for B8-1

Results	
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	7.6 in
Critical Depth	8.9 in
Channel Slope	0.050 ft/ft
Critical Slope	0.028 ft/ft



Worksheet for B6-1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.190	ft/ft
Discharge	23.23	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	14.00
0+39	6.00
0+50	6.00
0+63	11.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 14.00)	(0+39, 6.00)	0.040
(0+39, 6.00)	(0+50, 6.00)	0.040
(0+50, 6.00)	(0+63, 11.50)	0.040

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results		
Normal Depth	3.5	in
Roughness Coefficient	0.040	
Elevation	6.29	ft
Elevation Range	6.0 to 14.0 ft	
Flow Area	3.5	ft²
Wetted Perimeter	13.2	ft
Hydraulic Radius	3.2	in
Top Width	13.09	ft
Normal Depth	3.5	in
Critical Depth	5.9	in
Critical Slope	0.031	ft/ft
Velocity	6.67	ft/s
Velocity Head	0.69	ft
Specific Energy	0.98	ft
Froude Number	2.280	
Flow Type	Supercritical	

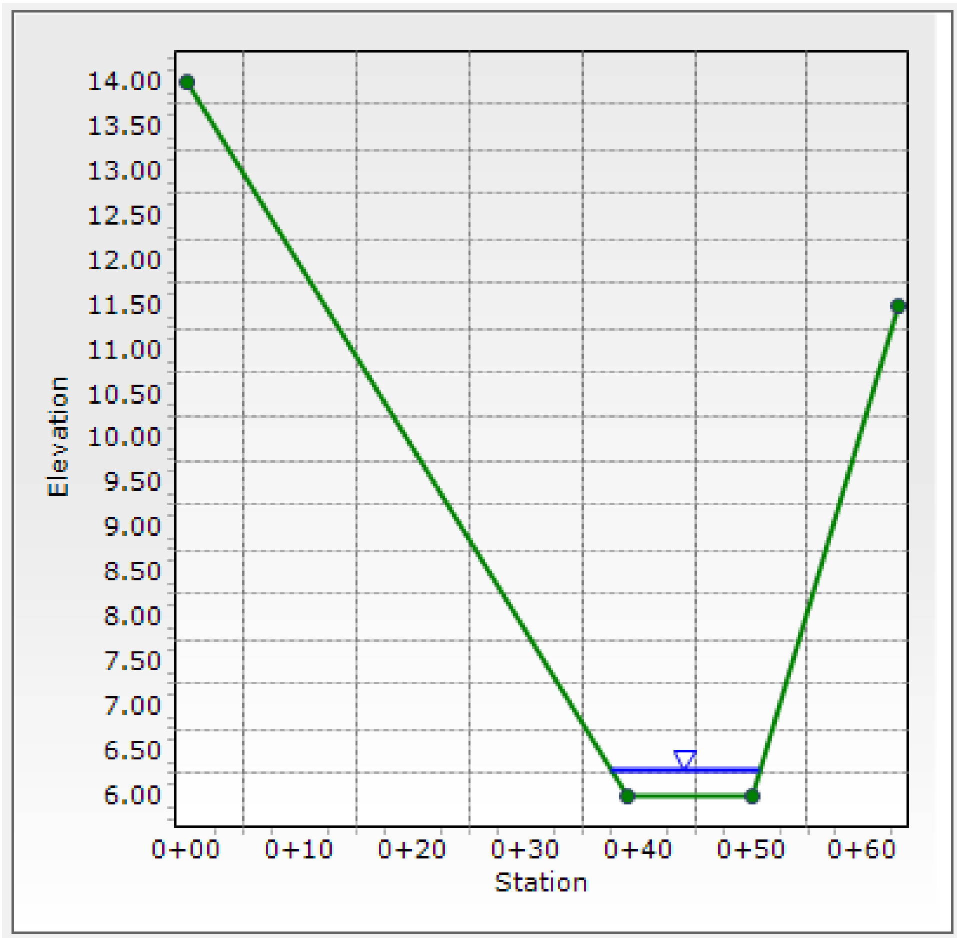
Worksheet for B6-1

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.5 in
Critical Depth	5.9 in
Channel Slope	0.190 ft/ft
Critical Slope	0.031 ft/ft



Worksheet for B7-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.046 ft/ft
Discharge	5.64 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	95.00
0+25	92.00
0+50	91.75
0+90	98.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 95.00)	(0+25, 92.00)	0.040
(0+25, 92.00)	(0+50, 91.75)	0.040
(0+50, 91.75)	(0+90, 98.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

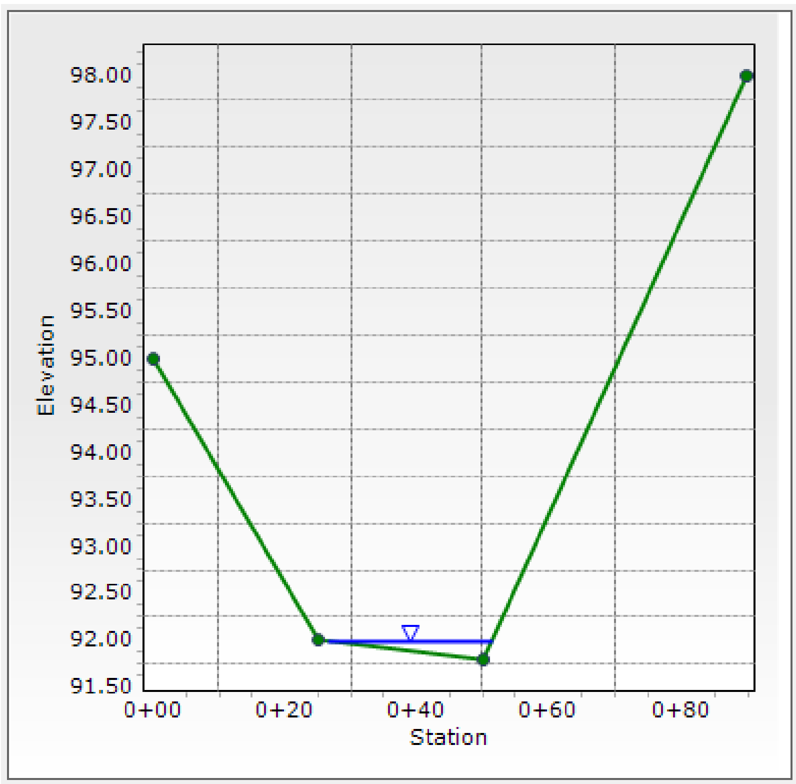
Normal Depth	2.8 in
Roughness Coefficient	0.040
Elevation	91.99 ft
Elevation Range	91.8 to 98.0 ft
Flow Area	2.9 ft²
Wetted Perimeter	25.1 ft
Hydraulic Radius	1.4 in
Top Width	25.05 ft
Normal Depth	2.8 in
Critical Depth	2.8 in
Critical Slope	0.048 ft/ft
Velocity	1.91 ft/s
Velocity Head	0.06 ft
Specific Energy	0.29 ft
Froude Number	0.983

Worksheet for B7-1

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.8 in
Critical Depth	2.8 in
Channel Slope	0.046 ft/ft
Critical Slope	0.048 ft/ft



