



Final Drainage Letter for Flying Horse Foundation

May, 2025

HR Green Project No: 2502010

Prepared For:

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Owner Representative: Drew Balsick

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SF256 & PPR 256

Engineer's Statement

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


 05/14/2025
Richie Lyon, PE Date
State of Colorado No. 53921
For and on behalf of HR Green Development, LLC



Developer's Statement

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

Flying Horse Development, LLC

 05/14/2025
Drew Balsick Date
Vice President
Flying Horse Development, LLC
2138 Flying Horse Club Drive
Colorado Springs, CO 80921

El Paso County

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

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

Date



Table of Contents

Engineer's Statement	1
Developer's Statement	1
El Paso County	1
Table of Contents	2
I. General Purpose, Location and Description.....	4
a. Purpose	4
b. Location	4
c. Description of Existing Conditions.....	4
d. Description of Proposed Conditions	5
e. Floodplain Statement	6
II. Drainage Basins and Subbasins	6
a. Major Basin Description	6
b. Existing Basin Description	6
c. Proposed Basin Description	7
III. Drainage Design Criteria	10
a. Development Criteria Reference	10
b. Hydrologic Criteria	10
c. Hydraulic Criteria	10
IV. Drainage Facility Design.....	10
a. General Concept	10
b. Major Drainageways.....	11
c. Inspection and Maintenance	11
d. Grading and Erosion Control Plan.....	11
e. Four Step Method to Minimize Adverse Impacts of Urbanization	11
f. Drainage and Bridge Fees	12
g. Hydraulic Grade Line Calculations	12
V. Summary	12
VI. Drawings.....	12
VII. References	12



Appendices

- A. Vicinity Map, FEMA Map, NRCS Soil Survey
- B. Hydrologic Analysis
- C. Hydraulic Analysis
- D. Water Quality & Detention
- E. Reference Material
- F. Drainage Maps

I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Letter for the Flying Horse Foundation is to describe the on-site and off-site drainage patterns, existing and proposed storm infrastructure, and to safely route developed stormwater to adequate drainageways. The Final Drainage Letter details the change in site layout and impervious areas which yield new peak stormwater runoff quantities to downstream existing drainageways and storm infrastructure. The design intent is to convey on-site stormwater via the existing natural tertiary drainageway that starts at the southeast end of the site and flows northeast through the adjacent Country View Estates subdivision. The existing drainage pattern and concept remain unchanged in this letter. However, based on the evaluation of existing and proposed runoff, it is recommended that channel lining be installed in the natural drainageway up to the culvert under the existing driveway on the north boundary of Country View Estates to minimize erosion and sediment transfer. Drainage design for amended areas and analysis of existing and proposed stormwater infrastructure and downstream development are provided to demonstrate compliance with County stormwater criteria and consistency with previously approved plans and reports.

b. Location

The existing parcel number 5100000291 (legally described as NE4SW4, W2NW4SE4 OF SEC 31-11-65, TOG WITH R/W OVER N 30 FT OF NE4NW4SE4, NE4SE4 SD SEC 31) totals 60.57 acres. The existing parcel is to be subdivided into two lots, described in the final plat. The development of the proposed charitable foundation special use property, a 20.18 acre area, is referred to as 'the site' herein and is designated as Lot 1 Flying Horse North Foundation. The remaining 40.39 acre area to the west of the site is designated as Lot 2 Flying Horse Foundation. The site is in the northeast quarter of the southwest quarter of Section 31, Township 11 South, Range 65 West of the 6th P.M., Colorado Springs, El Paso County, Colorado.

The site is bound to the east by the Country View Estates subdivision, and to the south by the Palmer Divide subdivision. The undeveloped land to the north, west, and southwest of the site are future planned Flying Horse North subdivision filings. A vicinity map is presented in Appendix A.

There are no public roadways internal to the site but there is an existing 50' width access easement that extends from Black Forest Road through the north boundary of Country View Estates to this property. This is the primary driveway access to the site. The property is not within a Streamside Zone or FEMA floodplain. There are no no-build or preservation easements or areas within the platted parcel nor are there are platted areas that prohibit development.

c. Description of Existing Conditions

The existing site (zoned RR-5) contains improvements such as a two-story single-family home, barns, sheds, stables and a gravel driveway. The existing vegetative cover is 90 percent as evidenced by a field survey and aerial imagery. The existing vegetation includes native grasses and weeds, shrubs, and pinyon pine trees. The development site generally slopes from west to east at an average of 6% grade. The northwest 20 percent of the site is sloped between 0.5% and 10% to three off-site basins containing undeveloped land and golf course, one to the northwest, one to the north, and one to the northeast, that are analyzed in this letter. Stormwater in the southeast 80 percent of site is conveyed to an existing natural tertiary drainageway which ultimately leads to an existing private 18 inch HDPE pipe that crosses under the existing gravel driveway.

The site consists of 100% Peyton-Pring complex per the USDA, NRCS web soil survey. This soil is categorized as Hydrologic Soil Group B. The NRCS soil survey is presented in Appendix A.

d. Description of Proposed Conditions

This Final Drainage Letter analyzes existing drainageways and existing and proposed infrastructure affected by the development of the proposed Flying Horse Foundation building and advises improvements to existing off-site storm infrastructure deemed inadequate by the analysis. The northwestern 20 percent of the site contains no areas of disturbance and stormwater draining through the existing basins will be unaffected by the development. Within the southeastern 80 percent of the site, stormwater overland sheet flows until reaching the existing tertiary drainageway where flow is channelized. Stormwater flows within this drainageway off-site to the northeast at an average slope of 6% to an existing private 18 inch HDPE culvert that crosses under the existing private gravel driveway that starts at Black Forest Road (Rec. No. 099035037).

The proposed site layout removes an existing 3,250 square foot two-story single family residential home and proposes a 52,000 square foot horse riding arena. A 12 foot wide gravel driveway starting at the southern end of Stableford Terrace within Tract F of Flying Horse North Filing No. 4 is to be the new primary entrance to the site. The proposed change from the existing conditions in site layout increases the site imperviousness by 4.9%. The increased imperviousness has a minimal effect on the calculated stormwater flow values which result in minimal increases in depth and velocity. However, the natural drainageway is recommended to be lined per county criteria based on calculations of the flows through the channel in the existing and proposed conditions. The existing 18 inch HPDE culvert passing under the secondary driveway originating from Black Forest Road was not planned to be large enough to handle flows from tributary areas of the Country View Estates subdivision and upstream tributary areas because the previously approved *Final Drainage Report for Country View Estates* (provided in Appendix E) does not provide a calculation to demonstrate this culvert's capacity for the minor and major storm events. Hydraulic analysis for this development, provided in Appendix C, shows the maximum flow through the existing culvert pipe before overtopping the gravel driveway is 18 cfs. Stormwater is anticipated to overtop the existing driveway in a major storm event. For this reason, this existing driveway access is no longer the primary access to the Site and is considered a secondary emergency access only as it has access to fire hydrants used for fire suppression in this area.

This letter proposes an area of disturbance to contain the footprint of the proposed riding arena and the associated daylight grading to the existing surface and construction control measures. There are on-site and off-site disturbances proposed for the installation of turf reinforced mat in the existing natural drainageway and for the proposed gravel driveway entry from Stableford Terrace. The existing electric meter and line connected to the existing single-family home is to be relocated/replaced as needed to connect to the proposed pole barn. The existing OWTS is to be abandoned, and a new system is to be constructed, as shown on the Site Development Plan. Other utilities are not expected to encumber construction.

It is demonstrated within this letter that the increase in stormwater peak runoff for the minor and major storm events is considered minimal. Improvements are prescribed for existing infrastructure that was assessed and deemed insufficient per county standards. The existing downstream tertiary drainageway was found to have scouring velocities in the existing condition, and lining of the channel is proposed with the development. Stormwater quality treatment and detention is provided for all disturbed areas by the existing off-site full spectrum detention Pond A of Flying Horse North Filing No. 4. The existing off-site PCM functions as intended and will continue to function as intended with the implementation of the modifications detailed in this report,

include an increase in the outlet structure height and modification to the orifice plate. The recommended improvements create a suitable outfall on-site that drains downstream to off-site developments and infrastructure that will experience no negative impacts due to development of this site.

e. Floodplain Statement

Based on FEMA Firm map 08041C0315G dated December 7, 2018, the site is Zone X, which are areas determined to be outside the 0.2% annual chance flood. No portion of the site is within a designated FEMA floodplain.

II. Drainage Basins and Subbasins

a. Major Basin Description

Flying Horse Foundation is located within the East Cherry Creek Basin. There is not a current planning study of the drainage basin, but generally it slopes from southwest to northeast. The basin eventually flows into the South Platte River.

The site drains to an existing tertiary drainage channel via overland sheet flow where it is then channelized and routed to a driveway side swale which then ultimately flows under the private driveway for 14820 Black Forest Road into an undeveloped basin.

b. Existing Basin Description

The existing basins are delineated using the existing drainage patterns. Undeveloped land, golf course, and 5-acre residential lots comprise the existing basins. The total on-site area has a composite imperviousness of 4.98% and the total off-site area have a composite imperviousness of 3.08%.

The following basins have been assigned.

Existing Basin A has a tributary area of **70.16 acres with a minor (5-year event) runoff of 24.26 cfs and major (100-year event) runoff of 123.47 cfs.**

The on-site portion of the basin contains improvements such as barns, stables, a single-family residential home, and a gravel driveway. The basin contains the area in the southeast 80 percent of the site. The existing on-site vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Stormwater runoff overland sheet flows over rooftops of buildings and the surrounding landscape and is channelized within the existing tertiary drainageway.

The off-site portion of the basin is located to the southwest, south, and east of the property and contains parts of Country View Estates and Palmer Ridge subdivisions. The off-site basin area contains 5-acre residential lots and undeveloped area. The existing off-site vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Stormwater runoff overland sheet flows over rooftops of buildings and the surrounding landscape and is conveyed to the existing tertiary drainageway where it is channelized.

The basin ultimately flows from the southwest to the northeast through the drainageway and drains to **Design Point 1**, a private 18 inch HDPE culvert pipe.

Existing Basin B has a tributary area of **56.85 acres with a minor (5-year event) runoff of 20.21 cfs and major (100-year event) runoff of 96.95 cfs.** The off-site portion of the basin is located to the northeast of

the site and consists of 5-acre single family residential lots. The on-site portion of the basin includes part of the gravel driveway and undeveloped land. The existing vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Basin B accepts stormwater from Basin A via **Design Point 1**. Stormwater within Basin B is routed through roadside channels and drainage swales which ultimately flow to **Design Point 2**, Pond A within Flying Horse North Filing No. 4.

Existing Basin C has a tributary area of **57.17 acres with a minor (5-year event) runoff of 12.84 cfs and major (100-year event) runoff of 94.15 cfs**. The off-site portion of the basin is located to the north of the site and consists of undeveloped land. The on-site portion of the basin is on the north end of the site. The basin is fully comprised of undeveloped land. The existing vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Stormwater within Basin C overland flows over the natural terrain into an existing tertiary drainage channel which ultimately flows under Old Stagecoach Road via a public 48 inch RCP culvert pipe (**Design Point 3**).

Existing Basin D has a tributary area of **78.81 acres with a minor (5-year event) runoff of 21.35 cfs and major (100-year event) runoff of 153.46 cfs**. The off-site portion of the basin is located to the northwest of the site and consists of undeveloped land and golf course. The on-site portion of the basin improvements such as a barn and stables and is categorized as 5-acre residential. The existing vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Stormwater within Basin D overland sheet flows over building roofs and golf course area and is collected in a natural existing tertiary drainage channel which flows to northwest through the adjacent golf course and ultimately is conveyed to **Design Point 4**, detention pond in the northwest of the basin.

Drainage maps detailing the existing basins are included in Appendix F.

c. Proposed Basin Description

The proposed basins remain unchanged in imperviousness from the existing basins with the exception of Basin A. The proposed Basin A has increased roof area compared to the existing Basin A due to the addition of a new pole barn. The total on-site area has a composite imperviousness of 9.86% and the total off-site area has a composite imperviousness of 3.08%.

The following basins are delineated per the site layout.

Proposed Basin A has a tributary area of **70.16 acres with a minor (5-year event) runoff of 26.19 cfs and major (100-year event) runoff of 125.83 cfs**.

The on-site portion of the basin contains existing improvements such as barns, stables, a single-family residential home, and a gravel driveway. The basin contains the area in the southeast 80 percent of the site. The existing on-site vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Stormwater runoff overland sheet flows over rooftops of existing buildings and the surrounding landscape and is channelized within the existing tertiary drainageway. A 3,250 square foot two-story single family residential home is to be demolished and a 52,000 square foot pole barn riding arena is to be built, resulting in an increase in 48,750 square feet in roof area within the basin. This increases the imperviousness of Basin A from 6.31% in the existing condition to 7.72% in the proposed condition. Drainage from the roof of the pole barn is routed through a swale to the west and south of the proposed building and flows to the southeast into the tertiary drainageway.

The off-site portion of the basin is located to the southwest, south, and east of the property and is to remain unchanged from the existing condition. The off-site basin area contains 5-acre residential lots and undeveloped area. The existing off-site vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Stormwater runoff overland sheet flows over rooftops of buildings and the surrounding landscape and is conveyed to the existing tertiary drainageway where it is channelized.

The basin ultimately flows to the northeast through the drainageway and drains to **Design Point 1**, an existing private 18 inch HDPE culvert pipe.

Proposed Basin B has a tributary area of **56.85 acres with a minor (5-year event) runoff of 20.21 cfs and major (100-year event) runoff of 96.95 cfs**. The off-site portion of the basin is located to the northeast of the site and consists of 5-acre single family residential lots. The on-site portion of the basin includes part of the gravel driveway and undeveloped land. The existing vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent. Basin B accepts stormwater from Basin A via **Design Point 1**. Downstream of **Design Point 1**, stormwater is conveyed via a 60 inch RCP culvert under Rubble Drive. The hydraulic capacity of this culvert, documented in the Flying Horse North Filing No. 4 Final Drainage Report as Culvert 2 (DPA4), is provided within Appendix C of this report and is sufficient for the increased flow to the culvert. Stormwater within Basin B is routed through culverts, roadside channels and drainage swales which ultimately flow to **Design Point 2**, Pond A within Flying Horse North Filing No. 4. An updated UD-Detention spreadsheet and modified outlet structure details are provided in Appendix D. These modifications ensure the Flying Horse North Filing No. 4 Full Spectrum Detention Pond A has capacity to accept and treat the increased flows due to this development.

Proposed Basin C has a tributary area of **57.17 acres with a minor (5-year event) runoff of 12.84 cfs and major (100-year event) runoff of 94.15 cfs**. The off-site portion of the basin is located to the north of the site and consists of undeveloped land. The on-site portion of the basin is on the north end of the site. The basin is fully comprised of undeveloped land. The existing vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent and is to be unchanged. Stormwater within Basin C overland flows over the existing topography into a natural existing tertiary drainage channel which ultimately flows under Old Stagecoach Road via a public 48 inch RCP culvert pipe (**Design Point 3**).

Proposed Basin D has a tributary area of **78.81 acres with a minor (5-year event) runoff of 21.35 cfs and major (100-year event) runoff of 153.46 cfs**. The off-site portion of the basin is located to the northwest of the site and consists of undeveloped land and golf course. The on-site portion of the basin improvements such as a barn and stables and is categorized as 5-acre residential. The existing vegetation coverage includes native grasses and weeds, shrubs, and sparse pinyon pine at 90 percent and is to be unchanged. Stormwater within Basin D overland flows over existing topography and is collected in a natural existing tertiary drainage channel which flows to northwest through the adjacent golf course and ultimately is conveyed to an **Design Point 4**, a detention pond in the northwest of the basin.

Two summary tables are provided below showing the increase in 5-year storm and 100-year storm event runoff to each design point.

Cumulative Design Point Summary Table - 5 Yr Storm							
Design Point	Contributing Basins	Tributary Area (ac.)	Ex. Composite % Imperviousness	Pr. Composite % Imperviousness	Ex. ΣQ_5 (cfs)	Pr. ΣQ_5 (cfs)	% Increase Q_5 (cfs)
1	A	70.16	6.31%	7.72%	24.26	26.19	7.92%
2	A, B	127.01	7.00%	7.00%	44.45	46.37	4.32%
3	C	58.17	2.01%	2.01%	12.84	12.84	0.00%
4	D	78.81	2.18%	2.18%	21.35	21.35	0.00%

Cumulative Design Point Summary Table - 100 Yr Storm							
Design Point	Contributing Basins	Tributary Area (ac.)	Ex. Composite % Imperviousness	Pr. Composite % Imperviousness	Ex. ΣQ_{100} (cfs)	Pr. ΣQ_{100} (cfs)	% Increase Q_{100} (cfs)
1	A	70.16	6.31%	7.72%	123.47	125.83	1.91%
2	A, B	127.01	7.00%	7.00%	220.29	222.65	1.07%
3	C	58.17	2.01%	2.01%	94.15	94.15	0.00%
4	D	78.81	2.18%	2.18%	153.46	153.46	0.00%

The summary table below compares the 100-year water depths and velocities at various sections along the existing tertiary drainageways in the existing condition and proposed condition.

Tertiary Drainage Channel 100-Yr Depth & Velocity Comparison						
Section	Ex. 100-Yr Depth (ft)	Pr. 100-Yr Depth (ft)	% Increase in Depth	Ex. 100-Yr Velocity (ft/s)	Pr. 100-Yr Velocity (ft/s)	% Increase in Velocity
A1	0.45	0.46	2.22%	3.30	3.31	0.30%
A2	0.95	0.96	1.05%	6.39	6.55	2.50%
A3	0.86	0.87	1.16%	5.29	5.42	2.46%
A4	0.72	0.73	1.39%	4.19	4.25	1.43%
A5	1.85	1.87	1.08%	4.84	4.86	0.41%

The existing runoff velocities through the channel highlighted the need to assess the requirement for channel lining within Basin A in the proposed conditions. Sections A1 through A4 were determined to need P300 channel lining. See Appendix C for calculations and Appendix E for product information.

Hydraulic analysis shows that the increase to the peak runoff events of on-site and off-site basins as a result of the proposed development are considered minor. The assessment shows that while this development does not significantly impact downstream swales or infrastructure, modification of downstream infrastructure is needed to meet county standards. The natural tertiary drainageway has capacity but was determined to need lining to meet county standards in the existing condition and is to be improved with this project. The existing private 18 inch HDPE culvert pipe under the existing gravel driveway to the site within the Country View Estates subdivision was determined to be undersized and may overtop in minor and major storm events. No stormwater

detention is proposed for this site as detention is to be provided by the Flying Horse North Filing No. 4 Pond A. The outlet structure height and orifice plate of the pond are modified in order to maintain acceptable release rates. The modifications to the Pond A outlet structure and orifice plate are detailed in Appendix D. This FDL has demonstrated the natural existing drainageway through Country View Estates is a suitable outfall for this development following the prescribed improvements.

Drainage maps detailing the proposed basins are included in Appendix F.

III. Drainage Design Criteria

a. Development Criteria Reference

The drainage analysis of existing and proposed storm sewer system follows the criteria from the *El Paso County Drainage Criteria Manual Volumes 1 and 2* (EPC DCM, latest revision October 2018).

b. Hydrologic Criteria

Hydrologic data was obtained from the *El Paso County, Colorado Drainage Criteria Manual – Chapter 5 Storm Runoff Methods of Analysis*. Off-site drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from NOAA Atlas 14 below. Runoff was calculated per *El Paso County, Colorado Drainage Criteria Manual – Section 5.2 - Rational Method*.

Rainfall Depths for Site Location		
Return Period (yr)	5	100
1-hr Rainfall Depth (in)	1.50	2.52

c. Hydraulic Criteria

Hydraulic criteria for culvert sizing were obtained from the *El Paso County, Colorado Drainage Criteria Manual – Chapter 9 Culvert Design*. Hydraulic criteria for swale sizing was obtained from the *El Paso County, Colorado Drainage Criteria Manual – Chapter 10 Open Channels and Structures*.

Existing tertiary drainage channel capacities are analyzed utilizing hydraulic modeling (AutoCAD Civil 3D Hydraflow Express channel analysis tool) by designing user-defined channels at various points along the channel with the proper Manning's coefficient, geometry of designed sections, and slopes. These user-defined capacity calculations are provided to determine the minor 5-year storm and major 100-year storm capacities in various areas of the existing channel to ensure that they have freeboard in a storm event.

Existing and proposed culvert capacities are analyzed utilizing hydraulic modeling (AutoCAD Civil 3D Hydraflow Express culvert analysis tool) by defining pipe and embankment geometry and elevations, pipe roughness, and flows through the culverts. These culvert capacity calculations are provided to ensure that the headwater surface elevations have freeboard in the minor 5-year storm and major 100-year storm events and the water surface does not overtop the embankments.

IV. Drainage Facility Design

a. General Concept

Overland runoff areas include roof runoff from on-site buildings as well as initial overland sheet flow within undeveloped areas before reaching drainage channels or swales. On-site stormwater is conveyed as

channelized runoff within the existing drainage swale starting at the southeast of the site running to the northwest. Stormwater passes under the existing gravel driveway on the northern boundary of Country View Estates via **Design Point 1**, an existing 18 inch HDPE culvert pipe, into the grass lined channel section A-A within Flying Horse North Filing No. 4.

b. Major Drainageways

There are no formal major drainageways within the project boundary. The development is located within the East Cherry Creek Basin. There is not a current planning study of the drainage basin, but generally it slopes from southwest to northeast. The basin eventually flows into the South Platte River. The stormwater runoff from Basin A and outfalls through an existing 18 inch HDPE culvert under the existing gravel driveway into the Basin B. The combined area of Basin A and Basin B are captured by the full spectrum detention pond, Pond A, within Flying Horse North Filing No. 4. There are no anticipated negative impacts to surrounding and downstream developments, stormwater infrastructure, or drainageways.

c. Inspection and Maintenance

Inspection and maintenance to be provided by property owner to ensure private storm culverts operate as designed.

d. Grading and Erosion Control Plan

Due to the project disturbance area, a separate Grading and Erosion Control plan will be required. The Grading and Erosion Control Plan will be submitted for review and approval with subsequent submittals of this FDL.

e. Four Step Method to Minimize Adverse Impacts of Urbanization

In accordance with the *El Paso County, Colorado Drainage Criteria Manual – Chapter 7 Runoff Reduction Methods*, the site has implemented the four-step process to minimize adverse impacts of urbanization.

Step 1 – Reducing Runoff Volumes: The project site and surrounding areas are categorized as large lot (greater than 5 acre) single family residential, golf course, and undeveloped prairie which have low imperviousness and runoff coefficients. The developed areas are disbursed with open land areas of vegetation between which provide runoff reduction into the pervious soil.

Step 2 – Treat and slowly release the WQCV: Water quality treatment is provided by the existing off-site Flying Horse North Filing No. 4 Pond A. The existing off-site full spectrum detention pond captures all of the disturbed site area and slowly releases the WQCV of the disturbed site area. Runoff from pervious areas of the site is treated via infiltration through the pervious surrounding soil and removal of pollutants via phytoremediation before reaching the existing off-site detention pond. A map is provided in Appendix F showing the disturbed areas tributary to the existing off-site Flying Horse North Filing No. 4 Pond A and a table with a summary of the water quality treatment.

Step 3 – Stabilize stream channels: The existing tertiary drainageways are assessed for stormwater runoff capacity, velocity, and shear stress. The assessment determined turf reinforced mat lining to be necessary per county standards to stabilize stream channels. Proposed disturbance areas and drainage swales are stabilized with permanent seeding and erosion control blanket as needed.

Step 4 – Consider the need for source controls: No industrial uses are proposed within this development and therefore no industrial source controls are proposed. The developed area is not anticipated to have uses

that would require commercial source controls such as a grease trap/interceptor at this time. Should the uses of that building change, the appropriate source controls will be implemented to meet code requirements.

f. Drainage and Bridge Fees

As of the February 2025, the East Cherry Creek Basin does not have any drainage, bridge, or pond fees and therefore no drainage basin fees are due.

g. Hydraulic Grade Line Calculations

Hydraulic Grade Line analysis for the existing 18 inch HDPE storm culvert under the existing driveway and the existing 60 inch RCP storm culvert under Rubble Drive in Flying Horse North Filing No. 4 are presented in Appendix C.

V. Summary

The Flying Horse Foundation development remains consistent with pre-development drainage conditions with the implementation of the recommended drainage improvements. This FDL presents the layout changes to the site and the resultant drainage changes with design solutions for these revisions. The existing tertiary drainageway was determined to need channel lining to minimize erosion and sediment transfer. The undersized culvert at the north of the adjacent Country View Estates subdivision is likely to cause stormwater to overtop the existing driveway. The proposed development will not adversely affect downstream stormwater infrastructure or surrounding developments and meets the latest El Paso County drainage criteria.

VI. Drawings

Please refer to the appendices for vicinity and drainage basin maps.

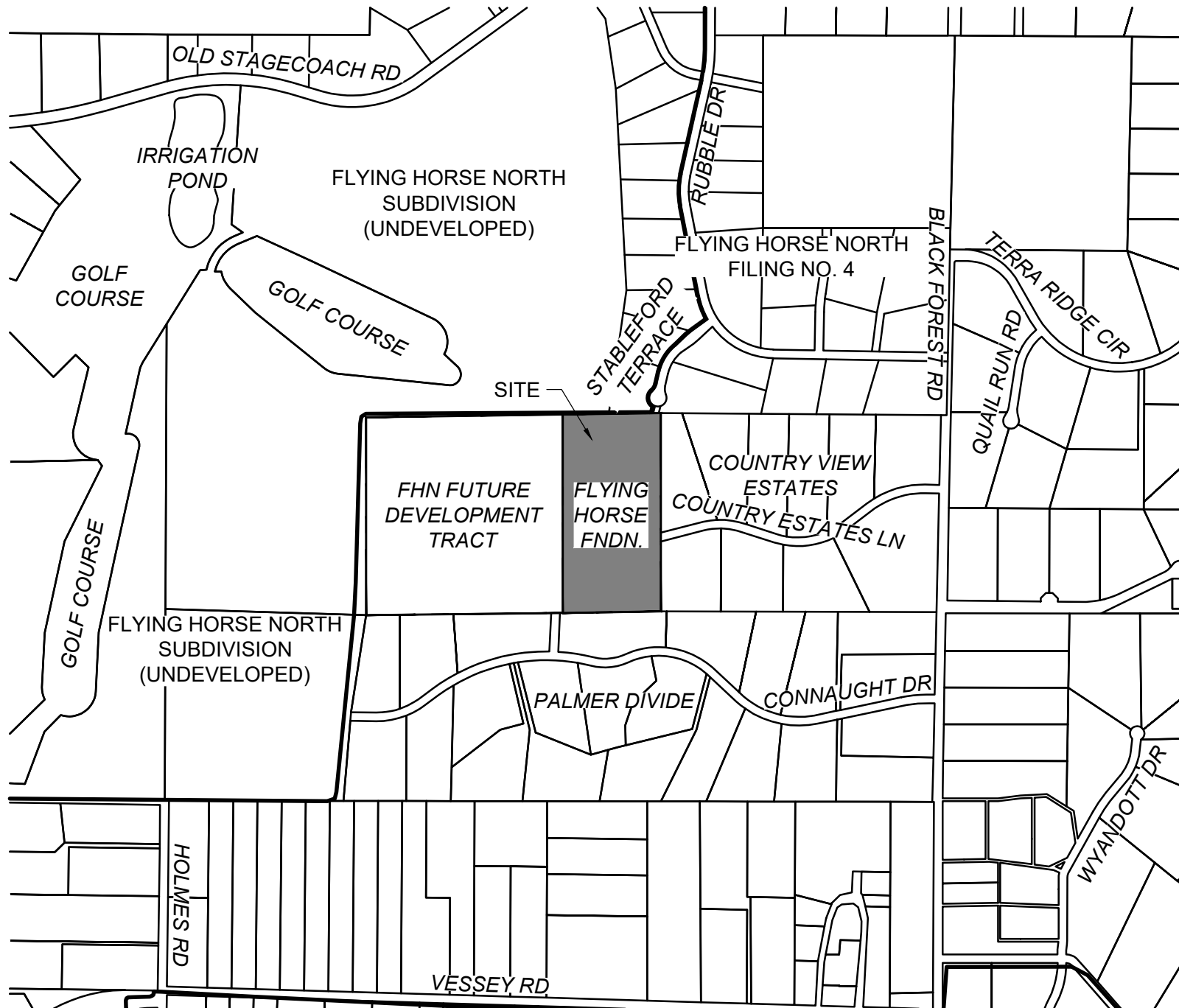
VII. References

1. El Paso County – Drainage Criteria Manual Volume 1, Revised October 2018.
2. El Paso County – Drainage Criteria Manual Volume 2, Revised October 2018.
3. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.
4. “Final Drainage Report for Country View Estates”, approved December 1998 and prepared by Associated Design Professionals, Inc.
5. “Preliminary Plan Country View Estates” prepared by Associated Design Professionals, Inc.



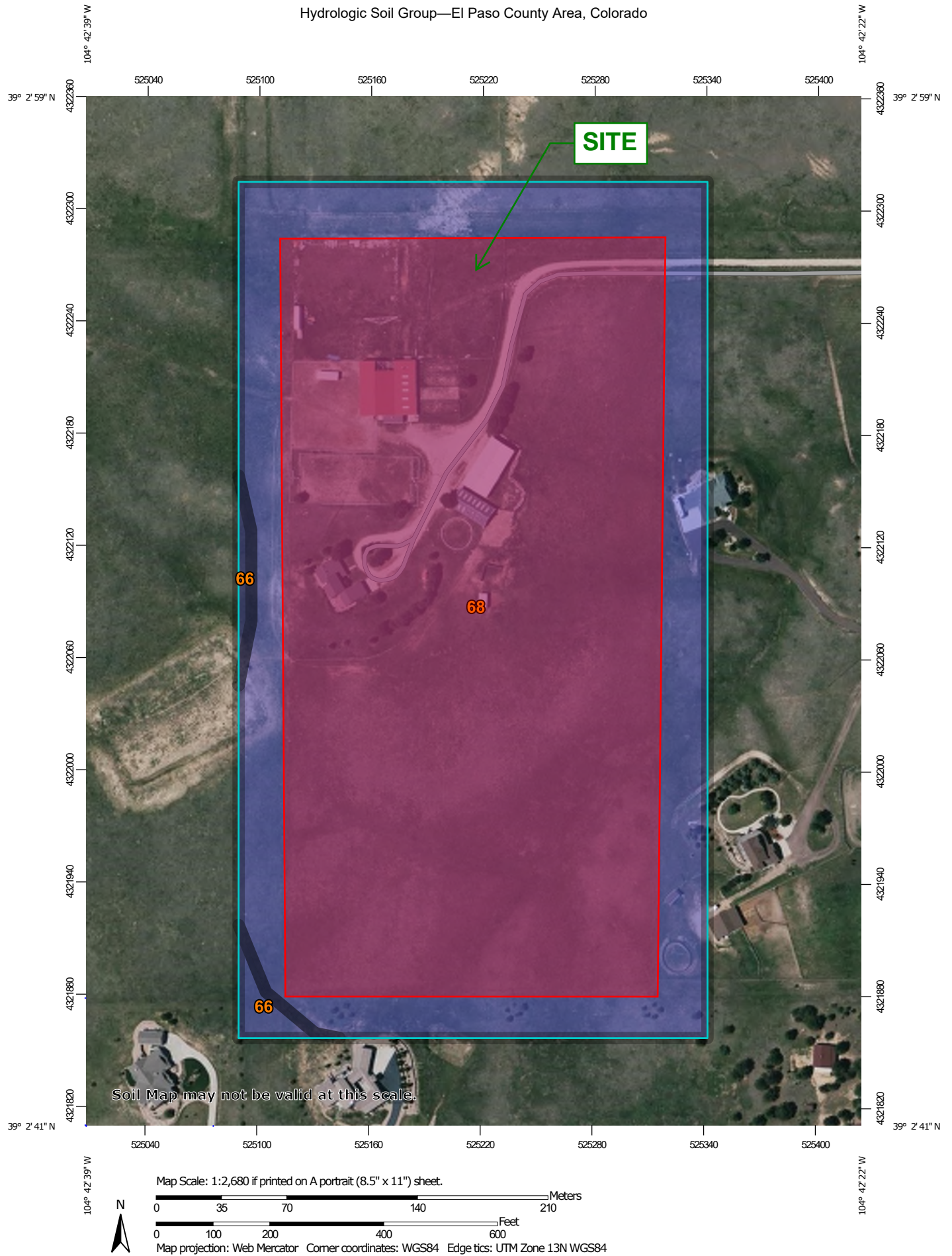
APPENDIX A – VICINITY MAP, SOIL MAP, FEMA MAP

VICINITY MAP
FLYING HORSE FOUNDATION



N.T.S.









Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND**Area of Interest (AOI)**
 Area of Interest (AOI)
Soils**Soil Rating Polygons**





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


Soil Rating Lines






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


Soil Rating Points

-  A
-  A/D
-  B
-  B/D

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

Water Features
 Streams and Canals
Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background
 Aerial Photography
MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: 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
66	Peyton sandy loam, 1 to 5 percent slopes	B	0.4	1.3%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	28.2	98.7%
Totals for Area of Interest			28.6	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



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:LWKR XW %DVH)ORRG (O
=RQH \$ 9 \$
:LWK %)(R URQH SWK2 \$+ 9
5HJXODWRU\)ORRGZD\

\$QQXDO &KDQFH)ORRG
RI DQQXDO FKDQFH IOI
GHSWK OHVV WKDQ RQH
DUHDV RI OHVV WKDQ RQH

)XWXUH &RQLWLRQV
&KDQFH)ORRG +DJDUG
\$UHD ZLWK 5HGXFHG)ORRG
/HYHH 6HHH RWHV
\$UHD ZLWK)ORRG 5LVN

12 6&5((\$UHD RI 0LQLPDO)ORRG
(IHFWLYH /205V
27+(5 \$5 (\$6 \$UHD RI 8QGHWHUPLQHG
*(1(\$ /--- &KDQQHO &XOYHUW RU
6758&785(16111 /HYHH 'LNH RU)ORRGZD

&URVV 6HFWLRQV ZLWK
:DWHU 6XUIDFH (OHYDWL
--- &RDVDO 7UDQVHF
%DVH)ORRG (OHYDWLRQ
/LPLW RI 6WXG\
-XULVGLFWLRQ %RXQGDU
--- &RDVDO 7UDQVHF %DVH
27+(5 3URLOH %DVHOLQH
((\$785(6 +\GURJUDSKLF)HDWXUH

'LJLWDO 'DWD \$YDLODEO
1R 'LJLWDO 'DWD \$YDLODEO
0\$3 3\$1(/6 8QPDSHG

7KH SLQ GLVSOD\HG RQ WKH
SRLQW VHOHFWHG E\ WKH XV
DQ DXWKRULWDWLYH SURSHU

7KLV PDS FRPSOLHV ZLWK)(0\$ V VWDQ
GLJLWDO IORRG PDSV LI LW LV QRW YR
7KH EDVHPDS VKRZQ FRPSOLHV ZLWK)(DFFXUDF\ VWDQGDUGV

7KH IORRG KDJDUG LQIRUPDWLRQ LV GH
DXWKRULWDWLYH 1)+/ ZHE VHUFLFHV S
ZDV H[SRUWHG RQ W DQG GRHV QRW
UHIOHFV FKDQJHV RU DPHQGPHQWV VX
WLPH 7KH 1)+/ DQG HIIHFWLYH LQIRUP
EHFRPH VXSHUVHG HG E\ QHZ GDWD RYH

7KLV PDS LPDJH LV YRLG LI WKH RQH R
HOHPHQWV GR QRW DSSHDU EDVHPDS
OHJHQG VFDOH EDU PDS FUDHWLRQ G
,50 SDQHO QXPEHU DQG),50 HIIHFWLY
XQPDSSHG DQG XQPRGHUQLJHG DUHDV
UHJXODWRU\ SXUSRVHV



APPENDIX B – HYDROLOGIC CALCULATIONS



FLYING HORSE FOUNDATION
EXISTING CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	CMD
Checked by:	RDL
Date:	5/13/2025

SUMMARY RUNOFF TABLE						
BASIN	AREA (ac)	% IMP.	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
A	70.16	6.31	0.13	0.38	24.26	123.47
B	56.85	7.00	0.14	0.39	20.21	96.95
C	58.17	2.01	0.08	0.35	12.84	94.15
D	78.81	2.18	0.08	0.35	21.35	153.46
ONSITE TOTAL	20.18	5.0%	0.11	0.37	6.98	35.51
OFFSITE TOTAL	243.81	4.2%	0.11	0.37	71.69	432.52
GRAND TOTAL	263.99	4.3%	0.11	0.37	78.67	468.03

CUMULATIVE DESIGN POINT SUMMARY TABLE					
DESIGN POINT	CONTRIBUTING BASINS	ΣQ ₅ (cfs)	ΣQ ₁₀₀ (cfs)	Tributary Area (ac.)	Weighted % Impervious
1	A	24.26	123.47	70.16	4.43
2	A, B	44.45	220.29	127.01	4.23
3	C	12.84	94.15	58.17	1.17
4	D	21.35	153.46	78.81	1.72



FLYING HORSE FOUNDATION
EXISTING CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	CMD
Checked by:	RDL
Date:	5/13/2025

COMPOSITE 'C' FACTORS																					
BASIN	GRAVEL DRIVEWAY	ROOF	RESIDENTIAL (5.0 AC LOT)	GOLF COURSE / UNDEVELOPED	TOTAL	SOIL TYPE	GRAVEL DRIVEWAY			ROOF			RESIDENTIAL (5.0 AC LOT)			GOLF COURSE / UNDEVELOPED			COMPOSITE IMPERVIOUSNESS & C		
	ACRES						%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀	%I	C ₅ [*]	C ₁₀₀ [*]	%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀
A	0.23	0.25	52.60	17.09	70.16	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	6.31	0.13	0.38
B	0.00	0.00	56.85	0.00	56.85	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	7.00	0.14	0.39
C	0.00	0.00	0.13	58.04	58.17	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	2.01	0.08	0.35
D	0.00	0.00	2.89	75.92	78.81	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	2.18	0.08	0.35
TOTAL ONSITE	0.23	0.25	4.13	15.57	20.18														4.98%	0.11	0.37
TOTAL OFFSITE	0.00	0.00	108.34	135.48	243.81														4.22%	0.11	0.37
GRAND TOTAL	0.23	0.25	112.47	151.05	263.99														4.28%	0.11	0.37

NOTES: *Runoff coefficient determined by composite coefficient calculation utilizing lawn and impervious pavement coefficients at a 93% and 7% ratio.



FLYING HORSE FOUNDATION
EXISTING CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	CMD
Checked by:	RDL
Date:	5/13/2025

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_t)			TRAVEL TIME (T_t)					TOTAL	$tc=(L/180)+10$	Design tc
DESIGNATION	C_s	AREA (ac)	LENGTH (ft)	SLOPE %	t_t (min)	C_v	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc_{max}	$tc_{design} (min)$
A	0.13	70.16	300	2.08	24.2	10	2490	3.04	1.7	23.8	48.0	25.5	25.5
B	0.14	56.85	300	5.70	17.1	10	2930	3.61	1.9	25.7	42.8	27.9	27.9
C	0.08	58.17	300	4.50	19.6	10	2400	2.60	1.6	24.8	44.4	25.0	25.0
D	0.08	78.81	300	1.30	29.6	10	1030	6.70	2.6	6.6	36.2	17.4	17.4

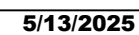


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5/13/2025



FLYING HORSE FOUNDATION
PROPOSED CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	CMD
Checked by:	RDL
Date:	5/13/2025

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMP.	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
A	70.16	7.72	0.14	0.39	26.19	125.83
B	56.85	7.00	0.14	0.39	20.21	96.95
C	58.17	2.01	0.08	0.35	12.84	94.15
D	78.81	2.18	0.08	0.35	21.35	153.46
ONSITE TOTAL	20.18	9.9%	0.14	0.39	7.53	36.19
OFFSITE TOTAL	243.81	4.2%	0.11	0.37	73.06	434.20
GRAND TOTAL	263.99	4.7%	0.11	0.37	80.59	470.39

CUMULATIVE DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ ₅ (cfs)	ΣQ ₁₀₀ (cfs)	Tributary Area (ac.)	Weighted % Impervious
1	A	26.19	125.83	70.16	5.41
2	A, B	46.37	222.65	127.01	4.77
3	C	12.84	94.15	58.17	1.17
4	D	21.35	153.46	78.81	1.72



FLYING HORSE FOUNDATION
PROPOSED CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	CMD
Checked by:	RDL
Date:	5/13/2025

COMPOSITE 'C' FACTORS																					
BASIN	GRAVEL DRIVEWAY	ROOF	RESIDENTIAL (5.0 AC LOT)	GOLF COURSE / UNDEVELOPED	TOTAL	SOIL TYPE	GRAVEL DRIVEWAY			ROOF			RESIDENTIAL (5.0 AC LOT)			GOLF COURSE / UNDEVELOPED			COMPOSITE IMPERVIOUSNESS & C		
	ACRES						%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀	%I	C ₅ [*]	C ₁₀₀ [*]	%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀
A	0.23	1.37	52.60	15.97	70.16	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	7.72	0.14	0.39
B	0.00	0.00	56.85	0.00	56.85	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	7.00	0.14	0.39
C	0.00	0.00	0.13	58.04	58.17	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	2.01	0.08	0.35
D	0.00	0.00	2.89	75.92	78.81	B	80	0.59	0.70	90.00	0.71	0.81	7	0.14	0.39	2	0.08	0.35	2.18	0.08	0.35
TOTAL ONSITE	0.23	1.37	4.13	14.45	20.18														9.86%	0.14	0.39
TOTAL OFFSITE	0.00	0.00	108.34	135.48	243.81														4.22%	0.11	0.37
GRAND TOTAL	0.23	1.37	112.47	149.93	263.99														4.65%	0.11	0.37

NOTES: *Runoff coefficient determined by composite coefficient calculation utilizing lawn and impervious pavement coefficients at a 93% and 7% ratio.



FLYING HORSE FOUNDATION
PROPOSED CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	CMD
Checked by:	RDL
Date:	5/13/2025

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_t)			TRAVEL TIME (T_t)					TOTAL	$tc=(L/180)+10$	Design tc
DESIGNATION	C_s	AREA (ac)	LENGTH (ft)	SLOPE %	t_t (min)	C_v	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc_{max}	$tc_{design} (min)$
A	0.14	70.16	300	2.08	24.0	10	2490	3.04	1.7	23.8	47.8	25.5	25.5
B	0.14	56.85	300	5.70	17.1	10	2930	3.61	1.9	25.7	42.8	27.9	27.9
C	0.08	58.17	300	4.50	19.6	10	2400	2.60	1.6	24.8	44.4	25.0	25.0
D	0.08	78.81	300	1.30	29.6	10	1030	6.70	2.6	6.6	36.2	17.4	17.4



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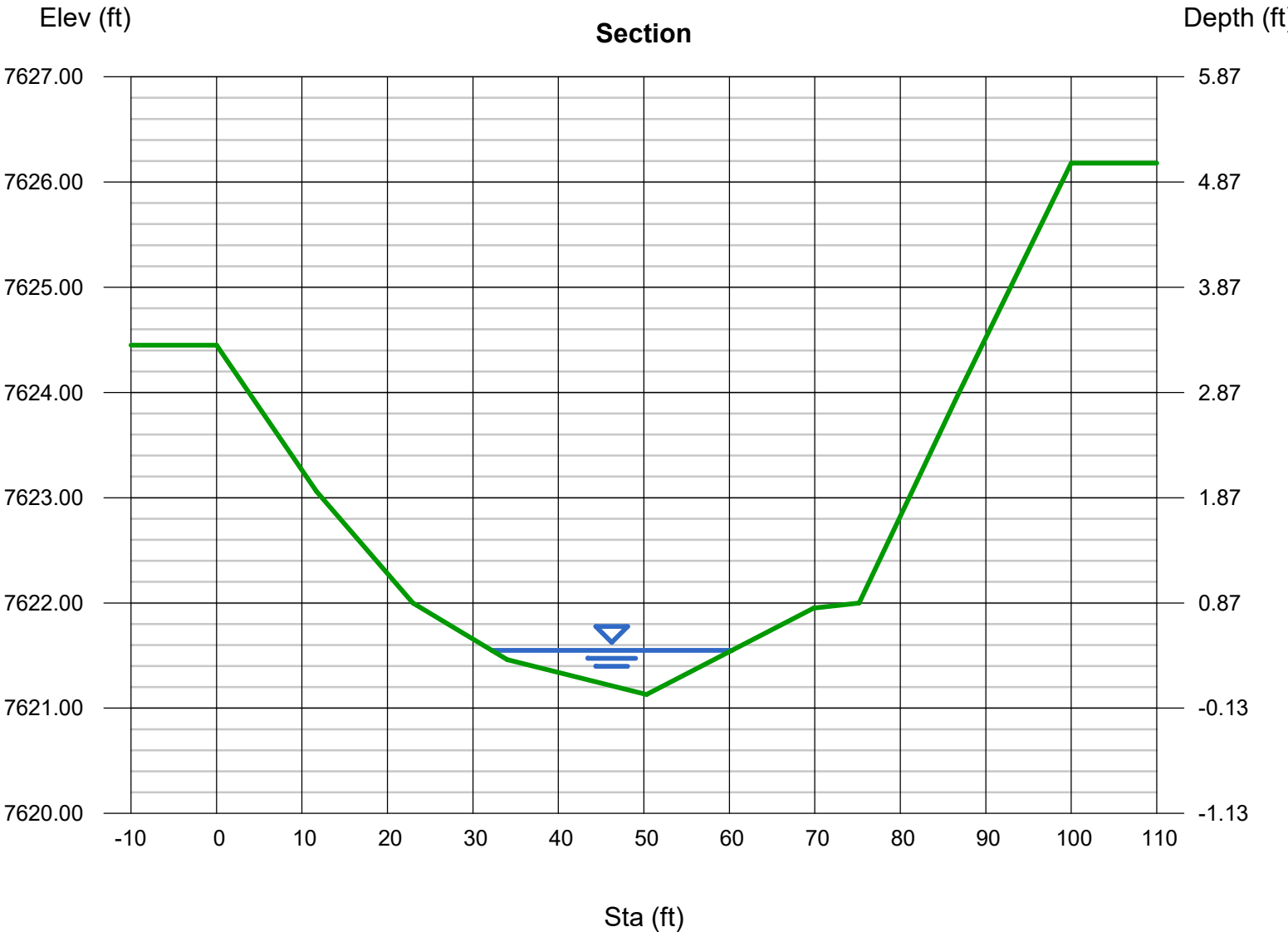


APPENDIX C – HYDRAULIC CALCULATIONS

Channel Report

Channel Section A1 - Existing 100-Yr WSEL

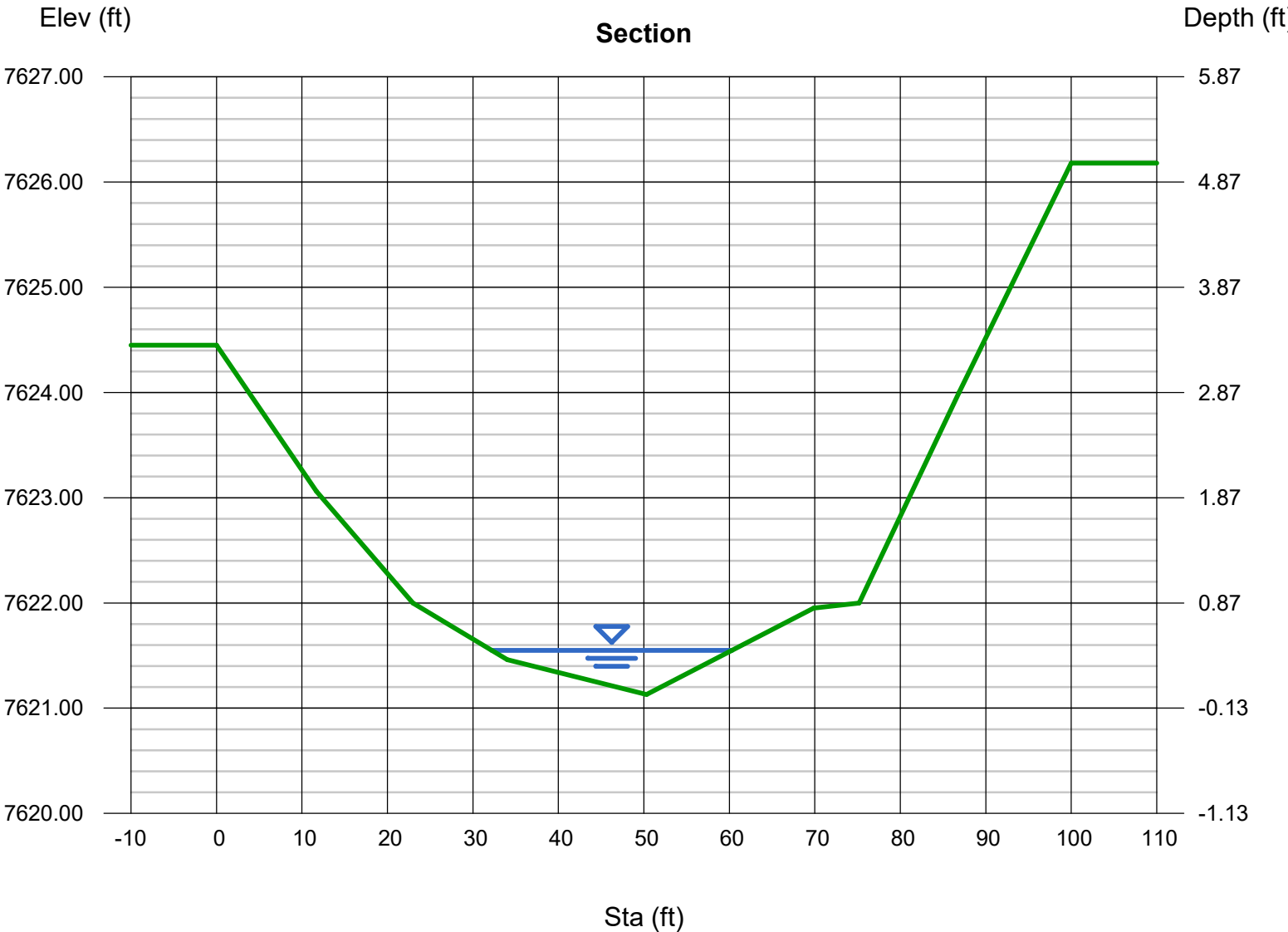
User-defined		Highlighted	
Invert Elev (ft)	= 7621.13	Depth (ft)	= 0.42
Slope (%)	= 4.20	Q (cfs)	= 19.90
N-Value	= 0.035	Area (sqft)	= 6.34
Calculations		Velocity (ft/s)	= 3.14
Compute by:	Known Q	Wetted Perim (ft)	= 28.15
Known Q (cfs)	= 19.90	Crit Depth, Yc (ft)	= 0.45
		Top Width (ft)	= 28.13
		EGL (ft)	= 0.57
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7624.45)-(11.71, 7623.06, 0.035)-(22.98, 7622.00, 0.035)-(34.02, 7621.46, 0.035)-(50.30, 7621.13, 0.035)-(69.87, 7621.95, 0.035)-(75.18, 7622.00, 0.035)			
-(86.88, 7624.00, 0.035)-(100.00, 7626.18, 0.035)			



Channel Report

Channel Section A1 - Proposed 100-Yr WSEL

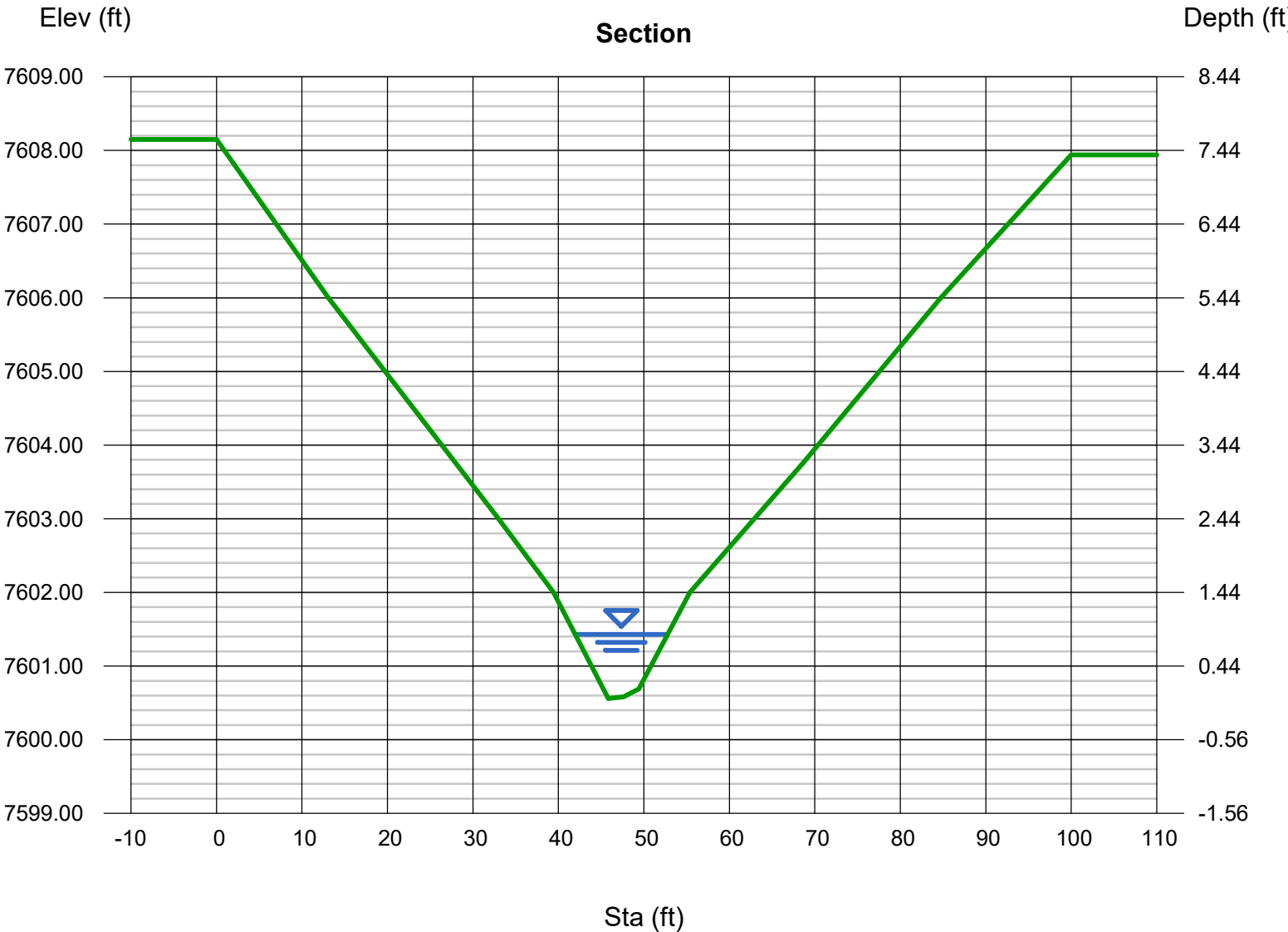
User-defined		Highlighted	
Invert Elev (ft)	= 7621.13	Depth (ft)	= 0.42
Slope (%)	= 4.20	Q (cfs)	= 20.28
N-Value	= 0.035	Area (sqft)	= 6.34
Calculations		Velocity (ft/s)	= 3.20
Compute by:	Known Q	Wetted Perim (ft)	= 28.15
Known Q (cfs)	= 20.28	Crit Depth, Yc (ft)	= 0.46
		Top Width (ft)	= 28.13
		EGL (ft)	= 0.58
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7624.45)-(11.71, 7623.06, 0.035)-(22.98, 7622.00, 0.035)-(34.02, 7621.46, 0.035)-(50.30, 7621.13, 0.035)-(69.87, 7621.95, 0.035)-(75.18, 7622.00, 0.035)			
-(86.88, 7624.00, 0.035)-(100.00, 7626.18, 0.035)			



Channel Report

Channel Section A2 - Existing 100-Yr WSEL

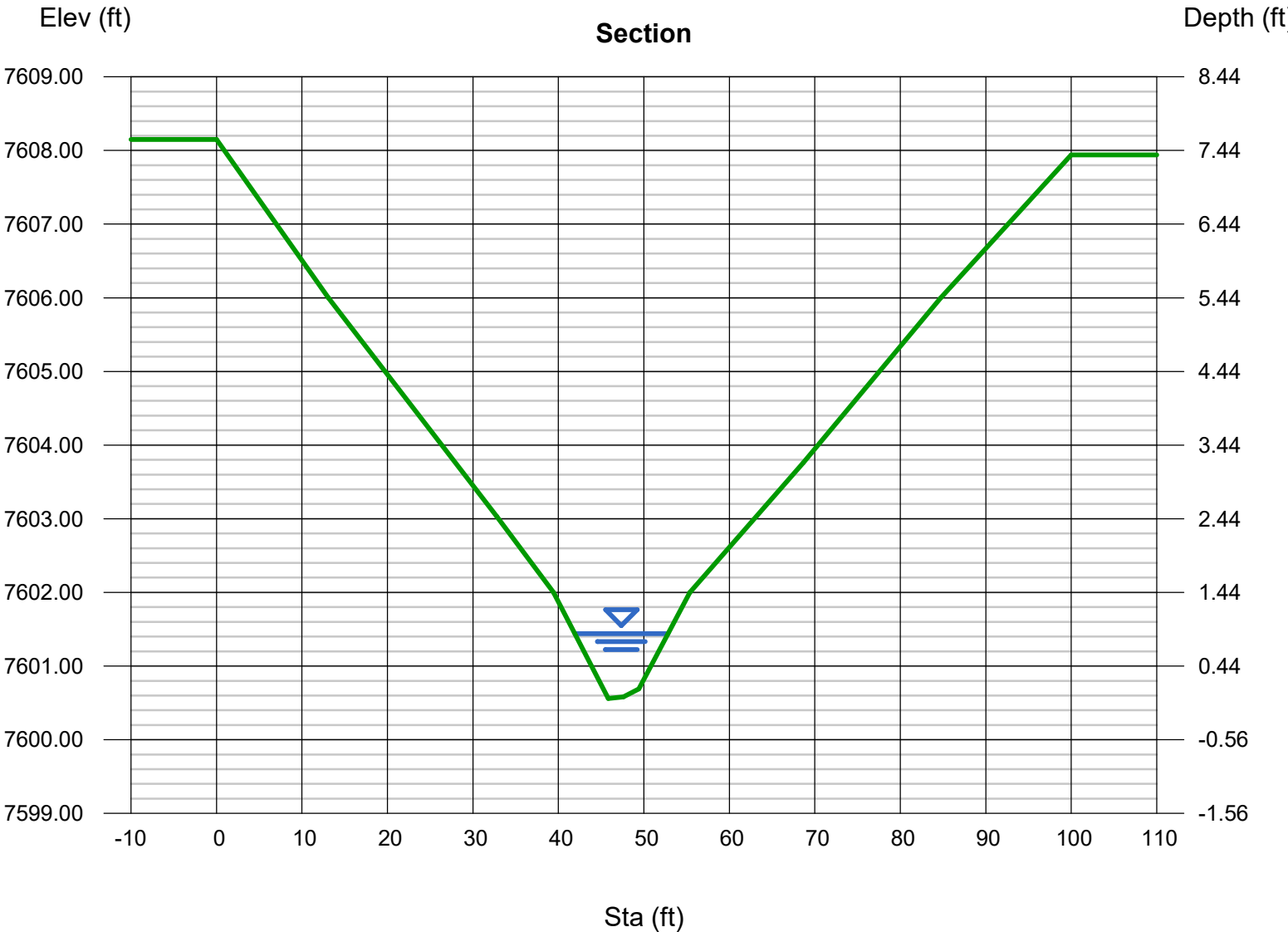
User-defined		Highlighted	
Invert Elev (ft)	= 7600.56	Depth (ft)	= 0.87
Slope (%)	= 4.90	Q (cfs)	= 36.22
N-Value	= 0.035	Area (sqft)	= 5.89
Calculations		Velocity (ft/s)	= 6.15
Compute by:	Known Q	Wetted Perim (ft)	= 11.00
Known Q (cfs)	= 36.22	Crit Depth, Yc (ft)	= 1.05
		Top Width (ft)	= 10.82
		EGL (ft)	= 1.46
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7608.15)-(13.10, 7606.00, 0.035)-(32.82, 7603.03, 0.035)-(39.42, 7602.00, 0.035)-(45.85, 7600.56, 0.035)-(47.60, 7600.58, 0.035)-(49.42, 7600.69, 0.035)-			
-(55.37, 7602.00, 0.035)-(68.66, 7603.76, 0.035)-(84.72, 7606.00, 0.035)-(100.00, 7607.94, 0.035)			



Channel Report

Channel Section A2 - Proposed 100-Yr WSEL

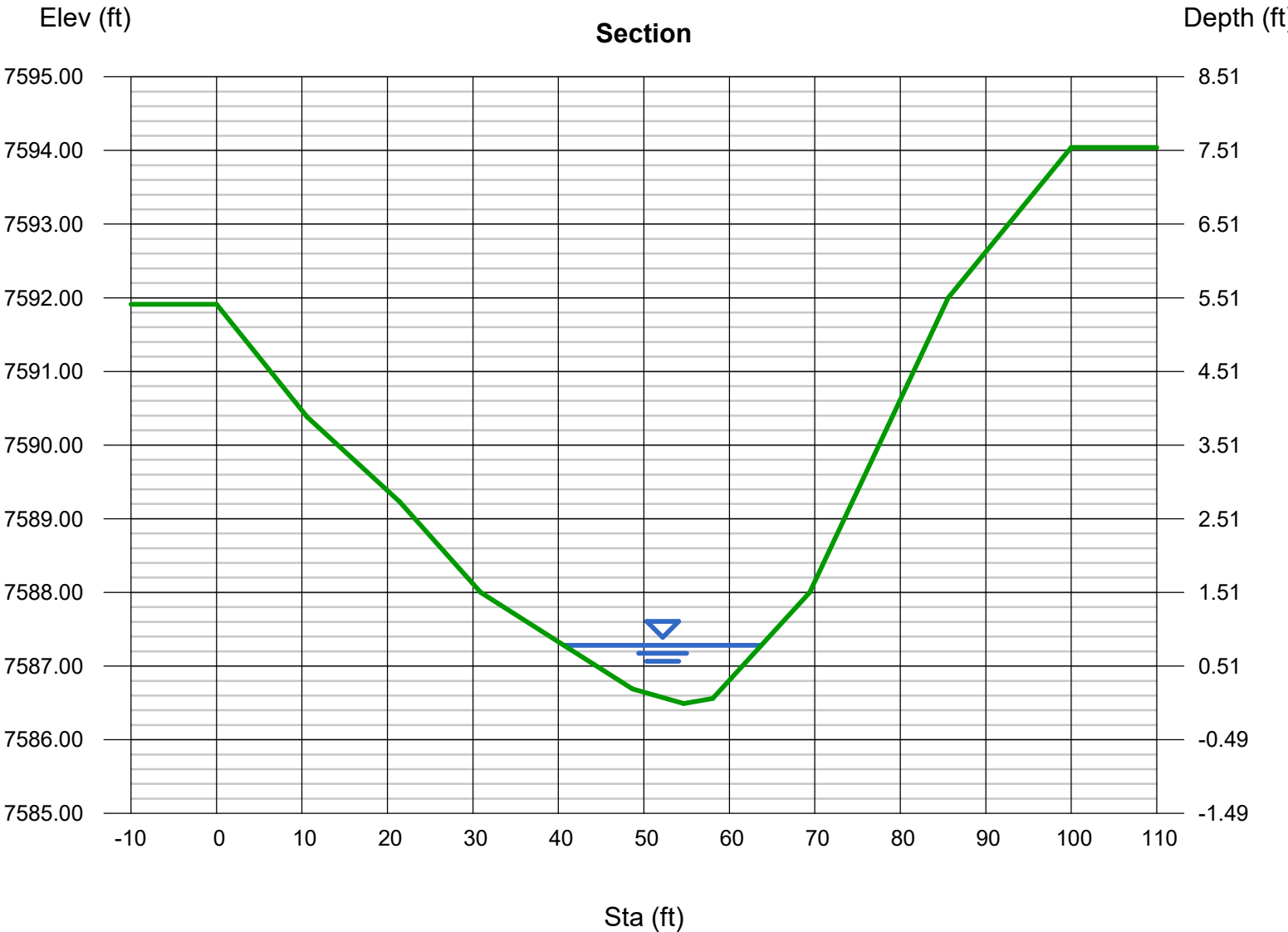
User-defined		Highlighted	
Invert Elev (ft)	= 7600.56	Depth (ft)	= 0.88
Slope (%)	= 4.90	Q (cfs)	= 36.91
N-Value	= 0.035	Area (sqft)	= 5.99
Calculations		Velocity (ft/s)	= 6.16
Compute by:	Known Q	Wetted Perim (ft)	= 11.09
Known Q (cfs)	= 36.91	Crit Depth, Yc (ft)	= 1.06
		Top Width (ft)	= 10.91
		EGL (ft)	= 1.47
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7608.15)-(13.10, 7606.00, 0.035)-(32.82, 7603.03, 0.035)-(39.42, 7602.00, 0.035)-(45.85, 7600.56, 0.035)-(47.60, 7600.58, 0.035)-(49.42, 7600.69, 0.035)-			
-(55.37, 7602.00, 0.035)-(68.66, 7603.76, 0.035)-(84.72, 7606.00, 0.035)-(100.00, 7607.94, 0.035)			



