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Final Drainage Report

Boyd Subdivision Filing No. 1

Project No. 61170

August 18, 2022

PCD File No. MS224

Final Drainage Report

for

Boyd Subdivision Filing No. 1

Project No. 61170

August 18, 2022

prepared for

Christopher and Jessica Boyd
6238 Gilmer Way
Weserville, OH 43081

prepared by

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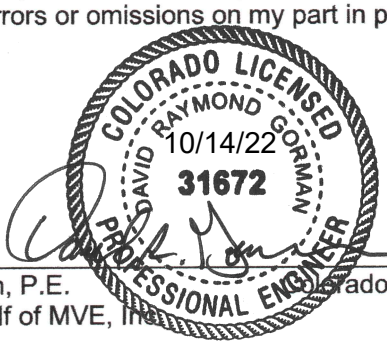
Statements and Acknowledgments

Engineer's Statement

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable 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.



David R. Gorman, P.E. Colorado No. 31672
For and on Behalf of MVE, Inc.

Developer's Statement

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

10 Oct 2022
Date

Christopher Boyd
6238 Gilmer Way
Westerville, OH 43081

El Paso County

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

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

Date

Conditions:

Contents

Final Drainage Report

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the proposed Boyd Subdivision Filing No. 1 site. The development project is a large-lot rural residential subdivision zoned RR-5. The report will examine existing and proposed developed drainage conditions of the site and contributing off-site areas. The report and included maps present results of hydrologic and drainage facilities analyses. The report will discuss any recommended drainage improvements to the site and identify drainage requirements relative to the proposed project. This report has been prepared and submitted in accordance with the requirements of the El Paso County development approval process. An Appendix is included with this report with pertinent calculations and graphs used in the drainage analyses and design.

1 General Location and Description

1.1 Location

The proposed Boyd Subdivision Filing No. 1 site is located within the south one-half of Lot 2 of Section 7, Township 11 South, Range 65 west of the 6th Principal Meridian in El Paso County, Colorado. The 35.88± acre site is situated at the end of Brown Road, north of Walker Road. Brown Road, an existing unpaved public road, ends at a cul-de-sac at the northwest corner of the site. This parcel is currently undergoing platting consideration under the name “Prairie Ridge”. The site is undeveloped prairie. An undeveloped unplatted parcel (zoned RR5) lies west of the site. To the north, east and south of the site, there are unplatted parcels (zoned RR-5) with existing single family residential development. The El Paso County Assessor's Schedule Number for the site is 5100000433. The proposed site has never been platted. A **Vicinity Map** is included in the **Appendix**. The site is located East Cherry Creek Drainage Basin.

1.2 Description of Property

The Boyd Subdivision Filing No. 1 site is 35.88± acres and is zoned RR-5 (Residential Rural (5 Acres)). Proposed Boyd Subdivision Filing No. 1 will create a total of three (3) rural residential lots. Lot 1, on the west portion of the site, will be 15.26± acres. Lot 2 is located in the middle portion of the site will be 10.00± acres. Lot 3 will be 10.62± acres and located on the eastern portion of the site.

The ground cover is in fair to good condition and consists of native grasses and weeds. A singular tree is located on the dividing line between lots 2 and 3.

The existing site topography varies throughout the site. The northern portion of the site slopes southeast with grades that range from 3% to 15%. The existing site topography on the southern side of the site slopes north with grades that range from 5% to 13%. A drainage way and small holding pond traverse the southern portion of the site from west to east.

There is a large drainage way in the Boyd Subdivision Filing No. 1 site, which as mentioned above, crosses the southern portion of the site. All storm runoff flows drain south and north to this drainage way and then off the property towards the east. There is no storm drain system in the surrounding area.

According to the National Resource Conservation Service, there are two (2) soil types in the Boyd Subdivision Filing No. 1 site. Brussett loam (map unit 15) makes up the north 25% of the site. The soil is deep and well drained. Permeability is moderately rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Brussett loam is classified as being part of Hydrologic Soil Group B. Peyton sandy loam makes up the south 75% of the site. The soil is deep and well drained. Permeability is moderately rapid, surface runoff is moderate, and the hazard of erosion is moderate. Peyton sandy loam is classified as being part of Hydrologic Soil Group B.

A portion of the Soil Map and data tables from the National Cooperative Soil Survey and relevant Official Soil Series Descriptions (OSD) are included in the **Appendix**.[1] [2]

The Soils and Geology Study for the site was prepared by RMG Engineers / Architects.[3] soils report was also prepared for the site. Soils found on the site, especially near the surface, are described as Silty Clay (Strong, Blocky) or Silty Clay Loam (Strong, Blocky) overlying Sandy Clay Loam (Moderate). These soils are generally considered to be cohesive, that is, soils that do not crumble, can be excavated with vertical sideslopes, and are plastic when moist. Cohesive soils are hard to break up when dry, and exhibit significant cohesion when submerged.

2 Drainage Basins and Sub-Basins

2.1 Major Basin Descriptions

The Boyd Subdivision Filing No. 1 site is located in the unstudied East Cherry Creek Drainage Basin (CYCY0200).

The current Flood Insurance Study of the region includes Flood Insurance Rate Maps (FIRM), effective on December 7, 2018.[4] The proposed subdivision is included in the Community Panel Numbered 08041C0305 G of the Flood Insurance Rate Maps for the El Paso County. No part of the site is shown to be included in a 100-year flood hazard area as determined by FEMA. A portion of the current FEMA Flood Insurance Rate Maps with the site delineated is included in the **Appendix**.

2.2 Sub-Basin Description

The existing drainage patterns of the Boyd Subdivision Filing No. 1 project are described by three (3) on-site drainage basins. All of these basins are previously undisturbed or developed to a degree as described below. All existing basin delineations and data are depicted on the attached **Existing Drainage Map**.

2.2.1 Existing Drainage Patterns (Off-Site)

The Boyd Subdivision Filing No. 1 site receives drainage flows from approximately 0.5 square miles of area to the west of the site. That enters from a large drainage way along the south west edge of the site. There is also a small off-site basin that deposits flows onto the site at the northwest edge.

2.2.2 Existing Drainage Patterns (On-Site)

Existing sub-basin EX-A, located in the western portion of the site, containing an existing stock pond, drains easterly from the western edge of the site before collecting into an existing stock pond. From there runoff exits the pond and continues east through sub-basin EX-B.

Existing sub-basin EX-B is located in the middle and eastern portion of the site. The sub-basin contains existing prairie and the afore mentioned drainage way. All flows from sub-basin B exit the site to the east via the drainage way into the adjacent site. These flows continue east through adjacent properties and eventually enter East Cherry Creek.

Existing sub-basin EX-C, located on the northeast side of the site, containing prairie, drains to the southeast and exits the site into the adjacent site. These flows continue southeast through the

1 WSS
2 OSD
3 SGS
4 FIRM

adjacent property and combine with the flows in the drainage way eventually entering East Cherry Creek.

3 Drainage Design Criteria

3.1 Development Criteria Reference

This Final Drainage Report for Boyd Subdivision Filing No. 1 has been prepared according to the report guidelines presented in the latest edition of *El Paso County Drainage Criteria Manual* (DCM)[5]. The County has also adopted portions of the City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2, especially concerning the calculation of rainfall runoff flow rates.[6] [7] The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey[8], and existing topographic data by Polaris Surveying, Inc.

3.2 Previous Drainage Studies

A drainage report has been submitted and approved for the proposed subdivision located west of the site (Prairie Ridge Filing No. 1). The Prairie Ridge report was used for information only. Drainage calculations for Boyd Subdivision were performed independently of the Prairie Ridge Filing No. 1 report, but results are comparable.

3.3 Hydrologic Criteria

For the on-site and local sub-basins in this Final Drainage Report, the Rational Method as described in the *Drainage Criteria Manual* has been used for all Storm Runoff calculations, as the development and all sub-basins are less than 130 acres in area. "Colorado Springs Rainfall Intensity Duration Frequency" curves, Figure 6-5 in the DCM, was used to obtain the design rainfall values; a copy is included in the **Appendix**. The "Overland (Initial) Flow Equation" (Eq. 6-8) in the DCM, and Manning's equation with estimated depths were used in time of concentration calculations. "Runoff Coefficients for Rational Method", Table 6-6 in the DCM, was utilized as a guide in estimating runoff coefficient and Percent Impervious values; a copy is included in the **Appendix**. Peak runoff discharges were calculated for each drainage sub-basin for both the 5-year storm event and the 100-year storm event with the Rational Method formula, (Eq. 6-5) in the DCM.[9]

For the overall site and large upstream basins flowing through the site in the drainage way, the NRCS Curve Number Loss and Dimensionless Unit Hydrograph Method as described in the (DCM) was applied to calculate the 5-year and 100-year peak storm runoff rates for each drainage sub-basin using the "Hydrologic Engineering Center - Hydrologic Modeling System" (HEC-HMS) Version 4.3 computer program by U.S. Army Corps of Engineers. [10]

Rainfall depths for 5-year and 100-year, 24-hour rainfall event were estimated using the National Oceanic and Atmospheric Administration, Precipitation-Frequency Atlas of the Western United States, Volume III-Colorado (NOAA Atlas 2). [11] Precipitation depth maps shown in the NOAA Atlas were used to determine the representative 24-hour point rainfall value of 4.6 inches over the drainage basin. The NOAA Atlas 2 map is included in the appendix. The rainfall depth is applied to the NRCS 24-Hour Type II Rainfall Distribution to produce a design storm with Depth-Area Reduction Factors (DARF) correction factors determined by the HEC-HMS program based on the return period of the storm and basin area.

The NRCS Curve Numbers used to calculate the volume of runoff from the 5-year and 100-year storm events in each sub-basin are estimated using the predominate Hydrologic Soil Group, discussed in the section above, the land cover, land use condition and the Antecedent Runoff

5 DCM Section 4.3 and Section 4.4
6 CS DCM Vol 1
7 CS DCM Vol 2
8 WSS
9 DCM
10 HEC-HMS
11 NOAA

Condition (ARC) of each basin. ARC II is used for all sub-basin Curve Numbers in this analysis. The NRCS Curve numbers for the individual sub-basins range from 66 to 66.5. The appendix contains the NRCS Curve number calculations and summary.