ROADSIDE DITCH SUMMARY TABLE

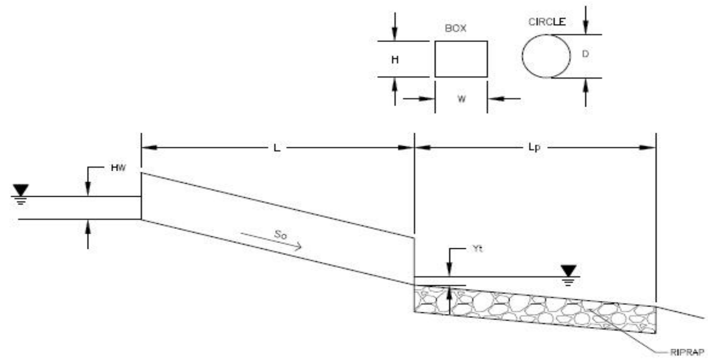
ROADWAY	FROM STA	TO STA	PROPOSED SLOPE (%)	SIDE	SIDE SLOPE	CHANNEL DEPTH (FT)	FRICTION FACTOR	BASIN	Q100 FLOW (CFS)	DITCH FLOW % OF BASIN	DITCH FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	DITCH LINING	NOTES
HATBAND DRIVE	1+30	2+80	2.75%	LEFT	4:1/3:1	3	0.04	A1	41.29	100.0%	41.29	1.53	5.02	GRASS	
HATBAND DRIVE	1+30	3+40	2.75%	RIGHT	4:1/3:1	3	0.04	A2	92.96	1.0%	0.93	0.37	1.95	GRASS	
HATBAND DRIVE	2+80	3+80	2.75%	LEFT	4:1/3:1	3	0.04	A2	92.96	1.0%	0.93	0.37	1.95	GRASS	
HATBAND DRIVE	4+90	7+20	2.75%	LEFT	4:1/3:1	3	0.04	A2	92.96	1.0%	0.93	0.37	1.95	GRASS	
HATBAND DRIVE	6+13	7+20	2.75%	RIGHT	4:1/3:1	3	0.04	A2	92.96	1.0%	0.93	0.37	1.95	GRASS	
HATBAND DRIVE	12+60	15+00	1.00%	LEFT	4:1/3:1	3	0.04	B1	80.40	0.7%	0.56	0.37	1.17	GRASS	
HATBAND DRIVE	12+60	15+00	1.00%	RIGHT	4:1/3:1	3	0.04	B1	80.40	0.5%	0.40	0.33	1.08	GRASS	
HATBAND DRIVE	15+00	18+00	2.00%	LEFT	4:1/3:1	3	0.04	B1	80.40	25.0%	20.10	1.24	3.72	GRASS	
HATBAND DRIVE	15+00	18+00	2.00%	RIGHT	4:1/3:1	3	0.04	B1	80.40	0.6%	0.48	0.31	1.46	GRASS	
HATBAND DRIVE	19+75	20+45	3.00%	RIGHT	4:1/3:1	3	0.04	B1	80.40	0.1%	0.08	0.14	1.09	GRASS	
HATBAND DRIVE	20+45	22+00	2.00%	RIGHT	4:1/3:1	3	0.04	B2	38.64	1.0%	0.39	0.28	1.39	GRASS	
HATBAND DRIVE	20+20	22+75	2.40%	LEFT	4:1/3:1	3	0.04	B1	80.40	1.3%	1.05	0.40	1.90	GRASS	
SALOON DRIVE	3+30	5+70	1.25%	LEFT	4:1/3:1	3	0.04	A2	92.96	0.40%	0.37	0.30	1.15	GRASS	
SALOON DRIVE	3+30	6+10	1.50%	RIGHT	4:1/3:1	3	0.04	A2	92.96	45.0%	41.83	1.75	4.02	GRASS	
SALOON DRIVE	7+00	10+80	6.00%	LEFT	4:1/3:1	3	0.04	A2	92.96	2.0%	1.86	0.42	3.10	GRASS	
SALOON DRIVE	10+80	END	1.30%	LEFT	4:1/3:1	3	0.04	A2	92.96	1.0%	0.93	0.43	1.47	GRASS	
CAMPOUT DRIVE	7+95	8+90	9.50%	RIGHT	4:1/3:1	3	0.04	B1	80.40	0.2%	0.16	0.15	1.99	GRASS	
CAMPOUT DRIVE	11+10	12+40	7.75%	RIGHT	4:1/3:1	3	0.04	B1	80.40	0.4%	0.32	0.20	2.20	GRASS	
CAMPOUT DRIVE	11+20	14+50	5.15%	LEFT	4:1/3:1	3	0.04	B6	106.95	23.0%	24.60	1.13	5.58	GRASS	
CAMPOUT DRIVE	16+80	25+80	1.00%	LEFT	4:1/3:1	3	0.04	B6	106.95	85.0%	90.91	2.49	4.19	GRASS	
CAMPOUT DRIVE	25+80	END	1.00%	LEFT	4:1/3:1	3	0.04	B6	106.95	13.0%	13.90	1.23	2.62	GRASS	
CAMPOUT DRIVE	27+80	29+60	1.00%	RIGHT	4:1/3:1	3	0.04	B6	106.95	0.3%	0.28	0.28	0.99	GRASS	
APEX RANCH ROAD	START	3+65	2.20%	LEFT	4:1/3:1	3	0.04	OS-C1	59.93	4.3%	15.90*	1.12	3.64	GRASS	* INLCUDES FOLW FROM SUB-BASINS OS-C1, OS-A2, AND A2
APEX RANCH ROAD	3+65	4+85	4.65%	LEFT	4:1/3:1	3	0.04	OS-A2	11.46	27.0%	13.31*	0.91	4.62	GRASS	* INLCUDES FLOW FROM SUB-BASINS OS-A2, AND A2
APEX RANCH ROAD	3+70	4+30	4.20%	RIGHT	4:1/3:1	3	0.04	OS-A2	11.46	1.4%	0.16	0.18	1.47	GRASS	
APEX RANCH ROAD	12+20	16+60	10.00%	LEFT	4:1/3:1	3	0.04	A2	92.96	2.0%	1.86	0.38	3.75	GRASS	
APEX RANCH ROAD	16+60	18+30	5.15%	LEFT	4:1/3:1	3	0.04	A2	92.96	0.7%	0.65	0.28	2.25	GRASS	
APEX RANCH ROAD	12+65	16+60	10.00%	RIGHT	4:1/3:1	3	0.04	B6	106.95	2.0%	2.14	0.40	3.89	GRASS	
APEX RANCH ROAD	16+60	18+65	5.15%	RIGHT	4:1/3:1	3	0.04	B6	106.95	0.4%	0.43	0.25	2.03	GRASS	

Culvert & Riprap Summary													
Culvert Details							*Riprap Details*						
Culvert ID	Basin	Q100 flow (cfs)	Flow % of Basin	Flows (cfs)	HW/D Ratio	Diameter (in)	Length (ft)	Width (ft)	D50 Type	D50 Size (in)	D50 Thickness (in)	Normal Depth in Pipe (ft)	Upstream Headwater Elevation (ft)
A1	A1	41.42	100.00%	41.42	1.13	36	19	7	L	9	18	2.32	7208.06
A2-A	A2	92.96	10.00%	9.30	1.39	18	7	4	VL	6	12	0.75	7211.83
A2-B	A2	92.96	8.00%	7.44	1.12	18	5	3	VL	6	12	0.56	7221.28
A2-C	A2	92.96	49.00%	45.55	1.21	36	21	8	L	9	18	1.17	7223.80
A2-D	A2	92.96	11.00%	10.23	0.86	24	6	4	VL	6	12	0.89	7315.02
B1-A	B1	80.40	28.00%	22.51	0.99	30	11	5	VL	6	12	0.85	7218.23
B1-B	B1	80.40	34.00%	27.34	1.16	30	14	6	L	9	18	1.52	7221.92
B6	B6	106.95	100.00%	106.95	1.01	36 (3 Barrels)	30	15	L	9	18	1.50	7231.07

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: OVERLOOK
ID: CULVERT A1



Soil Type:
Choose One:
◉ Sandy
○ Non-Sandy

Design Information:

Design Discharge	Q =	41.42	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	36	inches
Inlet Edge Type (Choose from pull-down list)	Square Edge with Headwall		
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7204.67	ft
Outlet Elevation OR Slope	Elev OUT =	7204.42	ft
Culvert Length	L =	68.15	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

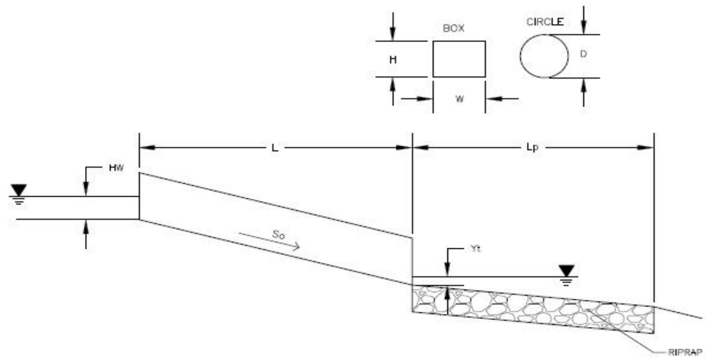
Calculated Results:

Culvert Cross Sectional Area Available	A =	7.07	ft^2
Culvert Normal Depth	Y_n =	2.32	ft
Culvert Critical Depth	Y_c =	2.10	ft
Froude Number	Fr =	0.81	
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.42	
Sum of All Loss Coefficients	k_s =	1.92	ft
Headwater:			
Inlet Control Headwater	HW_I =	3.39	ft
Outlet Control Headwater	HW_O =	3.32	ft
Design Headwater Elevation	HW =	7208.06	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	1.13	
Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.66	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.20	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	4.85	
Flow Area at Max Channel Velocity	A_t =	8.28	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	19	ft
Width of Riprap Protection at Downstream End	T =	7	ft
Adjusted Diameter for Supercritical Flow	Da =	-	ft
Minimum Theoretical Riprap Size	d_{50} min=	7	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	Type =	L	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: OVERLOOK
ID: CULVERT A2-A



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	9.3	cfs

Circular Culvert:

Barrel Diameter in Inches	D =	18	inches
Inlet Edge Type (Choose from pull-down list)	Square Edge with Headwall		

OR:

Box Culvert: OR

Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			

Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7209.75	ft
Outlet Elevation OR Slope	Elev OUT =	7207.31	ft
Culvert Length	L =	93	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t, Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	1.77	ft^2
Culvert Normal Depth	Y_n =	0.75	ft
Culvert Critical Depth	Y_c =	1.18	ft
Froude Number	Fr =	2.40	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	1.44	
Sum of All Loss Coefficients	k_s =	2.94	ft

Headwater:

Inlet Control Headwater	HW_I =	2.08	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	HW =	7211.83	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	1.39	

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:

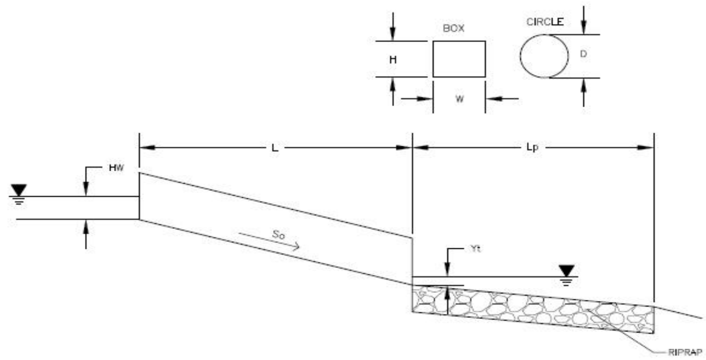
Flow/(Diameter^2.5)	Q/D^2.5 =	3.37	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	0.60	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	4.05	
Flow Area at Max Channel Velocity	A_t =	1.86	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	7	ft
Width of Riprap Protection at Downstream End	T =	4	ft

Adjusted Diameter for Supercritical Flow	Da =	1.13	ft
Minimum Theoretical Riprap Size	d_{50} min=	5	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	Type =	VL	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: OVERLOOK
ID: CULVERT A2-B



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	7.44	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	18	inches
Inlet Edge Type (Choose from pull-down list)	Square Edge with Headwall		
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7219.6	ft
Outlet Elevation OR Slope	Elev OUT =	7215.35	ft
Culvert Length	L =	87.8	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	1.77	ft^2
Culvert Normal Depth	Y_n =	0.56	ft
Culvert Critical Depth	Y_c =	1.06	ft
Froude Number	Fr =	3.39	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	1.36	
Sum of All Loss Coefficients	k_s =	2.86	ft
Headwater:			
Inlet Control Headwater	HW_I =	1.68	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	HW =	7221.28	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	1.12	

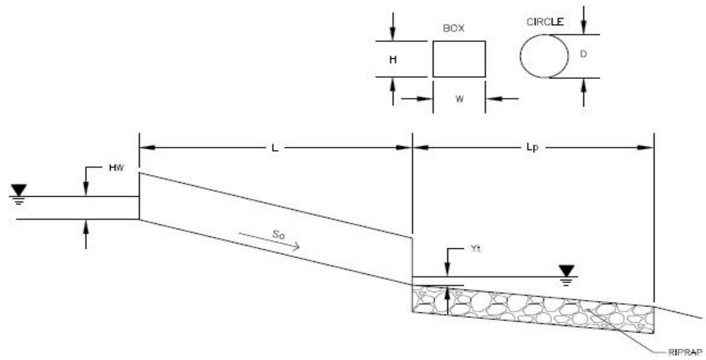
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.70	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	0.60	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	4.79	
Flow Area at Max Channel Velocity	A_t =	1.49	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	5	ft
Width of Riprap Protection at Downstream End	T =	3	ft
Adjusted Diameter for Supercritical Flow	Da =	1.03	ft
Minimum Theoretical Riprap Size	d_{50} min=	4	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	Type =	VL	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: OVERLOOK
ID: CULVERT A2-C