Channel Report

Channel Section A3 - Existing 100-Yr WSEL

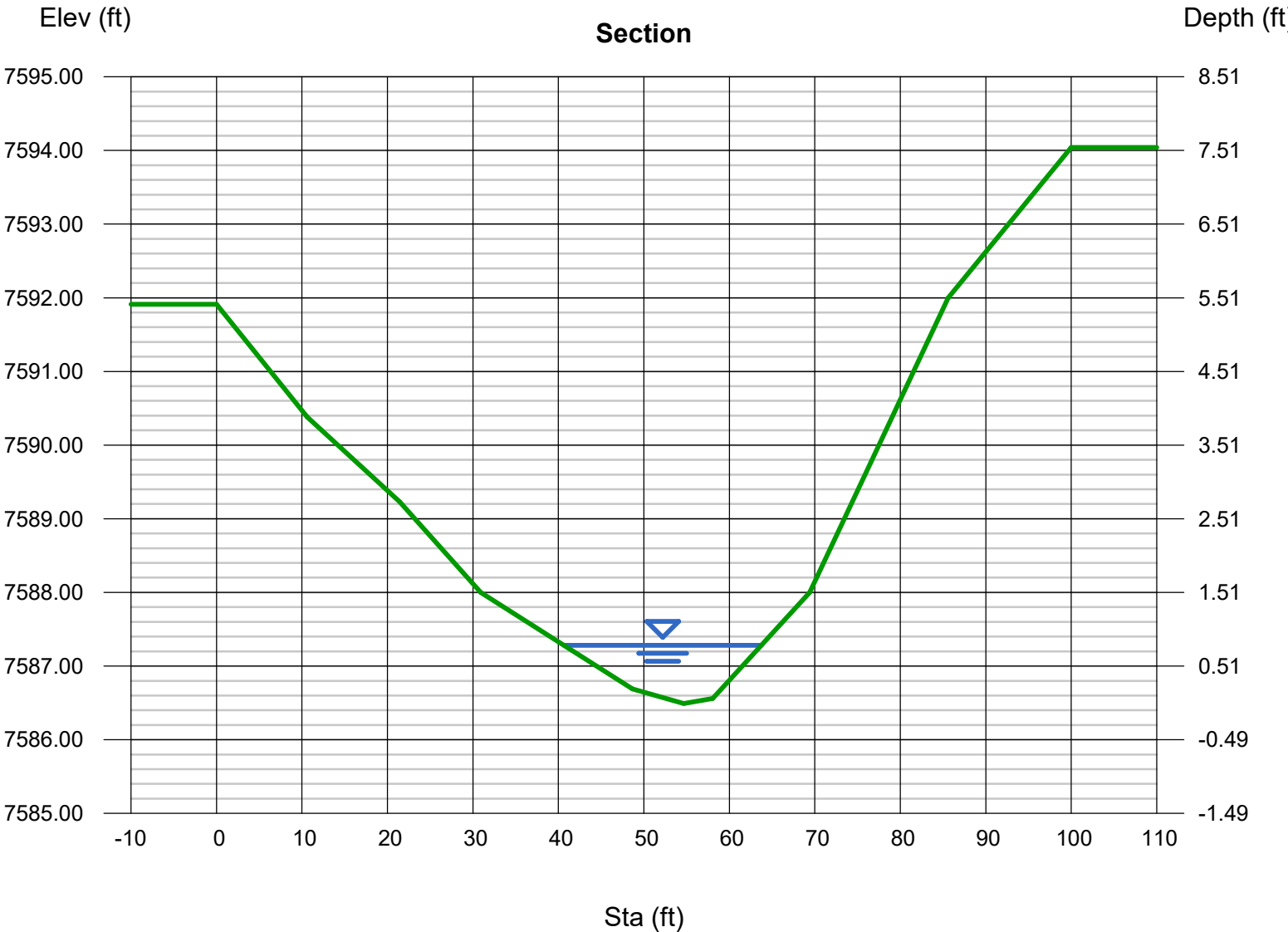
User-defined		Highlighted	
Invert Elev (ft)	= 7586.49	Depth (ft)	= 0.79
Slope (%)	= 3.90	Q (cfs)	= 56.04
N-Value	= 0.035	Area (sqft)	= 11.11
Calculations		Velocity (ft/s)	= 5.05
Compute by:	Known Q	Wetted Perim (ft)	= 23.14
Known Q (cfs)	= 56.04	Crit Depth, Yc (ft)	= 0.89
		Top Width (ft)	= 23.07
		EGL (ft)	= 1.19
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7591.91)-(10.60, 7590.38, 0.035)-(21.43, 7589.23, 0.035)-(30.91, 7588.00, 0.035)-(48.66, 7586.69, 0.035)-(54.67, 7586.49, 0.035)-(58.05, 7586.56, 0.035)			
-(69.41, 7588.00, 0.035)-(85.59, 7592.00, 0.035)-(100.00, 7594.04, 0.035)			



Channel Report

Channel Section A3 - Proposed 100-Yr WSEL

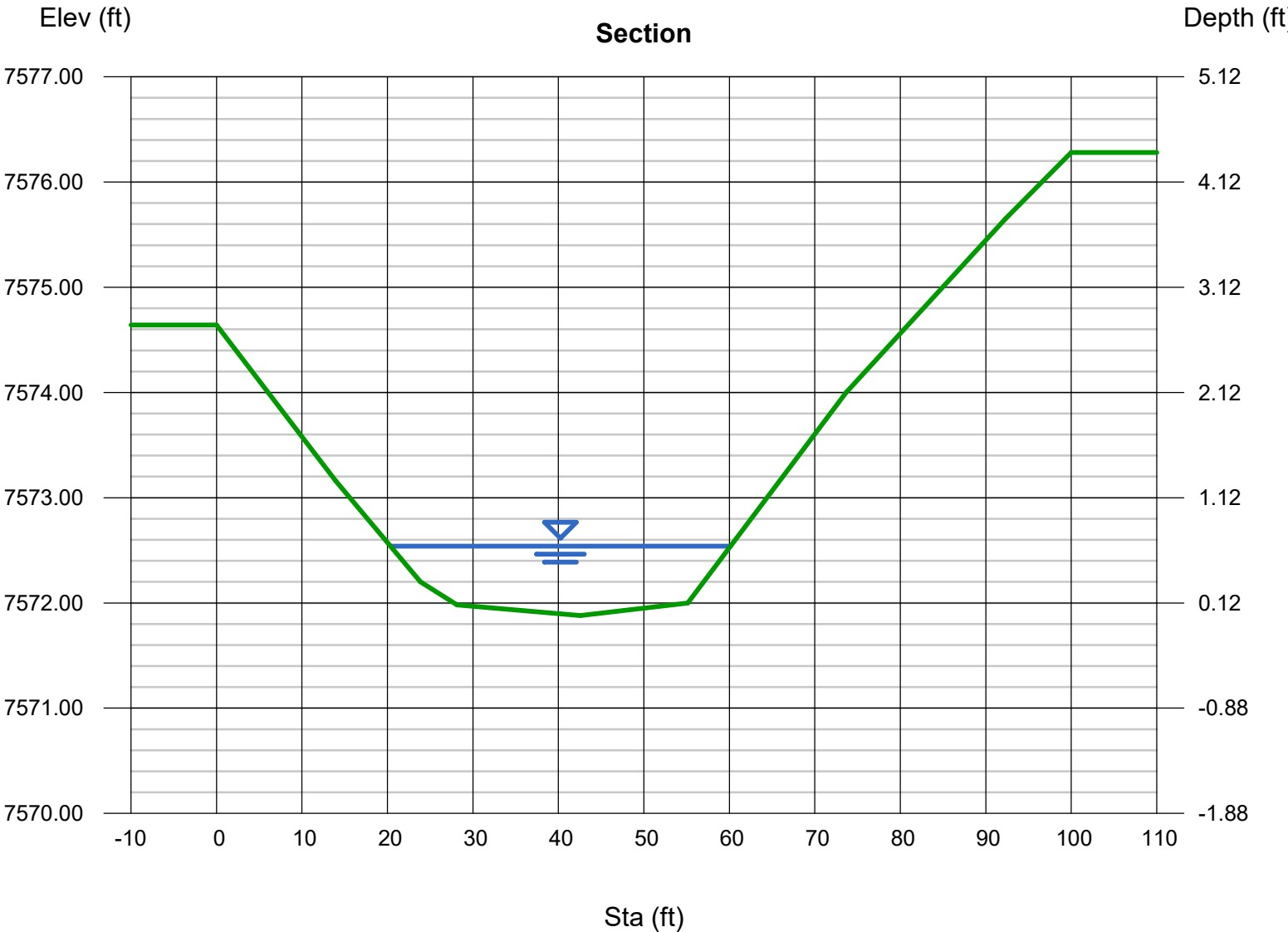
User-defined		Highlighted	
Invert Elev (ft)	= 7586.49	Depth (ft)	= 0.79
Slope (%)	= 3.90	Q (cfs)	= 57.11
N-Value	= 0.035	Area (sqft)	= 11.11
Calculations		Velocity (ft/s)	= 5.14
Compute by:	Known Q	Wetted Perim (ft)	= 23.14
Known Q (cfs)	= 57.11	Crit Depth, Yc (ft)	= 0.90
		Top Width (ft)	= 23.07
		EGL (ft)	= 1.20
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7591.91)-(10.60, 7590.38, 0.035)-(21.43, 7589.23, 0.035)-(30.91, 7588.00, 0.035)-(48.66, 7586.69, 0.035)-(54.67, 7586.49, 0.035)-(58.05, 7586.56, 0.035)			
-(69.41, 7588.00, 0.035)-(85.59, 7592.00, 0.035)-(100.00, 7594.04, 0.035)			



Channel Report

Channel Section A4 - Existing 100-Yr WSEL

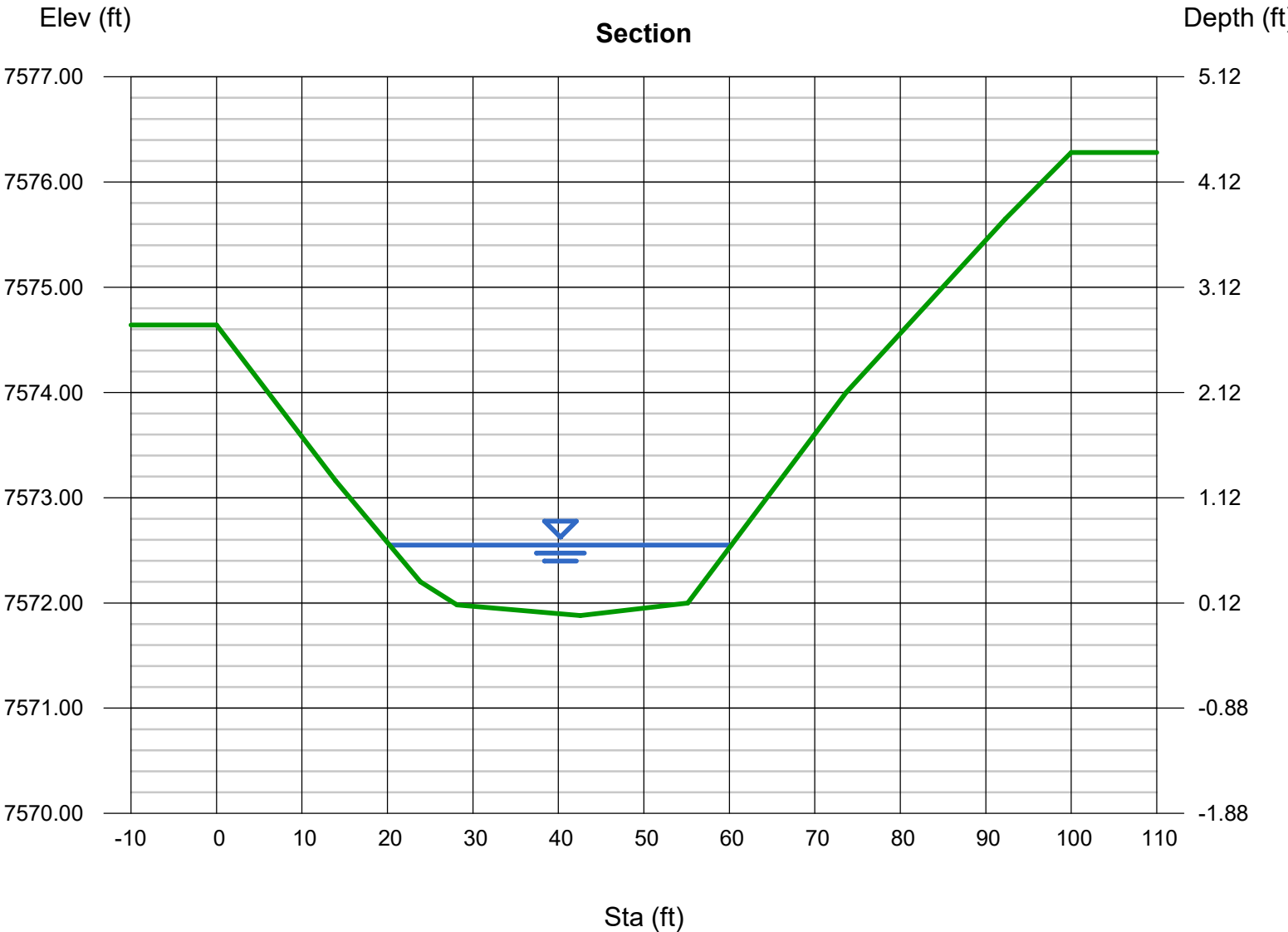
User-defined		Highlighted	
Invert Elev (ft)	= 7571.88	Depth (ft)	= 0.66
Slope (%)	= 2.20	Q (cfs)	= 80.13
N-Value	= 0.035	Area (sqft)	= 20.22
Calculations		Velocity (ft/s)	= 3.96
Compute by:	Known Q	Wetted Perim (ft)	= 39.85
Known Q (cfs)	= 80.13	Crit Depth, Yc (ft)	= 0.66
		Top Width (ft)	= 39.80
		EGL (ft)	= 0.90
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7574.64)-(13.94, 7573.16, 0.035)-(23.85, 7572.20, 0.035)-(28.16, 7571.98, 0.035)-(42.58, 7571.88, 0.035)-(55.14, 7572.00, 0.035)-(73.66, 7574.00, 0.035)			
-(92.28, 7575.65, 0.035)-(100.00, 7576.28, 0.035)			



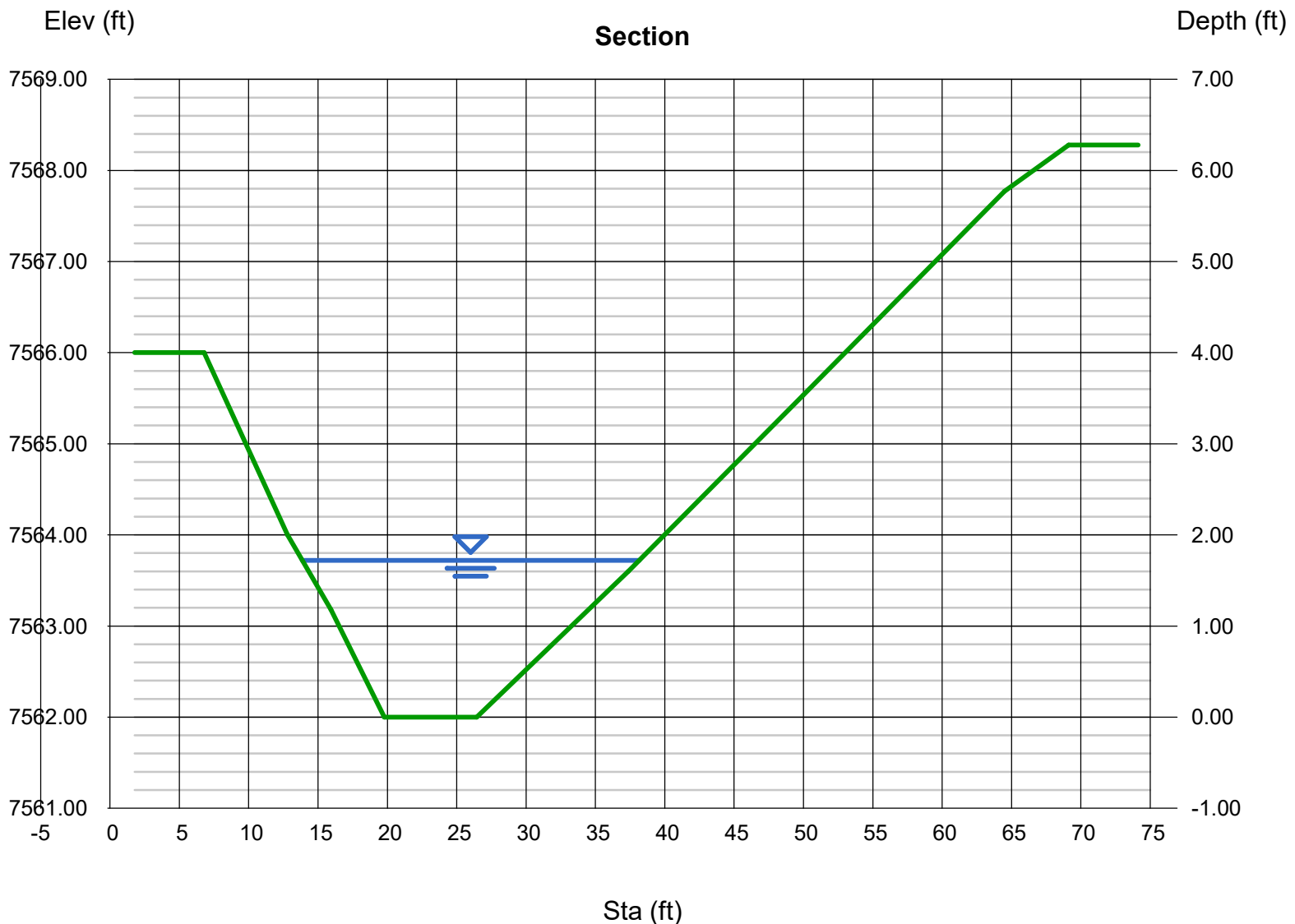
Channel Report

Channel Section A4 - Proposed 100-Yr WSEL

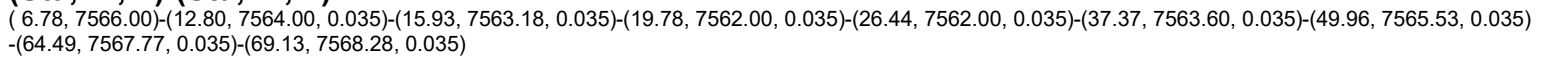
User-defined		Highlighted	
Invert Elev (ft)	= 7571.88	Depth (ft)	= 0.67
Slope (%)	= 2.20	Q (cfs)	= 81.66
N-Value	= 0.035	Area (sqft)	= 20.61
Calculations		Velocity (ft/s)	= 3.96
Compute by:	Known Q	Wetted Perim (ft)	= 40.04
Known Q (cfs)	= 81.66	Crit Depth, Yc (ft)	= 0.66
		Top Width (ft)	= 39.99
		EGL (ft)	= 0.91
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7574.64)-(13.94, 7573.16, 0.035)-(23.85, 7572.20, 0.035)-(28.16, 7571.98, 0.035)-(42.58, 7571.88, 0.035)-(55.14, 7572.00, 0.035)-(73.66, 7574.00, 0.035)			
-(92.28, 7575.65, 0.035)-(100.00, 7576.28, 0.035)			



Tuesday, Apr 8 2025



Tuesday, Apr 8 2025



SHEAR STRESS & CHANNEL LININGS			CALCULATED BY:		CMD	DATE:	4/8/2025				
PROJECT: 2502010 FLYING HORSE FOUNDATION			CHECKED BY:		RDL						
Shear Stress Calculations: 100-YR						Channel Lining Determination					
Section	unit weight of water	Depth of flow	Slope	Shear Stress		Calculated Values			P300 Max Values		
-	lb/ft^3	ft	ft/ft	lb/ft^2		Section	Shear Stress	Velocity	Shear Stress	Velocity	Lining Required
A1	62.43	0.42	0.0420	1.10		A1	1.10	3.20	3	9	P300
A2	62.43	0.88	0.0490	2.69		A2	2.69	6.16	3	9	P300
A3	62.43	0.79	0.0490	2.42		A3	2.42	5.14	3	9	P300
A4	62.43	0.67	0.0220	0.92		A4	0.92	3.96	3	9	P300
A5	62.43	1.74	0.0110	1.19		A5	1.19	4.67	3	9	NONE

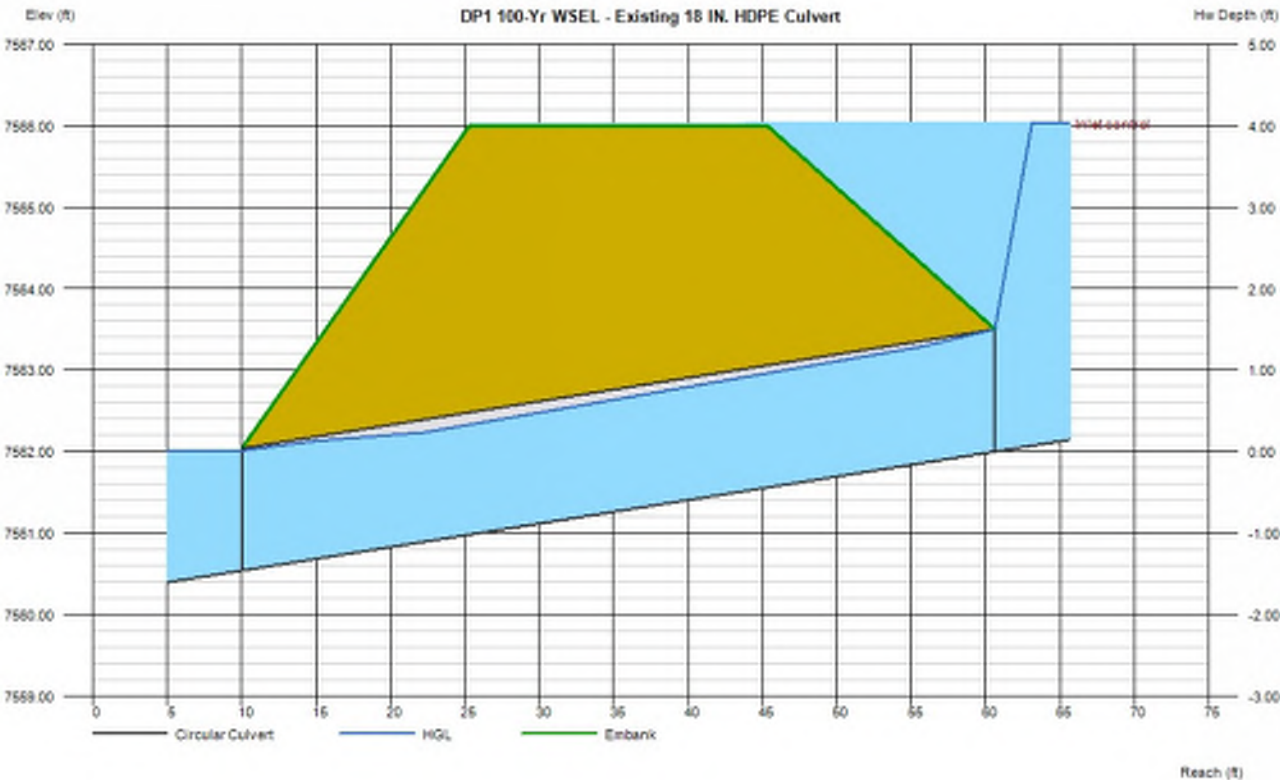
Culvert Report

DP1 100-Yr WSEL - Existing 18 IN. HDPE Culvert

Invert Elev Dn (ft)	= 7560.54
Pipe Length (ft)	= 50.62
Slope (%)	= 2.88
Invert Elev Up (ft)	= 7562.00
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment	
Top Elevation (ft)	= 7566.00
Top Width (ft)	= 20.00
Crest Width (ft)	= 50.00

Calculations	
Qmin (cfs)	= 18.00
Qmax (cfs)	= 18.00
Tailwater Elev (ft)	= (dc+D)/2
Highlighted	
Qtotal (cfs)	= 18.00
Qpipe (cfs)	= 17.24
Qovertop (cfs)	= 0.76
Veloc Dn (ft/s)	= 9.80
Veloc Up (ft/s)	= 9.88
HGL Dn (ft)	= 7562.01
HGL Up (ft)	= 7563.44
Hw Elev (ft)	= 7566.03
Hw/D (ft)	= 2.69
Flow Regime	= Inlet Control



Culvert Report

Culvert 2 (DPA4) capacity calculation from
Flying Horse North Filing No. 4 FDR.

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, Sep 13 2024

Culvert 2 - DPA4 (100-Year)

Invert Elev Dn (ft) = 7545.83
Pipe Length (ft) = 210.30
Slope (%) = 1.19
Invert Elev Up (ft) = 7548.34
Rise (in) = 60.0
Shape = Circular
Span (in) = 60.0
No. Barrels = 1
n-Value = 0.012
Culvert Type = Circular Concrete
Culvert Entrance = Square edge w/headwall (C)
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

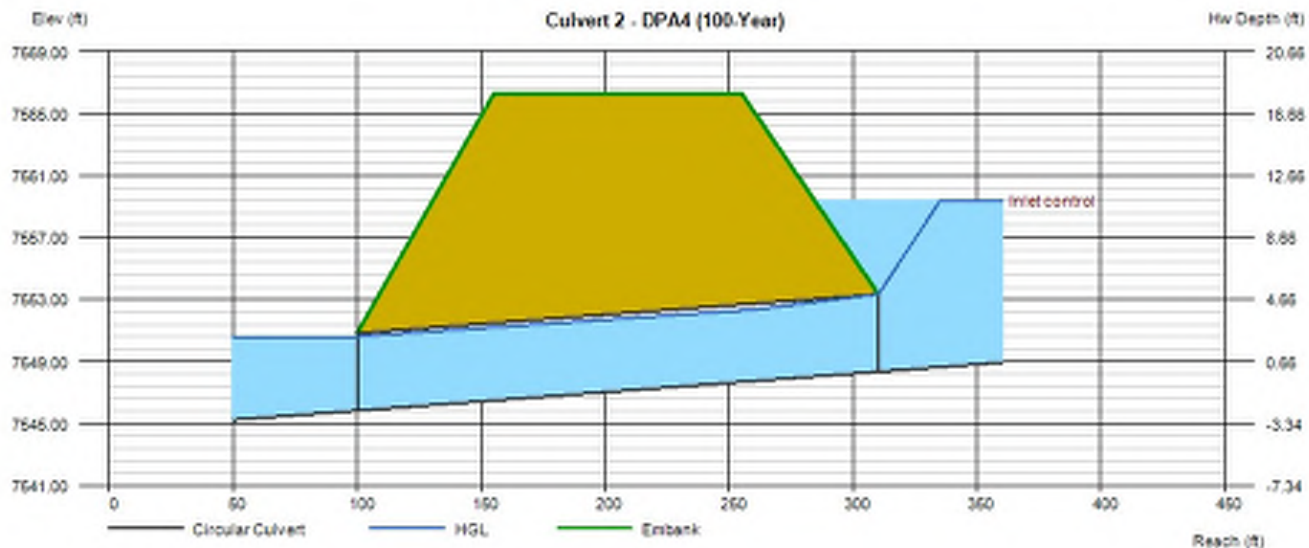
Top Elevation (ft) = 7566.27
Top Width (ft) = 100.00
Crest Width (ft) = 270.00

Calculations

Qmin (cfs) = 274.00
Qmax (cfs) = 274.00
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 274.00
Qpipe (cfs) = 274.00
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 14.18
Veloc Up (ft/s) = 14.59
HGL Dn (ft) = 7550.61
HGL Up (ft) = 7552.90
Hw Elev (ft) = 7559.41
Hw/D (ft) = 2.21
Flow Regime = Inlet Control





APPENDIX D – WATER QUALITY & DETENTION

Note: The following calculations are excerpts from the Flying Horse North Filing No. 4 Final Drainage Report (SF2422). The existing Full Spectrum Detention Pond A is modified to accept increased flows due to this development.