Times of Concentration for sub-basin runoff is calculated using three flow components: Overland Flow Time, Shallow Concentrate Flow Time, and Concentrated Flow Time. The Overland Flow Component is calculated using the Overland Flow Equation as required (DCM Eq 6-15) with maximum overland flow length of 300 feet and the appropriate Manning's Roughness Coefficient according to the surface description (DCM Table 6-11). Shallow Concentrated Flow times are determined based on watercourse slope, ground cover and flow velocity using DCM Table 6-25. Concentrated flow velocities and times are estimated using the Manning' Equation with channel waterway characteristics taken from the basin mapping. The referenced equations, coefficients and tables are included in the appendix. Calculations for Times of Concentration and Lag Times are also included in the appendix.

The Muskingum-Cunge method was utilized for hydrograph channel routing as applied in the HEC-HMS program using waterway course length, slope, channel shape, bottom width and side slopes as determined from the basin mapping. Lower Manning's roughness coefficients were used to represent the thicker vegetation found in the center of the drainage path and higher values for the vegetation on the outer portions of the drainage path.

4 Drainage Facility Design

4.1 General Concept

The intent of the drainage concept presented in this Final Drainage Report is to allow for the development of the three rural residential lots while maintaining the existing drainage patterns on the site. There will be no significant grading on the site and no public facilities constructed. The site will be in compliance with the County's Stormwater Management regulations without the need for permanent water quality treatment facilities due to the site being entirely large lot rural residential lots, which are excluded from water quality requirements. No roadways are being constructed and disturbance will be less than 1 acre. Major and minor storm flows will continue to be safely conveyed through the site and downstream.

The existing and proposed drainage hydrologic conditions are described in more detail below. Input data and results for all calculations are included in the **Appendix**. Drainage maps for the hydrology are also included in the **Appendix**.

4.2 Specific Details

4.2.1 Existing Main Stem Drainage Way Hydrologic Conditions

The existing drainage way that that crossing the southern portion of the site flows from the west edge of the site, through a stock pond just inside the western edge and continuing across to the east and off the site along the eastern edge.

Approximately 0.25 square miles of area drain to the stock pond approximately 2,000 feet west of the site at the beginning of the drainage way. The off-site will generate peak storm runoff discharges of Q_5 = 49.4 cfs and Q_{100} = 236.9 cfs (existing flow) which drains easterly into the stock pond at Design Point 1 (DP1) which includes sub-basins OS-1 and OS-2.

These flows continue easterly in the drainage way and combine with the flows from OS-3 and OS-4 just west of Brown Road. The drainage way has a peak storm runoff discharge of Q_5 = 60.8 cfs and Q_{100} = 293.4 cfs (existing flow) at this Design Point 2 (DP2) which includes sub-basins OS-1, OS-2, OS-3 and OS-4.

These flows continue easterly in the drainage way and combine with the flows from OS-5 just inside the western edge of the site at an existing stock pond. The drainage way has a peak storm runoff discharge of Q_5 = 73.1 cfs and Q_{100} = 354.4 cfs (existing flow) at this Design Point 3 (DP3) which includes sub-basins OS-1, OS-2, OS-3, OS-4 and OS-5.

These flows continue in the drainage way and combine with the flows of this site (SCS sub-basin B) at Design Point 4 (DP4). The flows will generate peak storm runoff discharges of Q_5 = 87.0 cfs and Q_{100} = 423.8 cfs (existing flow) that leave the site in the existing drainage way to the east.

4.2.2 Existing On-Site Hydrologic Conditions

The Boyd Subdivision Filing No. 1 site includes three (3) sub-basins. The northern and southern portions of the site drain southerly and northerly into a drainage way before draining east toward East Cherry Creek The sub-basins are described in more detail below without looking at the existing flows in the drainage way. Those flows are described later in this report.

There is no significant signs of erosion along the drainageway and is considered to be in a stable condition. The drainageway features thick vegetation on average of 1-2 feet with the tallest vegetation (2-3 feet) found in the center of the drainageway.

Existing sub-basin OS-A1, located off-site on the southwest side of the site, is 2.45± acres in area. Sub-basin OS-A1 is undeveloped prairie. Peak storm runoff rates are Q_5 = 0.7 cfs and Q_{100} = 5.4 cfs (existing flows) which drain onto the site from the south into sub-basin EX-A.

Existing sub-basin EX-A, located in the western portion of the site, is 4.90± in area. Sub-basin EX-A contains an existing stock pond. Peak storm runoff rates are Q_5 = 1.4 cfs and Q_{100} = 10.6 cfs (existing flows) which drain east into sub-basin EX-B. This sub-basin contains an existing livestock watering pond. Although the pond in actuality provides some peak flow attenuation during storm events, it does not have an outlet structure. Therefore, the presence of the pond is not considered in the hydrologic analysis and detention effects are not accounted for in the downstream drainageway peak flow rates. The pond is more fully discussed in a section below.

Existing sub-basin OS-B1, located off-site on the northwest side of the site, is 4.34± acres in area. Sub-basin OS-B1 is undeveloped prairie with a gravel drive along the northern edge. Peak storm runoff rates are Q_5 = 1.5 cfs and Q_{100} = 9.5 cfs (existing flows) which drain onto the site from the west and into sub-basin EX-B.

Existing sub-basin OS-B2, located off-site on the south side of the site, is 26.81± acres in area. Sub-basin OS-B2 is undeveloped prairie. Peak storm runoff rates are Q_5 = 7.0 cfs and Q_{100} = 51.6 cfs (existing flows) which drain onto the site from the south and into sub-basin EX-B.

Existing sub-basin EX-B, located in the central and southeastern portion of the site, is 26.86± acres in area. Sub-basin EX-B contains a gravel driveway along the northern edge, prairie and the drainage way. Peak storm runoff rates are Q_5 = 7.0 cfs and Q_{100} = 50.0 cfs (existing flows) which drain off-site to the east. These flows continue to drain east through adjacent properties and eventually flow into East Cherry Creek.

Existing sub-basin EX-C, located on the northeast corner of the site, is 4.12± acres in area. Sub-basin EX-C contains a gravel driveway along the northern edge and prairie. Peak storm runoff rates are Q_5 = 1.5 cfs and Q_{100} = 9.1 cfs (existing flows) which drain southeast off of the site. The flows will continue flowing southeasterly through the adjacent property and into the drainage way eventually flowing into East Cherry Creek.

4.2.3 Proposed On-Site Hydrologic Conditions

The proposed drainage basins for Boyd Subdivision Filing No. 1 mirror the existing basins as no changes will be made to the site that affect the layout of the basins. Three (3) sub-basins have been identified in the Boyd Subdivision Filing No. 1 project site for analysis of the developed drainage condition. The site is to contain three rural residential lots. Lot 1 will be 15.26 acres. Lot 2 will be 10.00 acres and Lot 3 will be 10.62 acres. Access to all three lots will be from the cul-de-sac at the end of Brown Road at the northwest corner of the site and on an existing shared driveway along the north edge of the site. The existing driveway is located on the northern border of Lots 1, 2 and 3. Lots 1, 2 and 3 are assumed to each contain a 5,000 sf house footprint, 1,000 sf of exterior hardscape and 200 foot long 12' wide gravel driveway. The resulting percent imperviousness was used in the hydrologic calculations and the Drainage and Bridge Fee calculations. The sub-basins are described in more detail below.

Proposed sub-basin A (4.90 acres), located on the southwestern corner of the site, will continue to drain south and north to the existing natural drainageway as in existing conditions. An existing livestock pond is located in Sub-basin A near the the southwestern corner of the site and runoff from the sub-basin drains directly into the pond. This pond is an existing approved livestock tank and will not have any necessary modifications. No detention is required for this site and the pond is not designed to provide detention. Ownership and maintenance of the livestock pond will be vested to Lot 1. Access to said pond shall be through Lot 1 exclusively. The sub-basin is not expected to contain any improvements. Proposed sub-basin A will continue to generate peak storm runoff discharges of Q_5 = 1.4 cfs and Q_{100} = 10.6 cfs (historic flows) which exit the pond and flow east into sub-basin B.

Proposed sub-basin B (26.86 acres) will continue to drain southeast and northeast to the existing natural drainageway as in existing conditions. Proposed sub-basin B is expected to contain two (2) single family residences with assumed gravel driveways. Sub-basin B will generate peak storm runoff discharges of Q_5 = 7.8 cfs and Q_{100} = 50.9 cfs (proposed flow) which drains easterly out of the site. This represents increases of 0.8 cfs for the 5-year storm and 0.9 cfs for the 100-year storm. These flows will continue to drain easterly through adjacent properties and eventually flow into East Cherry Creek.

Proposed sub-basin C (4.12 acres) will continue to drain off the site as in existing conditions. The proposed sub-basin C is expected to contain one (1) single family residence, and assumed gravel driveway. Sub-basin C will generate peak storm runoff discharges of Q_5 = 2.0 cfs and Q_{100} = 9.6 cfs (proposed flow) which drains easterly out of the site. This represents increases of 0.5 cfs for the 5-year storm and 0.5 cfs for the 100-year storm. The flows will continue flowing southeasterly through the adjacent property and into the drainage way eventually flowing into East Cherry Creek.

4.2.4 Developed Main Stem Drainage Way Hydrologic and Hydraulic Conditions

A natural existing drainage way crosses the southern portion of the site and flows from the west edge of the site, through a livestock pond located just inside the western edge and continues to the east and then off-site at the eastern edge of the site.

Approximately 0.46 square miles of area drain to the livestock pond just inside the western edge of the site. The off-site basins generate peak storm runoff discharges of Q_5 = 73.1 cfs and Q_{100} = 354.0 cfs (existing flow) which drains easterly into the site at Design Point 3 (DP3) which includes sub-basins OS-1, OS-2, OS-3, OS-4 and OS-5. The pond has one 15” CMP outlet pipe located in the upper elevation of the pond embankment. Due to the location and size of the outlet pipe, it is largely ineffectual in draining flows from the pond and can be ignored hydrologic or hydraulic purposes. When the pond reaches capacity, overflows exit the pond at the opening provided at the south side of the embankment and continue east in the drainageway in accordance with the design associated with the livestock pond permit.

The flows exit the pond and continue easterly in the drainage way, combining with the developed flows from SCS sub-basin B at Design Point 4 (DP4). Having peak storm runoff discharges of Q_5 = 88.0 cfs and Q_{100} = 425.8 cfs (developed flow). This represents increases of 1.0 cfs for the 5-year storm and 2.0 cfs for the 100-year storm leaving the site in the drainage way. This is an insignificant and inconsequential increase in flows.