Soil Type:
Choose One:
- (●) Sandy
- ( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	45.55	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	36	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7220.18	ft
Outlet Elevation OR Slope	Elev OUT =	7216.35	ft
Culvert Length	L =	101.4	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	7.07	ft^2
Culvert Normal Depth	Y_n =	1.17	ft
Culvert Critical Depth	Y_c =	2.20	ft
Froude Number	Fr =	3.35	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.62	
Sum of All Loss Coefficients	k_s =	2.12	ft
Headwater:			
Inlet Control Headwater	HW_I =	3.62	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	HW =	7223.80	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	1.21	

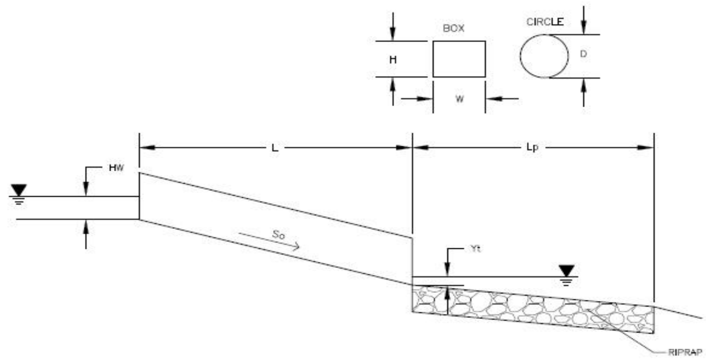
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.92	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.20	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	4.49	
Flow Area at Max Channel Velocity	A_t =	9.11	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	21	ft
Width of Riprap Protection at Downstream End	T =	8	ft
Adjusted Diameter for Supercritical Flow	Da =	2.09	ft
Minimum Theoretical Riprap Size	d_{50} min=	8	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	Type =	L	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Overlook
ID: A2-D



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	10.23	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	24	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7313.3	ft
Outlet Elevation OR Slope	Elev OUT =	7312.4	ft
Culvert Length	L =	86.6	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	3.14	ft^2
Culvert Normal Depth	Y_n =	0.89	ft
Culvert Critical Depth	Y_c =	1.14	ft
Froude Number	Fr =	1.62	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.91	
Sum of All Loss Coefficients	k_s =	2.41	ft
Headwater:			
Inlet Control Headwater	HW_I =	1.72	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	HW =	7315.02	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	0.86	

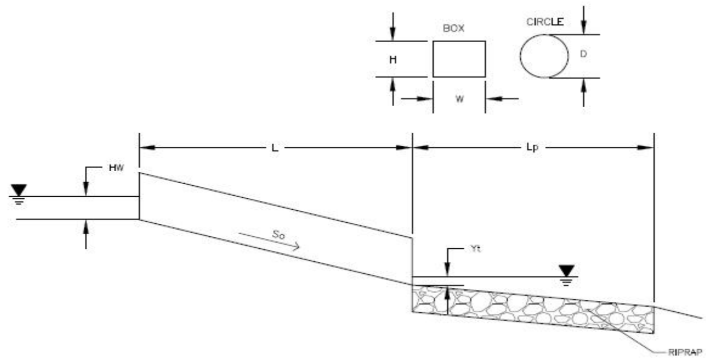
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	1.81	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	0.80	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	5.93	
Flow Area at Max Channel Velocity	A_t =	2.05	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	6	ft
Width of Riprap Protection at Downstream End	T =	4	ft
Adjusted Diameter for Supercritical Flow	Da =	1.45	ft
Minimum Theoretical Riprap Size	d_{50} min=	3	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	Type =	VL	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: OVERLOOK
ID: CULVERT B1-A



Soil Type:
Choose One:
◉ Sandy
○ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	22.51	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	30	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7215.76	ft
Outlet Elevation OR Slope	Elev OUT =	7210.52	ft
Culvert Length	L =	125.2	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	4.91	ft^2
Culvert Normal Depth	Y_n =	0.85	ft
Culvert Critical Depth	Y_c =	1.61	ft
Froude Number	Fr =	3.45	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.98	
Sum of All Loss Coefficients	k_s =	2.48	ft
Headwater:			
Inlet Control Headwater	HW_I =	2.47	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	HW =	7218.23	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	0.99	

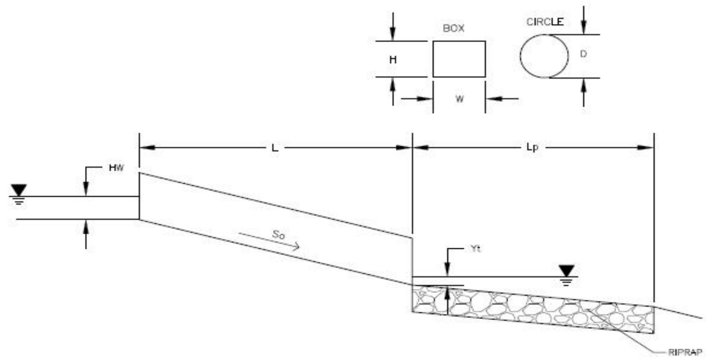
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.28	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.00	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	5.36	
Flow Area at Max Channel Velocity	A_t =	4.50	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	11	ft
Width of Riprap Protection at Downstream End	T =	5	ft
Adjusted Diameter for Supercritical Flow	Da =	1.67	ft
Minimum Theoretical Riprap Size	d_{50} min=	5	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	Type =	VL	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: OVERLOOK
ID: CULVERT B1-B



Soil Type:
Choose One:
- (●) Sandy
- ( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	27.34	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	30	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7219.01	ft
Outlet Elevation OR Slope	Elev OUT =	7218.46	ft
Culvert Length	L =	68.26	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

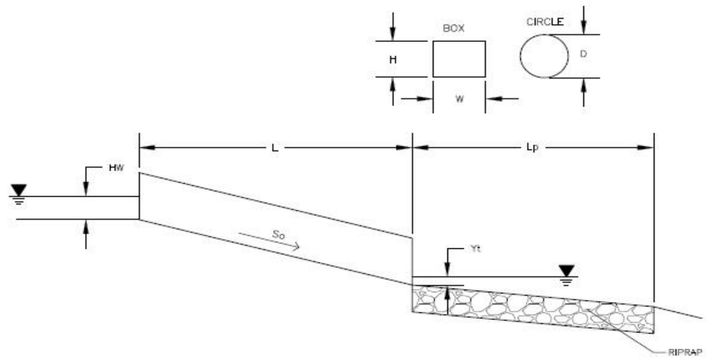
Culvert Cross Sectional Area Available	A =	4.91	ft^2
Culvert Normal Depth	Y_n =	1.52	ft
Culvert Critical Depth	Y_c =	1.78	ft
Froude Number	Fr =	1.37	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.53	
Sum of All Loss Coefficients	k_s =	2.03	ft
Headwater:			
Inlet Control Headwater	HW_I =	2.91	ft
Outlet Control Headwater	HW_O =	2.57	ft
Design Headwater Elevation	HW =	7221.92	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	1.16	
Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.77	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.00	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	4.70	
Flow Area at Max Channel Velocity	A_t =	5.47	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	L_p =	14	ft
Width of Riprap Protection at Downstream End	T =	6	ft
Adjusted Diameter for Supercritical Flow	Da =	2.01	ft
Minimum Theoretical Riprap Size	d_{50} min=	6	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	Type =	L	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Overlook

ID: CULVERT B6



Soil Type:

Choose One:

(●) Sandy

( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

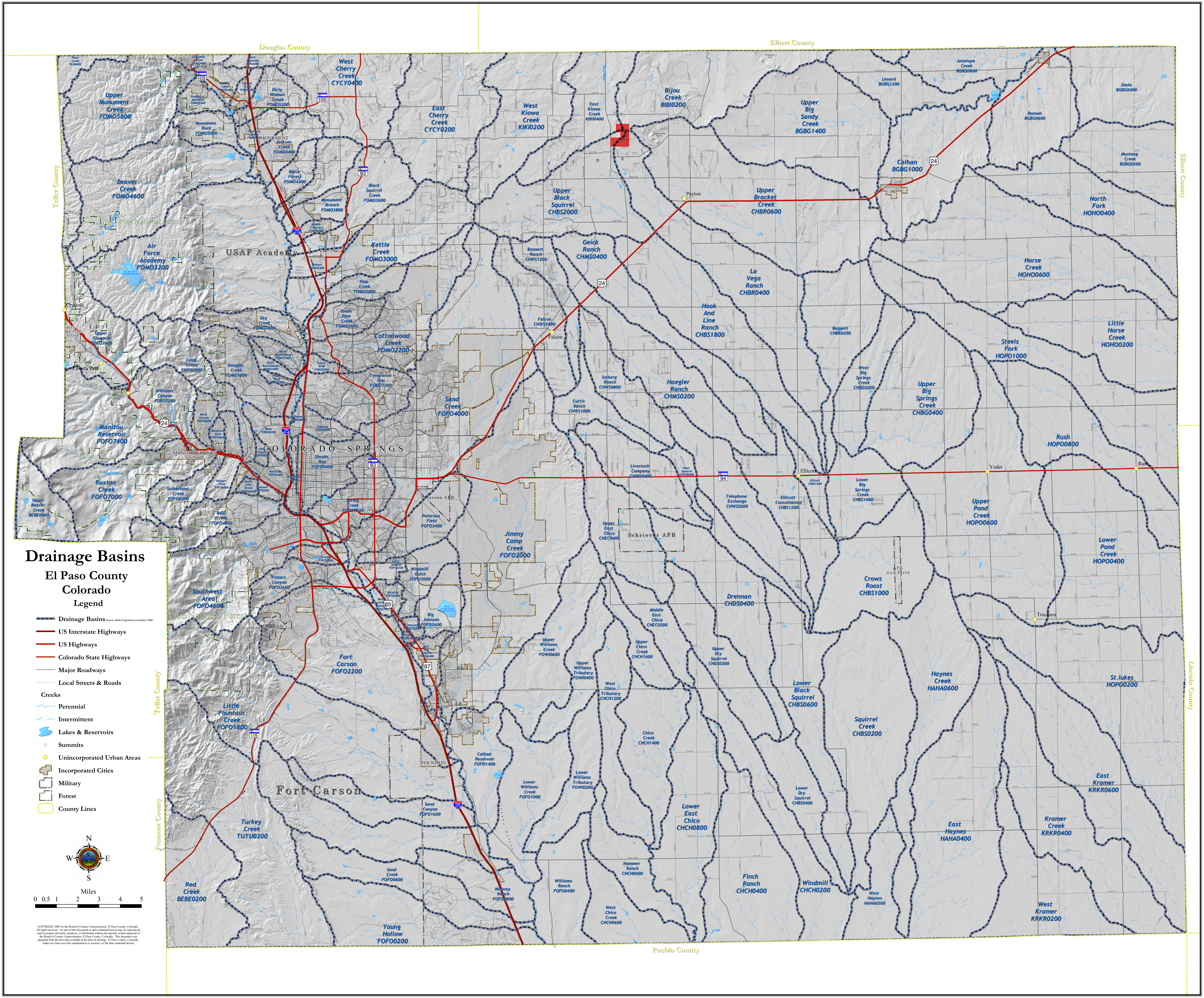
Design Information:

Design Discharge	Q =	106.95	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	36	inches
Inlet Edge Type (Choose from pull-down list)	Square Edge with Headwall		
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	3	
Inlet Elevation	Elev IN =	7228.05	ft
Outlet Elevation OR Slope	Elev OUT =	7227.55	ft
Culvert Length	L =	51.93	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	7.07	ft^2
Culvert Normal Depth	Y_n =	1.50	ft
Culvert Critical Depth	Y_c =	1.94	ft
Froude Number	Fr =	1.63	Supercritical!
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.32	
Sum of All Loss Coefficients	k_s =	1.82	ft
Headwater:			
Inlet Control Headwater	HW_I =	3.02	ft
Outlet Control Headwater	HW_O =	2.69	ft
Design Headwater Elevation	HW =	7231.07	ft
Headwater/Diameter OR Headwater/Rise Ratio	HW/D =	1.01	
Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.29	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.20	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	5.35	
Flow Area at Max Channel Velocity	A_t =	21.39	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	9.00	ft
Length of Riprap Protection	L_p =	30	ft
Width of Riprap Protection at Downstream End	T =	15	ft
Adjusted Diameter for Supercritical Flow	Da =	2.25	ft
Minimum Theoretical Riprap Size	d_{50} min=	6	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	Type =	L	

APPENDIX E: EL PASO COUNTY DRAINAGE BASIN MAP



Drainage Basins
El Paso County
Colorado
Legend
Drainage Basins
US Interstate Highways
US Highways
Colorado State Highways
Major Roadways
Local Streets & Roads
Creeks
Perennial
Intermittent
Lakes & Reservoirs
Summits
Unincorporated Urban Areas
Incorporated Cities
Military
Forest
County Lines
N
S
E
W
Miles
0 0.5 1 2 3 4 5
Douglas County
Elbert County
Teller County
Fremont County
Lincoln County
Pueblo County
COLORADO SPRINGS
USAF Academy
Fort Carson
Schriever AFB
Peyton
Falcon
Ellicott
Yoder
Rush
Truckton
Upper Monument Creek FOMO5800
West Cherry Creek CYCY0400
East Cherry Creek CYCY0200
West Kiowa Creek KIKI0200
Bijou Creek BIBI0200
Upper Big Sandy Creek BGBG1400
Calhan BGBG1000
Beaver Creek FOMO4600
Upper Black Squirrel Creek CHBS2000
Upper Bracket Creek CHBR0600
North Fork HOHO0400
Air Force Academy FOMO3200
Kettle Creek FOMO3000
Geick Ranch CHMS0400
La Vega Ranch CHBR0400
Horse Creek HOHO0600
Hook And Line Ranch CHBS1800
Little Horse Creek HOHO0200
Steels Fork HOPO1000
Cottonwood Creek FOMO2200
Haegler Ranch CHMS0200
Upper Big Springs Creek CHBG0400
Sand Creek FOFO4000
Manitou Reservoir FOFO7400
Rush HOPO0800
Ruxton Creek FOFO7000
Upper Pond Creek HOPO0600
Jimmy Camp Creek FOFO2000
Lower Pond Creek HOPO0400
Southwest Area FOFO4600
Crows Roost CHBS1000
Drennan CHBS0400
Fort Carson FOFO2200
Haynes Creek HAHA0600
St.lukes HOPO0200
Lower Black Squirrel CHBS0600
Squirrel Creek CHBS0200
Little Fountain Creek FOFO1800
East Kramer KRKR0600
Lower East Chico CHCH0800
Turkey Creek TUTU0200
East Haynes HAHA0400
Kramer Creek KRKR0400
Red Creek BEBE0200
Finch Ranch CHCH0400
Windmill CHCH0200
West Kramer KRKR0200
Young Hollow FOFO0200

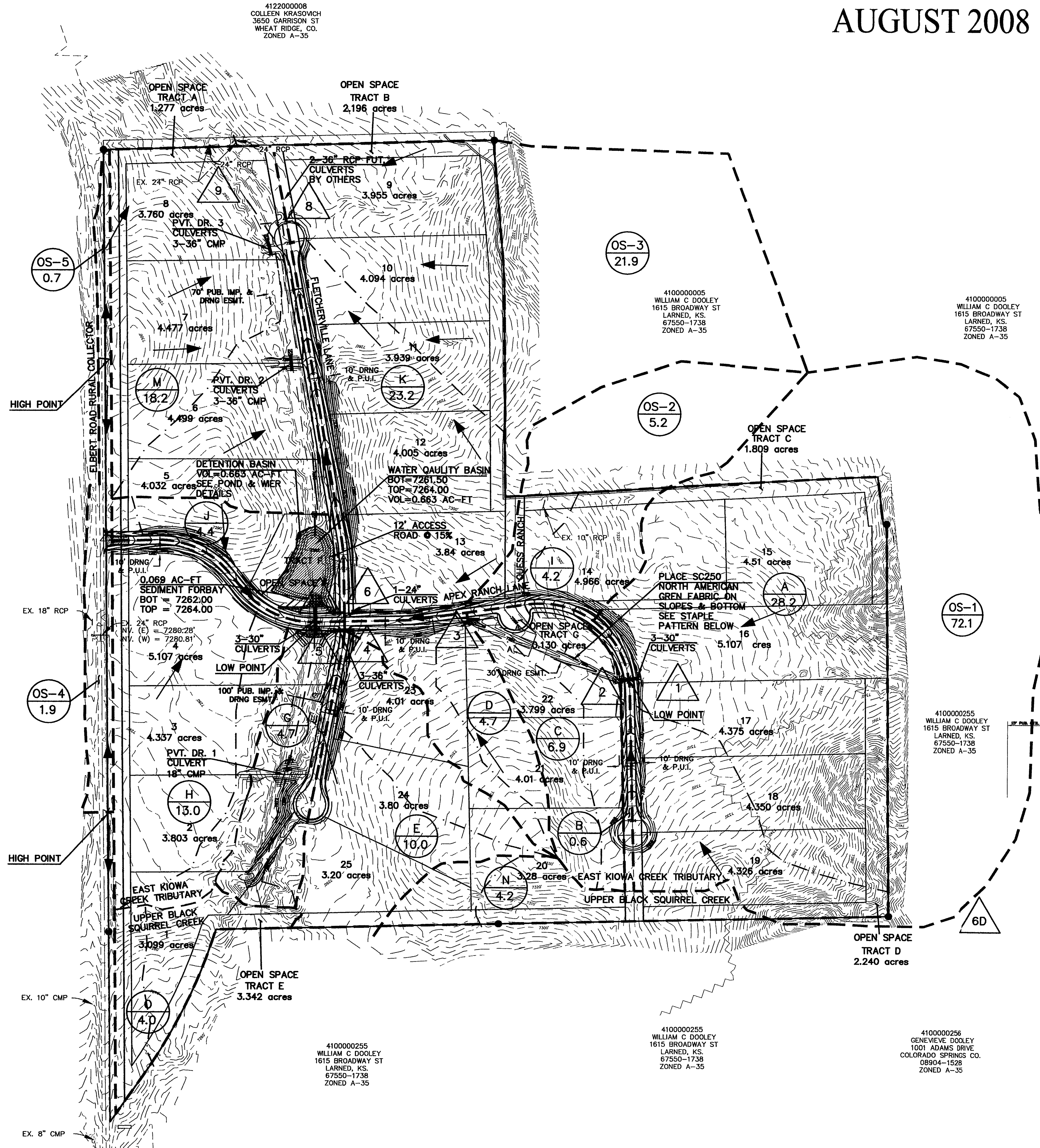
APPENDIX F: APEX RANCH DRAINAGE REPORT

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	**QUENTIN ARMIJO**
Company:	**TERRA NOVA ENG.**
Date:	**April 2, 2008**
Project:	**APEX RANCH ESTATES**
Location:	**PEYTON, CO**

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = 10.00 % i = 0.10
B) Contributing Watershed Area (Area)	Area = 76.80 acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV = 0.07 watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = 0.515 acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	X Orifice Plate ___ Perforated Riser Pipe ___ Other:
B) Depth at Outlet Above Lowest Perforation (H)	H = 2.50 feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = 0.81 square inches
D) Perforation Dimensions **(enter one only)**: i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	 D = 1.0000 inches, **OR** W = ___ inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = 1 number
F) Actual Design Outlet Area per Row (A_o)	A_o = 0.79 square inches
G) Number of Rows (nr)	nr = 8 number
H) Total Outlet Area (A_{ot})	A_{ot} = 5.89 square inches
3. Trash Rack	
A) Needed Open Area: $A_t = 0.5 * \text{(Figure 7 Value)} * A_{ot}$	A_t = 200 square inches
B) Type of Outlet Opening (Check One)	X $\leq$ 2" Diameter **Round** ___ 2" High **Rectangular** ___ Other:
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = 9 inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = 54 inches