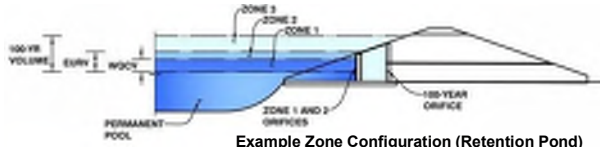
Updated UD-Detention Spreadsheet for Flying Horse North Filing No. 4 Pond A

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **FLYING HORSE NORTH FILING NO. 4**

Basin ID: **POND A**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.92	0.65	Orifice Plate
Zone 2 (EURV)	3.48	0.42	Circular Orifice
Zone 3 (User)	5.12	1.76	Weir&Pipe (Restrict)
Total (all zones)		2.83	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

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

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 1-5/8 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00					
Orifice Area (sq. inches)	2.12	2.12	2.12					

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice
Zone 2 Circular Not Selected
Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

NOTE: NOT APPLICABLE AS EURV DRAINS BY OVERFLOW WEIR

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

Zone 3 Weir Not Selected
Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type = N/A
Debris Clogging % = %

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area = N/A
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Zone 3 Restrictor Not Selected
Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

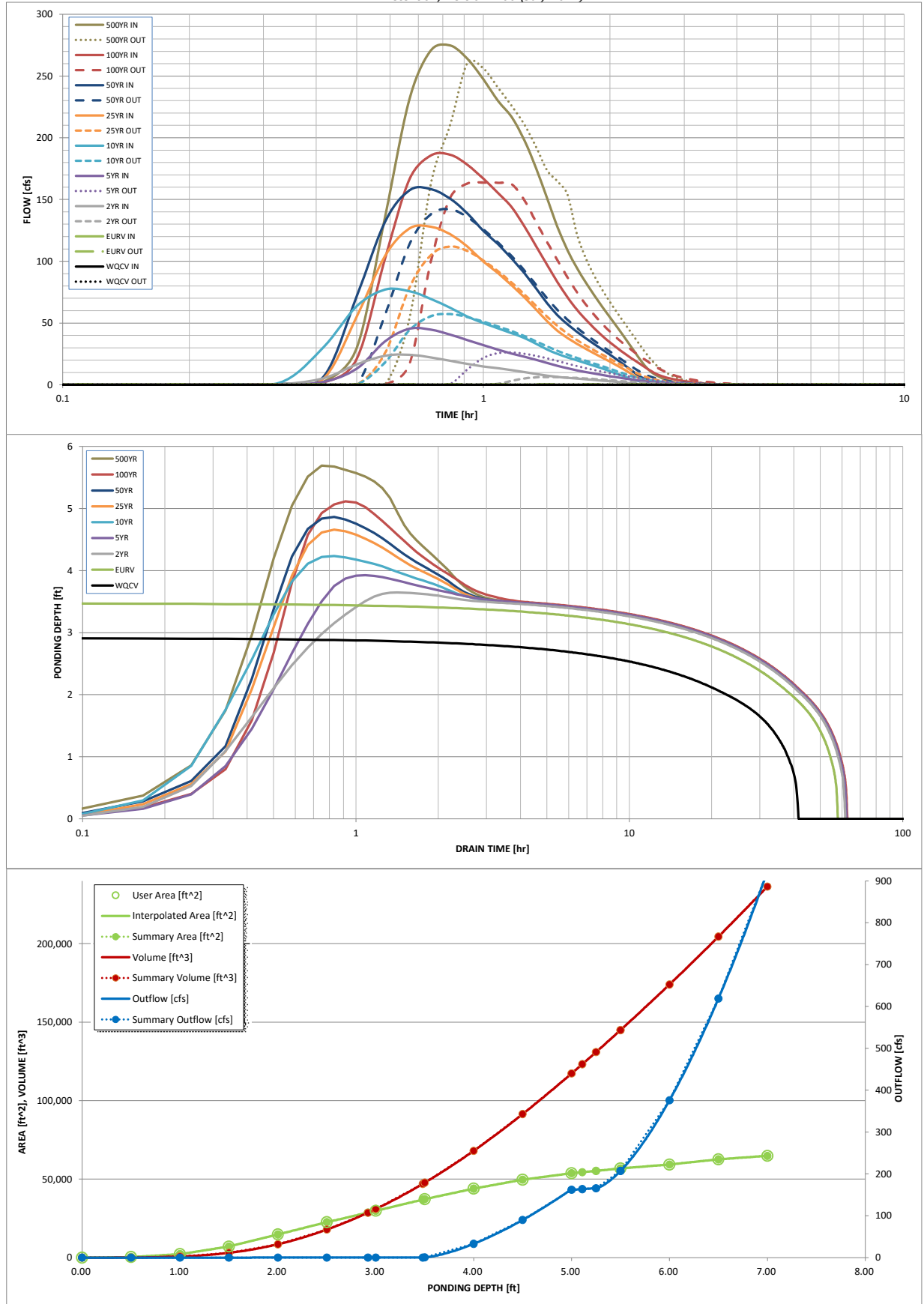
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in)	0.653	1.073	1.617	3.665	5.721	9.429	11.939	15.571	22.164
CUHP Runoff Volume (acre-ft)	N/A	N/A	1.617	3.257	5.721	9.429	11.939	15.120	22.164
User Override Inflow Hydrograph Volume (acre-ft)	N/A	N/A	16.2	44.9	67.6	120.7	151.3	192.2	267.2
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	16.2	44.9	67.6	120.7	151.3	192.2	267.2
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A	16.2	44.9	67.6	120.7	151.3	192.2	267.2
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.13	0.35	0.53	0.94	1.18	1.25	2.08
Peak Inflow Q (cfs)	N/A	N/A	24.4	45.5	77.1	128.1	158.4	186.3	274.8
Peak Outflow Q (cfs)	0.3	0.3	6.3	26.2	57.3	112.0	142.1	164	260.8
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.6	0.8	0.9	0.9	1.0	1.0
Structure Controlling Flow	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps)	N/A	N/A	0.08	0.3	0.7	1.5	1.8	2.1	2.2
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	38	53	55	51	45	38	34	30	20
Time to Drain 99% of Inflow Volume (hours)	40	56	58	57	54	51	49	47	42
Maximum Ponding Depth (ft)	2.92	3.48	3.65	3.93	4.23	4.66	4.86	5.11	5.69
Area at Maximum Ponding Depth (acres)	0.66	0.85	0.90	0.98	1.07	1.17	1.21	1.25	1.33
Maximum Volume Stored (acre-ft)	0.66	1.08	1.22	1.48	1.80	2.28	2.52	2.83	3.56
Elevation (ft)	7534.92	7535.48		7535.93				7537.11	
Pond Bottom (ft)	7532.00								

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.02	0.05
	0:15:00	0.00	0.00	0.13	0.10	0.27	0.18	0.24	0.11	0.36
	0:20:00	0.00	0.00	0.57	0.30	2.62	0.59	0.71	0.29	2.52
	0:25:00	0.00	0.00	5.36	2.41	30.47	5.12	6.71	1.88	29.80
	0:30:00	0.00	0.00	16.52	13.05	63.62	55.17	71.61	20.97	135.59
	0:35:00	0.00	0.00	23.52	35.13	77.06	104.24	131.89	101.89	231.36
	0:40:00	0.00	0.00	24.39	45.45	75.83	126.55	157.48	166.39	270.75
	0:45:00	0.00	0.00	22.19	44.62	69.58	128.06	158.42	185.68	274.76
	0:50:00	0.00	0.00	19.35	40.59	62.34	121.87	150.62	186.26	263.84
	0:55:00	0.00	0.00	16.90	36.20	55.25	111.77	138.68	178.12	247.25
	1:00:00	0.00	0.00	14.86	32.09	49.89	99.68	124.46	166.72	229.77
	1:05:00	0.00	0.00	13.41	28.35	45.72	90.36	113.74	155.23	216.91
	1:10:00	0.00	0.00	11.90	25.28	41.81	80.69	102.30	143.95	198.12
	1:15:00	0.00	0.00	10.32	22.68	37.94	70.85	90.47	128.32	175.41
	1:20:00	0.00	0.00	8.74	20.23	33.22	60.95	78.14	112.28	151.11
	1:25:00	0.00	0.00	7.33	17.78	28.60	51.51	66.12	97.19	127.77
	1:30:00	0.00	0.00	6.33	15.39	25.05	43.75	56.32	83.19	109.01
	1:35:00	0.00	0.00	5.65	13.34	22.22	37.92	48.97	70.84	94.69
	1:40:00	0.00	0.00	5.07	11.76	19.74	33.24	43.00	60.91	83.00
	1:45:00	0.00	0.00	4.52	10.39	17.46	29.12	37.73	52.90	72.60
	1:50:00	0.00	0.00	3.97	9.08	15.33	25.41	32.98	45.89	63.18
	1:55:00	0.00	0.00	3.42	7.91	13.19	21.93	28.52	39.70	54.39
	2:00:00	0.00	0.00	2.86	6.89	10.99	18.58	24.25	34.29	46.15
	2:05:00	0.00	0.00	2.28	6.00	8.77	15.28	20.00	29.57	38.16
	2:10:00	0.00	0.00	1.71	5.15	6.60	12.00	15.77	25.32	30.31
	2:15:00	0.00	0.00	1.15	4.35	4.57	8.75	11.60	21.47	22.62
	2:20:00	0.00	0.00	0.67	3.59	3.11	5.62	7.60	17.84	15.56
	2:25:00	0.00	0.00	0.41	2.88	2.30	3.47	4.89	14.39	10.60
	2:30:00	0.00	0.00	0.29	2.22	1.79	2.21	3.28	11.19	7.41
	2:35:00	0.00	0.00	0.23	1.72	1.40	1.44	2.24	8.60	5.16
	2:40:00	0.00	0.00	0.18	1.38	1.09	0.93	1.52	6.79	3.50
	2:45:00	0.00	0.00	0.14	1.16	0.83	0.61	1.04	5.51	2.29
	2:50:00	0.00	0.00	0.10	0.99	0.62	0.40	0.70	4.50	1.41
	2:55:00	0.00	0.00	0.08	0.85	0.45	0.25	0.46	3.69	0.83
	3:00:00	0.00	0.00	0.06	0.72	0.31	0.17	0.32	3.02	0.54
	3:05:00	0.00	0.00	0.05	0.60	0.22	0.12	0.23	2.46	0.39
	3:10:00	0.00	0.00	0.04	0.50	0.16	0.09	0.17	1.99	0.31
	3:15:00	0.00	0.00	0.03	0.40	0.12	0.07	0.13	1.60	0.24
	3:20:00	0.00	0.00	0.02	0.31	0.09	0.05	0.10	1.26	0.18
	3:25:00	0.00	0.00	0.02	0.23	0.06	0.04	0.07	0.94	0.13
	3:30:00	0.00	0.00	0.01	0.17	0.04	0.02	0.05	0.65	0.09
	3:35:00	0.00	0.00	0.01	0.12	0.02	0.02	0.03	0.46	0.06
	3:40:00	0.00	0.00	0.00	0.10	0.01	0.01	0.02	0.33	0.03
	3:45:00	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.24	0.01
	3:50:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.17	0.00
	3:55:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.12	0.00
	4:00:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.09	0.00
	4:05:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.06	0.00
	4:10:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00
	4:15:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	4:20:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	4:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	4:30:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	4:35:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:40:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:45:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Updated UD-Detention Spreadsheet for Flying Horse North Filing No. 4 Pond A

DETENTION BASIN OUTLET STRUCTURE DESIGN

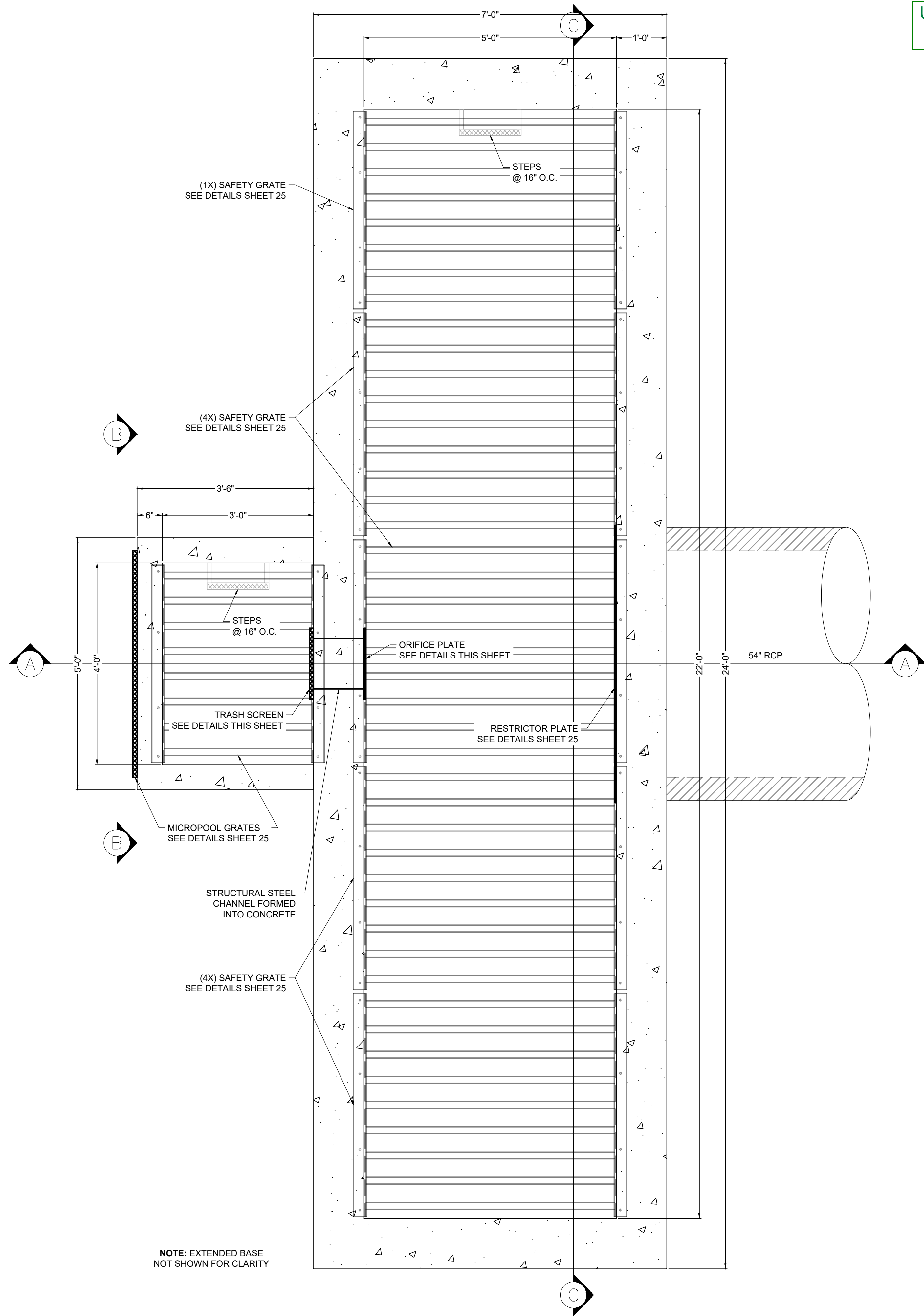
MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

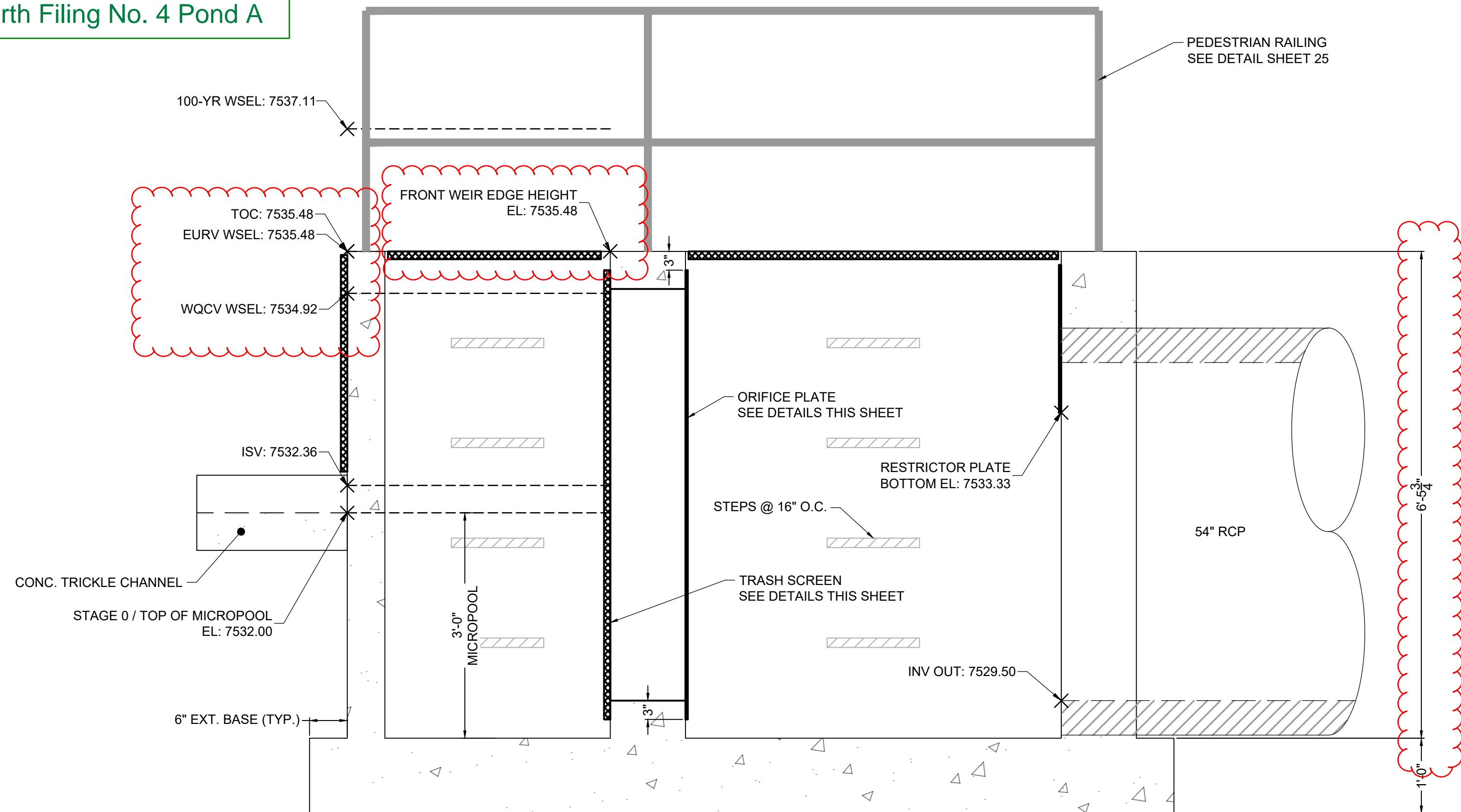
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

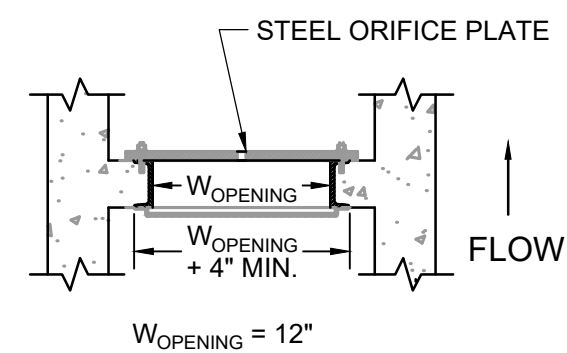


PLAN VIEW
POND A OUTLET STRUCTURE
SCALE: 1" = 1-1/4'

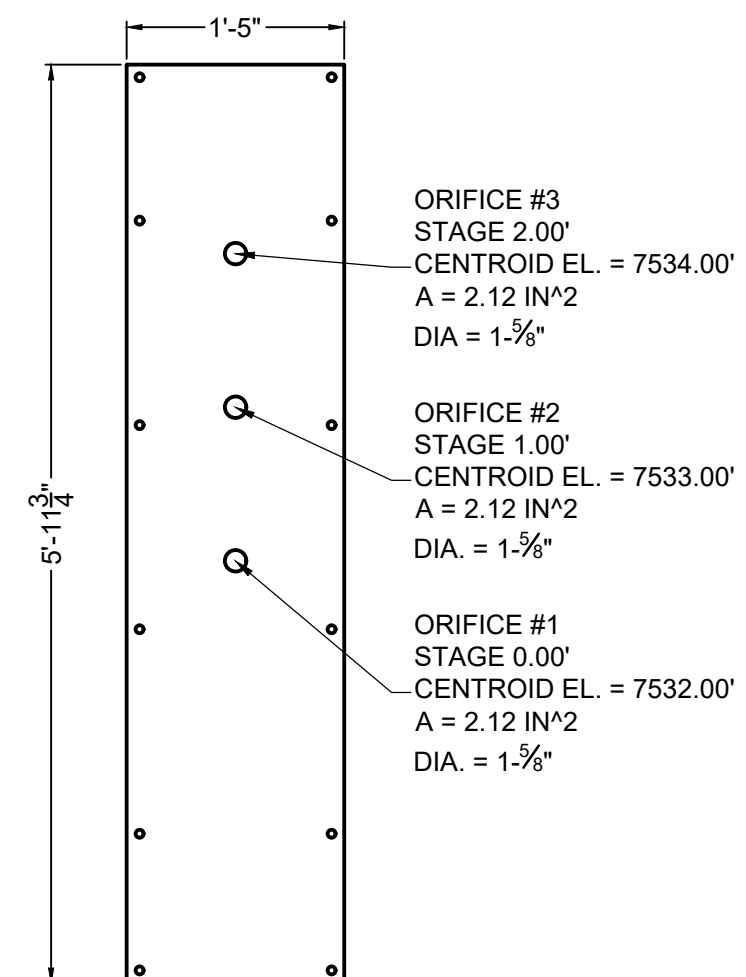
Updated Pond Outlet Structure Details for
Flying Horse North Filing No. 4 Pond A



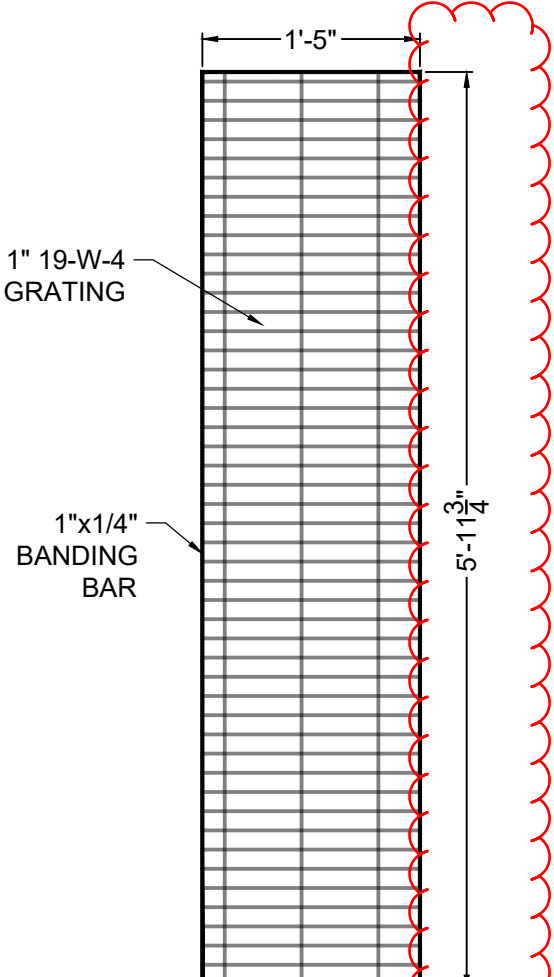
SECTION VIEW A-A
POND A OUTLET STRUCTURE
SCALE: 1" = 1-1/4'



DETAIL
TRASH SCREEN & ORIFICE PLATE
SCALE: NTS



ELEVATION VIEW
ORIFICE PLATE DETAIL
SCALE: 1" = 1-1/4'



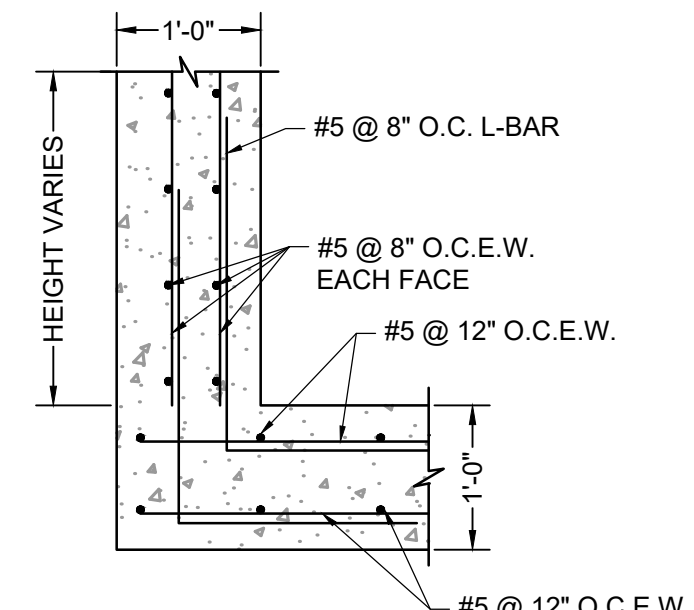
ELEVATION VIEW
TRASH SCREEN DETAIL
SCALE: 1" = 1-1/4'

TRASH SCREEN NOTES:

1. TRASH SCREEN SHALL BE JOHNSON STAINLESS STEEL WELL SCREEN WITH #93 VEE WIRE OR APPROVED EQUIVALENT AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.
2. TRASH SCREEN OPEN AREAS ARE FOR SPECIFIED TRASH RACK MATERIALS. TOTAL TRASH RACK SIZE MAY NEED TO BE ADJUSTED FOR MATERIALS HAVING DIFFERENT OPEN AREA/GROSS AREA RATIO (R VALUE).
3. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.
4. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR TRASH SCREEN FOR ENGINEER'S APPROVAL PRIOR TO CONSTRUCTION.

ORIFICE PLATE NOTES:

1. PLATE TO BE 3/8" THICK GALVANIZED STEEL.
2. BOLT PLATE TO CONCRETE 16" O.C. MAX.
3. PROVIDE CONTINUOUS NEOPRENE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE.
4. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ORIFICE PLATE FOR ENGINEER'S APPROVAL PRIOR TO CONSTRUCTION.



ELEVATION VIEW
OUTLET STRUCTURE REINFORCING DETAIL
SCALE: NTS

DRAWN BY: CMD JOB DATE: 4/8/25
APPROVED: RDL JOB NUMBER: 211030.240
CAD DATE: 8/22/2024
CAD FILE: J:\2021\211030\CAD\Drawings\C\Filing_No_4\Outlet_Structure_Details

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1" IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION



HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 160
COLORADO SPRINGS, CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