Drainage easements and no-build areas are established in the final plat to contain this drainage way, existing ponds and the seasonably high ground water areas of the site. The boundary of the drainage easement was determined by a hydraulic analysis of the drainage way. Calculations and results of the analysis are included in the A**ppendix.**

4.2.5 Detention Facilities

The existing livestock water tank (pond) is located in the southwestern portion of the subdivision within proposed Lot 1. The pond was constructed and maintained in accordance to the “Application for Approval of Livestock Water Tank” which was approved by the State Engineer's Office on December 27, 1957. A copy of this document is included in the Appendix. The pond has an east-west facing embankment that is well vegetated and stable. The Pond overflows at the spillway opening provided at the south side of the embankment in accordance with the design associated

with the livestock pond permit. The pond has one 15" CMP outlet culvert pipe located in the upper elevation of the pond embankment (about one foot below the embankment top) on the south side. Due to the position and size of the outlet pipe, it is largely ineffectual in draining flows from the pond and can be ignored for hydrologic or hydraulic purposes. The owners of the Boyd Subdivision property, Christopher and Jessica Boyd, own the pond and are responsible for maintenance. In the developed and platted condition, the owner of Lot 1 Boyd Subdivision will own and maintain the pond. Access to the pond by vehicle or foot is available from proposed Lot 1. No additional access easements will be needed to access the pond from Lot 1.

A permanent detention facility is not recommended for this site. The site is classified and large lot residential by both zoning and plat implementation. All three proposed lots are at least 10 acres in size. No public or private roadways will be constructed. Water Quality Treatment is not required by the ECM. The development's effect on peak runoff discharges is negligible with an increase of 2.0 cfs in the 100-year rainfall event. Therefore, a permanent detention facility is not recommended.

4.2.6 Drainageway Hydraulic Analysis

A hydraulic analysis of the significant drainageway flowing west to east through the site was conducted utilizing HEC-RAS computer modeling. Cross sections were sampled through the project site in approximately 50' intervals as well as a short distance upstream and downstream of the site. The drainageway exhibits minor winding and vegetated by long and dense native grasses in the channel and overbanks. Manning's roughness coefficient of 0.040 is selected due to the channel characteristics, vegetation and flow depths. Channel velocities range from 1 to 6 fps and average 4.1 fps. Three dispersed and isolated cross sections approach 6.5 fps, however these cross sections are located upstream or downstream of the site boundaries. Several gathered sources note permissible flow velocities of up to 6 pfs for channels lined with long native grasses for channel stability. The source is included in the Appendix of this report.

The drainageway was examined for signs of sedimentation or erosion. It is found that the flow path is vegetated with thick natural grasses without signs of erosion within the site boundaries. The existing drainageway is in a stable condition and flows are only negligibly increased as a result of the development. Photos of the reach are included in the Appendix. We recommend no channel stabilization measures for the project site.

4.3 Erosion Control

There is no public infrastructure construction associated with this subdivision. Any required best management practices (BMP's) for the individual lot home construction will be handled on the BESQCP for each lot at time of building permit.

4.4 Four Step Process

El Paso County Engineering Criteria Manual, Appendix I, contains the policies and procedures for Stormwater Quality. Section I.7.1.B provides for exclusions to the requirements to provide Post Construction Stormwater Quality facilities. All areas of proposed Boyd Subdivision Filing No. 1 qualify for the allowed exemptions. The project consists of large (2.5-acre or larger) single-family rural residential lots. No public roadway improvements are proposed. There are no activities or improvements that require permanent water quality facilities for this project.

According to Section I.7.1.B.5, "A single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling and having a total lot impervious area of less than 10 percent" is excluded. The total area of the site is 35.88± acres. All 35.88± acres is comprised of large lot single-family rural residential units. The total lot imperviousness for rural residential lots is less than 10%. The entire site is excluded.

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) requires the consideration of a "Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long term source controls". It is determined in the section above that this project is exempt from the requirements of Section I.7.1 to provide Post Construction Stormwater Management

Facilities with Water Quality Capture Volume (WQCV). However, aspects of the Four Step Process are considered and implemented in the Boyd Subdivision Filing No. 1 project.

1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible. There is only minimal concrete or other hard surfaces proposed. Minimized Directly Connected Impervious Areas (MDCIA) is employed on the project because runoff passes through an open space forest and meadow areas before leaving the site.

2) All existing swales will remain covered with the existing natural grasses. All of the onsite swales are “U” shaped with wide bottoms widths and flat side slopes. Based on visual observations the swales are very stable with only negligible indications of erosion. The vegetation for each swale includes medium height prairie grasses that are periodically mowed. It is not anticipated that any of the swales will be modified in the future. It can be safely assumed that the negligible increase in flow as a result of development will have minimal negative impacts on the existing onsite swales.

3) The project contains no potentially hazardous uses. The site is exempted from the use of WQCV BMPs by ECM 1.7.1.B.5 by virtue of the large lot rural residential nature of the site having percent imperviousness of less than 10%.

4) The rural residential site is not anticipated to contain storage of potentially harmful substances or use of potentially harmful substances. No site specific or other source control BMPs are required.

5 Drainage and Bridge Fees

The site is located within the East Cherry Creek Drainage Basin which is a no fee basin.

6 Government Agency Requirements

A Wetlands Analysis Report was prepared for this project and submitted to the US Army Corps of Engineers (USACE).[12] The Corps of Engineer's has concurred with the wetland boundary contained with in the report and the boundary is contained within the Drainage Easement with No-Build and No Storage of Materials. No disturbance is planned within the easement.

7 Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the proposed Boyd Subdivision Filing No. 1 project. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The proposed project will not, with respect to stormwater runoff, negatively impact the adjacent properties and downstream properties.

12 Pinyon

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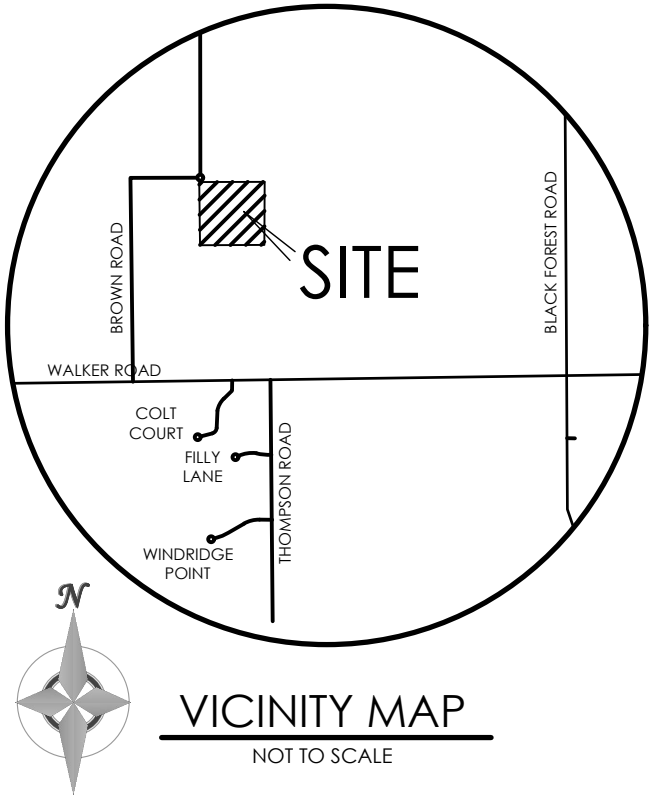
Wetland Analysis Report, 18735 Brown Road Project, El Paso County, Colorado. Pinyon Environmental, Inc. (Lakewood, CO: , December 3, 2021).

Appendices

8 General Maps and Supporting Data

Vicinity Map
Portions of Flood Insurance Rate Map
Portion of Drainage Area Identification Study Map
NRCS Soil Map and Tables
SCS Soil Type Descriptions
Hydrologic Soil Group Map and Tables
Existing Livestock Pond Application
Urban Drainage Natural Stream Hydraulic Parameters



VICINITY MAP

NOT TO SCALE

National Flood Hazard Layer FIRMette

FEMA

104°43'26"W 39°6'27"N

104°42'48"W 39°5'59"N

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

1:6,000

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

Legend

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

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

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

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

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

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

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

N

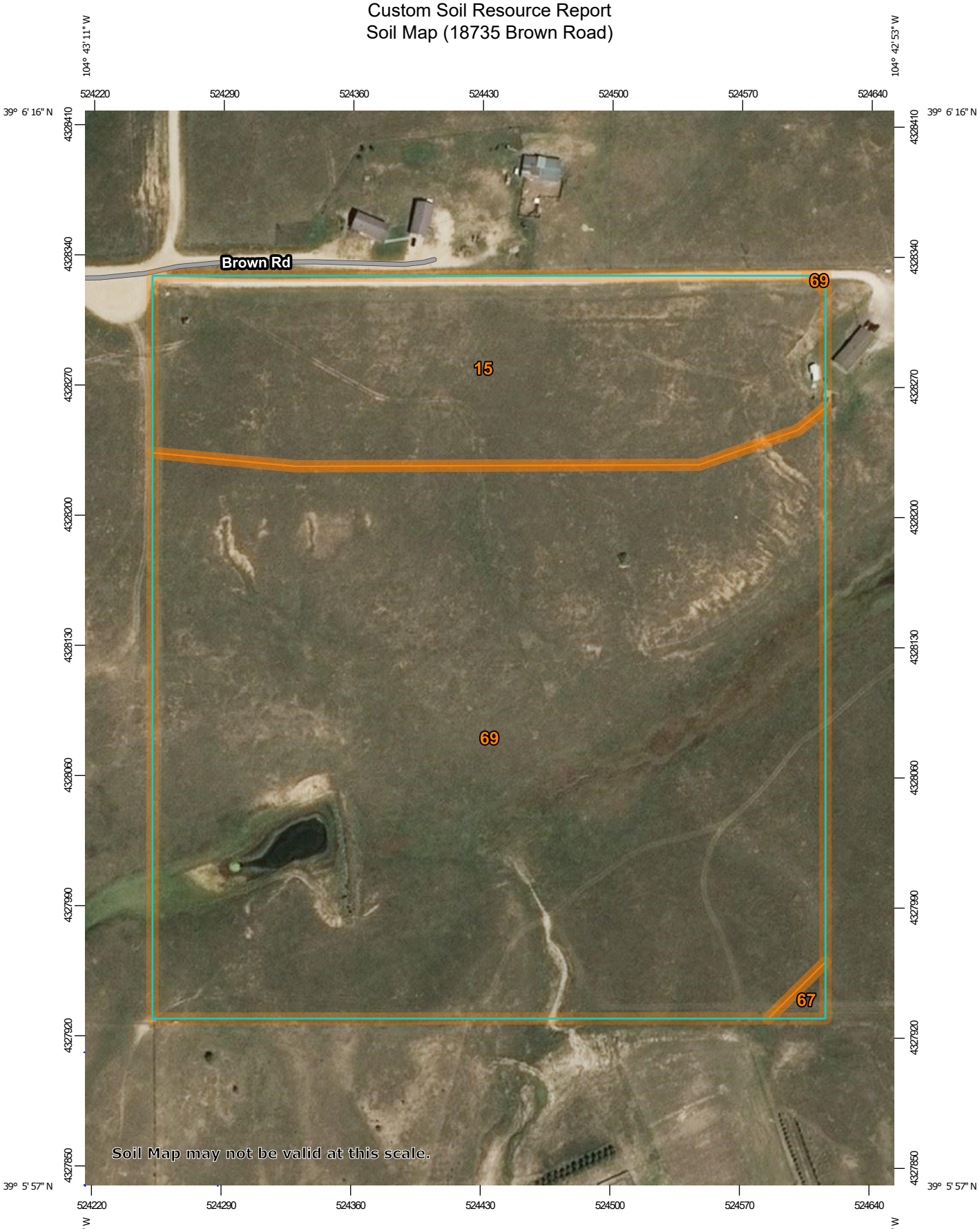
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/7/2022 at 10:28 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Custom Soil Resource Report
Soil Map (18735 Brown Road)