APEX RANCH ESTATES
EL PASO COUNTY, COLORADO
FINAL DRAINAGE MAP
AUGUST 2008

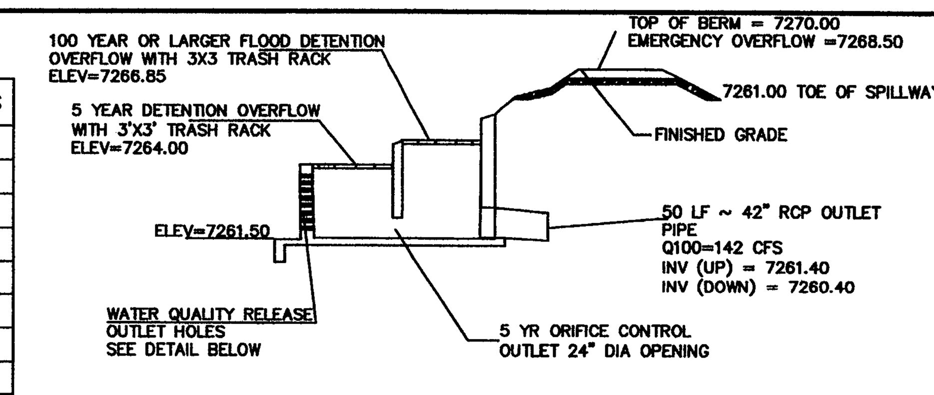


DEVELOPED CONDITIONS

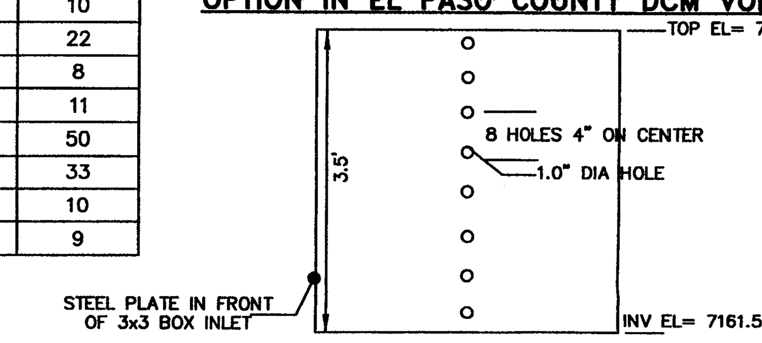
BASIN	ACRES	Q5 CFS	Q100 CFS
OS-1	72.1	45	102
OS-2	5.2	4	9
OS-3	21.9	13	29
OS-4	1.9	4	8
OS-5	0.7	1	3
A	28.2	29	64
B	0.6	2	3
C	6.9	6	12
D	4.7	4	9
E	10.0	8	18
G	4.7	5	10
H	13.0	10	22
I	4.2	4	8
J	4.4	5	11
K	23.2	22	50
M	18.2	15	33
N	4.2	5	10
O	4.0	4	9

DESIGN POINT SUMMARY

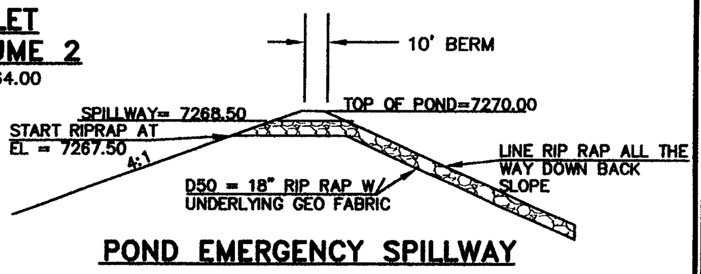
DP	CONTRIBUTING BASINS	Q5 CFS	Q100 CFS
1	OS-1 & A	58	130
2	DP-1 & B	59	131
3	DP-2 & C	61	134
4	DP-3, D & E	68	148
5	DP-4, G & H	78	170
6	OS-2 & I	8	18
7	DP-5, DP-6, J & OS-4	87	188
8	OS-3 & K	29	64
9	DP-8, L, M, OS-5 & POND RELEASE	102	227
10	N & O	8	19



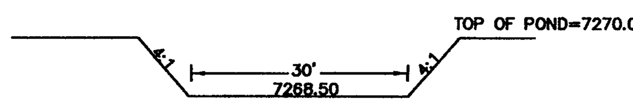
POND 2 OUTLET DETAIL
SEE ALSO FIG. 2-A DROP BOX OUTLET OPTION IN EL PASO COUNTY DCM VOLUME 2