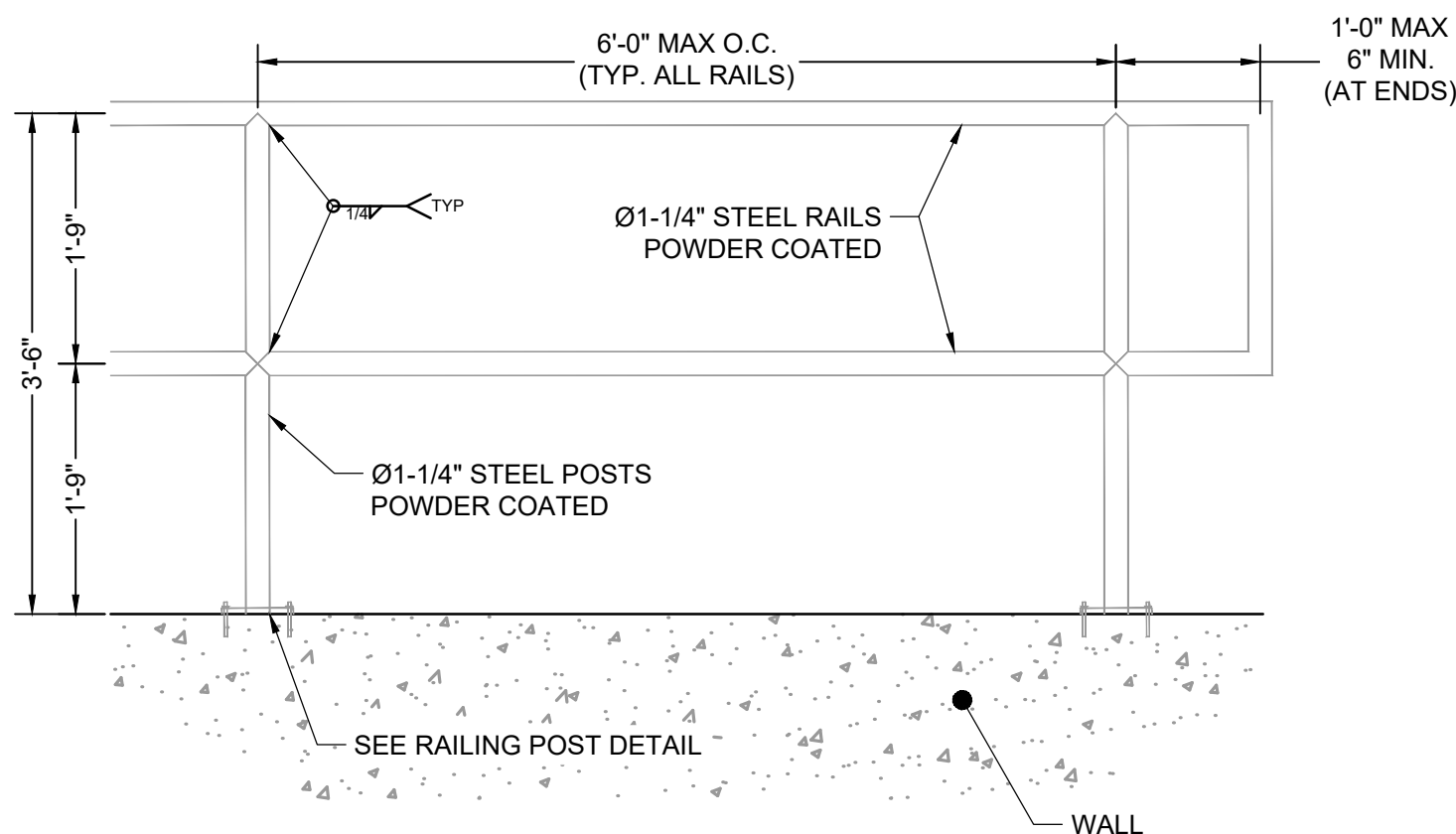
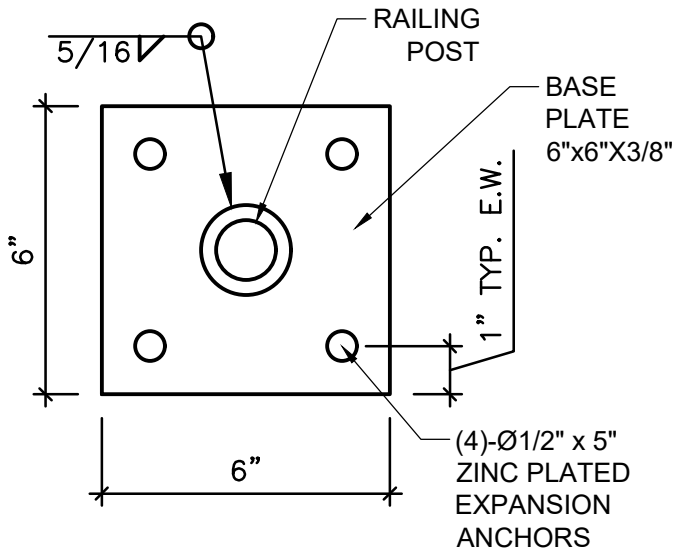
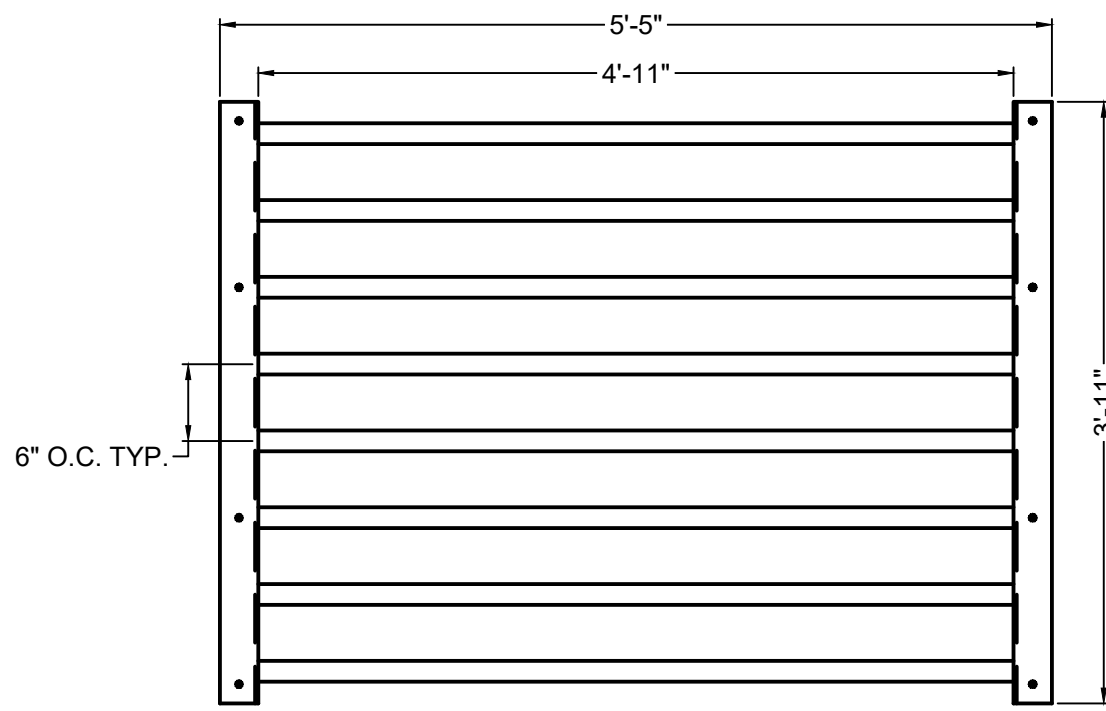
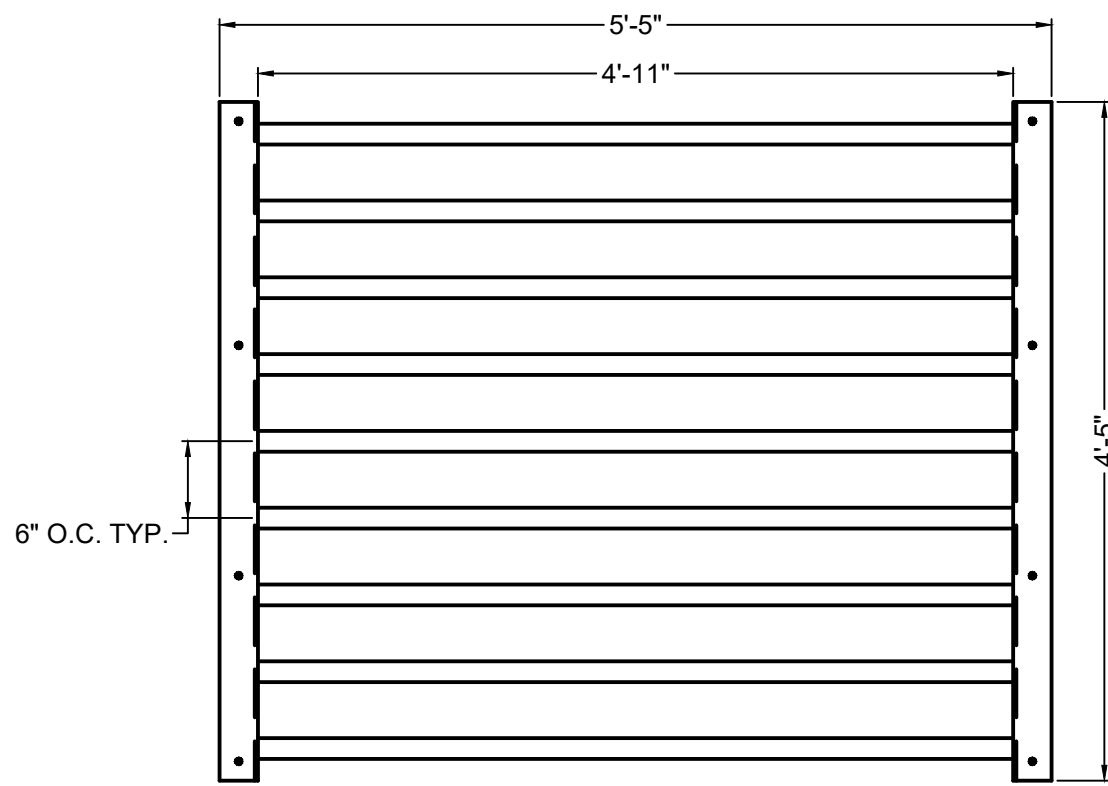
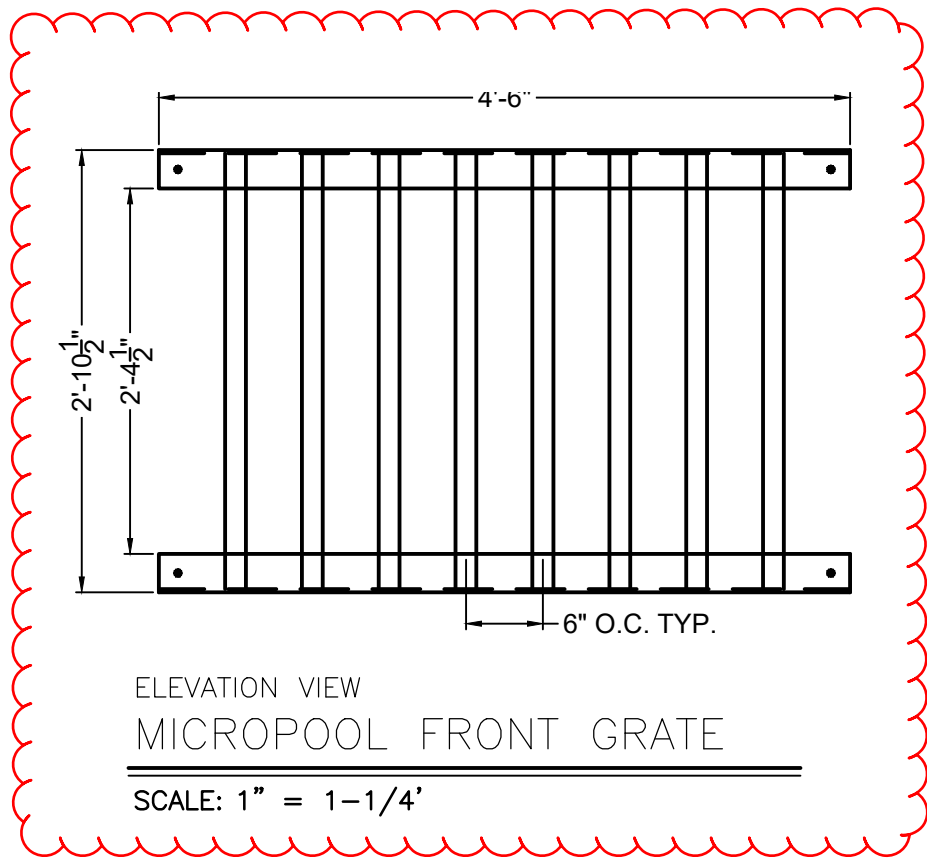
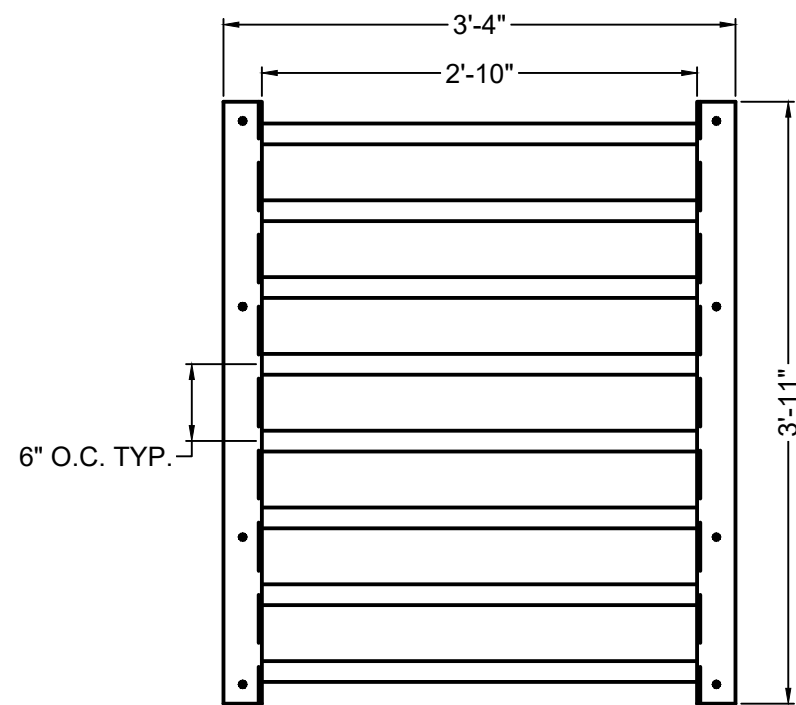
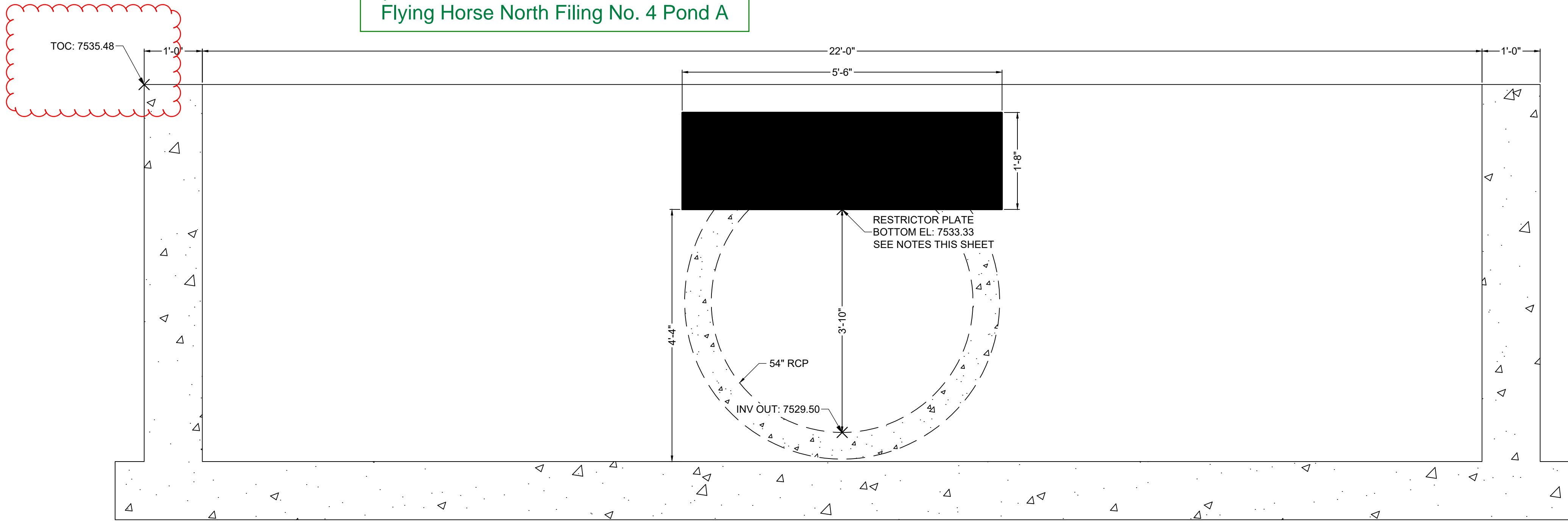
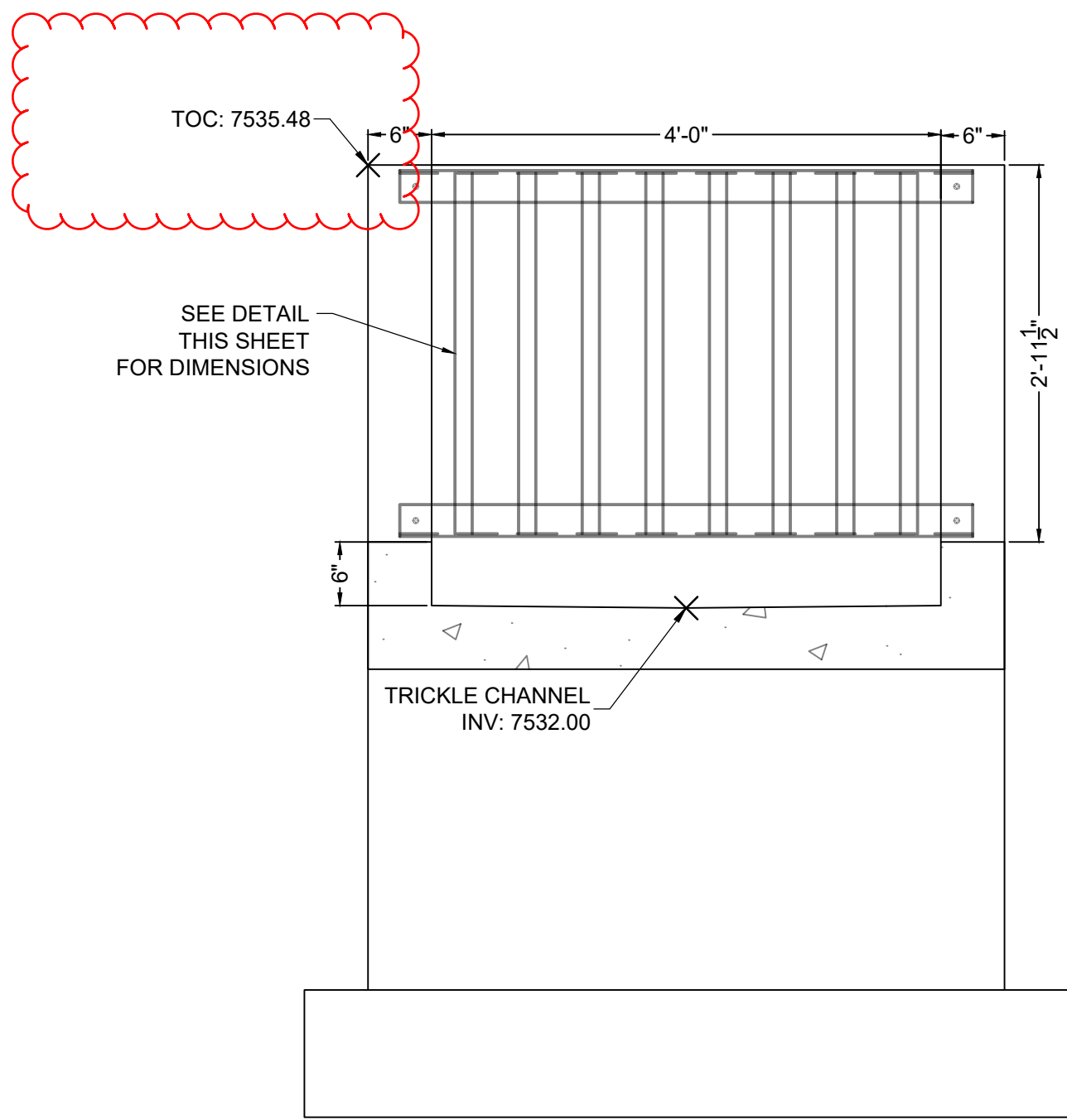
FLYING HORSE NORTH FILING 4
PRI #2, LLC.
EL PASO COUNTY, CO

POND DETAILS
POND A OUTLET STRUCTURE

SHEET
PND

24

Updated Pond Outlet Structure Details for
Flying Horse North Filing No. 4 Pond A



SAFETY GRATES/TRASH RACK NOTES:

1. TRASH RACKS AND SAFETY GRATES SHALL BE 1-1/2" SCH. 40 STEEL PIPE, @ 6" CENTERS BOUNDED BY 3"x3"x1/4" ANGLE IRON. ALL GRATES SHALL BE MOUNTED USING ZINC PLATED STEEL HARDWARE.
2. REMOVABLE GRATE SECTIONS SHALL BE MOUNTED USING ZINC PLATED STEEL HARDWARE AND PROVIDED WITH HINGED & LOCKABLE OR BOLTABLE ACCESS PANELS AS SHOWN ON THE PLANS.
3. STEEL GRATES SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER COATED AFTER GALVANIZING.
4. STRUCTURAL STEEL FOR GRATES SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH CDOT STANDARD SPECIFICATIONS, SUBSECTION 712.06.
5. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR GRATING FOR ENGINEER'S APPROVAL PRIOR TO CONSTRUCTION.

RESTRICTOR PLATE NOTES:

1. 3/8" THICK RESTRICTOR PLATE, GALVANIZED STEEL.
2. BOLT PLATE TO CONCRETE @ 12" O.C. MAX.
3. PROVIDE CONTINUOUS NEOPRENE GASKET MATERIAL BETWEEN PLATE AND CONCRETE.
4. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR RESTRICTOR PLATE FOR ENGINEER'S APPROVAL PRIOR TO CONSTRUCTION.

TWO SIGNS SHALL BE INSTALLED AROUND THE POND PERIMETER. THE SIGNS SHALL BE CONSTRUCTED OF A DURABLE MATERIAL SUCH AS METAL OR PLASTIC AND HAVE RED LETTERING ON A WHITE BACKGROUND WITH THE BELOW MESSAGE.

WARNING:
THIS AREA IS A
STORMWATER
FACILITY AND
IS SUBJECT TO
PERIODIC
FLOODING

Minimum Sign Area: 3 sqft

POND WARNING SIGN
DETAIL
SCALE: N.T.S.



APPENDIX E – REFERENCE MATERIAL

FINAL
DRAINAGE REPORT
FOR
COUNTRY VIEW ESTATES

Prepared For:
Northgate Investment
940 Carlson Drive
Colorado Springs, CO 80916

Prepared By:
Associated Design Professionals, Inc.
1861 Austin Bluffs Parkway, Suite 101
Colorado Springs, Colorado 80918
(719) 266-5212

October 15, 1998
980308



ENGINEERS STATEMENT:

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



Michael A. Bartusek, P.E., #23329



DEVELOPER'S STATEMENT:

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

Northgate Investments
Business Name

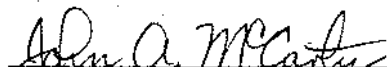
By: 

Title: Manager

Address: 940 Carlson Drive
Colorado Springs, CO 80916

EL PASO COUNTY:

Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.


John A. McCarty, P.E.
County Engineer/Manager

12-30-98
Date

Conditions:

COUNTRY VIEW ESTATES FINAL DRAINAGE REPORT

GENERAL

This is a drainage study for a 60.41 acre site described as being in the Southeast quarter of Section 31, Township 11 South, Range 65 West of the 6TH PM. The site is located within the Cherry Creek Basin, Northeast of Colorado Springs in Black Forest, Colorado, El Paso County. The site is a proposed subdivision consisting of eleven lots no smaller than five acres. This study will consider the impact, if any, on the existing development and neighboring properties.

The site is located west of Black Forest Road on the proposed public road, Country View Lane. No portion of the site is located within a designated FEMA 100-year floodplain as designated on Map No. 080059-0045B dated December 16, 1986. According to the El Paso County Area Soil Survey, the soil on the site is classified as a Peyton-Pring complex. This soil can be described as having a moderate permeability, slow to medium surface runoff and moderate hazard of erosion. The soil classification is B.

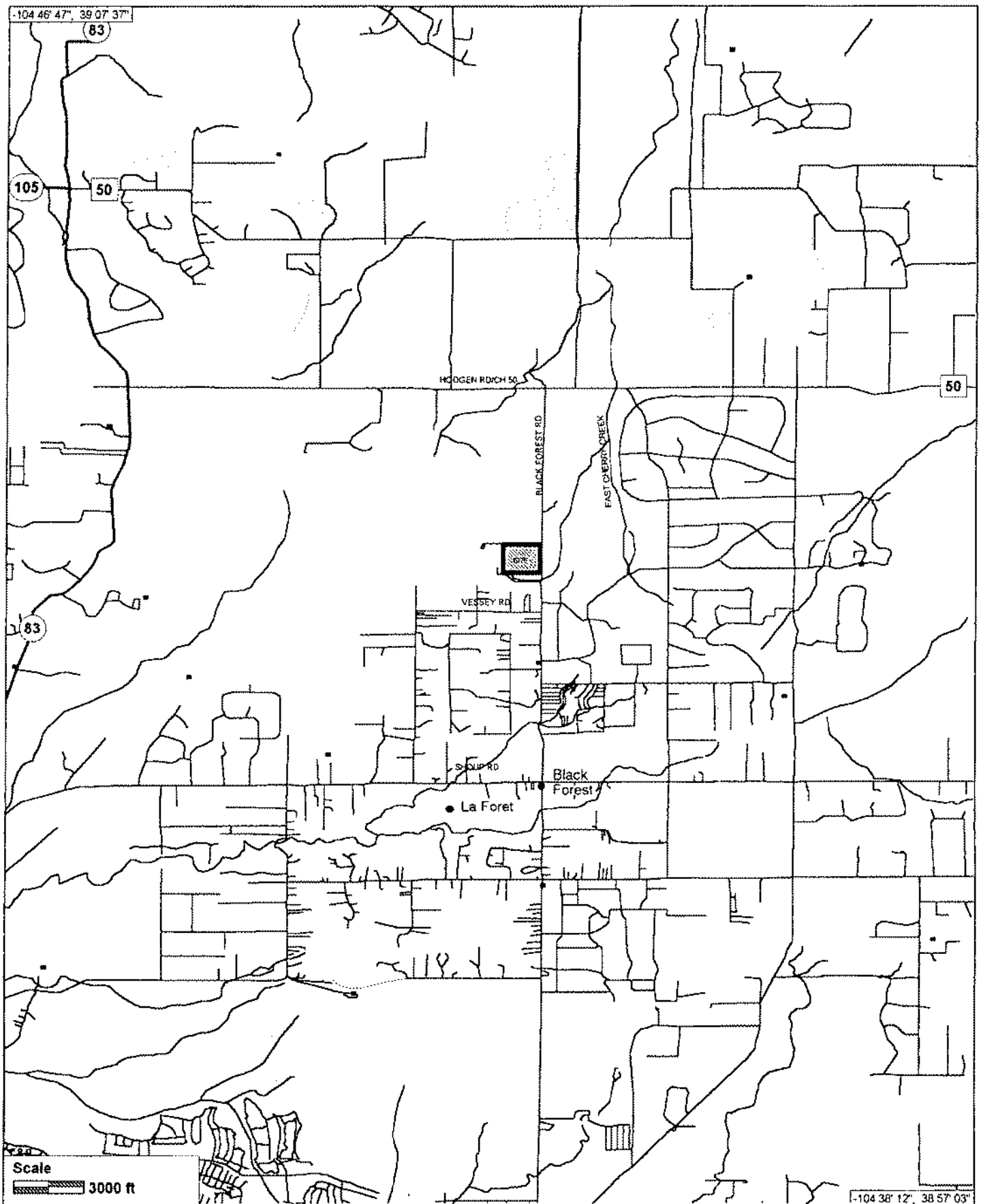
METHOD OF COMPUTATIONS:

The Methodology utilized for this report is in accordance with the City/County Drainage Criteria Manual. The Rational Method for computation of runoff was used.

$$Q = cia$$

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

COUNTRY VIEW ESTATES - VICINITY MAP



EXISTING DRAINAGE CHARACTERISTICS

The site is currently undeveloped and has been utilized as pasture land. It is currently vegetated by range land grasses. Grades on the site vary from four to ten percent. Since no overlot grading will occur on the site, there will be no difference between the boundaries for existing conditions and developed conditions. The only difference will be the time of concentrations. Basin A drains southerly through overland flow to the Black Forest Road Ditch which continues south. Off-site Basin OS1 combines with Basin B and drains easterly to an existing 30-inch CMP across Black Forest Road. Basins C and J drain north by overland flow to natural swales dividing the basins. Off-site Basin OS3 combines with Basin F and flows into the westerly pond site. Basins OS2, D, E, G, H and I combine with the flows from the westerly pond site and flows into the eastern pond site. Flow from the pond sites travel to the north across an existing driveway through an existing 18-inch HDPE. This flow continues northerly approximately 1500 linear feet where it crosses Black Forest Road.

Based on the existing conditions of the site, the following storm flows will result:

Sub-Basin	5-Year Flow	100-Year Flow	Accumulated Flows	
	(CFS)	(CFS)	5-Year	100-Year
A	0.5	1.2	--	--
B	7.2	17.5	13.7	33.4
C	1.2	3.0	--	--
D	5.9	14.3	6.7	16.3
E	3.3	8.2	--	--
F	5.3	12.9	22.3	54.5
G	2.2	5.3	--	--
H	1.2	2.9	4.2	10.4
I	9.1	22.2	28.2	69.1
J	6.6	16.1	31.6	77.2
OS1	1.7	4.1	--	--
OS2	1.7	4.1	--	--
OS3	19.0	46.5	--	--

Cumulative flow at the existing driveway before development equal 31.6 CFS for a 5-year storm and 77.2 CFS for a 100-year storm. The combined flows leaving Basin B at Black Forest Road is estimated to be 13.7 CFS for a 5-year storm and 33.4 for a 100-year storm.

PROPOSED DRAINAGE CHARACTERISTICS

The proposed development will consist of the construction of Country View Lane and the development of 11 lots. This development will consist of a single family dwelling and drive for each lot. There will be ditches constructed on each side of Country View Lane to intercept flows along the roadway. Two pipes will be installed across the new roadway. These pipes will convey the 100-year storm event with 3.3 CFS intercepted by an 18-inch CMP in the eastern pipe and 17.4 CFS intercepted in a 24-inch CMP in the western pipe. A 2-inch bottom ditch will be constructed around the proposed cul-de-sac to intercept flow from the existing swale from the south in Basin E of 9.0 CFS for the 100 year flow. Estimated flow depth in the ditch will be 0.5 ft. A portion of this ditch will be riprap lined along the north side of the cul-de-sac.

As detailed in the Existing Conditions section, there will be no changes to the existing drainage patterns due to this project. The proposed roadway will bisect the existing drainage basins; however, flow will continue northerly through two (2) culverts and join back into the existing swales. Basin A will not be affected by this subdivision. Basin OS1 combines with Basin B and continues flowing across Black Forest Road through the existing 30-inch CMP. The 100-year flow is estimated at 34.7 CFS, 1.3 CFS greater than existing.

Basin C flows will be intercepted by the Country View Lane roadside ditches and transported through a proposed 18-inch CMP. The 100-year flow of 3.3 CFS will continue through Basin J in an existing natural swale.

The off-site Basin OS2 will continue flowing through Basin D. The combined flow of 17.4 CFS for the 100-year storm will be directed into roadside ditches and then cross the roadway

in a 24-inch CMP. This flow will continue northerly through Basin I within a ten-foot natural swale.

Basin E will be intercepted by the proposed cul-de-sac ditch and be directed around the roadway within a riprap-lined ditch. The 100-year flow of 9.0 CFS will be directed to a natural swale within Basin H. These flows will continue northerly until they intersect with the easterly swale.

The off-site Basin OS3 combines with flows from Basin F through an existing swale. These flows drained through an existing stock pond, which has been removed. From this point, the existing swale turns easterly and travels through Basin G. The 100-year flow at this point is 63.6 CFS. This flow will continue easterly and combine with flows from Basins H and I. The combined flow of 71.9 CFS for the 100-year storm will flow through another existing pond site, which has been removed. These flows continue to an existing 18-inch HDPE along the northerly drive.

Based on the developed conditions of the site, the following storm flows will result:

Sub-Basin	5-Year Flow	100-Year Flow	Accumulated Flows	
	(CFS)	(CFS)	5-Year	100-Year
A	0.5	1.2	--	--
B	8.2	19.3	14.4	34.7
C	1.4	3.3	--	--
D	6.4	15.2	7.3	17.4
E	3.8	9.0	--	--
F	6.0	14.2	22.8	55.4
G	2.5	5.9	23.2	56.2
H	1.4	3.2	4.8	11.4
I	10.3	24.4	29.9	71.9
J	7.5	17.8	33.7	80.9
OS1	8.3	20.3	--	--
OS2	1.7	4.1	--	--
OS3	19.0	46.5	--	--

Cumulative developed flow from this site, coming into the 18-inch pipe beneath the existing driveway is equal to 33.7 CFS for a 5-year storm and 80.9 CFS for a 100-year storm. The

developed cumulative flows to the 30-inch CMP under Black Forest Road is 14.4 CFS for a 5-year storm and 34.7 CFS for a 100-year storm.

DRAINAGE IMPROVEMENT COSTS

The drainage facilities proposed under this Drainage Report are in accordance with the requirements of the City/County Drainage Manual. The proposed non-reimbursable drainage improvements are as follows:

<u>Description</u>	<u>Quantity</u>
18" CMP	54 LF
24" CMP	60 LF
Riprap Type L	115 CY

For improvements costs, see the attached signed Bid from Lacy Excavating, Inc.

EROSION CONTROL COSTS

No overlot grading will be performed within this subdivision; therefore, the erosion control measures proposed are only for grading necessary to construct Country View Lane and the associated drainage improvements. These erosion control items are delineated on the Roadway Construction plans. The estimated erosion control costs are as follows:

Item	Quantity	Unit Cost	Cost
Silt Fence	1,600 LF	\$2/LF	\$3,200
Ditch Checks	3 Each	\$20/EA	60
Reseeding	2.5 Acres	\$1,000/AC	<u>2,500</u>
Total			\$5,760

Associated Design Professionals, Inc. cannot, and does not, guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development. The Bid from Lacy Excavating, Inc. also includes the costs for erosion control.

SUMMARY

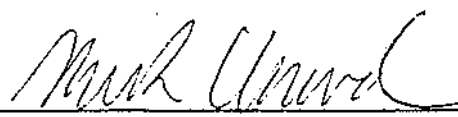
The site drainage will cause no damage to adjacent property owners. The drainage pattern is not being changed. Riprap areas will be placed at the downstream end of the proposed culverts to prevent erosion. The existing North Drive is proposed to be raised three inches in the area of the 18-inch culvert to prevent overtopping of the roadway. The estimated flow increase at the north drive for the 100-year storm is 0.1 CFS, which represents a negligible flow increase. The existing pond sites have been eliminated and will be seeded as part of this project. No overlot grading will take place. No other improvements are required to avoid damage to adjacent properties. All areas disturbed by construction will be reseeded and erosion control measures will be installed during construction of the proposed road and homesites.