Map Scale: 1:2,820 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 40 80 160 240

Feet
0 100 200 400 600

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

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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

Map Unit Legend (18735 Brown Road)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
15	Brussett loam, 3 to 5 percent slopes	8.9	24.7%
67	Peyton sandy loam, 5 to 9 percent slopes	0.1	0.3%
69	Peyton-Pring complex, 8 to 15 percent slopes	27.0	74.9%
Totals for Area of Interest		**36.0**	**100.0%**

Map Unit Descriptions (18735 Brown Road)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

15—Brussett loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 367k
Elevation: 7,200 to 7,500 feet
Frost-free period: 115 to 125 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Brussett and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brussett

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits

Typical profile

A - 0 to 8 inches: loam
BA - 8 to 12 inches: loam
Bt - 12 to 26 inches: clay loam
Bk - 26 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

67—Peyton sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369d
Elevation: 6,800 to 7,600 feet
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

69—Peyton-Pring complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 369g
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy clay loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

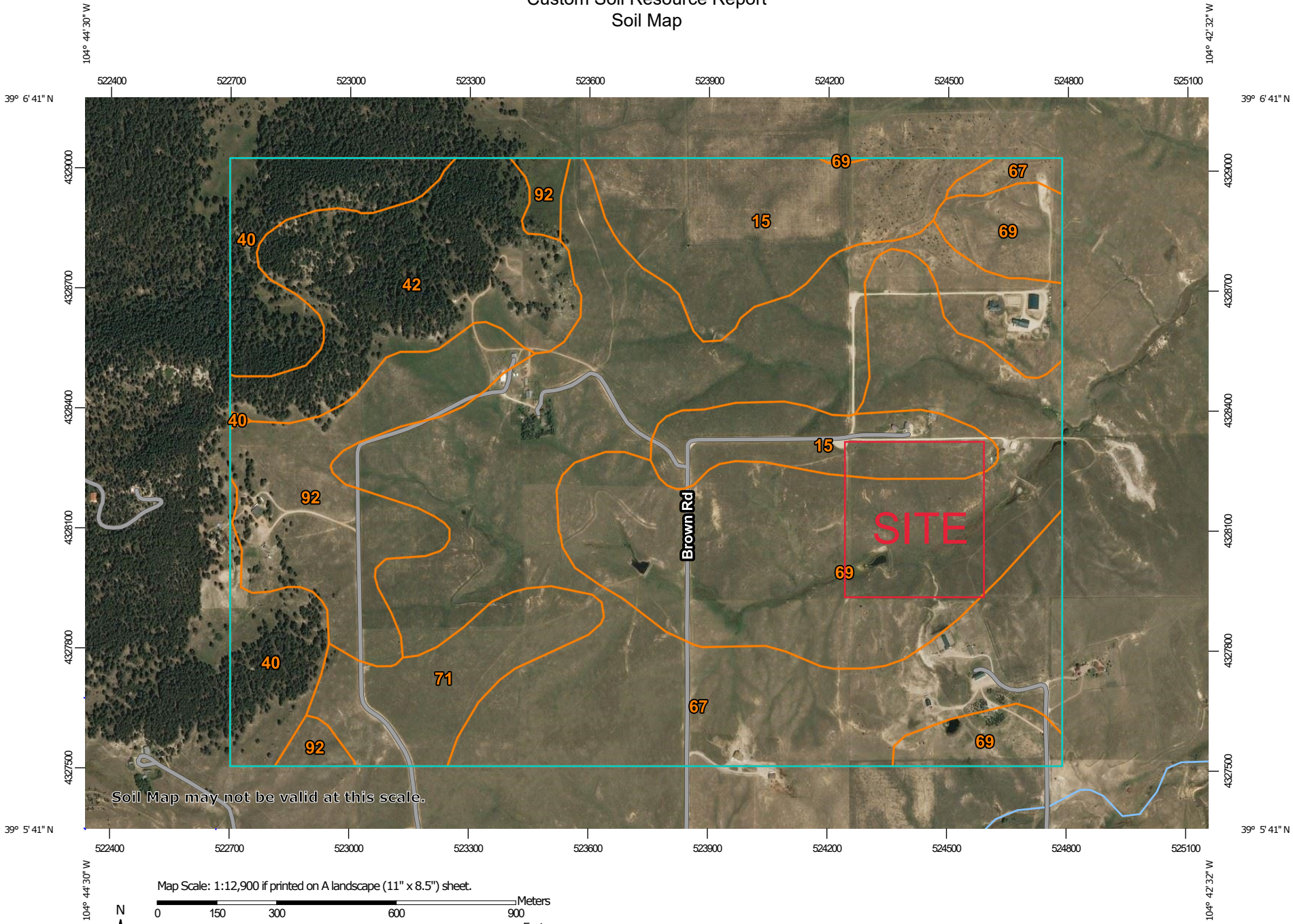
Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

Custom Soil Resource Report
Soil Map



Map Scale: 1:12,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

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

Soils
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- Soil Map Unit Lines
- Soil Map Unit Points

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- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

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Coordinate System: Web Mercator (EPSG:3857)

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Survey Area Data: Version 19, Aug 31, 2021

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Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
15	Brussett loam, 3 to 5 percent slopes	96.4	12.2%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	56.5	7.2%
42	Kettle-Rock outcrop complex	76.2	9.7%
67	Peyton sandy loam, 5 to 9 percent slopes	265.9	33.8%
69	Peyton-Pring complex, 8 to 15 percent slopes	181.8	23.1%
71	Pring coarse sandy loam, 3 to 8 percent slopes	38.3	4.9%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	72.4	9.2%
Totals for Area of Interest		**787.4**	**100.0%**

Davisson RECEIPT NO. 5385

5385

STATE OF COLORADO

DEPARTMENT OF WATER RESOURCES

Office of State Engineer

Standard Plans, Drawings

and

SPECIFICATIONS

Including

RULES AND REGULATIONS

Pertaining to

THE FILING OF APPLICATIONS

for

THE APPROVAL

of

LIVESTOCK WATER TANKS

PURSUANT TO H.B. No. 750
SESSION LAWS OF 1941

DENVER, COLORADO, MAY 1, 1941

1-5

Co 21

APPLICATION FOR APPROVAL OF LIVESTOCK WATER TANK

This application and Statement is made in conformity with provisions of the Livestock Water Tank Act of Colorado.

5385

This application must be accompanied by a filing fee of one dollar, payable to the State Engineer of Colorado.

Gus Davisson (Name of Owner) Motor Rte 3, Colo. Spgs, Colo (P. O. Address)

Location of Tank SW¼ Section 7, Township 11 S 50, Range 65 W 6th P.M.

Name of water course on which tank is located Trib. to East Cherry Creek

Is water course normally dry Yes

Approximate area of drainage basin above tank 50 acres.

Nature of vegetative cover over drainage basin above tank Grass, Farm land

Character of topography of drainage basin (steep, medium or flat) Medium

Character of surface formation of drainage basin (rock, rocky soil, or soil) Soil

Approximate elevation of drainage basin above sea level 7470 feet.

Is water course subject to floods at times No

Height of top of dam above bottom of water course 9.0 feet.

Height of bottom of spillway above bottom of water course 5.0 feet.

Approximate capacity of tank 0.12 1.35 acre feet.

Location of spillway with respect to dam Around right side facing downstream.

Bottom width of spillway at narrowest point 23 feet.

Distance of lower end of spillway below dam 400 feet.

Kind of formations in which spillway is located (rock, shale, clay, earth or mixture of soil and rock) Earth

Width of top of dam 8.0 feet.

Length of top of dam 194 feet.

Slope of upstream face of dam 3:1.

Slope of downstream face of dam 2:1.

Nature of riprap or other protection to be placed over water face of dam

Is the reservoir to be provided with an outlet pipe No

If so, give kind and size of pipe

Give location by section, township and range, and size of every other stock tank now constructed in drainage basin in which this tank will be located

NOTE—Remainder of statements to be furnished by State Engineer's office.

Date of receipt of application by State Engineer DEC 17 '57, 19....

Date of notice from applicant of completion of tank ....., 19....

Tank or site inspected by ....., 19....

Recommendation of Inspector

Date of return of plans and specifications to applicant for correction or revision

Reasons therefor

Filing Fee Paid DEC 17 57, 19....