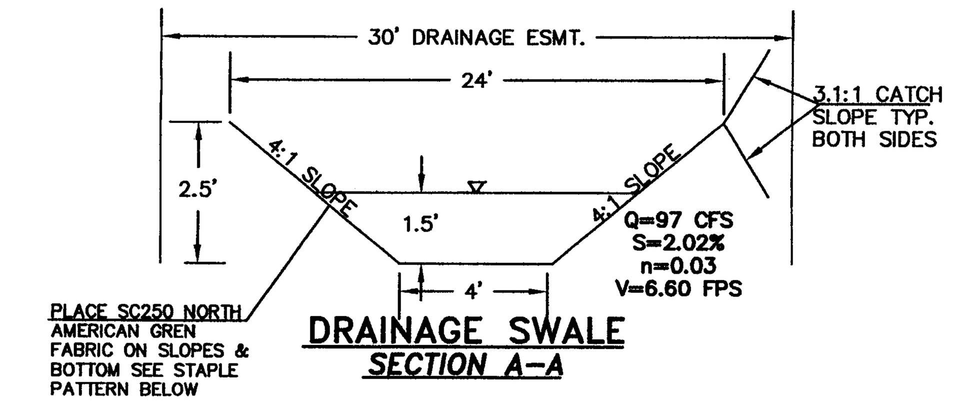
POND PERFORATED HOLE PATTERN



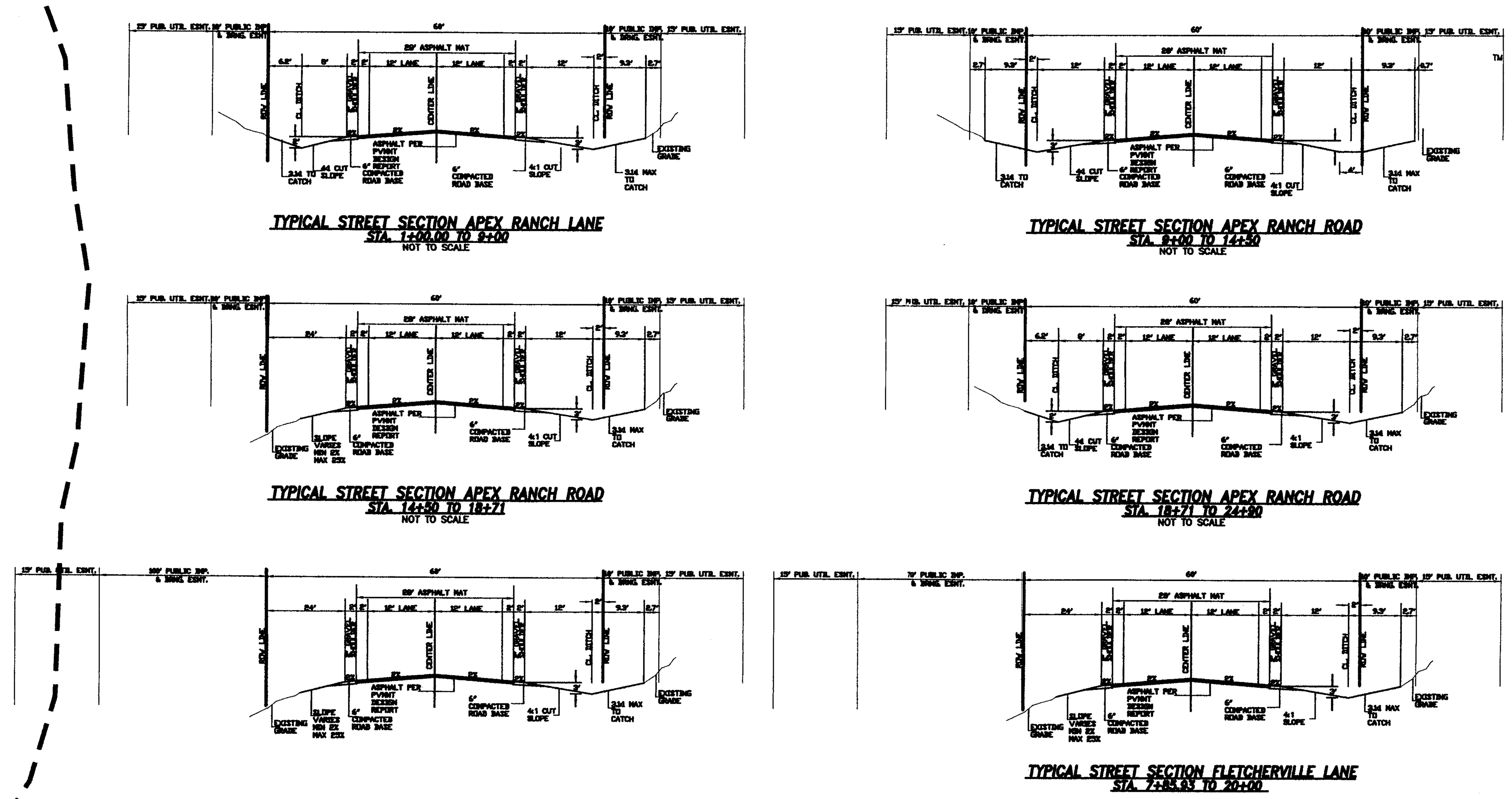
POND EMERGENCY SPILLWAY



POND OVERFLOW WEIR DETAIL



DRAINAGE SWALE
SECTION A-A



TYPICAL STREET SECTION APEX RANCH LANE
STA. 1+00.00 TO 9+00
NOT TO SCALE

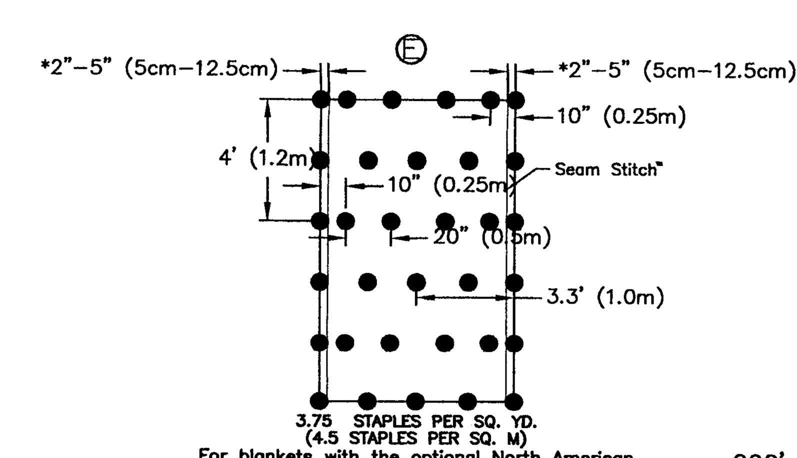
TYPICAL STREET SECTION APEX RANCH ROAD
STA. 9+00 TO 14+50
NOT TO SCALE

TYPICAL STREET SECTION APEX RANCH ROAD
STA. 14+50 TO 18+71
NOT TO SCALE

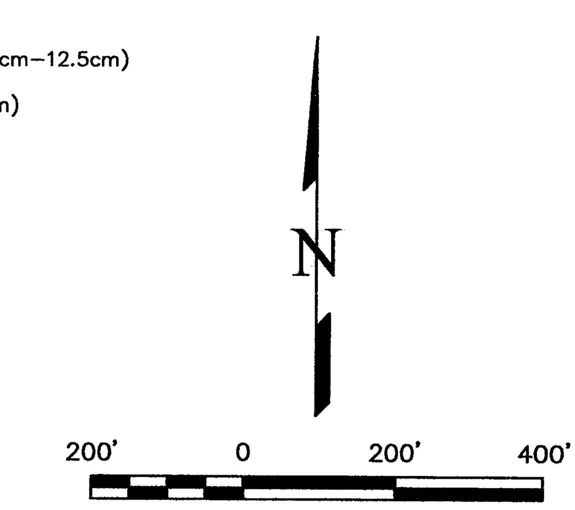
TYPICAL STREET SECTION APEX RANCH ROAD
STA. 18+71 TO 24+80
NOT TO SCALE

TYPICAL STREET SECTION FLETCHERVILLE LANE
STA. 2+37.49 TO 7+85.83
NOT TO SCALE

TYPICAL STREET SECTION FLETCHERVILLE LANE
STA. 7+85.83 TO 20+00



STAPLE PATTERN E
FOR SC250 FABRIC



SCALE: 1"=200'

LEGEND

- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- PROPOSED 10' CONTOUR
- PROPOSED 2' CONTOUR
- PROPOSED CULVERT
- DIRECTION OF FLOW
- BASIN BOUNDARY
- TIME OF CONCENTRATION
- BASIN ID — X-XX
- ACRES — X.X
- DESIGN POINT — 3
- DETENTION AREA

REVISIONS NO.	DESCRIPTION	DATE
1.	REVISED PER COUNTY COMMENTS	11/9/07

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
APEX RANCH ESTATES, LLC
ATTN: CRAIG MCCONNELL
P.O. BOX 267
PEYTON, COLORADO 80831

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
125 N. WAHSATCH AVE., SUITE 101
COLORADO SPRINGS, CO. 80903
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

APEX RANCH ESTATES

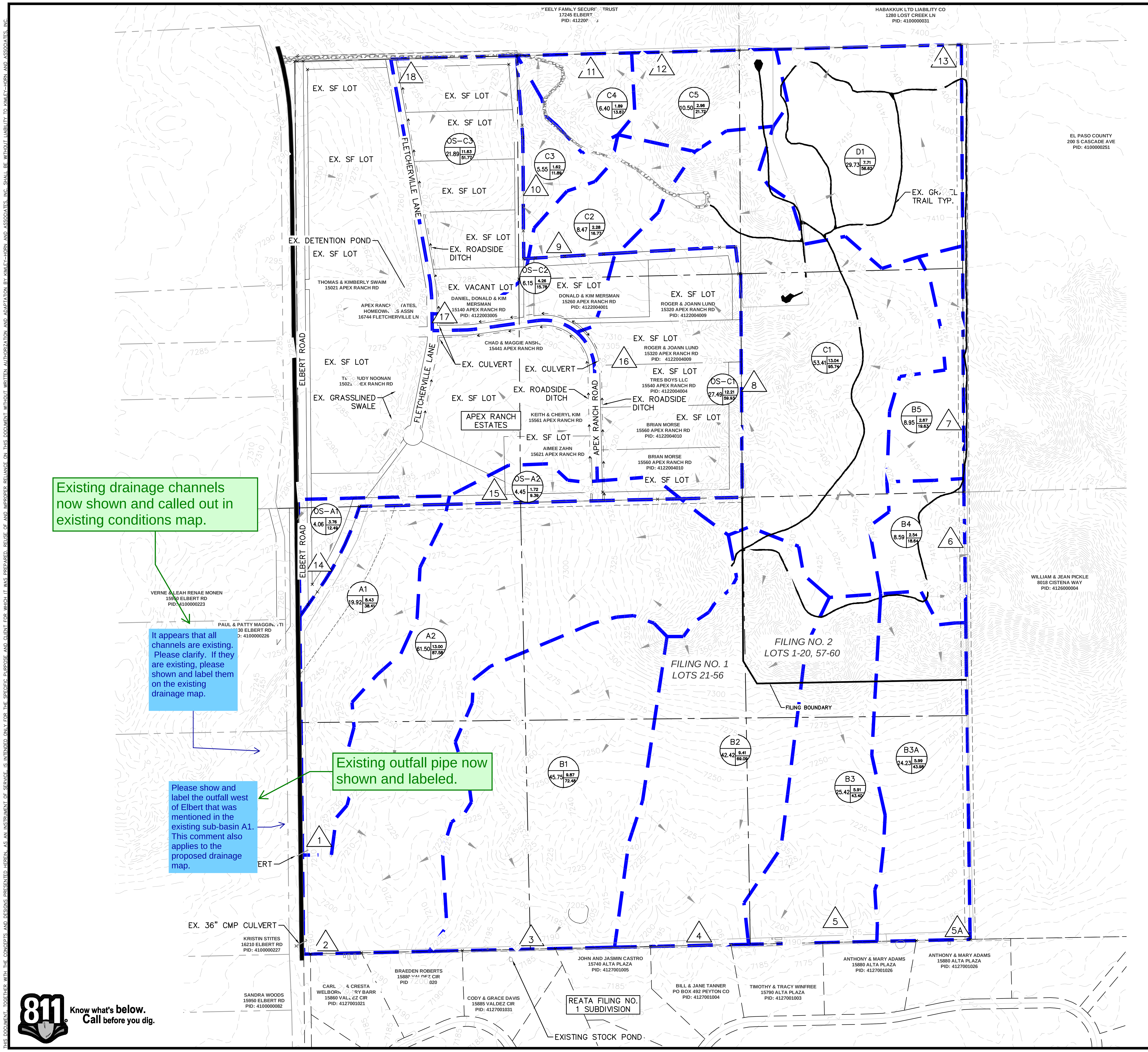
FINAL DRAINAGE MAP
DEVELOPED CONDITIONS

DESIGNED BY QNA
DRAWN BY LAE
CHECKED BY LDR
H-SCALE 1"=200'
V-SCALE
JOB NO. 0565.00
DATE ISSUED 8/26/08
SHEET NO. 1 OF 1

APPENDIX G: DRAINAGE MAPS

The early grading project is for Overlook at Homestead Filing 1. Remove Filing 2 or grey out to clearly identify what basins are applicable to this filing specifically.

FILING 2 NOW GRAYED OUT



Existing drainage channels now shown and called out in existing conditions map.

It appears that all channels are existing. Please clarify. If they are existing, please shown and label them on the existing drainage map.

Existing outfall pipe now shown and labeled.

Please show and label the outfall west of Elbert that was mentioned in the existing sub-basin A1. This comment also applies to the proposed drainage map.

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

EXISTING FLOW DIRECTION
PROPERTY LINE
DRAINAGE BASIN BOUNDARY
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR

A - Upper Black Squirrel Drainage Basin (CHBS2000)
B - La Vega Ranch Drainage Basin (CHBR0400)
C - East Kiowa Creek Drainage Basin (KIKI0400)
D - Bijou Creek Drainage Basin (BIBI0200)

Kimley»Horn

PROJECT NAME: Overlook 1/24/2024
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

EXISTING CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS Q2	CFS Q5	CFS Q100	% IMPERVIOUS
FDR Basins						
1	A1	19.92	4.19	8.43	38.41	8%
2	A2	61.50	3.44	13.00	87.58	1%
3	B1	45.75	1.98	9.87	72.48	0%
4	B2	42.42	1.88	9.41	69.09	0%
5	B3	25.42	1.18	5.91	43.40	0%
5A	B3A	24.23	1.20	5.99	43.98	0%
14	OS-A1	4.06	2.27	3.62	12.02	19%
15	OS-A2	4.45	0.70	2.10	11.46	7%
ON-SITE BASIN TOTAL						
BASIN A TOTAL		81.42	7.63	21.43	125.99	3%
BASIN B TOTAL		137.82	6.24	31.18	228.94	0%
ON-SITE TOTAL		**219.24**	**13.87**	**52.61**	**354.92**	**1%**
OFF-SITE BASIN TOTAL						
OFF-SITE BASIN A		8.51	2.97	5.72	23.48	13%
OFF-SITE TOTAL		**8.51**	**2.97**	**5.72**	**23.48**	**13%**
SITE TOTAL		**227.75**	**16.84**	**58.33**	**378.41**	**1%**