LACY EXCAVATING, INC.
2180 Victor Place
Colorado Springs CO 80915
(719) 570-7176 FAX (719) 574-6333

PROJECT

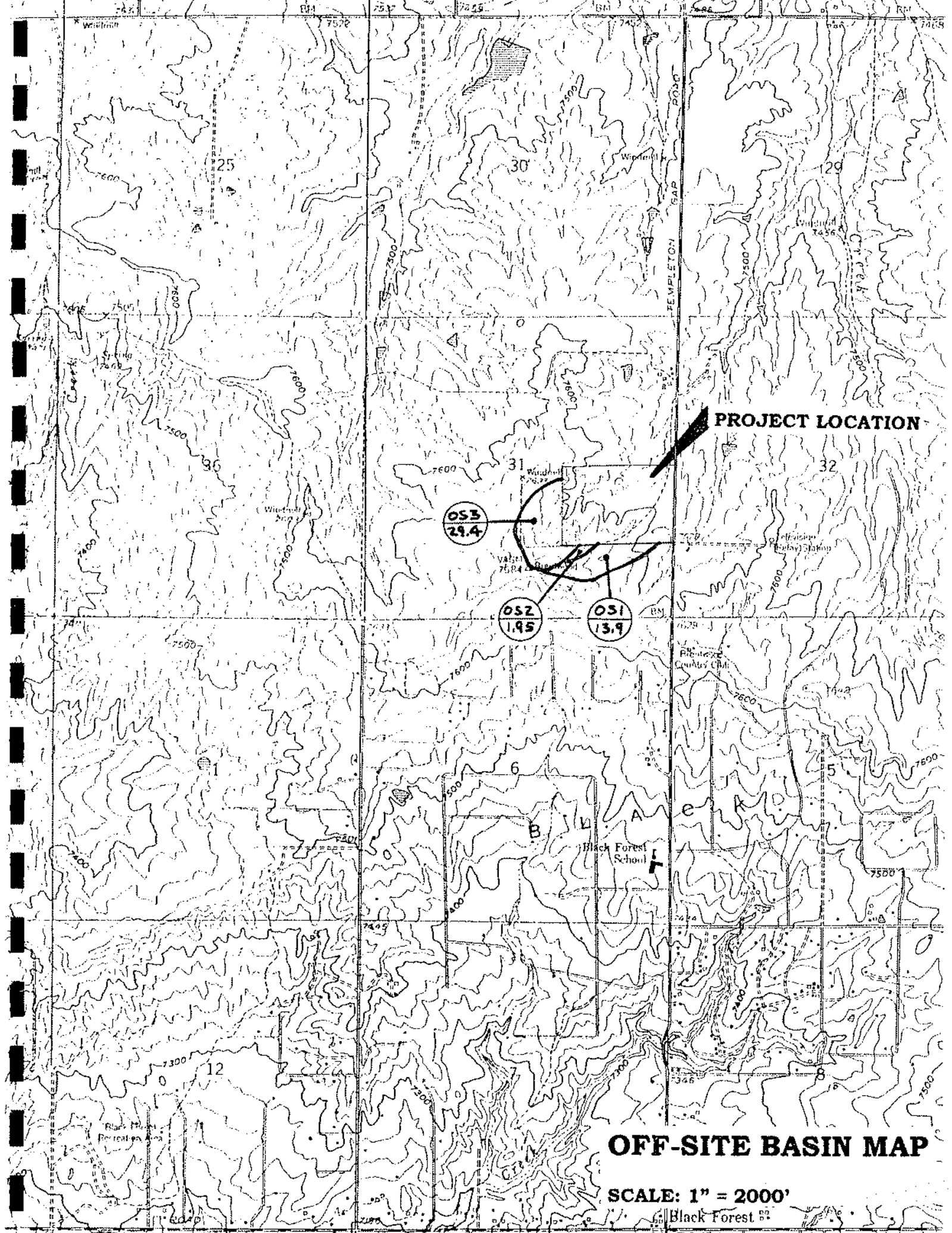
Countryview Estates
Blackforest Colorado

BID DATE: 10/28/98

		YES	NO
Submitted to: R.B.J. Enterprises Contact: Rudy Address: _____ Street: _____ CITY _____ STATE _____ ZIP CODE _____	F.O.B. Jobsite	XXX	
	Installed	XXX	
	Tax Inc.	XXX	
	Posted/Prevailing wage		
	Is bond included?		
	Can you bond project?		
	Bond Rate/Cost		
PHONE: _____ FAX: _____	MBE	WBE	D&E
	Addenda	None	
	DESCRIPTION	BID AMOUNT	
	Strip and grade road ditch	\$24,500.00	
	Road base/delivery, and grader	Inc.	
	Regrading slopes, cut areas	Inc.	
	Two Culverts	\$2,066.00	
	Install Rip Rap at end of culverts	Inc.	
	Silt Fence per D.O.T. regulations		
	YES	NO	
Per Plans & Specs			Total Bid \$26,566.00
SPECIFIC QUALIFICATIONS OR EXCLUSIONS:			
EXCLUDES:			
Alt. No.	Description	Amt. Add/Deduct	
			President
Bidder's Authorized Signature Michael W. Underwood			Title

Appendix A

Design Calculations



PROJECT LOCATION

OS3
29.4

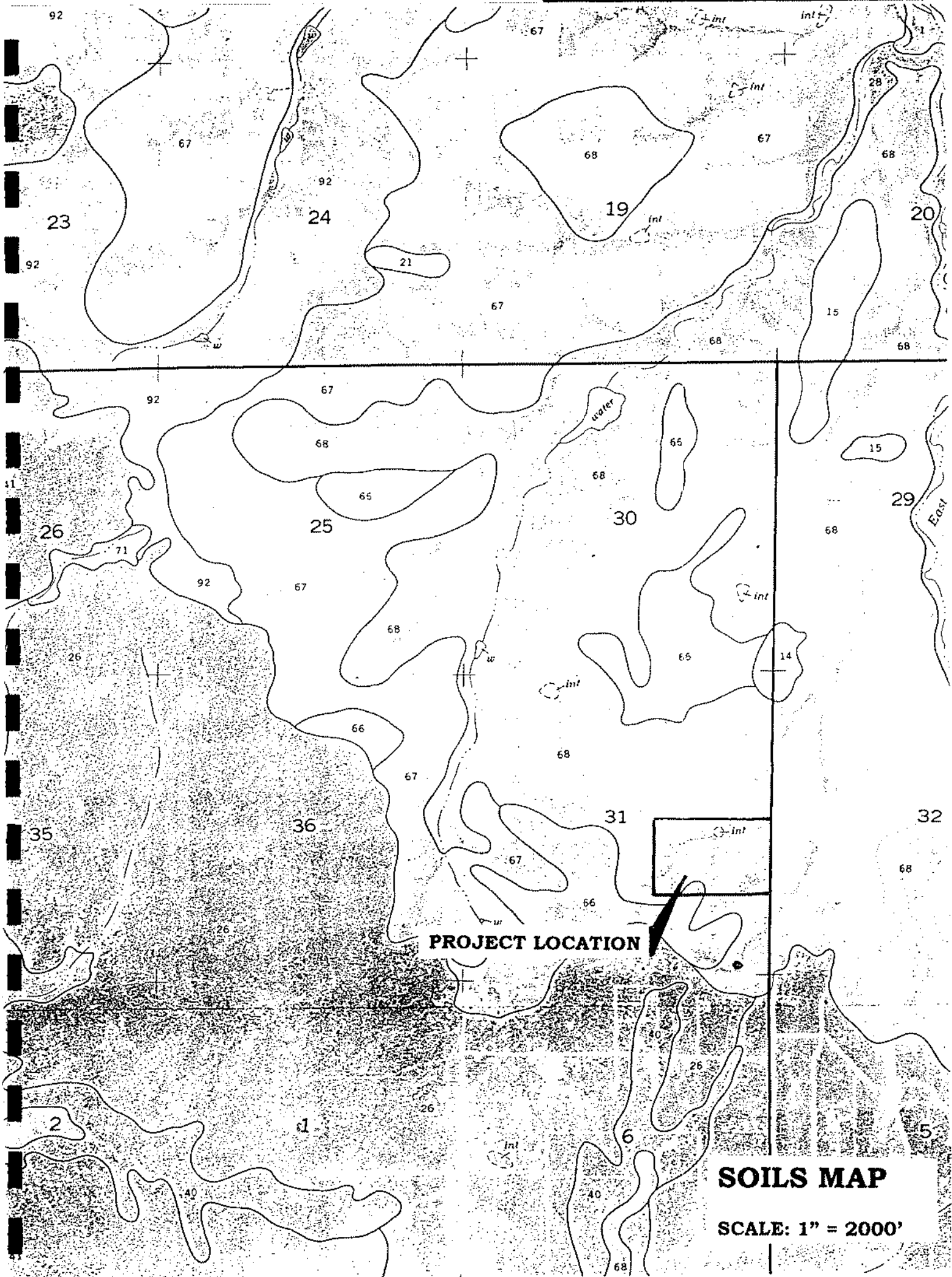
OS2
1.95

OS1
13.9

OFF-SITE BASIN MAP

SCALE: 1" = 2000'

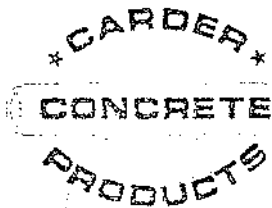
Black Forest



PROJECT LOCATION

SOILS MAP

SCALE: 1" = 2000'



CARDER CONCRETE PRODUCTS COMPANY
8311 W. CARDER CT.
LITTLETON, CO 80125
(303) 791-1500 (303) 791-1710 FAX

DATE

PAGE

of

AVERAGE 'C' FACTOR CALCULATION

5 ACRE LOTS = 217,800 SF

DRIVEWAY - 100' X 20' = 2000 SF

$C_s = 0.8$ $C_{100} = 0.85$

HOUSE - = 4000 SF

$C_s = 0.9$ $C_{100} = 0.95$

ROADWAY - 300'(1/2) X 16' = 4800 SF

$C_s = 0.9$ $C_{100} = 0.95$

10,800 SF

UNDEVELOPED LAND = 217,800 - 10,800 = 207,000 SF $C_s = 0.25$ $C_{100} = 0.35$

Avg C_s

$$\frac{2000 \times 0.8 + 4000 \times 0.9 + 4800 \times 0.9 + 207,000 \times 0.25}{217,800} = 0.28$$

Avg C_{100}

$$\frac{2000 \times 0.85 + 4000 \times 0.95 + 4800 \times 0.95 + 207,000 \times 0.35}{217,800} = 0.38$$

COUNTRY VIEW ESTATES																					
PROJ. #980306																					
DRAINAGE CALCULATION SHEET																					
08/17/98																					
AREA DESIG.	AREA (acre)	C5 (5 yr)	C100 (100 yr)	C5 X A	C100 X A	Initial Tci		Travel Time										length L (feet)	vel. V (fps)	t (min)	AREA DESIG.
						Slope (%)	ti (min)	Slope (%)	V (fps)	Tt (min)	TC (min)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)						
EXISTING CONDITIONS																					
A	0.53	0.25	0.35	0.13	0.19	250	8.00	12.65	0	1.00	1.00	0.00	12.65	3.65	6.38	0.48	1.18				
OS1	13.90	0.25	0.35	3.48	4.87	500	4.00	22.49	1300	5.40	3.60	6.02	28.51	2.39	4.17	8.30	20.30	750	3.0	4.17	OS1
B	10.93	0.25	0.35	2.73	3.83	500	5.60	20.13	750	4.30	3.00	4.17	24.30	2.82	4.57	7.16	17.50				B
DP 1				6.21	8.69								32.68	2.20	3.85	13.67	33.44				DP 1
C	1.44	0.25	0.35	0.36	0.50	250	5.00	14.78	0	1.00	1.00	0.00	14.78	3.40	5.94	1.22	2.99	750	3.2	3.91	C
OS2	1.95	0.25	0.35	0.49	0.68	200	4.00	14.23	0	1.00	1.00	0.00	14.23	3.46	6.04	1.69	4.13	800	3.3	4.04	OS2
D	6.79	0.25	0.35	1.70	2.38	200	6.00	12.44	375	4.70	3.30	1.89	14.34	3.45	6.02	5.85	14.31				D
DP 2				2.19	3.06								18.27	3.06	5.34	6.68	16.33	650	3.2	3.39	DP 2
E	3.76	0.25	0.35	0.94	1.32	200	8.50	11.09	420	4.30	3.00	2.33	13.43	3.56	6.21	3.34	8.17	400	3.7	1.80	E
H	1.30	0.25	0.35	0.33	0.46	200	7.50	11.56	250	5.60	3.70	1.13	12.69	3.65	6.38	1.19	2.90				H
DP 3				1.27	1.77								15.23	3.35	5.85	4.24	10.36				DP 3
OS3	29.40	0.25	0.35	7.35	10.29	500	4.00	22.49	600	8.00	4.30	2.33	24.82	2.59	4.52	19.02	46.51	600	3.4	2.94	OS3
F	7.30	0.25	0.35	1.83	2.56	500	8.00	17.89	400	3.25	2.70	2.47	20.36	2.89	5.04	5.27	12.88				F
DP 4				9.18	12.85								27.76	2.43	4.24	22.27	54.45	250	1.3	3.21	DP 4
G	2.83	0.25	0.35	0.71	0.99	520	8.00	18.25	0	1.00	1.00	0.00	18.25	3.06	5.34	2.16	5.29				G
OS3-G				9.88	13.84								30.97	2.28	3.97	22.49	54.99				OS3-G
DP5				11.15	15.61								30.97	2.28	3.97	25.37	62.03	630	1.3	8.08	DP5
I	12.63	0.25	0.35	3.16	4.42	450	8.00	16.98	475	2.00	2.20	3.60	20.57	2.87	5.01	9.06	22.16				I
DP 6				14.31	20.03								39.04	1.97	3.45	28.24	69.05	200	1.3	2.56	DP 6
J	9.39	0.25	0.35	2.35	3.29	500	6.40	19.26	300	2.00	2.20	2.27	21.53	2.80	4.89	6.57	16.07				J
DP 7				16.65	23.31								41.61	1.90	3.31	31.58	77.21				DP 7

AREA	AREA	C5	C100	C5 X A	C100 X A		Initial Tci			Travel Time		Tt	TC	IS	I100	Q5	Q100	length	vel.		AREA
DESIG.	(acre)	(5 yr)	(100 yr)			L (ft)	Slope (%)	ti (min)	L (ft)	Slope (%)	V (fps)	(min)	(min)	(in/hr)	(in/hr)	(cfs)	(cfs)	L (feet)	V (fps)	t (min)	DESIG.
DEVELOPED CONDITIONS																					
A	0.53	0.25	0.35	0.13	0.19	250	8.00	12.65	0	1.00	1.00	0.00	12.65	3.65	6.38	0.48	1.18				
OS1	13.90	0.25	0.35	3.48	4.87	500	4.00	22.49	1300	5.40	3.60	6.02	28.51	2.39	4.17	8.30	20.30	750	3.0	4.17	OS1
B	10.93	0.28	0.38	3.06	4.15	500	5.60	19.42	750	4.30	3.00	4.17	23.59	2.66	4.65	8.15	19.32				B
DP 1				6.54	9.02								32.68	2.20	3.85	14.40	34.70				DP 1
C	1.44	0.28	0.38	0.40	0.55	250	5.00	14.25	0	1.00	1.00	0.00	14.25	3.46	6.04	1.39	3.30	750	3.2	3.91	C
OS2	1.95	0.25	0.35	0.49	0.68	200	4.00	14.23	0	1.00	1.00	0.00	14.23	3.46	6.04	1.69	4.13	800	3.3	4.04	OS2
D	6.79	0.28	0.38	1.90	2.58	200	6.00	12.01	600	4.70	3.30	3.03	15.04	3.37	5.89	6.41	15.19				D
DP 2				2.39	3.26								18.27	3.06	5.34	7.30	17.41	650	3.2	3.39	DP 2
E	3.76	0.28	0.38	1.05	1.43	200	8.50	10.70	420	4.30	3.00	2.33	13.04	3.61	6.30	3.80	9.00	400	3.7	1.80	E
H	1.30	0.28	0.38	0.36	0.49	200	7.50	11.15	250	5.60	3.70	1.13	12.28	3.70	6.47	1.35	3.20				H
DP 3				1.42	1.92								14.84	3.39	5.92	4.80	11.39				DP 3
OS3	29.40	0.25	0.35	7.35	10.29	500	4.00	22.49	600	8.00	4.30	2.33	24.82	2.59	4.52	19.02	46.51	600	3.4	2.94	OS3
F	7.30	0.28	0.38	2.04	2.77	500	8.00	17.26	400	3.25	2.70	2.47	19.73	2.93	5.13	6.00	14.22				F
DP 4				9.39	13.06								27.76	2.43	4.24	22.80	55.38	250	1.3	3.21	DP 4
G	2.83	0.28	0.38	0.79	1.08	520	8.00	17.61	0	1.00	1.00	0.00	17.61	3.11	5.44	2.47	5.85				G
OS3-G				10.19	14.14								30.97	2.28	3.97	23.18	56.20				OS3-G
DP5				11.60	16.06								30.97	2.28	3.97	26.40	63.84	630	1.3	8.08	DP5
I	12.63	0.28	0.38	3.54	4.80	450	8.00	16.38	475	2.00	2.20	3.60	19.98	2.92	5.09	10.31	24.44				I
DP 6				15.14	20.86								39.04	1.97	3.45	29.89	71.93	200	1.3	2.56	DP 6
J	9.39	0.28	0.38	2.63	3.57	500	6.40	18.58	300	2.00	2.20	2.27	20.86	2.85	4.98	7.49	17.76				J
DP 7				17.77	24.43								41.61	1.90	3.31	33.69	80.91				DP 7

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW ESTATES

Comment: CULVERT CAPACITY

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	1.50 ft
Slope.....	0.0200 ft/ft
Manning's n.....	0.024
Discharge.....	8.05 cfs

Computed Results:

Full Flow Capacity.....	8.05 cfs
Full Flow Depth.....	1.50 ft
Velocity.....	4.55 fps
Flow Area.....	1.77 sf
Critical Depth....	1.10 ft
Critical Slope....	0.0254 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	8.05 cfs
QMAX @.94D.....	8.66 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW ESTATES

Comment: CULVERT CAPACITY

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	2.00 ft
Slope.....	0.0250 ft/ft
Manning's n.....	0.024
Discharge.....	19.37 cfs

Computed Results:

Full Flow Capacity.....	19.37 cfs
Full Flow Depth.....	2.00 ft
Velocity.....	6.17 fps
Flow Area.....	3.14 sf
Critical Depth....	1.58 ft
Critical Slope....	0.0267 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	19.37 cfs
QMAX @.94D.....	20.84 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW ESTATES

Comment: CULVERT CAPACITY

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	2.50 ft
Slope.....	0.0400 ft/ft
Manning's n.....	0.024
Discharge.....	44.44 cfs

Computed Results:

Full Flow Capacity.....	44.44 cfs
Full Flow Depth.....	2.50 ft
Velocity.....	9.05 fps
Flow Area.....	4.91 sf
Critical Depth....	2.22 ft
Critical Slope....	0.0357 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	44.44 cfs
QMAX @.94D.....	47.80 cfs
Froude Number.....	FULL

PROJECT: COUNTRY VIEW ESTATESSTATION: 7+40 - CULVERT D

CULVERT DESIGN FORM

SHEET _____ OF _____

DESIGNER / DATE: MALB / 4/24/96

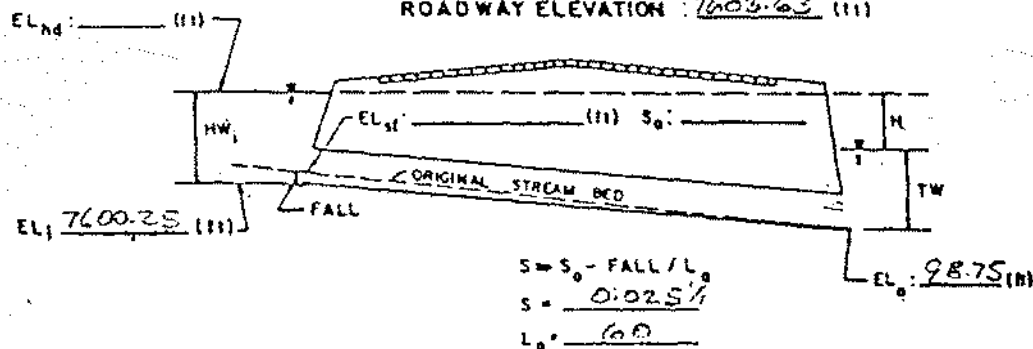
REVIEWER / DATE: _____ / _____

HYDROLOGICAL DATA

- SEE ADD'L SHEETS.
- ☐ METHOD: _____
- ☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: 2%
- ☐ CHANNEL SHAPE: b=2' z=3
- ☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAIWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
<u>100</u>	<u>17.4</u>	<u>0.9</u>
<u>5</u>	<u>7.3</u>	<u>0.6</u>



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS											CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
			INLET CONTROL					OUTLET CONTROL								
			HW ₁ /D (2)	HW ₁ (3)	FALL (4)	EL h ₁ (4)	TW (5)	d _c	$\frac{d_c + D}{2}$	h ₀ (6)	h ₀ (6)	H (7)	EL h ₀ (8)			
24" cmt - Projecting	17.4		1.45	2.9		03.15	0.9	1.5	1.75	1.75	0.9	1.95	02.45	03.15	7.0	20' R.P.R.P.
" "	7.3		0.75	1.5		01.75	0.6	1.1	1.55	1.55	0.9	0.45	00.75	01.75	5.7	"

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW₁/D = HW₁/D OR HW₁/D FROM DESIGN CHARTS(3) FALL = HW₁ - (EL_{hd} - EL_{st}); FALL IS ZERO FOR CULVERTS ON GRADE(4) EL_{h1} = HW₁ + EL₁ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h₀ = TW or (d_c + D/2) (WHICHEVER IS GREATER)(7) H = [1 + h₀ (25h₀² L) / R^{1.33}] V² / 2g(8) EL_{h0} = EL₀ + H + h₀

SUBSCRIPT DEFINITIONS:

0. APPROXIMATE
1. CULVERT FACE
2. DESIGN HEADWATER
3. HEADWATER IN INLET CONTROL
4. HEADWATER IN OUTLET CONTROL
5. INLET CONTROL SECTION
6. OUTLET
7. STREAMBED AT CULVERT FACE
8. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: _____

SHAPE: _____

MATERIAL: _____

ENTRANCE: _____

PROJECT: COUNTRY VIEW ESTATESSTATION: 14+50 - CULVERT

CULVERT DESIGN FORM

SHEET _____ OF _____

DESIGNER / DATE: M.A.B. / 4/24/96

REVIEWER / DATE: _____ / _____

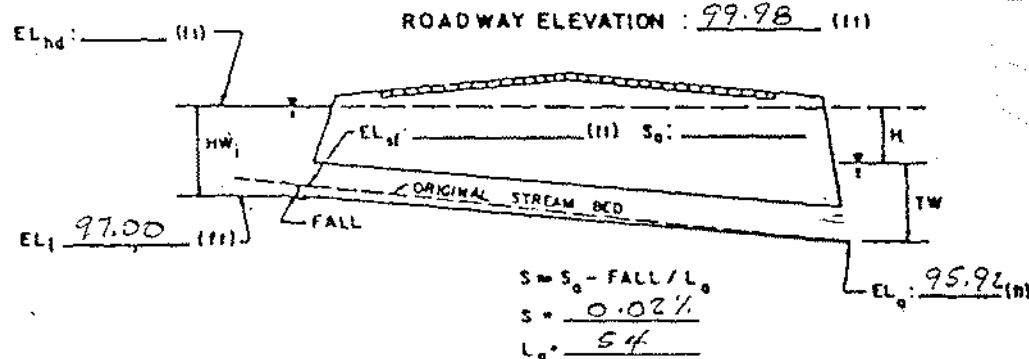
HYDROLOGICAL DATA

SEE ADDENDUMS

- ☐ METHOD: _____
- ☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: 2%
- ☐ CHANNEL SHAPE: b=2' z=3
- ☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAIWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
<u>100</u>	<u>3.3</u>	<u>0.4</u>
<u>5</u>	<u>1.4</u>	<u>0.3</u>



CULVERT DESCRIPTION:

MATERIAL - SHAPE - SIZE - ENTRANCE

TOTAL FLOW

Q (cfs)

FLOW PER CHANNEL

Q/N

HEADWATER CALCULATIONS

INLET CONTROL

OUTLET CONTROL

CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER CHANNEL Q/N	HEADWATER CALCULATIONS											CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
			HW ₁ /D (2)	HW ₁ (3)	FALL (3)	EL _{hi} (4)	TW (5)	d _c (6)	d _c +D/2 (7)	h ₀ (8)	L ₀ (9)	H (10)	EL _{ho} (11)			
18" CMP - PROPOSED	3.3		0.7	1.05		98.00	0.4	0.75	1.13	1.13	0.9	0.3	97.35	98.05	4.3	10' R. PRAP.
"	1.4		0.4	0.6		97.60	0.3	0.5	1.0	1.0	0.9	0.2	97.12	97.60	3.4	" "

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW₁/D = HW₁/D OR HW₁/D FROM DESIGN CHARTS(3) FALL = HW₁ - (EL_{hd} - EL_{sf}); FALL IS ZERO FOR CULVERTS ON GRADE(4) EL_{hi} = HW₁ + EL₁ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h₀ = TW or (d_c + D/2) (WHICHEVER IS GREATER)(7) $H = \left[1 + h_0 + 1.29 \frac{Q^2}{R^{1.33}} \right] V^2 / 2g$ (8) EL_{ho} = EL₀ + H + h₀

SUBSCRIPT DEFINITIONS:

- 0. APPROXIMATE
- 1. CULVERT FACE
- 4. DESIGN HEADWATER
- 5. HEADWATER IN INLET CONTROL
- 6. HEADWATER IN OUTLET CONTROL
- 7. INLET CONTROL SECTION
- 8. OUTLET
- 9. STREAMBED AT CULVERT FACE
- 10. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: _____

SHAPE: _____

MATERIAL: _____

ENTRANCE: _____

*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

DB TR-20 SUMMARY NO PLOTS
 TITLE 001 COUNTRY VIEW ESTATES TR20 RUN 24 HR. 100 YR. STORM
 TITLE EXISTING CONDITIONS W/ TYPE II STORM & DET BASINS : CVEY
 5 RAINFL 7 0.5
 8 0.0000 0.0040 0.0080 0.0100 0.0140
 8 0.0190 0.0220 0.0260 0.0300 0.0450
 8 0.0600 0.1000 0.7100 0.7500 0.7750
 8 0.8000 0.8200 0.8300 0.8400 0.8500
 8 0.8600 0.8700 0.8750 0.8850 0.8900
 8 0.9000 0.9050 0.9100 0.9200 0.9250
 8 0.9300 0.9350 0.9400 0.9450 0.9500
 8 0.9550 0.9600 0.9650 0.9700 0.9730
 8 0.9750 0.9800 0.9830 0.9870 0.9900
 8 0.9930 0.9960 0.9999 1.0000 1.0000
 9 ENDTBL
 2 XSECTN 001 1.0
 8 7559.5 0.0 0.0
 8 7559.7 10.0 3.00
 8 7559.9 20.0 4.88
 8 7560.1 50.0 9.29
 8 7560.3 100.0 15.30
 8 7560.7 200.0 25.36
 9 ENDTBL
 3 STRUCT 01
 8 7559.5 0.0 0.0
 8 7561.5 10.0 0.05
 8 7563.5 16.0 0.35
 8 7565.5 21.0 1.00
 8 7567.5 25.0 2.50
 8 7568.0 50.0 3.05
 9 ENDTBL
 6 RUNOFF 1 001 5 0.120 66.9 0.694 1
 6 RESVOR 2 01 5 2 7559.5 1
 7 INCREM 6 0.10
 7 COMPUT 7 001 01 0.0 4.40 1.0 7 2 01 01
 ENDCMP 1
 ENDJOB 2

*****END OF 80-80 LIST*****

EXECUTIVE CONTROL OPERATION INCREM

MAIN TIME INCREMENT = .10 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT

FROM XSECTION 1

RECORD ID

TO STRUCTURE 1

STARTING TIME = .00 RAIN DEPTH = 4.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 7 ANT. MOIST. COND= 2
 ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.31	77.11	(RUNOFF)
10.43	4.02	(RUNOFF)
12.69	3.53	(RUNOFF)
14.20	3.51	(RUNOFF)
18.90	2.16	(RUNOFF)
23.58	1.55	(RUNOFF)

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.90	24.97	7567.48
10.46	4.02	7560.30
12.75	3.49	7560.20
14.26	3.47	7560.19
18.95	2.16	7559.93
23.63	1.54	7559.81

EXECUTIVE CONTROL OPERATION ENDCMP

COMPUTATIONS COMPLETED FOR PASS 1

RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB

RECORD ID

TR20 XEQ 08-21-98 10:06
REV PC 09/83(.2)

COUNTRY VIEW ESTATES TR20 RUN 24 HR. 100 YR. STORM
EXISTING CONDITIONS W/ TYPE II STORM & DET BASINS : CVEX

JOB 1 SUMMARY
PAGE 1

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE	1	STORM	1											
XSECTION	1	RUNOFF	.12	7	2	.10	.0	4.40	24.00	1.39	---	6.31	77.11	642.6
STRUCTURE	1	RESVOR	.12	7	2	.10	.0	4.40	24.00	1.39	7567.48	6.90	24.97	208.1

TR20 XEQ 08-21-98 10:06
REV PC 09/83(.2)

COUNTRY VIEW ESTATES TR20 RUN 24 HR. 100 YR. STORM
EXISTING CONDITIONS W/ TYPE II STORM & DET BASINS : CVEX

JOB 1 SUMMARY
PAGE 2

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/
STRUCTURE
ID DRAINAGE
AREA
(SQ MI)

STORM NUMBERS.....
1

0 STRUCTURE 1 .12

ALTERNATE 1

24.97

0 XSECTION 1 .12

ALTERNATE 1

77.11

1END OF 1 JOBS IN THIS RUN



*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

OB TR-20 SUMMARY NOPLOTS

TITLE 001 COUNTRY VIEW ESTATES TR20 RUN 24 HR. 100 YR. STORM

TITLE DEVELOPED CONDITIONS W/ TYPE II STORM & DET BASINS : CVE

5 RAINFL 7	0.5				
8	0.0000	0.0040	0.0080	0.0100	0.0140
8	0.0190	0.0220	0.0260	0.0300	0.0450
8	0.0600	0.1000	0.7100	0.7500	0.7750
8	0.8000	0.8200	0.8300	0.8400	0.8500
8	0.8600	0.8700	0.8750	0.8850	0.8900
8	0.9000	0.9050	0.9100	0.9200	0.9250
8	0.9300	0.9350	0.9400	0.9450	0.9500
8	0.9550	0.9600	0.9650	0.9700	0.9730
8	0.9750	0.9800	0.9830	0.9870	0.9900
8	0.9930	0.9960	0.9999	1.0000	1.0000

9 ENDTBL

2 XSECTN 001	1.0			
8	7559.5	0.0	0.0	
8	7559.7	10.0	3.00	
8	7559.9	20.0	4.88	
8	7560.1	50.0	9.29	
8	7560.3	100.0	15.30	
8	7560.7	200.0	25.36	

9 ENDTBL

3 STRUCT 01				
8	7559.5	0.0	0.0	
8	7561.5	10.0	0.05	
8	7563.5	16.0	0.35	
8	7565.5	21.0	1.00	
8	7567.5	25.0	2.50	
8	7567.75	25.5	3.05	
8	7568.0	50.0	3.75	

9 ENDTBL

6 RUNOFF 1 001	5	0.120	67.7	0.694	1
6 RESVOR 2 01 5 2	7559.5				1
ENDATA					
7 INCREM 6		0.10			
7 COMPUT 7 001	01	0.0	4.40	1.0	7 2 01 01
ENDCMP 1					
ENDJOB 2					

*****END OF 80-80 LIST*****

EXECUTIVE CONTROL OPERATION INCREM

RECORD ID

MAIN TIME INCREMENT = .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT

RECORD ID

FROM XSECTION 1

TO STRUCTURE 1

STARTING TIME = .00 RAIN DEPTH = 4.40 RAIN DURATION = 1.00 RAIN TABLE NO. = 7 ANT. MOIST. COND = 2
ALTERNATE NO. = 1 STORM NO. = 1 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.31	80.96	(RUNOFF)
10.43	4.12	(RUNOFF)
12.69	3.61	(RUNOFF)
14.20	3.58	(RUNOFF)
18.89	2.21	(RUNOFF)
23.58	1.58	(RUNOFF)

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.91	25.16	7567.58
10.46	4.12	7560.32
12.75	3.57	7560.21
14.26	3.55	7560.21
18.95	2.21	7559.94
23.63	1.57	7559.81

EXECUTIVE CONTROL OPERATION ENDCMP

RECORD ID

COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL OPERATION ENDJOB

RECORD ID

TR20 XEQ 10-15-98 06:22
REV PC 09/83(.2)

COUNTRY VIEW ESTATES TR20 RUN 24 HR. 100 YR. STORM
DEVELOPED CONDITIONS W/ TYPE II STORM & DET BASINS : CVE

JOB 1 SUMMARY
PAGE 1

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE			
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
ALTERNATE	1	STORM	1										
SECTION 1	RUNOFF	.12	7	2	.10	.0	4.40	24.00	1.45	---	6.31	80.96	674.7
STRUCTURE 1	RESVOR	.12	7	2	.10	.0	4.40	24.00	1.45	7567.58	6.91	25.16	209.7

TR20 XEQ 10-15-98 06:22
REV PC 09/83(.2)

COUNTRY VIEW ESTATES TR20 RUN 24 HR. 100 YR. STORM
DEVELOPED CONDITIONS W/ TYPE II STORM & DET BASINS : CVE

JOB 1 SUMMARY
PAGE 2

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.....
------------------------------	-----------------------------	--------------------

STRUCTURE 1	.12	
-------------	-----	--

ALTERNATE 1		25.16
-------------	--	-------

XSECTION 1	.12	
------------	-----	--

ALTERNATE 1		80.96
-------------	--	-------

END OF 1 JOBS IN THIS RUN

175

176

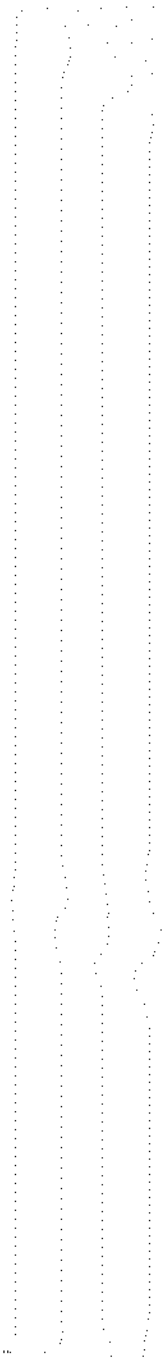
177

178

179

Appendix B

Roadside Ditch Capacity



Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 0+50 - 2+70 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	4.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0200 ft/ft
Discharge.....	1.90 cfs

Computed Results:

Depth.....	0.46 ft
Velocity.....	2.22 fps
Flow Area.....	0.86 sf
Flow Top Width...	3.70 ft
Wetted Perimeter.	3.82 ft
Critical Depth...	0.43 ft
Critical Slope...	0.0311 ft/ft
Froude Number....	0.81 (flow is Subcritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 0+50 - 2+70 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	4.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0200 ft/ft
Discharge.....	4.50 cfs

Computed Results:

Depth.....	0.64 ft
Velocity.....	2.75 fps
Flow Area.....	1.64 sf
Flow Top Width...	5.12 ft
Wetted Perimeter.	5.27 ft
Critical Depth...	0.60 ft
Critical Slope...	0.0278 ft/ft
Froude Number....	0.86 (flow is Subcritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 2+70 - 7+40 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0300 ft/ft
Discharge.....	3.20 cfs

Computed Results:

Depth.....	0.55 ft
Velocity.....	3.03 fps
Flow Area.....	1.06 sf
Flow Top Width...	3.85 ft
Wetted Perimeter.	4.00 ft
Critical Depth...	0.55 ft
Critical Slope...	0.0289 ft/ft
Froude Number....	1.02 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 2+70 - 7+40 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0300 ft/ft
Discharge.....	7.60 cfs

Computed Results:

Depth.....	0.76 ft
Velocity.....	3.76 fps
Flow Area.....	2.02 sf
Flow Top Width...	5.32 ft
Wetted Perimeter.	5.54 ft
Critical Depth...	0.78 ft
Critical Slope...	0.0258 ft/ft
Froude Number....	1.07 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 7+40 - 10+66 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0200 ft/ft
Discharge.....	3.20 cfs

Computed Results:

Depth.....	0.59 ft
Velocity.....	2.60 fps
Flow Area.....	1.23 sf
Flow Top Width...	4.15 ft
Wetted Perimeter.	4.32 ft
Critical Depth...	0.55 ft
Critical Slope...	0.0289 ft/ft
Froude Number....	0.84 (flow is Subcritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 7+40 - 10+66 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0200 ft/ft
Discharge.....	7.60 cfs

Computed Results:

Depth.....	0.82 ft
Velocity.....	3.23 fps
Flow Area.....	2.35 sf
Flow Top Width...	5.74 ft
Wetted Perimeter.	5.98 ft
Critical Depth...	0.78 ft
Critical Slope...	0.0258 ft/ft
Froude Number....	0.89 (flow is Subcritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 10+66 - 14+50 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0330 ft/ft
Discharge.....	1.10 cfs

Computed Results:

Depth.....	0.36 ft
Velocity.....	2.40 fps
Flow Area.....	0.46 sf
Flow Top Width...	2.53 ft
Wetted Perimeter.	2.64 ft
Critical Depth...	0.36 ft
Critical Slope...	0.0333 ft/ft
Froude Number....	1.00 (flow is Critical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 10+66 - 14+50 -100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0330 ft/ft
Discharge.....	2.50 cfs

Computed Results:

Depth.....	0.49 ft
Velocity.....	2.95 fps
Flow Area.....	0.85 sf
Flow Top Width...	3.45 ft
Wetted Perimeter.	3.59 ft
Critical Depth...	0.50 ft
Critical Slope...	0.0299 ft/ft
Froude Number....	1.05 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 14+50 - 16+00 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	4.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0100 ft/ft
Discharge.....	0.30 cfs

Computed Results:

Depth.....	0.26 ft
Velocity.....	1.08 fps
Flow Area.....	0.28 sf
Flow Top Width...	2.11 ft
Wetted Perimeter.	2.18 ft
Critical Depth...	0.20 ft
Critical Slope...	0.0398 ft/ft
Froude Number....	0.52 (flow is Subcritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: DITCH CAPACITY - STA 14+50 - 16+00 -100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	4.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0100 ft/ft
Discharge.....	0.80 cfs

Computed Results:

Depth.....	0.38 ft
Velocity.....	1.38 fps
Flow Area.....	0.58 sf
Flow Top Width...	3.05 ft
Wetted Perimeter.	3.14 ft
Critical Depth...	0.30 ft
Critical Slope...	0.0350 ft/ft
Froude Number....	0.56 (flow is Subcritical)

Appendix C

Swale Capacity

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 1 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0500 ft/ft
Discharge.....	14.40 cfs

Computed Results:

Depth.....	0.59 ft
Velocity.....	4.18 fps
Flow Area.....	3.45 sf
Flow Top Width...	11.74 ft
Wetted Perimeter.	11.80 ft
Critical Depth...	0.66 ft
Critical Slope...	0.0260 ft/ft
Froude Number....	1.36 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 1 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0500 ft/ft
Discharge.....	34.70 cfs

Computed Results:

Depth.....	0.82 ft
Velocity.....	5.21 fps
Flow Area.....	6.66 sf
Flow Top Width...	16.33 ft
Wetted Perimeter.	16.41 ft
Critical Depth...	0.94 ft
Critical Slope...	0.0231 ft/ft
Froude Number....	1.44 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 2 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	15.00:1 (H:V)
Right Side Slope.	15.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	1.40 cfs

Computed Results:

Depth.....	0.20 ft
Velocity.....	2.26 fps
Flow Area.....	0.62 sf
Flow Top Width...	6.10 ft
Wetted Perimeter.	6.11 ft
Critical Depth...	0.22 ft
Critical Slope...	0.0373 ft/ft
Froude Number....	1.25 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 2 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	15.00:1 (H:V)
Right Side Slope.	15.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	3.30 cfs

Computed Results:

Depth.....	0.28 ft
Velocity.....	2.80 fps
Flow Area.....	1.18 sf
Flow Top Width...	8.41 ft
Wetted Perimeter.	8.43 ft
Critical Depth...	0.31 ft
Critical Slope...	0.0332 ft/ft
Froude Number....	1.32 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 3 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	15.00:1 (H:V)
Right Side Slope.	15.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	6.40 cfs

Computed Results:

Depth.....	0.36 ft
Velocity.....	3.31 fps
Flow Area.....	1.94 sf
Flow Top Width...	10.78 ft
Wetted Perimeter.	10.80 ft
Critical Depth...	0.41 ft
Critical Slope...	0.0304 ft/ft
Froude Number....	1.37 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 3 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	15.00:1 (H:V)
Right Side Slope.	15.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	15.20 cfs

Computed Results:

Depth.....	0.50 ft
Velocity.....	4.10 fps
Flow Area.....	3.70 sf
Flow Top Width...	14.91 ft
Wetted Perimeter.	14.94 ft
Critical Depth...	0.58 ft
Critical Slope...	0.0271 ft/ft
Froude Number....	1.45 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 4 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	10.00 ft
Left Side Slope..	6.00:1 (H:V)
Right Side Slope.	6.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	7.30 cfs

Computed Results:

Depth.....	0.20 ft
Velocity.....	3.30 fps
Flow Area.....	2.21 sf
Flow Top Width...	12.38 ft
Wetted Perimeter.	12.41 ft
Critical Depth...	0.24 ft
Critical Slope...	0.0299 ft/ft
Froude Number....	1.37 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 4 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	10.00 ft
Left Side Slope..	6.00:1 (H:V)
Right Side Slope.	6.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	17.40 cfs

Computed Results:

Depth.....	0.33 ft
Velocity.....	4.45 fps
Flow Area.....	3.91 sf
Flow Top Width...	13.92 ft
Wetted Perimeter.	13.98 ft
Critical Depth...	0.42 ft
Critical Slope...	0.0256 ft/ft
Froude Number....	1.48 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 5 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	3.80 cfs

Computed Results:

Depth.....	0.34 ft
Velocity.....	3.21 fps
Flow Area.....	1.18 sf
Flow Top Width...	6.88 ft
Wetted Perimeter.	6.92 ft
Critical Depth...	0.39 ft
Critical Slope...	0.0310 ft/ft
Froude Number....	1.36 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 5 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	9.00 cfs

Computed Results:

Depth.....	0.48 ft
Velocity.....	3.98 fps
Flow Area.....	2.26 sf
Flow Top Width...	9.51 ft
Wetted Perimeter.	9.56 ft
Critical Depth...	0.55 ft
Critical Slope...	0.0277 ft/ft
Froude Number....	1.44 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 7 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	6.00:1 (H:V)
Right Side Slope.	6.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	4.20 cfs

Computed Results:

Depth.....	0.43 ft
Velocity.....	3.72 fps
Flow Area.....	1.13 sf
Flow Top Width...	5.21 ft
Wetted Perimeter.	5.28 ft
Critical Depth...	0.50 ft
Critical Slope...	0.0289 ft/ft
Froude Number....	1.41 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 7 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	6.00:1 (H:V)
Right Side Slope.	6.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0600 ft/ft
Discharge.....	10.20 cfs

Computed Results:

Depth.....	0.61 ft
Velocity.....	4.64 fps
Flow Area.....	2.20 sf
Flow Top Width...	7.26 ft
Wetted Perimeter.	7.36 ft
Critical Depth...	0.71 ft
Critical Slope...	0.0257 ft/ft
Froude Number....	1.49 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 8 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0500 ft/ft
Discharge.....	22.80 cfs

Computed Results:

Depth.....	0.70 ft
Velocity.....	4.69 fps
Flow Area.....	4.86 sf
Flow Top Width...	13.95 ft
Wetted Perimeter.	14.02 ft
Critical Depth...	0.80 ft
Critical Slope...	0.0244 ft/ft
Froude Number....	1.40 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 8 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0500 ft/ft
Discharge.....	55.40 cfs

Computed Results:

Depth.....	0.97 ft
Velocity.....	5.85 fps
Flow Area.....	9.47 sf
Flow Top Width...	19.46 ft
Wetted Perimeter.	19.56 ft
Critical Depth...	1.14 ft
Critical Slope...	0.0217 ft/ft
Froude Number....	1.48 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 9 - 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0500 ft/ft
Discharge.....	22.80 cfs

Computed Results:

Depth.....	0.70 ft
Velocity.....	4.69 fps
Flow Area.....	4.86 sf
Flow Top Width...	13.95 ft
Wetted Perimeter.	14.02 ft
Critical Depth...	0.80 ft
Critical Slope...	0.0244 ft/ft
Froude Number....	1.40 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 9 - 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0500 ft/ft
Discharge.....	55.40 cfs

Computed Results:

Depth.....	0.97 ft
Velocity.....	5.85 fps
Flow Area.....	9.47 sf
Flow Top Width...	19.46 ft
Wetted Perimeter.	19.56 ft
Critical Depth...	1.14 ft
Critical Slope...	0.0217 ft/ft
Froude Number....	1.48 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 10- 5 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	10.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope..	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0270 ft/ft
Discharge.....	29.90 cfs

Computed Results:

Depth.....	0.53 ft
Velocity.....	3.73 fps
Flow Area.....	8.03 sf
Flow Top Width...	20.52 ft
Wetted Perimeter.	20.57 ft
Critical Depth...	0.54 ft
Critical Slope...	0.0243 ft/ft
Froude Number....	1.05 (flow is Supercritical)

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: COUNTRY VIEW EST

Comment: SWALE CAPACITY - EXISTING SWALE 10- 100 YEAR

Solve For Depth

Given Input Data:

Bottom Width.....	10.00 ft
Left Side Slope..	10.00:1 (H:V)
Right Side Slope.	10.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0270 ft/ft
Discharge.....	71.90 cfs

Computed Results:

Depth.....	0.82 ft
Velocity.....	4.78 fps
Flow Area.....	15.06 sf
Flow Top Width...	26.50 ft
Wetted Perimeter.	26.58 ft
Critical Depth...	0.87 ft
Critical Slope...	0.0213 ft/ft
Froude Number....	1.12 (flow is Supercritical)

Appendix D

Design Charts

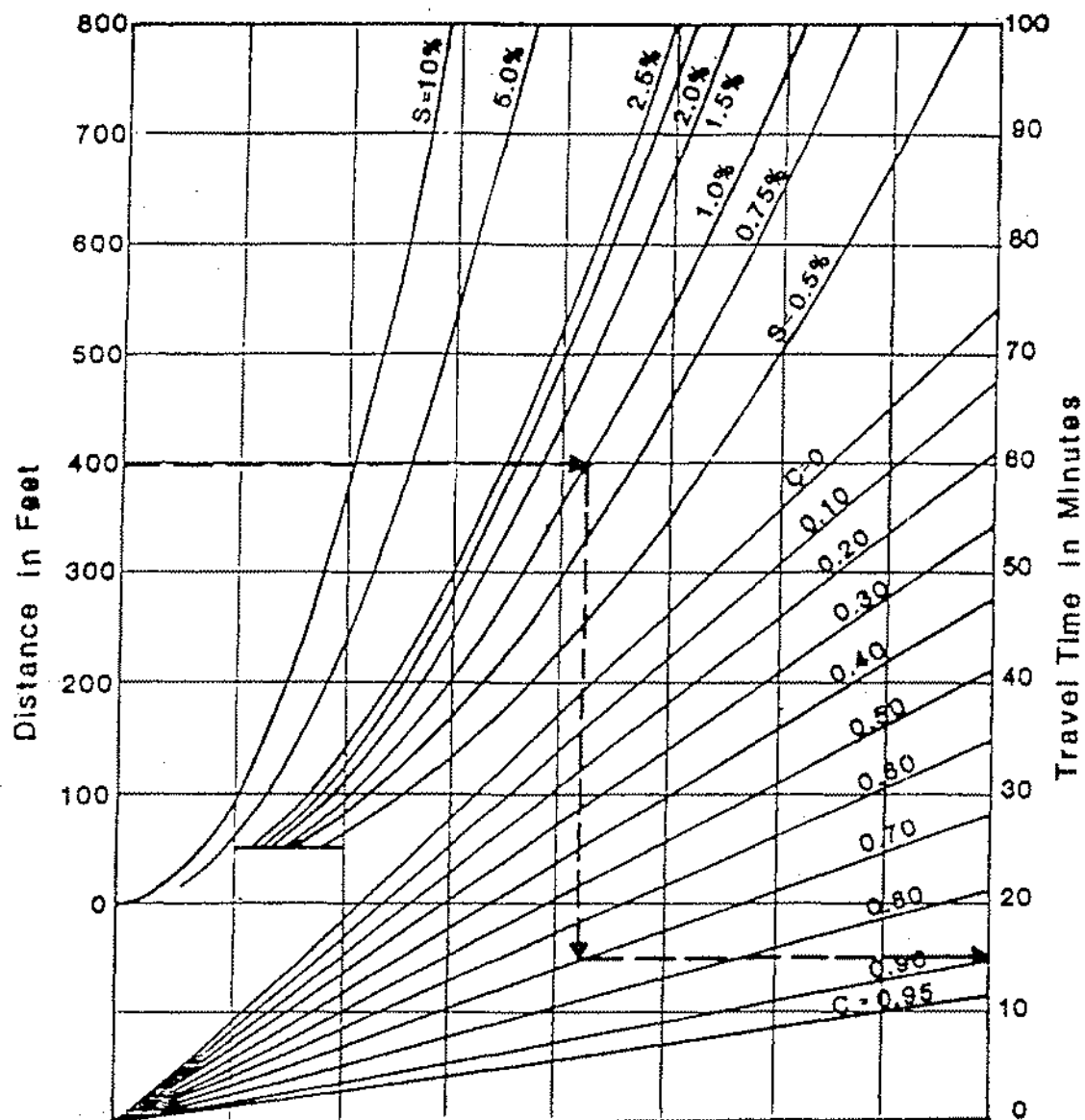
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY			
		10		100	
		A&B*	C&D*	A&B*	C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



REFERENCE : Wright - McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1,
 Denver Regional Council of Governments, Denver, Co. 1977



HDR Infrastructure, Inc.
 A Centerra Company

The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

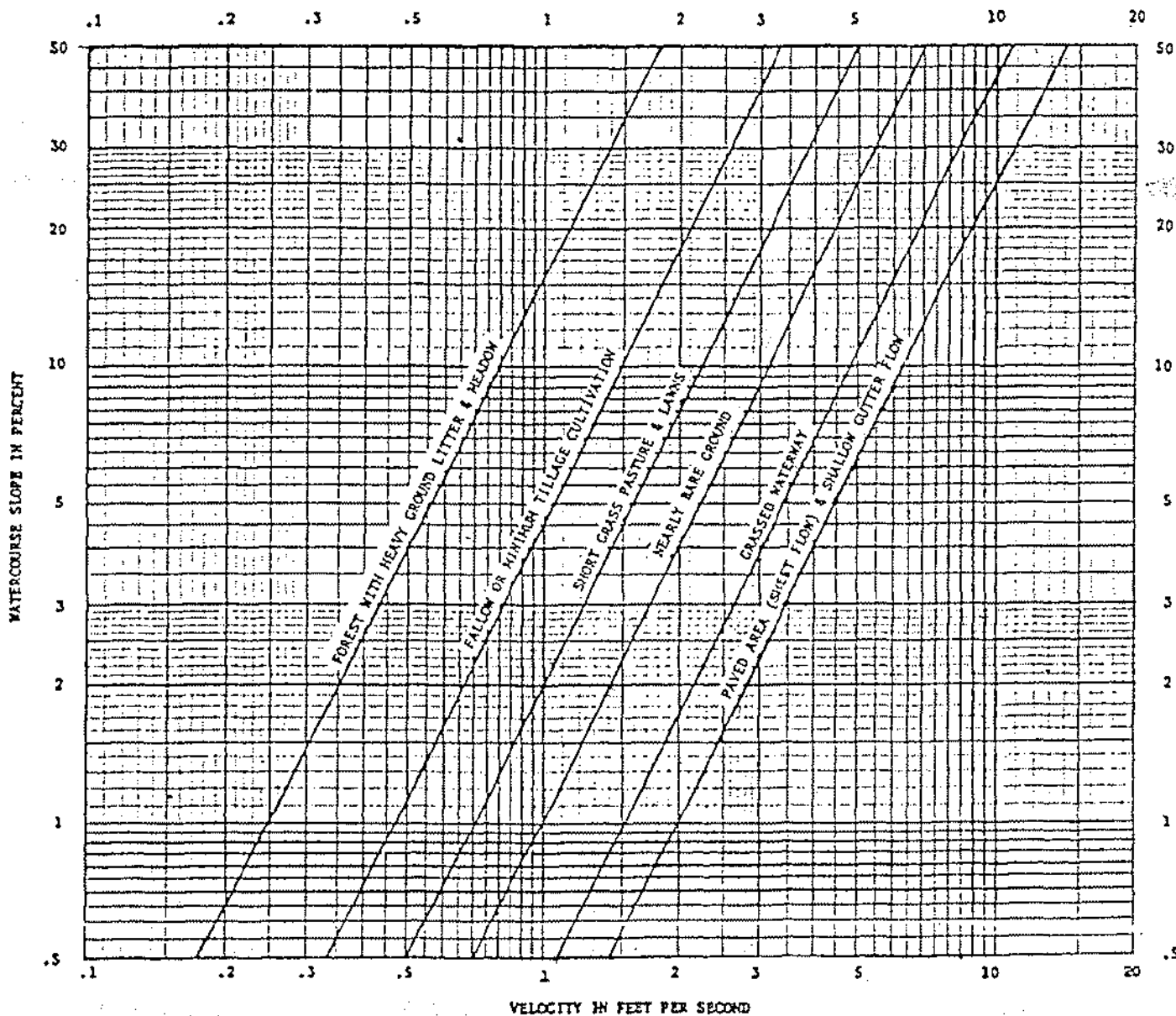
Overland Flow Curves

5-10

Date
 OCT. 1987

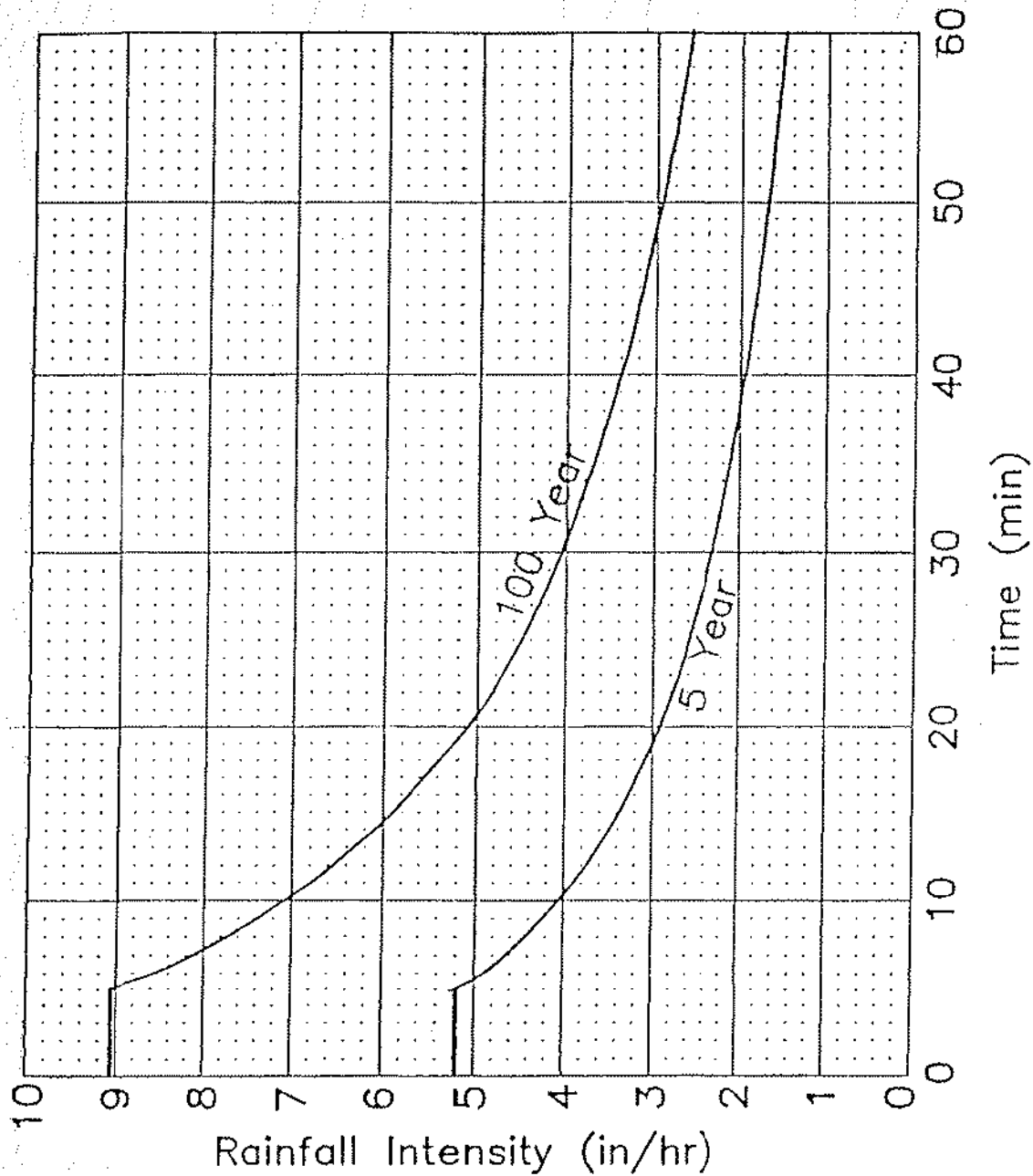
Figure

5-2



--Average velocities for estimating travel time for overland flow.

FIGURE 4



$$I_t = \frac{36.4 * I_{60}}{t_c^{0.83} + 6.72}$$

5 Year: $I_{60} = 1.50$
 100 Year: $I_{60} = 2.62$

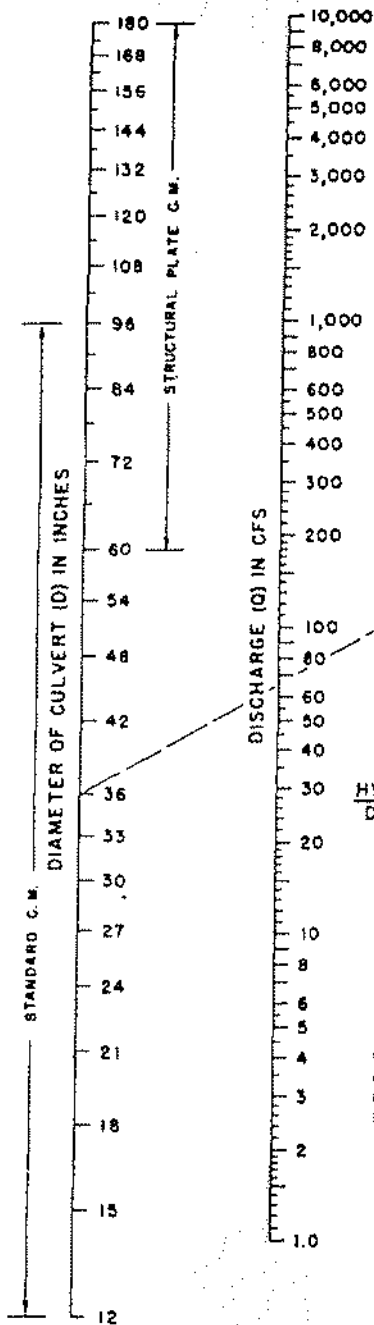
RE: Based upon Pikes Peak Area Council of Governments
 Areawide Urban Runoff Control Manual.

The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Storm Rainfall
 Time Intensity - Frequency Curves

Date:
 MAR. 1995

Figure:
 5 - 1



EXAMPLE

D = 36 inches (3.0 feet)
Q = 66 cfs

	$\frac{HW}{D}$	HW (feet)
(1)	1.8	5.4
(2)	2.1	6.3
(3)	2.2	6.6

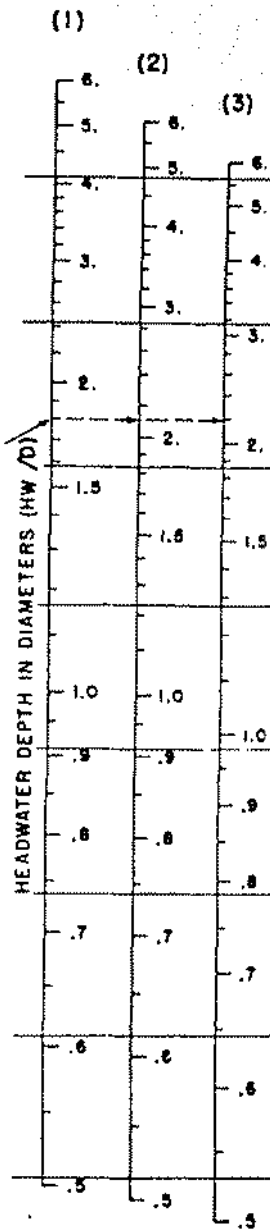
^aD in feet

$\frac{HW}{D}$ SCALE

ENTRANCE TYPE

- | | |
|-----|-----------------------------|
| (1) | Headwall |
| (2) | Mitered to conform to slope |
| (3) | Projecting |

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963



HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

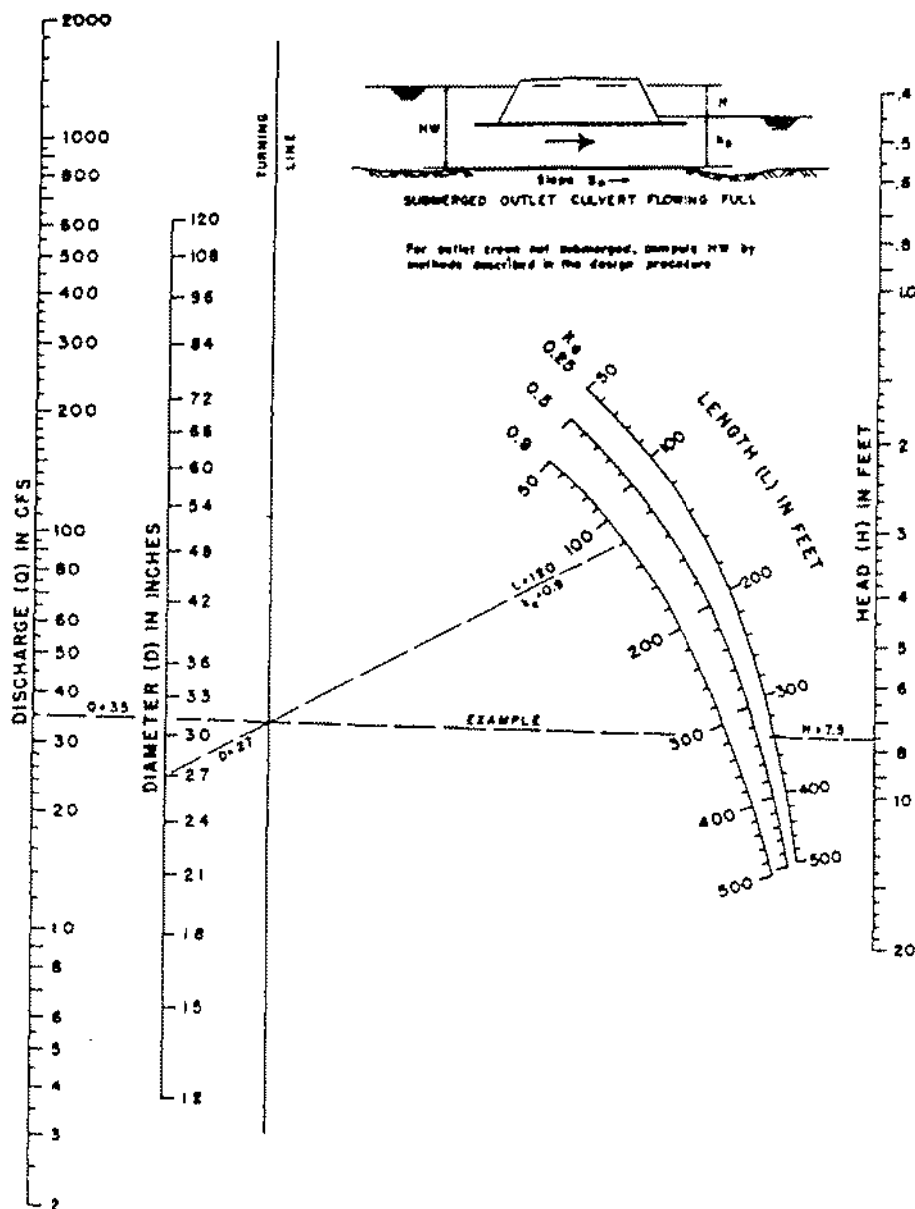
9-65

Date

OCT. 1987

Figure

9-37



BUREAU OF PUBLIC ROADS JAN. 1963



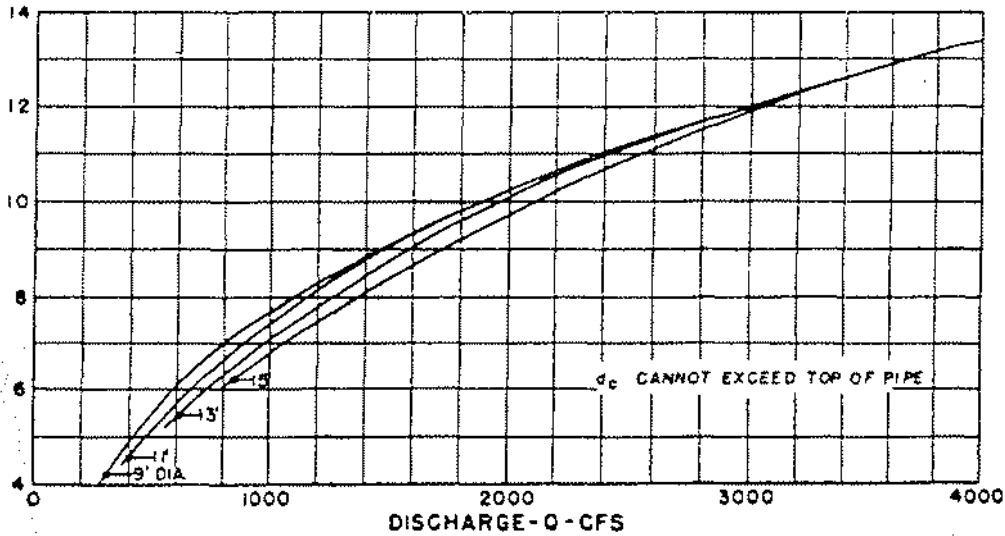
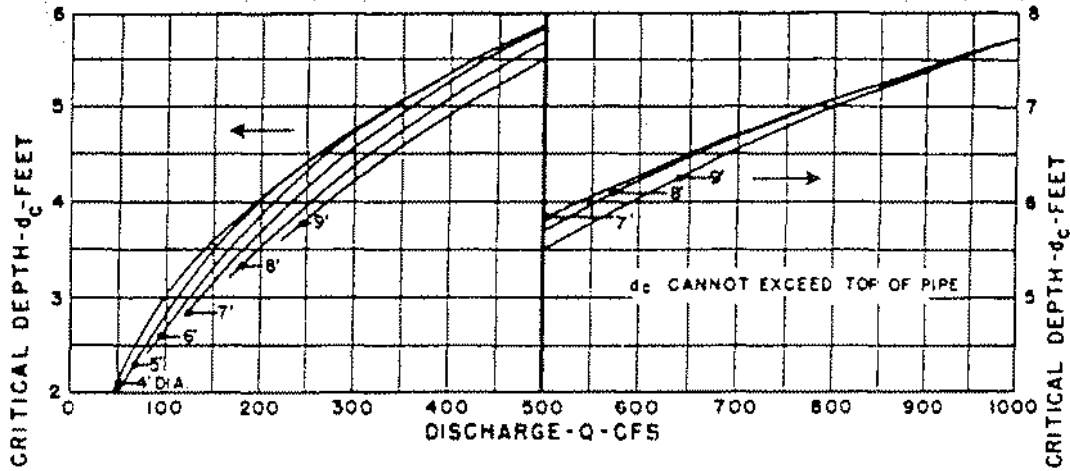
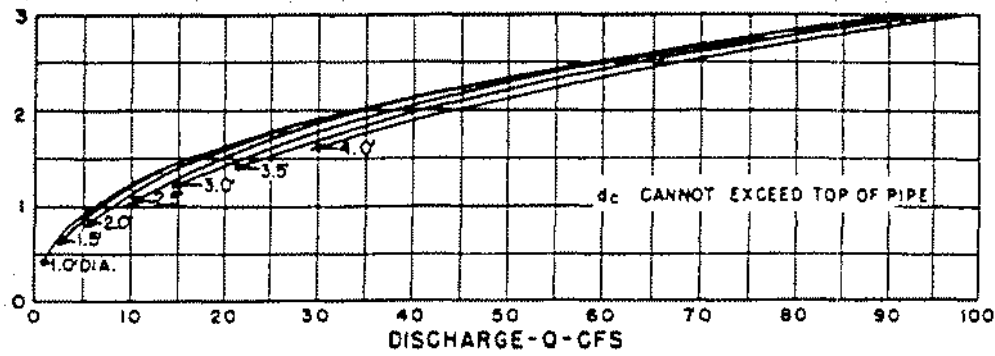
HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Date