Application approved this 27 day of December, 19 57

Number assigned this stock tank is

J. E. Whitten

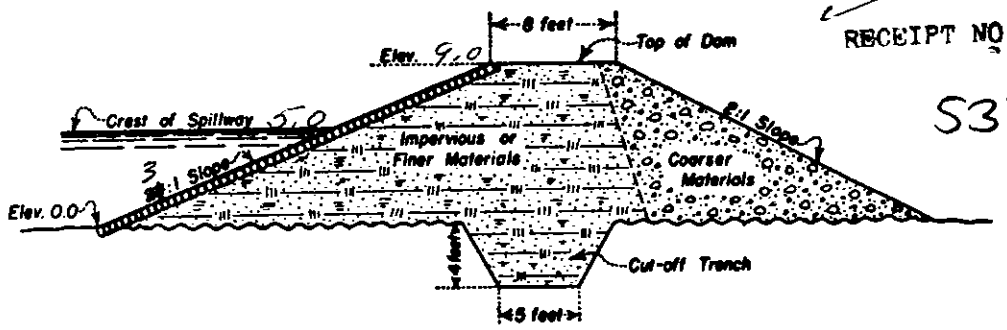
State Engineer

By C. C. Arnold

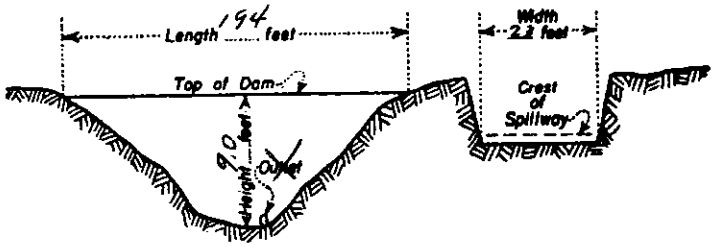
Deputy

RECEIPT NO. 5385

5385

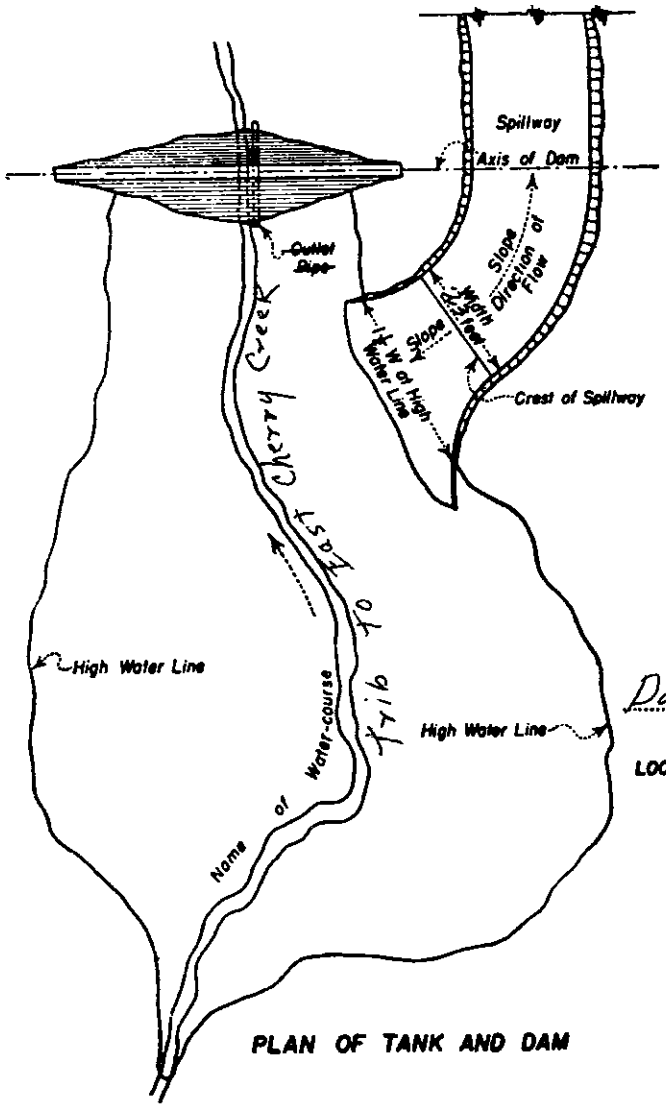


MAXIMUM CROSS-SECTION OF DAM



CROSS-SECTION OF DAM SITE AND SPILLWAY

Show length and height of dam and width of spillway on drawing



PLAN OF TANK AND DAM

STATEMENT BY OWNER

Know all men by these presents: That the undersigned G.K.S. Davisson, whose postoffice address is Motor Rte 3 - Colo. Spgs has caused to be located this Stock Water Tank, the essential features of which are shown by this map and plans, which together with the accompanying application and statements are hereby filed with the State Engineer pursuant to the provisions of law.

First: Height of dam above bottom of water-course is 9.0 feet.

Second: Height of spillway above bottom of water-course is 5.0 feet.

Third: Total capacity of said Stock Water Tank is 1.35 acre feet.

Fourth The source of supply for said Stock Water Tank is (name of stream) Trib. to East Cherry Creek

Fifth: Filing of this map and accompanying statements with the State Engineer was made on the 10 day of Dec., 1957

G.K.S. Davisson
Owner

MAP AND PLANS

FOR

Davisson **STOCK WATER TANK AND DAM**

LOCATED IN SECTION 7 **TWP.** 11 S **RANGE** 65 W **OF** 6TH **P.M.**

El Paso **COUNTY**

DRAINAGE AREA ABOVE DAM 50 **ACRES**

Approved this 27th day of December, 1957

J. C. Whitten
State Engineer

By C. C. Applehans
Deputy

5385

STATE OF COLORADO
DEPARTMENT OF WATER RESOURCES
OFFICE OF STATE ENGINEER

SPECIFICATIONS TO GOVERN THE CONSTRUCTION OF A LIVESTOCK WATER TANK IN COLORADO CONSTRUCTED AFTER APRIL 17, 1941

The following specifications and attached general plans shall be followed in the construction of stock water tank No. _____, located in Sec. 7, Township 11 S, Range 65 W 6TH P.M., for which the undersigned on December 10, 1957 filed an application with the State Engineer, as required by law.

Preparation of Foundation for Dam—All vegetable matter of every description, including roots to a depth of two feet, shall be removed from the entire area upon which the dam will rest, following which the top six-inch layer of soil, together with boggy or unstable materials shall be removed and deposited outside the toes of the dam. The banks of the stream channel shall be dressed to a slope of about 1½:1. A bonding trench, with sloping sides and a bottom width of not less than 5 feet and depth of 4 feet, shall then be excavated beneath the center line of the dam the full length thereof, which trench shall be refilled with the most impervious materials available. The foundation of the dam shall then be lightly plowed lengthwise of the dam, to provide proper contact between the foundation and the dam embankment.

Placing of Dam Embankment—The materials shall be placed in the bonding trench and in the embankment of the dam in layers not exceeding 6 inches in thickness, after which each layer shall be thoroughly compacted by a heavily loaded disc cultivator, a corrugated or sheep's foot roller, the treads of a caterpillar or trucks, or by livestock used in the construction. During the construction period, the top of the embankment shall be maintained as a horizontal plane the full width and length thereof, and no side dumping of materials shall be permitted. The materials shall at all times contain just sufficient moisture to provide proper compaction. Puddling of material with water shall not be permitted. No frozen material or large clods or stones shall be incorporated in the dam. The upstream face of the dam shall be constructed with a slope not steeper than 2½:1, and the downstream face on a slope not steeper than 2:1. The crest or top of the finished dam shall be not less than 8 feet in width.

The upstream two-thirds of the dam shall be constructed of the most impervious materials, such as clay loam, or a mixture of clay and sand, and the downstream one third of more pervious material, such as sand or gravel. The upstream face of the dam shall be adequately protected against wave action by stone riprap, or other suitable materials.

Outlet—Should the state engineer so require, there shall be located beneath the dam a galvanized, corrugated steel pipe of No. 14 gauge and not less than 8 inches in diameter, equipped with a suitable control valve attached to the upstream end of the pipe, together with suitable mechanism for operating the valve. Such outlet pipe, when required, shall be provided with concrete collars enclosing each joint of the pipe. The pipe shall be placed in a trench bottomed in stable formations, and shall be completely surrounded with well compacted impervious materials.

Spillway—For the protection of the dam, an adequate spillway or channel shall be constructed around one or both ends of the dam, of sufficient width to provide a capacity to carry the entire discharge from the drainage basin above the dam during periods of unusual runoff. The spillway shall be located in stable formations not easily eroded, and shall extend to a point well downstream from the dam. The following table shall be used to determine the necessary depth and width of spillway to meet the above requirements. The top of the dam at all points shall be not less than 4 feet above the bottom of the spillway.

Table Showing Required Freeboard, Widths and slopes of Spillways for small Earth Dams, with Drainage Areas above the Same as Shown, Based upon a maximum Peak Runoff of 640 Second Feet per Square Mile, or 1 Second Foot per Acre, with an Allowance of a Minimum Freeboard between the Maximum High Water Line and Top of Dam, of 2.3 Feet, and Maximum Velocities of 3.5 Feet per Second of Time.

AREA OF DRAINAGE BASIN ABOVE DAM IN ACRES	PEAK RUNOFF IN CU. FT. PER SECOND	ASSUMED VELOCITY THROUGH SPILLWAY IN FEET PER SECOND	REQUIRED WIDTH OF SPILLWAY "W" AT NARROWEST POINT IN FEET	DEPTH OF WATER IN SPILLWAY IN FEET	SLOPE OF SPILLWAY IN FEET PER 100 FEET OF LENGTH
100	100	3.0	22	1.5	0.25
200	200	3.0	44	1.5	0.25
300	300	3.0	66	1.5	0.25
400	400	3.0	88	1.5	0.25
500	500	3.0	110	1.5	0.25
600	600	3.0	133	1.5	0.25
700	700	3.0	155	1.5	0.25
800	800	3.0	177	1.5	0.25
900	900	3.0	200	1.5	0.25
1000	1000	3.0	220	1.5	0.25
1100	1100	3.0	210	1.6	0.25
1200	1200	3.2	214	1.7	0.25
1300	1300	3.3	220	1.7	0.25
1400	1400	3.4	240	1.7	0.25
1500	1500	3.4	260	1.7	0.25
1600	1600	3.5	270	1.7	0.25
1700	1700	3.5	285	1.7	0.25
1800	1800	3.5	300	1.7	0.25
1900	1900	3.5	315	1.7	0.25
2000	2000	3.5	330	1.7	0.25

The above spillway widths may be reduced at a point 50 feet below intake, by 25 per cent, where the spillway is located the full length thereof in hard clay or shale, and by 50 per cent when located in hard rock formations, if the slope or grade of the bottom is increased accordingly. The grade for clay and shale formations should be 0.30 foot per 100 feet, and for rock formations 0.9 foot per 100 feet. The width of the entrance to the spillway must in all cases be one-third wider than shown in the Table, and the bottom should slope from the lower end of the funnel section, toward the reservoir 1.0 foot in the distance of 50 feet.