NORTH

GRAPHIC SCALE IN FEET

Kimley»Horn
2023 KIMLEY-HORN AND ASSOCIATES, INC.
2 N NEVADA ST, SUITE 900
COLORADO SPRINGS, CO 80903 719-453-0180

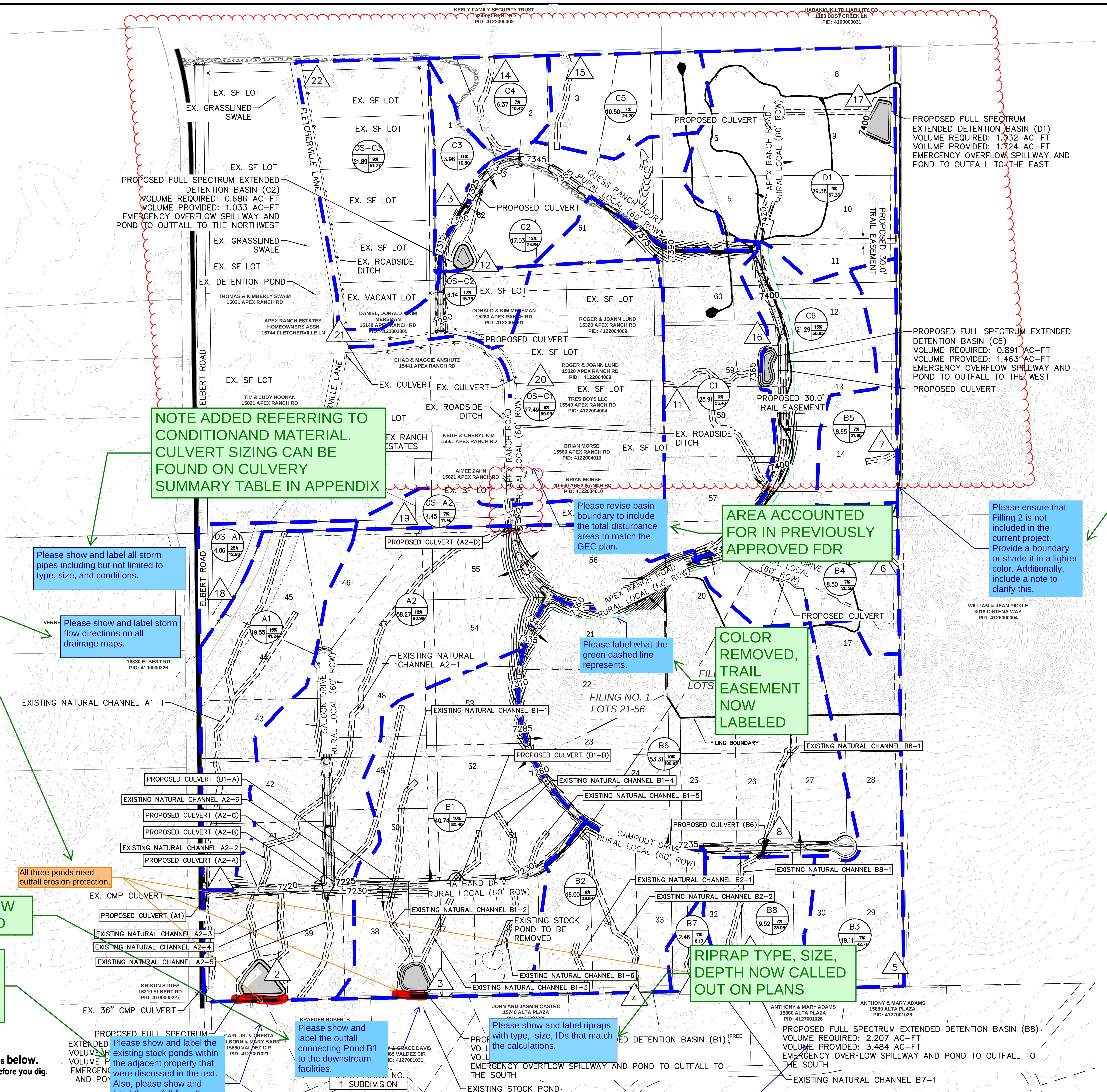
DESIGNED BY: KRK
DRAWN BY: AJL
CHECKED BY: KRK
DATE: 11/27/23

OVERLOOK FILING NO. 1
EL PASO COUNTY, COLORADO
PRELIMINARY DESIGN PLANS
EXISTING DRAINAGE MAP

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO. 196239003

SHEET EX-1



FLOW ARROWS ADDED TO DRAINAGE MAPS

OUTFALL PROTECTION, INCLUDING RIP RAP AND LEVEL SPREADER NOW SHOWN AND LABELED ON PONDS.

LEVEL SPREADER NOW SHOWN AND LABELED

POND DESIGN AND OUTFALL LOCATIONS UPDATED. APPLICABLE STOCK POND LABELED

POND LOCATION AND DESIGN UPDATED

NOTE ADDED REFERRING TO CONDITIONAND MATERIAL. CULVERT SIZING CAN BE FOUND ON CULVERY SUMMARY TABLE IN APPENDIX

Please show and label all storm pipes including but not limited to type, size, and conditions.

Please show and label storm flow directions on all drainage maps.

All three ponds need outfall erosion protection.

Please show and label the existing stock ponds within the adjacent property that were discussed in the text. Also, please show and label the outfall from the FSD A2, and B8 to the existing stock ponds.

Please show and label the outfall connecting Pond B1 to the downstream facilities.

Please show and label ripraps with type, size, IDs that match the calculations.

Note as mentioned in the PRELIM Plan PDR all temp and permanent ponds must be located back from the property boundaries to accommodate the outlets structures necessary and emergency overflows. Ensure next submittal shows these details.

Please label three pond as temporary ponds to match the text discussion and grading erosion control plan.

POND LABELS UPDATED TO MATCH GEC PLANS

RIPRAP TYPE, SIZE, DEPTH NOW CALLED OUT ON PLANS

Please revise basin boundary to include the total disturbance areas to match the GEC plan.

AREA ACCOUNTED FOR IN PREVIOUSLY APPROVED FDR

Please label what the green dashed line represents.

COLOR REMOVED, TRAIL EASEMENT NOW LABELED

Please ensure that Filing 2 is not included in the current project. Provide a boundary or shade it in a lighter color. Additionally, include a note to clarify this.

FILING 2 NOW GRAYED OUT

LEGEND

- A = BASIN DESIGNATION
- B = AREA (ACRES)
- C = BASIN IMPERVIOUSNESS
- D = 100YR DESIGN STORM RUNOFF (CFS)
- # = DESIGN POINT
- PROPOSED FLOW DIRECTION
- PROPOSED PROPERTY LINE
- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- DRAINAGE BASIN BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

EASEMENT NOTE

1. ALL PROPOSED EASEMENTS ARE 30' DRAINAGE EASEMENTS UNLESS OTHERWISE NOTED

A - ... nage Basin (CHBS2000)
B - ... Basin (CHBR0400)
C - East Kiowa Creek Drainage Basin (KIKI0400)
D - Bijou Creek Drainage Basin (BIBI0200)

Kimley»Horn
PROJECT NAME: Overlook 1/24/2024
PROJECT NUMBER: 196239003
CALCULATED BY: GKS
CHECKED BY: KRK

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS Q2	CFS Q5	CFS Q100	% IMPERVIOUS
PDR Basins						
1	A1	19.55	5.41	10.41	41.24	15%
2	A2	58.27	9.71	20.99	92.96	12%
3	B1	40.74	6.97	16.77	80.40	10%
4	B2	16.00	3.10	7.82	38.64	9%
5	B3	19.11	2.61	7.83	42.71	7%
8	B6	53.31	9.52	22.55	106.95	10%
9	B7	2.46	0.38	1.13	6.17	7%
10	B8	9.52	1.41	4.22	23.05	7%
18	OS-A1	4.06	2.57	4.12	12.86	25%
19	OS-A2	4.45	0.70	2.10	11.46	7%
ON-SITE BASIN TOTAL						
BASIN A TOTAL		77.82	15.12	31.40	134.20	12%
BASIN B TOTAL		141.14	23.98	60.32	297.91	9%
ON-SITE TOTAL		**218.96**	**23.98**	**60.32**	**297.91**	**10%**
OFF-SITE BASIN TOTAL						
OFF-SITE BASIN A		8.51	3.27	6.22	24.32	15%
OFF-SITE TOTAL		**8.51**	**3.27**	**6.22**	**24.32**	**15%**
SITE TOTAL		**227.47**	**27.25**	**66.54**	**322.23**	**10%**

NORTH

GRAPHIC SCALE IN FEET
0 150 300 600

NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
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2 N NEVADA ST, SUITE 900
COLORADO SPRINGS, CO 80903 719-453-0180

DESIGNED BY: KRK
DRAWN BY: AJL
CHECKED BY: KRK
DATE: 11/27/23

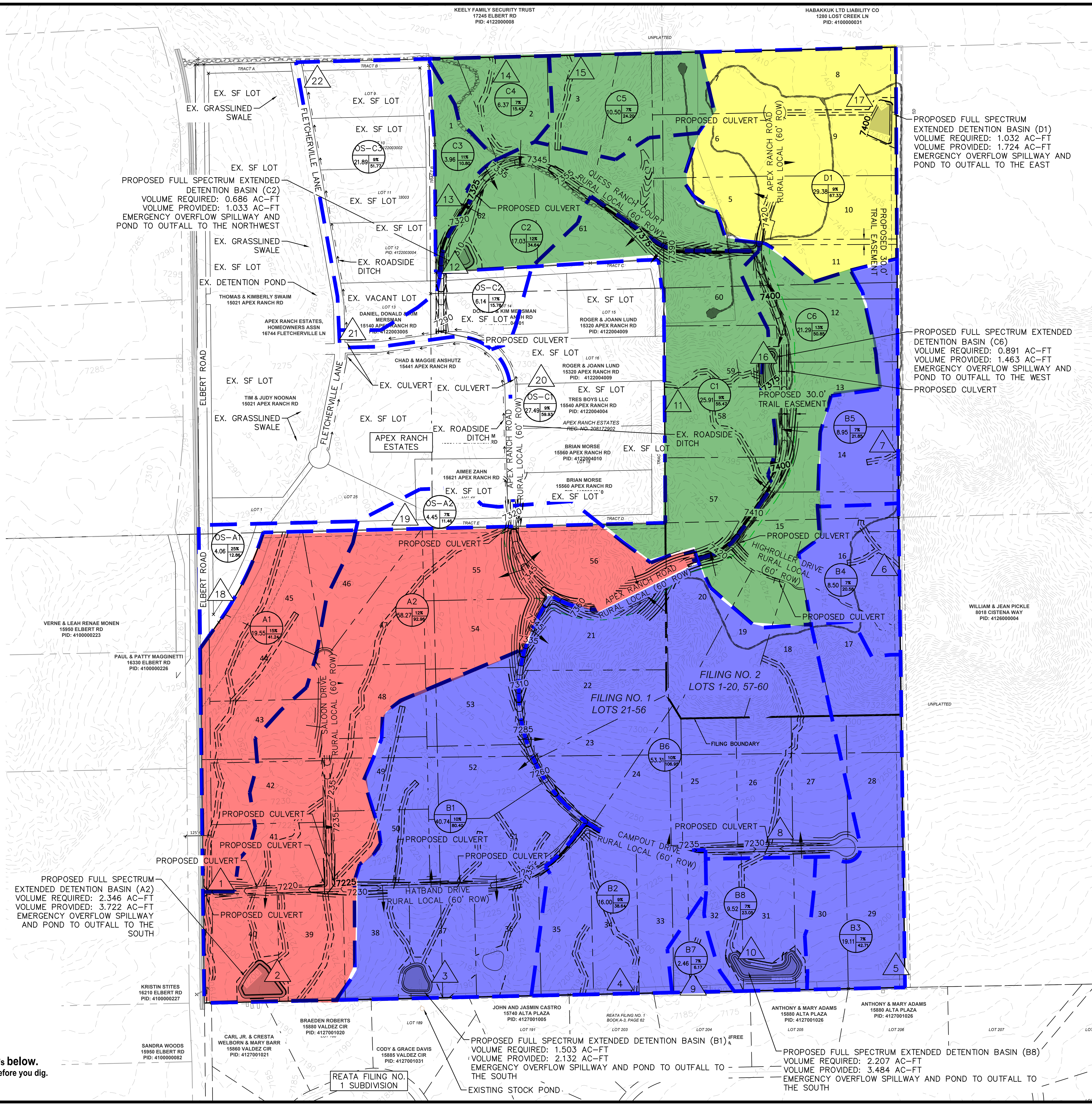
OVERLOOK FILING NO. 1
EL PASO COUNTY, COLORADO
PRELIMINARY DESIGN PLANS
PROPOSED DRAINAGE MAP