OCT. 1987

Figure



BUREAU OF PUBLIC ROADS
JAN. 1964

CRITICAL DEPTH CIRCULAR PIPE



HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

9-57

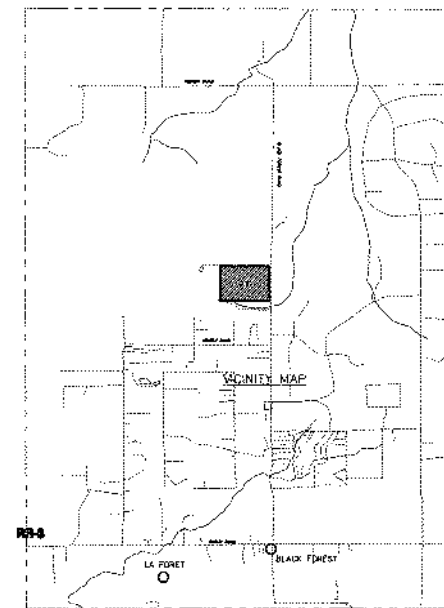
Date

OCT. 1987

Figure

9-29

A SUBDIVISION OF A PORTION OF THE SOUTHEAST QUARTER OF SECTION 31,
TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M.,
EL PASO COUNTY, COLORADO

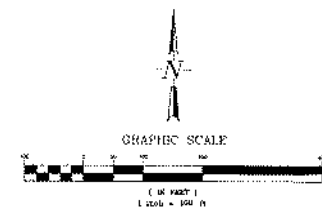


VICINLY MAP

Diagram illustrating the data fields for a stormwater management report:

- BASIN DESIGNATION** (Field 1)
- BASIN AREA, ACRES** (Field 2)
- 5 YEAR DEVELOPED STORM, CFS** (Field 3)
- 100 YEAR DEVELOPED STORM, CFS** (Field 4)
- 5 YEAR EXIST. STORM, CFS** (Field 5)
- 100 YEAR EXIST. STORM, CFS** (Field 6)

- 5 YEAR DEVELOPED ACCUMULATED FLOW, CFS
 100 YEAR DEVELOPED ACCUMULATED FLOW, CFS
- 0 YEAR FREST. ACCUMULATED FLOW, CFS
 100 YEAR FREST. ACCUMULATED FLOW, CFS
- BASIN BOUNDARY
 OVERLAND TIME FLOW PATH
 TRAVEL TIME FLOW PATH
 #100 DEPTH OF DEVELOPED 100 YEAR FLOW



ADP

PREPARED BY:

1861 Austin Bluffs Parkway,
Suite 101
Colorado Springs, CO 80901
(719) 522-5212
fax (719) 522-5541

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ROLLMAX™
ROLLED EROSION CONTROL

ROLLED EROSION CONTROL

SYSTEMS BROCHURE



**NORTH
AMERICAN
GREEN™**

Permanent RollMax™ Solutions



Back in the day, rock riprap, articulated concrete blocks and poured concrete were the only way to deal with erosion in high-flow channels, on shorelines and other areas where water and/or wind exceed the shear limits of unreinforced vegetation.

Not anymore. North American Green permanent Turf Reinforcement Mats (TRMs) use 100% synthetic components or a composite of synthetic and natural materials for long-term erosion protection and vegetation establishment. Whether compared to rock riprap or concrete, the RollMax™ Systems' permanent TRMs offer a number of significant advantages:

- ▶ Prevent loss of precious topsoil to wind and water erosion
- ▶ Permanently reinforce vegetation root and stem structures
- ▶ Provide excellent conditions for quick, healthy vegetation growth
- ▶ Stabilize slopes from erosion to keep roadways safe and clean
- ▶ Protect water quality in lakes, rivers and streams
- ▶ Protect dormant seeding during winter months
- ▶ Easily conform to landscape features
- ▶ Lightweight for easy handling and transportation



The TRMs easily conform to various landscape features to prevent the loss of precious topsoil.

VMAX® COMPOSITE TURF REINFORCEMENT MATS

VMax® C-TRMs combine three-dimensional matting with fiber matrix material for permanent erosion control on severe slopes, spillways, stream banks, shorelines and in high- to extreme-flow channels. These extensively tested products provide maximum performance through all three phases of reinforced vegetative lining development: unvegetated, establishment, and maturity. Incorporating the best performance features of temporary and permanent North American Green erosion control products, VMax C-TRMs deliver these tangible benefits:

- ▶ Surface-applied for the highest level of immediate soil protection
- ▶ Less than one third of the installed cost of rock or concrete
- ▶ No heavy equipment needed to install
- ▶ More attractive and effective "Green" alternative than rock riprap or concrete

VMax® High-Performance TRMs (HPTRMs)

VMax® HPTRMs utilize patent-pending woven 3-D structures that are soil-filled for use in areas experiencing high stress and strain. The VMax HPTRMs are designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces. Our HPTRMs are excellent for increased bearing capacity of vegetated soils subjected to heavy loads from maintenance equipment and other vehicular traffic.



The RollMax TRMs are installed in a one-step operation directly over the prepared seedbed saving time and money and ensuring the highest level of erosion control and vegetation reinforcement.



VMax® TMaxTM Permanent HPTRM

The TMax HPTRM woven polypropylene technology is designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces up to 15 pfs (kN/m^2), and with the highest tensile strength on the market up to 5,000 lbs/ft (73 kN/m). TMax maybe used as an alternative to hard armor system in extreme erosion control applications.

VMax® P550® Permanent TRM

P550® TRM has a polypropylene fiber matrix augmenting the permanent netting structure with permanent mulching and erosion control performance. Unvegetated, the P550 TRM reduces soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 4.0 lbs/ft² (191 Pa). The ultra-strong structure drives the vegetated shear resistance up to 14 lbs/ft² (672 Pa). The P550 TRM may be used as an alternative for poured concrete or articulated concrete blocks in extreme erosion control projects.

VMax® C350® Permanent TRM

A 100% coconut fiber matrix supplements the C350's permanent three-dimensional netting structure with initial mulching and erosion control performance for up to 36 months. Unvegetated, the C350® TRM reduces soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.2 lbs/ft² (153 Pa) and boosts permanent vegetation performance up to 12 lbs/ft² (576 Pa). This environmentally friendly alternative to 30 in. (76 cm) or larger rock riprap is ideal for severe erosion control projects.



To boost performance of the VMax turf reinforcement mats in critical applications, combine with our ShoreMax® flexible transition mat to create a system that can dramatically elevate the permissible shear stress and velocity protection beyond many hard armor solutions.

VMax® SC250® Permanent TRM

The SC250® permanent TRM has a 70% straw/30% coconut fiber matrix to enhance initial mulching and erosion control performance for up to 24 months. Unvegetated, SC250 TRMs reduce soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.0 lbs/ft² and increases permanent vegetation performance up to 10 lbs/ft² (480 Pa) for a green alternative to rock riprap.

ERONET™ PERMANENT EROSION CONTROL BLANKETS

The EroNet™ Permanent ECB provides immediate erosion protection and vegetation establishment assistance until vegetation roots and stems mature.

EroNet™ P300® Permanent Erosion Control Blankets

The P300® permanent erosion control blanket consists of UV-stabilized polypropylene fiber stitched between heavy-weight UV-stabilized polypropylene top and bottom nets. These mats reduce soil loss and protect vegetation from being washed away or uprooted, even under high stress. Unvegetated, they reduce soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.0 lbs/ft² (144 Pa), and protect vegetation from being washed away or uprooted when exposed to shear stresses up to 8 lbs/ft² (383 Pa).



VMax Mats are perfect for pipe outlets, channel bottoms, shoreline transition zones, and other areas subjected to highly turbulent water flows.

Temporary RollMax™ Solutions



Erosion control has never been so simple yet effective. North American Green RollMax™ temporary Erosion Control Blankets (ECBs) provide immediate erosion protection and vegetation establishment assistance, then degrade once the vegetation's root and stem systems are mature enough to stabilize the soil.

Our high-quality temporary solutions are available in varying functional longevitys and materials:

- ▶ Short-term photodegradable blankets with a functional longevity of 45 days up to 12 months
- ▶ Extended-term and long-term photodegradable blankets for protection up to 36 months
- ▶ Short-term biodegradable blankets for protection up to 12 months
- ▶ Extended-term and long-term biodegradable products for protection and mulching from 18 to 24 months

ERONET™ EROSION CONTROL BLANKETS

North American Green EroNet™ ECBs incorporate photodegradable nettings, which means they are broken down by the ultraviolet rays in sunlight. These temporary products can be used in a variety of scenarios, including moderate to steep slopes, medium-to high-flow channels, shorelines and other areas needing protection until permanent vegetation establishment.

EroNet™ C125® Long-Term Photodegradable Double-Net Coconut Blanket

The C125® ECB is made of 100% coconut fiber stitched between heavyweight UV-stabilized polypropylene nets. It offers excellent durability, erosion control and longevity for severe slopes, steep embankments, high-flow channels and other areas where vegetation may take up to 36 months to grow in.



The EroNet temporary ECBs are designed to provide immediate erosion protection and vegetation establishment assistance, and then degrade after the vegetation is mature enough to permanently stabilize the underlying soil. Both short-term and extended-term ECBs are available.



EroNet™ SC150® Extended-Term Photodegradable Double-Net Straw/Coconut Blanket

With a layer of 70% straw and 30% coconut fiber stitched between a heavyweight UV-stabilized polypropylene top net and a lightweight photodegradable polypropylene bottom net, the SC150® ECB has increased durability, erosion control capabilities and longevity. It is suitable for steeper slopes, medium-flow channels and other areas where it may take vegetation up to 24 months to grow in.

EroNet™ S150® Short-Term Photodegradable Double-Net Straw Blanket

The S150 ECB is made with a 100% straw fiber matrix stitched between lightweight photodegradable polypropylene top and bottom nets. The S150 ECB's double-net construction has greater structural integrity than single net blankets for use on steeper slopes and in channels with moderate water flow. It provides erosion protection and mulching for up to 12 months.

EroNet™ DS150™ Ultra Short-Term Photodegradable Double-Net Straw Blanket

The DS150™ ECB is suitable for high maintenance areas where close mowing will occur soon after installation. Special additives in the thread and top and bottom net ensure it degrades in adequate sunlight within 60 days.

EroNet™ S75® Short-Term Photodegradable Single-Net Straw Blanket

The S75® ECB protects and mulches moderate slopes and low-flow channels in low maintenance areas for up to 12 months. It is constructed of 100% straw fiber stitched with degradable thread to a lightweight photodegradable polypropylene top net.

EroNet™ DS75™ Ultra Short-Term Photodegradable Single-Net Straw Blanket

Designed for high maintenance areas where close mowing will occur soon after installation, the DS75™ ECB degrades within 45 days because of special additives in the thread and top net that facilitate rapid breakdown in adequate sunlight.

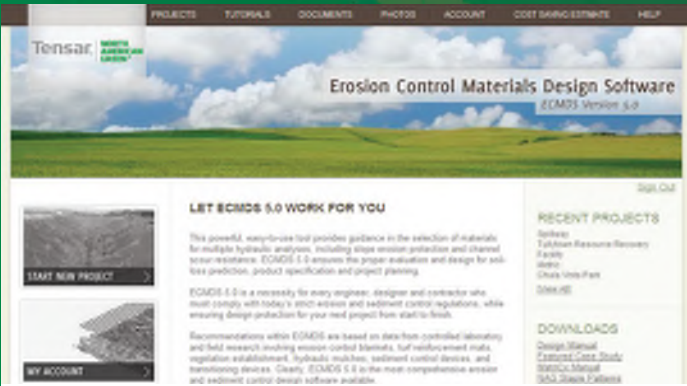


Every site has its own unique characteristics and challenges. EroNet Erosion Control Blankets are available in varying longevitys to suit a variety of scenarios and conditions.



With our Erosion Control Materials Design Software (ECMDS), you can select either short-term, extended-term or long-term EroNet blankets based on your specific design needs.

Design and Installation Tools



SHIFT, CONTROL, ENTER

Professional guidance on RECP selection, design and project planning is at your fingertips with Tensar’s proprietary Erosion Control Materials Design Software (ECMDS®). This web-based program incorporates design methodologies from the Federal Highway Administration and United States Department of Agriculture to analyze your specific site conditions, and make quantified recommendations based on data from controlled laboratory and field research. ECMDS is a must-have if you face tough erosion and sediment control regulations. Best of all, it’s free of charge, compliments of North American Green. To learn more and access the software directly, go to www.ECMDS.com.

INSTRUCTIONS INCLUDED

Proper anchoring patterns and rates must be used to achieve optimal results in RECP installation. View our installation guides for stapling patterns. Site specific staple pattern recommendations based on soil type and severity of application may be acquired through our ECMDS.



HOLD ON TIGHT

When under the pressure of severe conditions, even the best erosion control products can’t function to their full potential without proper installation and anchoring. North American Green supplies a wide variety of fastener options for nearly every application and soil type.

For use in cohesive soils, wire staples are a cost-effective means to fasten RECPs. Available in 6 in., 8 in., 10 in. and 12 in. lengths, our U-shaped staples can reach to various depths to ensure adequate pull-out resistance. For installation using our handy Pin Pounder installation tool, 6 in. V-top staples or 6 in. circle top pins are available.

Our biodegradable BioStakes® are available in 4 in. and 6 in. lengths and provide an environmentally friendly alternative to metal staples. For an even more durable, deeper reaching yet all-natural anchoring option, our wood EcoStakes® are available in 6 in., 12 in., 18 in. and 24 in. lengths.

For severe applications needing the ultimate, long-lasting hold, try our 12 and 18 in. rebar staples, our 12 in. plastic ShoreMax® stakes, or our complete line of percussion earth anchors. The Tensar earth anchors reach deep into the soil strata to offer enhanced anchoring in the worst conditions. Our variety of earth anchors are designed for durability and holding power under extreme hydraulic stresses and adverse soil conditions (*Table 1*).

For more information on the RollMax Systems or other systems within the North American Green Erosion Control Solutions, call **800-772-2040** or visit nagreen.com.

Earth Anchor Options								
End Piece Options with a PVC Face Plate	Tendon Type (½ in. x 36 in.)	Assembly Description	Fast Install	Economic Anchor	EA 400		EA 680	
					Stainless	Galvanized	Stainless	Galvanized
	Copper Stop Sleeve with Stainless Steel Washer	Manually crimped to the stainless steel cable to secure the face plate.		X	X		X	
	Grip End Piece with Stainless Steel Washer	Three-dimensional, self-securing metal end piece that does not require manual crimping for tendon tensioning.	X	X	X	X	X	X
	Wedge Grip Piece	Self-securing end piece that installs flush to the face plate. Does not require manual crimping for tendon tensioning.	X		X	X	X	X
	Aluminum Stop Sleeve with Stainless Steel Washer	Manually crimped to the galvanized cable to secure the face plate.		X		X		X

TABLE 1








The complete line of RollMax™ products offers a variety of options for both short-term and permanent erosion control needs. Reference the RollMax Products Chart below to find the right solution for your next project.



RollMax Product Selection Chart

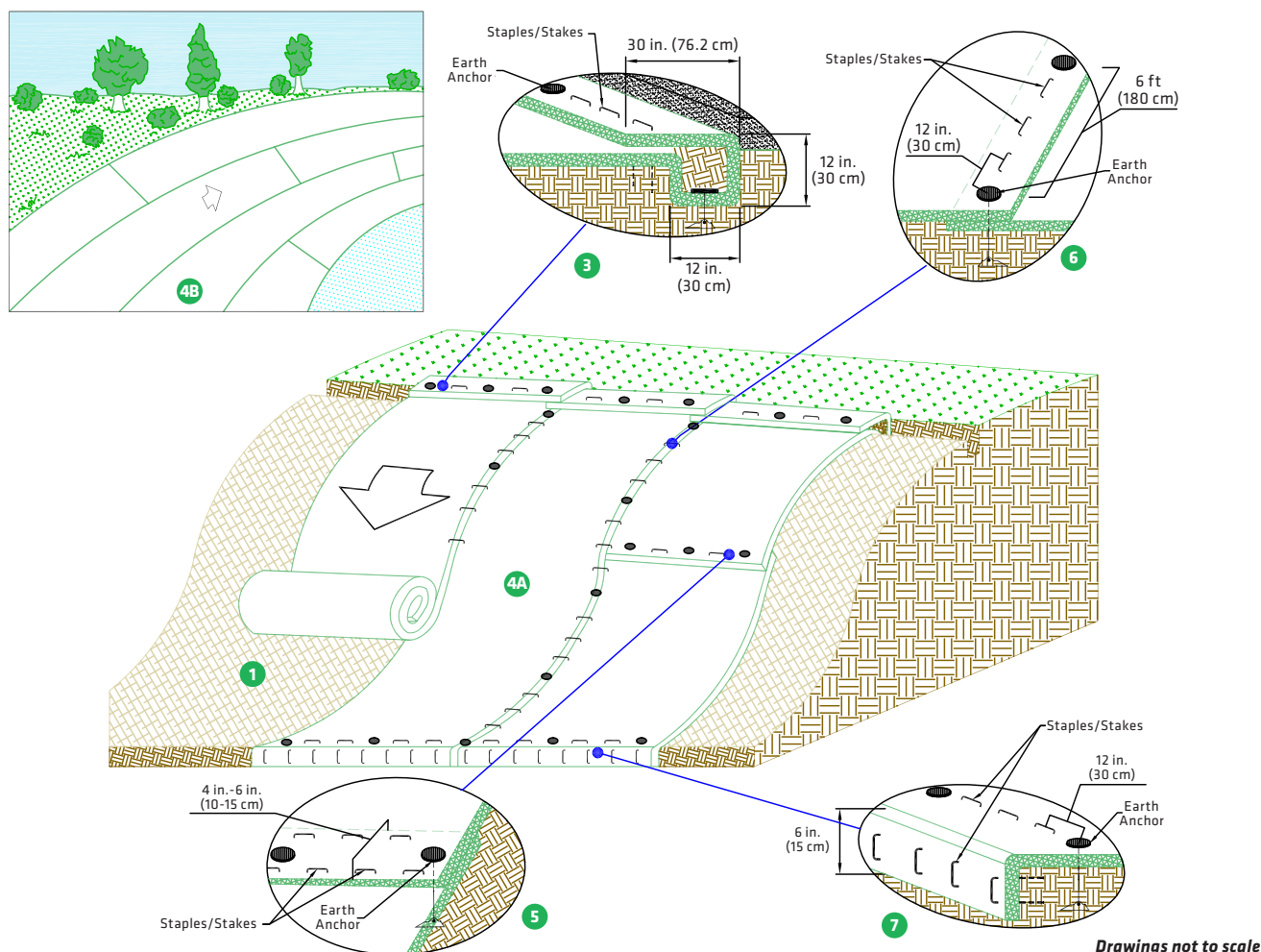
TEMPORARY					
	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
ERONET					
 DS75	1.5 lb., accelerated photodegradable, polypropylene top net, 100% straw fiber matrix	45 days	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
 DS150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	60 days	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
 S75	1.5 lb., photodegradable, polypropylene top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
 S150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
 SC150	2.9 lb., UV-stable polypropylene top net, 70% straw/30% coconut fiber matrix, 1.5 lb., photodegradable polypropylene bottom net	24 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.0 (96)	Unvegetated 8.0 (2.44)
 C125	2.9 lb., UV stable polypropylene top & bottom nets, 100% coconut fiber matrix	36 months	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.25 (108)	Unvegetated 10.0 (3.05)
BIONET					
 S75BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.60 (76)	Unvegetated 5.0 (1.52)
 S150BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix, 7.7 lb., woven biodegradable jute bottom net	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.85 (88)	Unvegetated 6.0 (1.83)
 SC150BN	9.3 lb., leno woven biodegradable jute top net, 70% straw/30% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	18 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.10 (100)	Unvegetated 8.0 (2.44)



TEMPORARY					
	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
BIONET CONT'D					
 C125BN	9.3 lb., leno woven biodegradable jute top net, 100% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	24 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
 C700BN	143 lb., (700 g) woven biodegradable coir top net, 100% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	36 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
PERMANENT					
ERONET					
 P300	5.0 lb., UV-stable polypropylene top net, 100% polypropylene fiber matrix, 3.0 lb., UV-stable polypropylene bottom net	Permanent	High Flow Channels 1:1 Slopes	Unvegetated 3.0 (144) Vegetated 8.0 (383)	Unvegetated 9.0 (2.7) Vegetated 16.0 (4.9)
VMAX					
 SC250	5.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.0 (144) Vegetated 10.0 (480)	Unvegetated 9.5 (2.9) Vegetated 15.0 (4.6)
 C350	8.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.2 (153) Vegetated 12.0 (576)	Unvegetated 10.5 (3.2) Vegetated 20.0 (6.0)
 P550	24.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Unvegetated 4.0 (191) Vegetated 14.0 (672)	Unvegetated 12.5 (3.8) Vegetated 25.0 (7.6)
 TMax	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 15.0 (718)	Vegetated 25.0 (7.6)
 W3000	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 16.0 (766)	Vegetated 25.0 (7.6)

Slope and Levee Installation Detail

Choosing the right solution is half the battle against costly erosion. The other half is proper installation. Tensar® North American Green® provides all of the tools and instructions you need for quick, effective installation on your site.

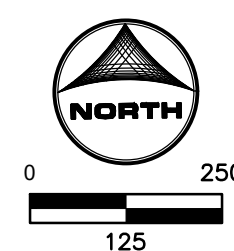


GENERAL INSTALLATION

1. Prepare soil before installing the High-Performance Turf Reinforcement Mat (HPTRM), including any necessary application of soil amendments such as lime or fertilizer.
2. See Seeding and Vegetating section for details regarding preseeding, overseeding, or use with sod.
3. Begin at the top of the slope by anchoring the HPTRM in 12 in. (30 cm) deep x 12 in. (30 cm) wide trench with approximately 30 in. (76.2 cm) of HPTRM extended beyond the up-slope portion of the trench. Anchor the HPTRM with a row of anchors/staples approximately 12 in. (30 cm) apart in the bottom of the trench. Backfill and compact the trench after stapling. Compact soil and fold remaining 30 in. (76.2 cm) portion of HPTRM back over compacted soil. Secure HPTRM over soil with a row of staples/stakes spaced approximately 12 in. (30 cm) across the width of the HPTRMs.
4. Roll the HPTRM (4A) down or (4B) horizontally across the slope. HPTRM will unroll with appropriate side against the soil surface. All HPTRM must be securely fastened to soil surface by placing anchors/staples/stakes in appropriate locations as shown in the anchoring detail.
5. Place consecutive HPTRMs end over end (shingle style) with a 4 in.-6 in. (10 cm-15 cm) overlap. Staple/stake through overlapped area, approximately 12 in. (30 cm) apart across entire HPTRM width.
6. Adjacent HPTRMs must be overlapped approximately 4 in. (10 cm) and fastened using staples/stakes every 12 in. (30 cm) between earth anchors. For curved sections, adjust the overlap edges accordingly to accommodate transitional segments.
7. The terminal end of the HPTRM must be anchored with a row of staples/stakes approximately 12 in. (30 cm) apart in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench. Backfill and compact the trench after stapling.



APPENDIX F – DRAINAGE MAPS



1	LOT 1 COUNTRY VIEW ESTATES PARCEL NO. 5131002013	1	LOT 1 PALMER DIVIDE PARCEL NO. 5131002008
2	LOT 2 COUNTRY VIEW ESTATES PARCEL NO. 5131002014	2	LOT 2 PALMER DIVIDE PARCEL NO. 5131002007
3	LOT 3 COUNTRY VIEW ESTATES PARCEL NO. 5131002003	3	LOT 3 PALMER DIVIDE PARCEL NO. 5131002009
4	LOT 4 COUNTRY VIEW ESTATES PARCEL NO. 5131002004	4	LOT 4 PALMER DIVIDE PARCEL NO. 5131002010
5	LOT 5 COUNTRY VIEW ESTATES PARCEL NO. 5131002005	5	LOT 5 PALMER DIVIDE PARCEL NO. 5131002011
6	LOT 6 COUNTRY VIEW ESTATES PARCEL NO. 5131001006	6	LOT 6 PALMER DIVIDE PARCEL NO. 5131002012
7	LOT 7 COUNTRY VIEW ESTATES PARCEL NO. 5131001005	7	LOT 7 PALMER DIVIDE PARCEL NO. 5131003001
8	LOT 8 COUNTRY VIEW ESTATES PARCEL NO. 5131001004	8	LOT 8 PALMER DIVIDE PARCEL NO. 5131003002
9	LOT 9 COUNTRY VIEW ESTATES PARCEL NO. 5131001003	9	LOT 9 PALMER DIVIDE PARCEL NO. 5131003003
10	LOT 10 COUNTRY VIEW ESTATES PARCEL NO. 5131001002		
11	LOT 11 COUNTRY VIEW ESTATES PARCEL NO. 5131001001		



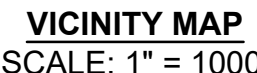
	PLAN	SECTION
PROPERTY LINE	—————	=====
EASEMENT LINE	-----	=====
RIGHT OF WAY	-----	=====
CENTERLINE	—————	=====
CURB & GUTTER	=====	=====
DRAINAGE BASIN	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■
DRAINAGE SWALE	← ← ← ← ← ← ← ←	← ← ← ← ← ← ← ←
TERTIARY DRAINAGE WAY	—————	—————
MAJOR CONTOUR	————— 5900	————— 5900
MINOR CONTOUR	————— 5902	————— 5902
STORM SEWER	=====	=====
ADA ROUTE	—————	—————
RETAINING WALL	—————	—————
FLOW DIRECTION	←	←
DESIGN POINT		▲

The diagram shows a circular basin labeled 'A1'. The area is divided into two parts: a larger section on the left labeled '1.00' and a smaller section on the right labeled '0.40' and '0.60'. The text 'BASIN DESIGNATION' is at the top, 'AREA (AC.)' is on the left, and 'MINOR 5-YR RUNOFF COEFF' and 'MAJOR 100-YR RUNOFF COEFF' are on the right.

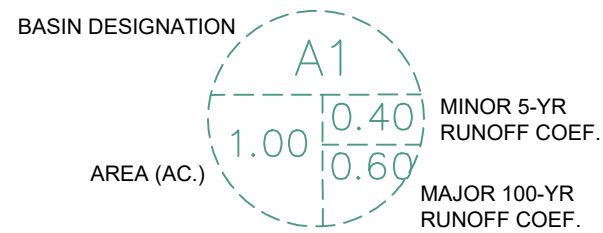
DESIGN POINT	CONTRIBUTING BASINS	ΣQ ₅ (cfs)	ΣQ ₁₀₀ (cfs)	Tributary Area (ac.)	Weighted % Impervious
1	A	24.26	123.47	70.16	4.43
2	A, B	44.45	220.29	127.01	4.23
3		12.84	94.15	58.17	1.17
4	D	21.35	153.46	78.81	1.72



- | | | | |
|----|--|---|--|
| 1 | LOT 1 COUNTRY VIEW ESTATES
PARCEL NO. 5131002013 | 1 | LOT 1 PALMER DIVIDE
PARCEL NO. 5131002008 |
| 2 | LOT 2 COUNTRY VIEW ESTATES
PARCEL NO. 5131002014 | 2 | LOT 2 PALMER DIVIDE
PARCEL NO. 5131002007 |
| 3 | LOT 3 COUNTRY VIEW ESTATES
PARCEL NO. 5131002003 | 3 | LOT 3 PALMER DIVIDE
PARCEL NO. 5131002009 |
| 4 | LOT 4 COUNTRY VIEW ESTATES
PARCEL NO. 5131002004 | 4 | LOT 4 PALMER DIVIDE
PARCEL NO. 5131002010 |
| 5 | LOT 5 COUNTRY VIEW ESTATES
PARCEL NO. 5131002005 | 5 | LOT 5 PALMER DIVIDE
PARCEL NO. 5131002011 |
| 6 | LOT 6 COUNTRY VIEW ESTATES
PARCEL NO. 5131001006 | 6 | LOT 6 PALMER DIVIDE
PARCEL NO. 5131002012 |
| 7 | LOT 7 COUNTRY VIEW ESTATES
PARCEL NO. 5131001005 | 7 | LOT 7 PALMER DIVIDE
PARCEL NO. 5131003001 |
| 8 | LOT 8 COUNTRY VIEW ESTATES
PARCEL NO. 5131001004 | 8 | LOT 8 PALMER DIVIDE
PARCEL NO. 5131003002 |
| 9 | LOT 9 COUNTRY VIEW ESTATES
PARCEL NO. 5131001003 | 9 | LOT 9 PALMER DIVIDE
PARCEL NO. 5131003003 |
| 10 | LOT 10 COUNTRY VIEW ESTATES
PARCEL NO. 5131001002 | | |
| 11 | LOT 11 COUNTRY VIEW ESTATES
PARCEL NO. 5131001001 | | |



LEGEND

[illegible]SWALE CROSS SECTION
BASIN LABEL

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMP.	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
A	70.16	7.72	0.14	0.39	26.19	125.83
B	56.85	7.00	0.14	0.39	20.21	96.95
C	58.17	2.01	0.08	0.35	12.84	94.15
D	79.81	0.08	0.08	0.35	21.35	153.46
ONSITE TOTAL	20.18	9.9%	0.14	0.39	7.53	36.19
OFFSITE TOTAL	243.81	4.2%	0.11	0.37	73.06	434.20
GRAND TOTAL	263.99	4.7%	0.11	0.37	80.59	470.39

CUMULATIVE DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)	Tributary Area (ac.)	Weighted % Impervious
1	A	26.19	125.83	70.16	5.41
2	A, B	46.37	222.65	127.01	4.77
3	C	12.84	94.15	58.17	1.17
4	D	21.35	153.46	78.81	1.72

NO.	DATE	BY	REVISION DESCRIPTION



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FLYING HORSE FOUNDATION
JEFFREY B. SMITH
EL PASO COUNTY, COLORADO

HYDROLOGY MAPS
PROPOSED CONDITIONS

SHEET
DR