Borrow Pits—Borrow pits, from which materials are taken to build the dam, shall be cleared of all vegetable matter, and no material shall be borrowed within a distance of 50 feet of any part of the dam. Materials excavated from the spillway, when suitable, are to be used in building the dam.

Date 12-10-57

Gus Dawson
Owner

RR 3 Lola Hayes Colo
Post Office Address

9 Supporting Photos

Photos of Existing Livestock Pond
Photos of Conditions of Drainageway

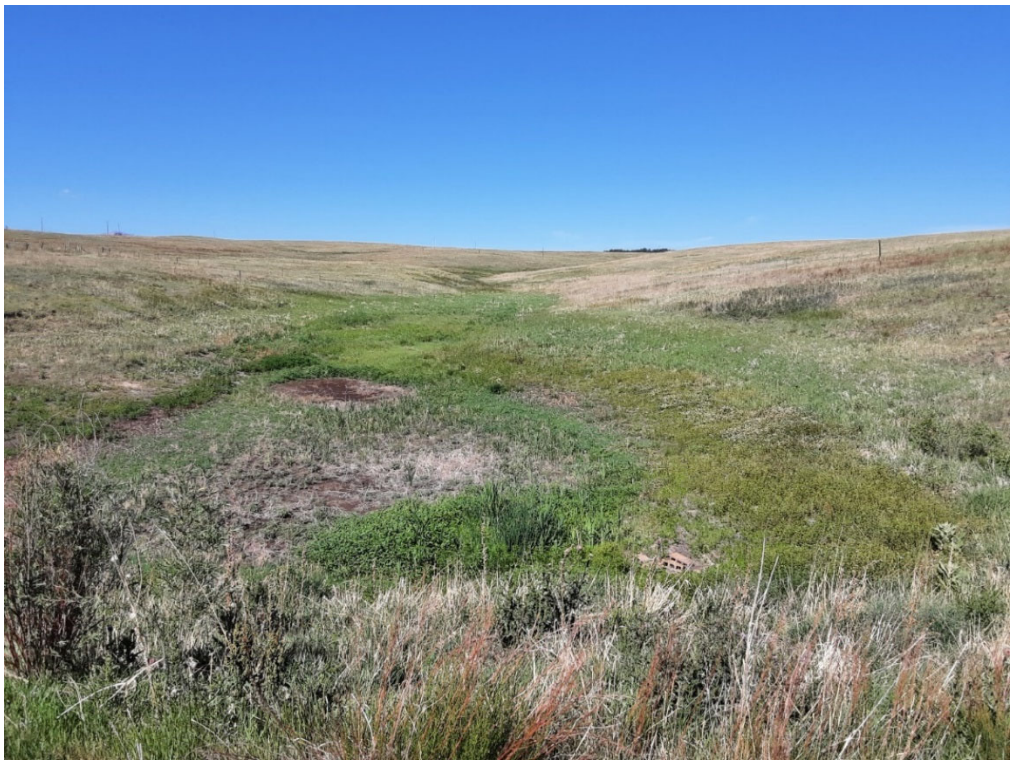


Figure 1: Upstream Photo of Existing Livestock Pond Facing West

Figure 2: Top of the Livestock Pond Facing South

Figure 3: North Side of Livestock Pond Facing North (Upstream of Pond)

Figure 4: North Side of Livestock Pond Facing North (Upstream of Pond) pond outlet pipe

Figure 4: Existing 15” Diameter Spillway Pipe

Figure 5: Measurement of Existing 15” Diameter Pipe

Figure 6: Downstream Drainageway with large brush found in its center

Figure 7: Downstream Brush Found Along Drainage Path
From Bottom of Pond Downstream Facing East

Figure 8: Ground Cover Throughout Drainageway

Figure 9: Density of Brush downstream (Taken along path facing west toward on-site Pond)

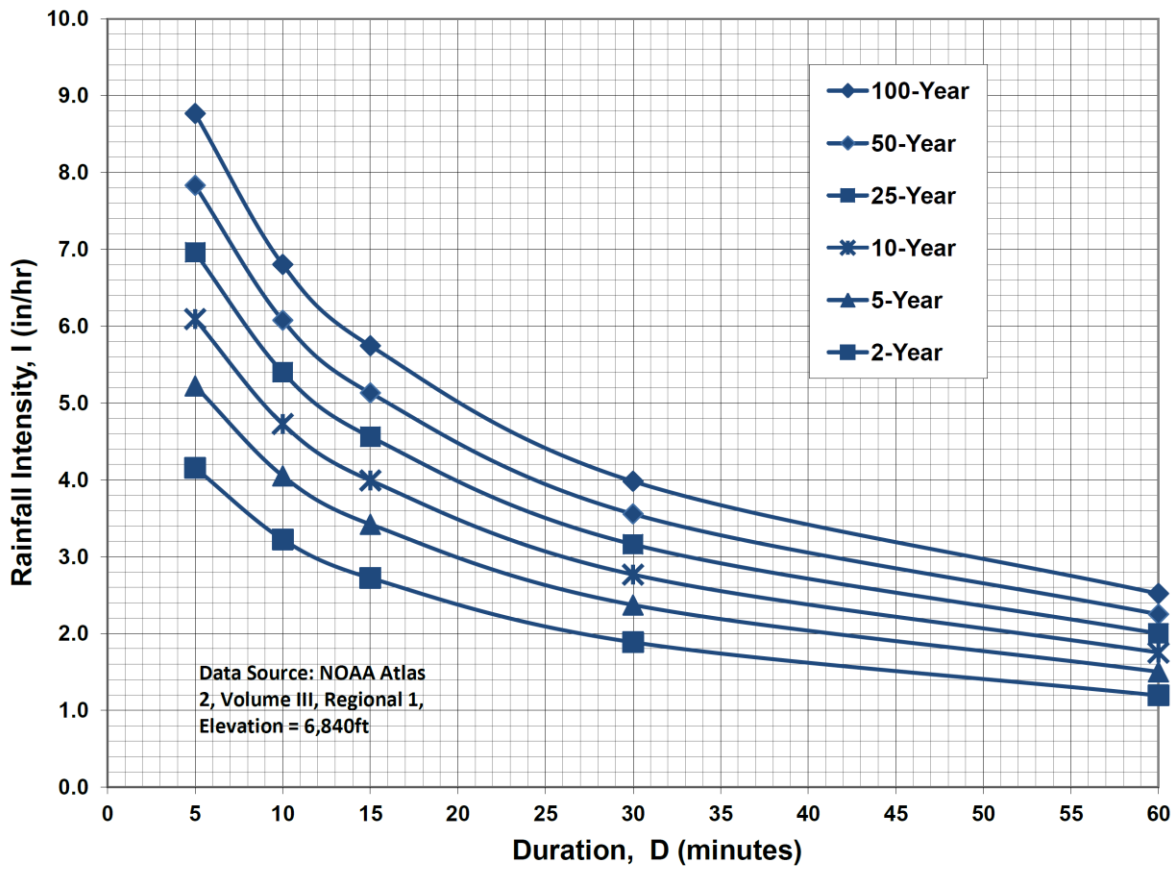
Figure 10: Erosion Found At Drainage Path 5 to 10 feet from East Property Line (Approximately 1-1.5 foot drop)

Figure 11: Land Cover Downstream of East Property Line

10 Hydrologic Calculations

Runoff Coefficients and Percent Imperviousness Table 6-6
Colorado Springs Rainfall Intensity Duration Frequency Figure 6-5
Hydrologic Calculations Summary Form SF-1 for Existing & Developed Conditions
Hydrologic Calculations Summary 5-yr Form SF-2 for Existing & Developed Conditions
Hydrologic Calculations Summary 100-yr Form SF-2 for Existing & Developed Conditions
CN Calculations
Time of Concentration Calculations
HEC-HMS Calculations Summary 5-yr Existing & Developed Conditions
HEC-HMS Calculations Summary 100-yr Existing & Developed Conditions

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Job No.: **61170** Date: **8/18/2022 9:00**

Project: **Boyd Subdivision** Calcs By: **TJW**

Checked By:

Time of Concentration (Modified from Standard Form SF-1)

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t_c Check		t_c
	Area (Acres)	C_5	C_{100}/CN	% Imp.	L_0 (ft)	S_0 (%)	t_i (min)	L_{0t} (ft)	S_{0t} (ft/ft)	v_{0sc} (ft/s)	t_t (min)	L_{0c} (ft)	S_{0c} (ft/ft)	v_{0c} (ft/s)	t_c (min)	L (min)	$t_{c,alt}$ (min)	(min)
OS-A1	2.45	0.08	0.35	0%	100	15%	7.5	556	0.063	1.8	5.3	0	0.000	0.0	0.0	656	13.6	12.8
OS-B1	4.34	0.10	0.38	7%	100	4%	11.4	946	0.037	1.3	11.7	0	0.000	0.0	0.0	1046	15.8	15.8
OS-B2	26.81	0.08	0.35	0%	100	4%	11.7	1273	0.053	1.6	13.2	0	0.000	0.0	0.0	1373	17.6	17.6
EX-A	4.90	0.08	0.35	0%	100	6%	10.2	466	0.112	2.3	3.3	50	0.020	2.2	0.4	616	13.4	13.4
EX-B	26.86	0.08	0.35	0%	100	5%	10.8	1120	0.070	1.8	10.1	440	0.023	3.5	2.1	1660	19.2	19.2
EX-C	4.12	0.10	0.37	4%	100	5%	10.6	672	0.086	2.1	5.4	0	0.000	0.0	0.0	772	14.3	14.3
A	4.90	0.08	0.35	0%	100	6%	10.2	466	0.112	2.3	3.3	50	0.020	2.2	0.4	616	13.4	13.4
B	26.86	0.09	0.36	2%	100	5%	10.7	1120	0.070	1.8	10.1	440	0.023	3.5	2.1	1660	19.2	19.2
C	4.12	0.13	0.39	8%	100	5%	10.3	672	0.086	2.1	5.4	0	0.000	0.0	0.0	772	14.3	14.3

Job No.: **61170**
Project: **Boyd Subdivision**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **8/18/2022 9:00**
Calcs By: **TJW**
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