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO.
196239003

SHEET
EX-2

Drainage Basin Exhibit



LEGEND

- A = BASIN DESIGNATION
- B = AREA (ACRES)
- C = BASIN IMPERVIOUSNESS
- D = 100YR DESIGN STORM RUNOFF (CFS)
- # = DESIGN POINT
- PROPOSED FLOW DIRECTION
- PROPOSED PROPERTY LINE
- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- DRAINAGE BASIN BOUNDARY
- XXXX EXISTING MAJOR CONTOUR
- XXXX EXISTING MINOR CONTOUR
- XXXX PROPOSED MAJOR CONTOUR
- XXXX PROPOSED MINOR CONTOUR

EASEMENT NOTE

1. ALL PROPOSED EASEMENTS ARE 30' DRAINAGE EASEMENTS UNLESS OTHERWISE NOTED

- A - Upper Black Squirrel Drainage Basin (CHBS2000)
- B - La Vega Ranch Drainage Basin (CHBR0400)
- C - East Kiowa Creek Drainage Basin (KIKI0400)
- D - Bijou Creek Drainage Basin (BIBI0200)

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY						
DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS			% IMPERVIOUS
			Q2	Q5	Q100	
PDR Basins						
1	A1	19.55	5.41	10.41	41.24	15%
2	A2	58.27	9.71	20.99	92.96	12%
3	B1	40.74	6.97	16.77	80.40	10%
4	B2	16.00	3.10	7.82	38.64	9%
5	B3	19.11	2.61	7.83	42.71	7%
6	B4	8.50	1.25	3.77	20.58	7%
7	B5	8.95	1.33	4.01	21.85	7%
8	B6	53.31	9.52	22.55	106.95	10%
9	B7	2.46	0.38	1.13	6.17	7%
10	B8	9.52	1.41	4.22	23.05	7%
11	C1	25.91	4.42	11.18	55.47	9%
12	C2	17.03	3.87	8.08	34.64	12%
13	C3	3.96	1.04	2.36	10.80	11%
14	C4	6.37	0.94	2.83	15.42	7%
15	C5	10.50	1.48	4.44	24.20	7%
16	C6	21.29	6.09	12.27	50.85	13%
17	D1	29.38	5.34	13.56	67.33	9%
18	OS-A1	4.06	2.57	4.12	12.86	25%
19	OS-A2	4.45	0.70	2.10	11.46	7%
20	OS-C1	27.49	4.90	12.21	59.93	9%
21	OS-C2	6.15	2.35	4.26	15.78	17%
22	OS-C3	21.89	5.33	11.63	51.77	11%
ON-SITE BASIN TOTAL						
BASIN A TOTAL		77.82	15.12	31.40	134.20	12%
BASIN B TOTAL		158.59	26.57	68.09	340.34	8%
BASIN C TOTAL		85.06	17.84	41.15	191.38	10%
BASIN D TOTAL		29.38	4.90	12.21	59.93	9%
ON-SITE TOTAL		**350.85**	**49.75**	**122.80**	**599.06**	**10%**
OFF-SITE BASIN TOTAL						
OFF-SITE BASIN A		8.51	3.27	6.22	24.32	15%
OFF-SITE BASIN C		55.53	12.58	28.11	127.48	11%
OFF-SITE TOTAL		**64.04**	**15.85**	**34.33**	**151.80**	**12%**
SITE TOTAL		**414.89**	**65.60**	**157.13**	**750.86**	**10%**

NORTH

GRAPHIC SCALE IN FEET
0 150 300 600

NO. | REVISION | BY | DATE | APPR.

Kimley»Horn
2023 KIMLEY–HORN AND ASSOCIATES, INC.
2 N NEVADA ST, SUITE 900
COLORADO SPRINGS, CO 80903 719-453-0180

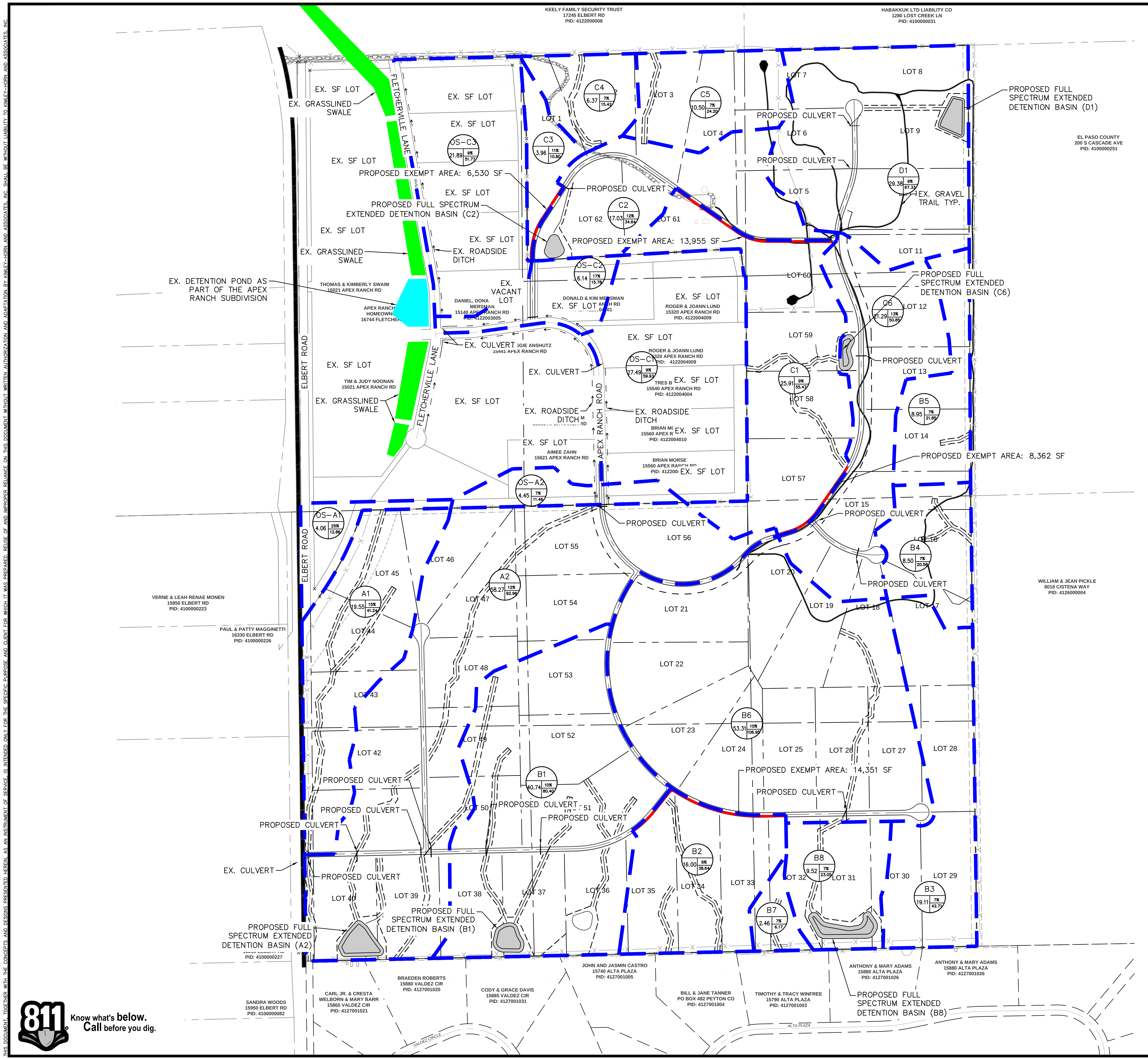
DESIGNED BY: KRK
DRAWN BY: AJL
CHECKED BY: KRK
DATE: 11/27/23

OVERLOOK FILING NO. 1
EL PASO COUNTY, COLORADO
PRELIMINARY DESIGN PLANS
PROPOSED DRAINAGE MAP

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO.
196239003

SHEET
EX-2



LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

PROPOSED PROPERTY LINE
EXISTING PROPERTY LINE
PROPOSED EASEMENT LINE
DRAINAGE BASIN BOUNDARY
EXISTING STORMWATER POND
EXISTING GRASSLINED DRAINAGE SWALE
PROPOSED EXEMPT AREA

EASEMENT NOTE

1. ALL PROPOSED EASEMENTS ARE 30' DRAINAGE EASEMENTS UNLESS OTHERWISE NOTED

EXEMPT AREAS (ECM I.7.1.C.1)

BASIN B2	= ±14,351 SF
BASIN C1	= ±22,316 SF
BASIN C3	= ±6,530 SF
TOTAL	= ±43,197 SF (0.99 ACRES)

Please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1. C.1 and exclusions listed in ECM App I.7.1.B.#). Show what areas drain to each proposed TSB and what are excluded.

Exhibit updated to show Pond tributary area as well as exclusions/exemptions

NORTH

GRAPHIC SCALE IN FEET
0 150 300 600

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OVERLOOK FILING NO. 1
EL PASO COUNTY, COLORADO
PRELIMINARY DESIGN PLANS
EXCLUSION EXHIBIT DRAINAGE MAP

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196239003

SHEET
EX-3