DP	Sub-Basin	Area (Acres)	C5	Direct Runoff t_c (min)	Direct Runoff CA (Acres)	Direct Runoff I5 (in/hr)	Direct Runoff Q5 (cfs)	Combined Runoff t_c (min)	Combined Runoff CA (Acres)	Combined Runoff I5 (in/hr)	Combined Runoff Q5 (cfs)	Streetflow Slope (%)	Streetflow Length (ft)	Streetflow Q (cfs)	Pipe Flow Q (cfs)	Pipe Flow Slope (%)	Pipe Flow Mnngs n	Pipe Flow Length (ft)	Pipe Flow D_{Pipe} (in)	Travel Time Length (ft)	Travel Time v_{0sc} (ft/s)	Travel Time t_t (min)
	OS-A1	2.45	0.08	12.8	0.20	3.76	0.74															
	OS-B1	4.34	0.10	15.8	0.43	3.44	1.50															
	OS-B2	26.81	0.08	17.6	2.14	3.28	7.03															
	EX-A	4.90	0.08	13.4	0.39	3.69	1.45															
	EX-B	26.86	0.08	19.2	2.22	3.15	7.00															
	EX-C	4.12	0.10	14.3	0.42	3.59	1.52															
OS-A1 + EX-A		7.35	0.08					16.2	0.59	3.41	2.0											
Existing		65.36	0.08					22.3	5.39	2.93	15.8											
	A	4.90	0.08	13.4	0.39	3.69	1.45															
	B	26.86	0.09	19.2	2.46	3.15	7.76															
	C	4.12	0.13	14.3	0.55	3.59	1.96															
OS-A1 + A		7.35	0.08					16.2	0.59	3.41	2.0											
Developed		65.25	0.09					22.3	5.57	2.93	16.3											

DCM: I = C1 * ln (tc) + C2
C1: 1.5
C1: 7.583

Job No.: **61170**
Project: **Boyd Subdivision**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **8/18/2022 9:00**
Calcs By: **TJW**
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C100	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
	OS-A1	2.45	0.35	12.8	0.86	6.31	5.41															
	OS-B1	4.34	0.38	15.8	1.65	5.78	9.54															
	OS-B2	26.81	0.35	17.6	9.38	5.50	51.64															
	EX-A	4.90	0.35	13.4	1.72	6.19	10.62															
	EX-B	26.86	0.35	19.2	9.45	5.29	49.96															
	EX-C	4.12	0.37	14.3	1.51	6.03	9.08															
OS-A1 + EX-A		7.35	0.35					16.2	2.57	5.72	14.7											
Existing		65.36	0.35					22.3	23.06	4.91	113.3											
	A	4.90	0.35	13.4	1.72	6.19	10.62															
	B	26.86	0.36	19.2	9.62	5.29	50.87															
	C	4.12	0.39	14.3	1.59	6.03	9.60															
OS-A1 + A		7.35	0.35					16.2	2.57	5.72	14.7											
Developed		65.25	0.35					22.3	23.15	4.91	113.8											

DCM: I = C1 * ln (tc) + C2
C1: 2.52
C1: 12.735

Sub-Basin OS-A1 Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	106,657	2.45	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**106,657**	**2.45**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	106657								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	656	50	-	-	-	-	
Initial Time	100	15	0.150	-	7.5	13.6	DCM Eq. 6-8
Shallow Channel	556	35	0.063	1.8	5.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.00	3.76	4.38	5.01	5.64	6.31
Runoff (cfs)	0.1	**0.7**	1.6	3.1	4.1	**5.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.7**	1.6	3.1	4.1	**5.4**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin OS-B1 Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	189,239	4.34	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**189,239**	**4.34**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	189239								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,046	39	-	-	-	-	
Initial Time	100	4	0.040	-	11.4	15.8	DCM Eq. 6-8
Shallow Channel	946	35	0.037	1.3	11.7	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**15.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.75	3.44	4.02	4.59	5.16	5.78
Runoff (cfs)	0.7	**1.5**	3.5	5.8	7.6	**9.5**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.7	**1.5**	3.5	5.8	7.6	**9.5**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin OS-B2 Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	1,167,697	26.81	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**1,167,697**	**26.81**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	1167697								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ = 100 ft; C_v = 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,373	71	-	-	-	-	
Initial Time	100	4	0.040	-	11.7	17.6	DCM Eq. 6-8
Shallow Channel	1,273	67	0.053	1.6	13.2	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**17.6 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.62	3.28	3.83	4.37	4.92	5.50
Runoff (cfs)	1.4	**7.0**	15.4	29.3	39.6	**51.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.4	**7.0**	15.4	29.3	39.6	**51.6**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-A Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	213,513	4.90	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**213,513**	**4.90**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	213513								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	616	59	-	-	-	-	
Initial Time	100	6	0.060	-	10.2	13.4	DCM Eq. 6-8
Shallow Channel	466	52	0.112	2.3	3.3	-	DCM Eq. 6-9
Channelized	50	1	0.020	2.2	0.4	-	Trap Ditch
				t_c	**13.4 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.94	3.69	4.30	4.92	5.53	6.19
Runoff (cfs)	0.3	**1.4**	3.2	6.0	8.1	**10.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**1.4**	3.2	6.0	8.1	**10.6**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-B Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Gravel	6,180	0.14	0.57	0.59	0.63	0.66	0.68	0.7	80%
Pasture/Meadow	1,163,992	26.72	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**1,170,172**	**26.86**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.4%**
	1170172								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,660	93	-	-	-	-	
Initial Time	100	5	0.050	-	10.8	19.2	DCM Eq. 6-8
Shallow Channel	1,120	78	0.070	1.8	10.1	-	DCM Eq. 6-9
Channelized	440	10	0.023	3.5	2.1	-	Trap Ditch
				t_c	**19.2 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.52	3.15	3.67	4.20	4.72	5.29
Runoff (cfs)	1.5	**7.0**	15.1	28.4	38.3	**50.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.5	**7.0**	15.1	28.4	38.3	**50.0**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-C Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Gravel	8,120	0.19	0.57	0.59	0.63	0.66	0.68	0.7	80%
Pasture/Meadow	171,130	3.93	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**179,250**	**4.12**	**0.04**	**0.10**	**0.17**	**0.27**	**0.32**	**0.37**	**3.6%**

179250

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ = 100 ft C_v = 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	772	63	-	-	-	-	
Initial Time	100	5	0.050	-	10.6	14.3	DCM Eq. 6-8
Shallow Channel	672	58	0.086	2.1	5.4	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	Trap Ditch
				t_c	**14.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.87	3.59	4.19	4.79	5.39	6.03
Runoff (cfs)	0.5	**1.5**	3.0	5.3	7.0	**9.1**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	**1.5**	3.0	5.3	7.0	**9.1**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin A Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	213,513	4.90	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**213,513**	**4.90**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	213513								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	616	59	-	-	-	-	
Initial Time	100	6	0.060	-	10.2	13.4	DCM Eq. 6-8
Shallow Channel	466	52	0.112	2.3	3.3	-	DCM Eq. 6-9
Channelized	50	1	0.020	2.2	0.4	-	Trap Ditch
				t_c	**13.4**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.94	3.69	4.30	4.92	5.53	6.19
Runoff (cfs)	0.3	**1.4**	3.2	6.0	8.1	**10.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**1.4**	3.2	6.0	8.1	**10.6**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-B Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Gravel	6,180	0.14	0.57	0.59	0.63	0.66	0.68	0.7	80%
Gravel	4,800	0.11	0.57	0.59	0.63	0.66	0.68	0.7	80%
Roofs	10,000	0.23	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	2,000	0.05	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,147,192	26.34	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**1,170,172**	**26.86**	**0.03**	**0.09**	**0.16**	**0.26**	**0.31**	**0.36**	**1.7%**
	1170172								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,660	93	-	-	-	-	
Initial Time	100	5	0.050	-	10.7	19.2	DCM Eq. 6-8
Shallow Channel	1,120	78	0.070	1.8	10.1	-	DCM Eq. 6-9
Channelized	440	10	0.023	3.5	2.1	-	Trap Ditch
				t_c	**19.2 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.52	3.15	3.67	4.20	4.72	5.29
Runoff (cfs)	2.2	**7.8**	15.9	29.3	39.2	**50.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.2	**7.8**	15.9	29.3	39.2	**50.9**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-C Runoff Calculations

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Gravel	8,120	0.19	0.57	0.59	0.63	0.66	0.68	0.7	80%
Gravel	2,400	0.06	0.57	0.59	0.63	0.66	0.68	0.7	80%
Roofs	5,000	0.11	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	1,000	0.02	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	162,730	3.74	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**179,250**	**4.12**	**0.08**	**0.13**	**0.20**	**0.29**	**0.34**	**0.39**	**7.8%**

179250

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 100 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	772	63	-	-	-	-	
Initial Time	100	5	0.050	-	10.3	14.3	DCM Eq. 6-8
Shallow Channel	672	58	0.086	2.1	5.4	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	Trap Ditch
				t_c	**14.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.87	3.59	4.19	4.79	5.39	6.03
Runoff (cfs)	0.9	**2.0**	3.4	5.8	7.5	**9.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.9	**2.0**	3.4	5.8	7.5	**9.6**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Combined Sub-Basin Runoff Calculations

Includes Basins OS-A1 EX-A

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	320,170	7.35	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**320,170**	**7.35**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A1	-	656	50	-	-	-	-	12.8
Channelized-1	Trap Ditch	3	410	30	5	2	2	2.0	3.4
Channelized-2									
Channelized-3									
Total			1,066	80					

3 = Natural, Winding, significant vegetation

t_c (min) **16.2**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.72	3.41	3.97	4.54	5.11	5.72
Site Runoff (cfs)	0.40	**2.00**	4.38	8.35	11.27	**14.71**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**2.0**	-	-	-	**14.7**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Combined Sub-Basin Runoff Calculations (Existing Site)

Includes Basins OS-A1 EX-A OS-B1 OS-B2 EX-B

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	2,651,859	60.88	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	6,180	0.14	0.57	0.59	0.63	0.66	0.68	0.7	80%
5 Acre	189,239	4.34	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**2,847,278**	**65.36**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.6%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A1	-	656	50	-	-	-	-	12.8
Channelized-1	Trap Ditch	3	410	30	5	2	2	2.0	3.4
Channelized-2	Trap Ditch	2	904	24	5	2	2	2.5	6.1
Channelized-3									
Total			1,970	104					

3 = Natural, Winding, significant vegetation

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **22.3**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.34	2.93	3.42	3.90	4.39	4.91
Site Runoff (cfs)	3.65	**15.77**	34.46	64.69	87.12	**113.30**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**15.8**	-	-	-	**113.3**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Combined Sub-Basin Runoff Calculations

Includes Basins OS-A1 A

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	320,170	7.35	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**320,170**	**7.35**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A1	-	656	50	-	-	-	-	12.8
Channelized-1	Trap Ditch	3	410	30	5	2	2	2.0	3.4
Channelized-2									
Channelized-3									
Total			1,066	80					

3 = Natural, Winding, significant vegetation

t_c (min) **16.2**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.72	3.41	3.97	4.54	5.11	5.72
Site Runoff (cfs)	0.40	**2.00**	4.38	8.35	11.27	**14.71**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**2.0**	-	-	-	**14.7**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Combined Sub-Basin Runoff Calculations (Developed Site)

Includes Basins OS-A1 A OS-B1 OS-B2 B

Job No.:	**61170**	Date:	**8/18/2022 9:00**
Project:	**Boyd Subdivision**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	2,635,059	60.49	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	6,180	0.14	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	2,000	0.05	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	10,000	0.23	0.71	0.73	0.75	0.78	0.8	0.81	90%
5 Acre	189,239	4.34	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**2,842,478**	**65.25**	**0.03**	**0.09**	**0.16**	**0.26**	**0.31**	**0.35**	**1.0%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A1	-	656	50	-	-	-	-	12.8
Channelized-1	Trap Ditch	3	410	30	5	2	2	2.0	3.4
Channelized-2	Trap Ditch	2	904	24	5	2	2	2.5	6.1
Channelized-3									
Total			1,970	104					

3 = Natural, Winding, significant vegetation

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **22.3**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.34	2.93	3.42	3.90	4.39	4.91
Site Runoff (cfs)	4.11	**16.30**	35.00	65.18	87.61	**113.76**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**16.3**	-	-	-	**113.8**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Boyd Subdivision
South Channel
M.V.E., Inc. March 2022

NRCS Curve Number Calculations

Basin	Basin Area (Sq Mi)	Basin Area (Ac)	Predominant Soil Type	Land Use (Type)	Land Use (Ac)	Land Use (CN)	Land Use (Type)	Land Use (Ac)	Land Use (CN)	Land Use (Type)	Land Use (Ac)	Land Use (CN)	**Composite (CN)**	**Initial Abstraction (in)**
OS-1	0.094	60.2	B	Pasture	60.2	66							**66.0**	**0.52**
OS-2	0.153	97.9	B	Pasture	97.9	66							**66.0**	**0.52**
OS-3	0.011	7.0	B	Pasture	7.0	66							**66.0**	**0.52**
OS-4	0.059	37.8	B	Pasture	37.8	66							**66.0**	**0.52**
OS-5	0.143	91.5	B	Pasture	51.5	66	RR5	40	67				**66.4**	**0.51**
B	0.091	58.2	B	Pasture	58.2	66							**66.0**	**0.52**
		352.6	Total AC.								Weighted Average CN =		66.1	

Boyd Subdivision
South Channel
M.V.E., Inc. March 2022

NRCS Curve Number Calculations (DEVELOPED)

Basin	Basin Area (Sq Mi)	Basin Area (Ac)	Predominant Soil Type	Land Use (Type)	Land Use (Ac)	Land Use (CN)	Land Use (Type)	Land Use (Ac)	Land Use (CN)	Land Use (Type)	Land Use (Ac)	Land Use (CN)	**Composite (CN)**	**Initial Abstraction (in)**
OS-1	0.094	60.2	B	Pasture	60.2	66							**66.0**	**0.52**
OS-2	0.153	97.9	B	Pasture	97.9	66							**66.0**	**0.52**
OS-3	0.011	7.0	B	Pasture	7.0	66							**66.0**	**0.52**
OS-4	0.059	37.8	B	Pasture	37.8	66							**66.0**	**0.52**
OS-5	0.143	91.5	B	Pasture	51.5	66	RR5	40	67				**66.4**	**0.51**
B	0.091	58.2	B	Pasture	27.2	66	RR5	31	67				**66.5**	**0.50**
		352.6	Total AC.									Weighted Average CN =	66.2	

Boyd Subdivision
South Channel
M.V.E., Inc. March 2022

Time of Concentration/Lag Time Calculations

			Overland Flow					Shallow Concentrated Flow				
Basin	Basin Area (Sq Mi)	Basin Area (Ac)	Manning's n	Length (ft)	P2 (in)	Slope (ft/ft)	**Ti (hr)**	Cover Type	Length (ft)	Slope (%)	V (fps)	**Tsc (hr)**
OS-1	0.094	60.2	0.130	300	2.1	0.117	**0.21**	Pasture	1050	7.1	1.9	**0.15**
OS-2	0.153	97.9	0.130	300	2.1	0.200	**0.17**	Pasture	785	8.9	2.1	**0.10**
OS-3	0.011	7.0	0.130	300	2.1	0.017	**0.46**	Pasture	370	9.5	2.2	**0.05**
OS-4	0.059	37.8	0.130	300	2.1	0.093	**0.23**	Pasture	1070	6.5	1.8	**0.17**
OS-5	0.143	91.5	0.130	300	2.1	0.026	**0.39**	Pasture	1380	1.9	1	**0.38**
B	0.091	58.2	0.130	300	2.1	0.060	**0.28**	Pasture	1380	5.8	1.7	**0.23**

Boyd Subdivision
South Channel
M.V.E., Inc. March 2022

Time of Concentration/Lag Time Calculations

	Concentrated Flow											Total Time of Conc	Lag Time
Basin	Length (ft)	Slope (%)	Manning's n	Bot Width (ft)	Est Flow (cfs)	Est d (ft)	Calc Q (cfs)	Calc A (ft)	Calc P (ft)	V (fps)	**Tcf (hr)**	**Tc (hr)**	**(Min)**
OS-1	1895	3.2	0.035	15	100	1.00	100	14.9	17.0	7.0	**0.08**	**0.44**	**16**
OS-2	1460	3.8	0.035	8	160	1.88	160	15.0	11.8	9.8	**0.04**	**0.32**	**11**
OS-3	450	4	0.035	2	15	1.50	15	3.0	5.0	6.1	**0.02**	**0.53**	**19**
OS-4	1185	4.6	0.035	15	65	0.72	65	10.8	16.4	6.9	**0.05**	**0.45**	**16**
OS-5	1250	2.2	0.035	15	100	1.10	100	16.5	17.2	6.1	**0.06**	**0.83**	**30**
B	750	2.0	0.035	5	95	2.51	95	12.6	10.0	7.0	**0.03**	**0.53**	**19**
											227	**3.8**	**136.2** composite
											min	hr	

Global Summary Results for Run "5yr Existing"

Project: Boyd Subdivision Simulation Run: 5yr Existing

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 08Apr2022, 16:10:00

Basin Model: Boyd
Meteorologic Model: 5-yr
Control Specifications: 24-hr

Show Elements: All Elements Volume Units: (•) IN ( ) ACRE-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-OS2	0.153	34.8	01Jan2000, 12:07	0.41
Subbasin-OS1	0.094	16.7	01Jan2000, 12:12	0.40
Junction-1	0.247	49.4	01Jan2000, 12:08	0.41
Reach-1	0.247	48.8	01Jan2000, 12:11	0.40
Subbasin-OS4	0.059	10.5	01Jan2000, 12:12	0.40
Subbasin-OS3	0.011	1.7	01Jan2000, 12:16	0.40
Junction-2	0.317	60.8	01Jan2000, 12:12	0.40
Reach-2	0.317	60.7	01Jan2000, 12:15	0.40
Subbasin-OS5	0.143	17.2	01Jan2000, 12:29	0.41
Junction-3	0.460	73.1	01Jan2000, 12:16	0.41
Reach-3	0.460	73.0	01Jan2000, 12:18	0.41
Subbasin-B	0.091	14.3	01Jan2000, 12:16	0.40
Junction-4	0.551	87.0	01Jan2000, 12:18	0.41

Global Summary Results for Run "5yr Developed"

Project: Boyd Subdivision Simulation Run: 5yr Developed

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 08Apr2022, 16:09:58

Basin Model: Boyd - Developed
Meteorologic Model: 5-yr
Control Specifications: 24-hr

Show Elements: All Elements

Volume Units: (•) IN ( ) ACRE-FT

Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-OS2	0.153	34.8	01Jan2000, 12:07	0.41
Subbasin-OS1	0.094	16.7	01Jan2000, 12:12	0.40
Junction-1	0.247	49.4	01Jan2000, 12:08	0.41
Reach-1	0.247	48.8	01Jan2000, 12:11	0.40
Subbasin-OS4	0.059	10.5	01Jan2000, 12:12	0.40
Subbasin-OS3	0.011	1.7	01Jan2000, 12:16	0.40
Junction-2	0.317	60.8	01Jan2000, 12:12	0.40
Reach-2	0.317	60.7	01Jan2000, 12:15	0.40
Subbasin-OS5	0.143	17.2	01Jan2000, 12:29	0.41
Junction-3	0.460	73.1	01Jan2000, 12:16	0.41
Reach-3	0.460	73.0	01Jan2000, 12:18	0.41
Subbasin-B	0.091	15.2	01Jan2000, 12:16	0.42
Junction-4	0.551	88.0	01Jan2000, 12:18	0.41

Global Summary Results for Run "100yr Existing"

Project: Boyd Subdivision Simulation Run: 100yr Existing

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 08Apr2022, 16:09:53

Basin Model: Boyd
Meteorologic Model: 100-yr
Control Specifications: 24-hr

Show Elements: All Elements | Volume Units: (•) IN ( ) ACRE-FT | Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-OS2	0.153	163.2	01Jan2000, 12:05	1.45
Subbasin-OS1	0.094	81.0	01Jan2000, 12:10	1.45
Junction-1	0.247	236.9	01Jan2000, 12:06	1.45
Reach-1	0.247	234.9	01Jan2000, 12:08	1.45
Subbasin-OS4	0.059	50.8	01Jan2000, 12:10	1.45
Subbasin-OS3	0.011	8.5	01Jan2000, 12:13	1.45
Junction-2	0.317	293.4	01Jan2000, 12:09	1.45
Reach-2	0.317	293.2	01Jan2000, 12:12	1.45
Subbasin-OS5	0.143	81.9	01Jan2000, 12:25	1.47
Junction-3	0.460	354.4	01Jan2000, 12:13	1.45
Reach-3	0.460	354.0	01Jan2000, 12:14	1.45
Subbasin-B	0.091	70.1	01Jan2000, 12:13	1.45
Junction-4	0.551	423.8	01Jan2000, 12:14	1.45

Global Summary Results for Run "100yr Developed"

Project: Boyd Subdivision Simulation Run: 100yr Developed

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 08Apr2022, 16:09:52

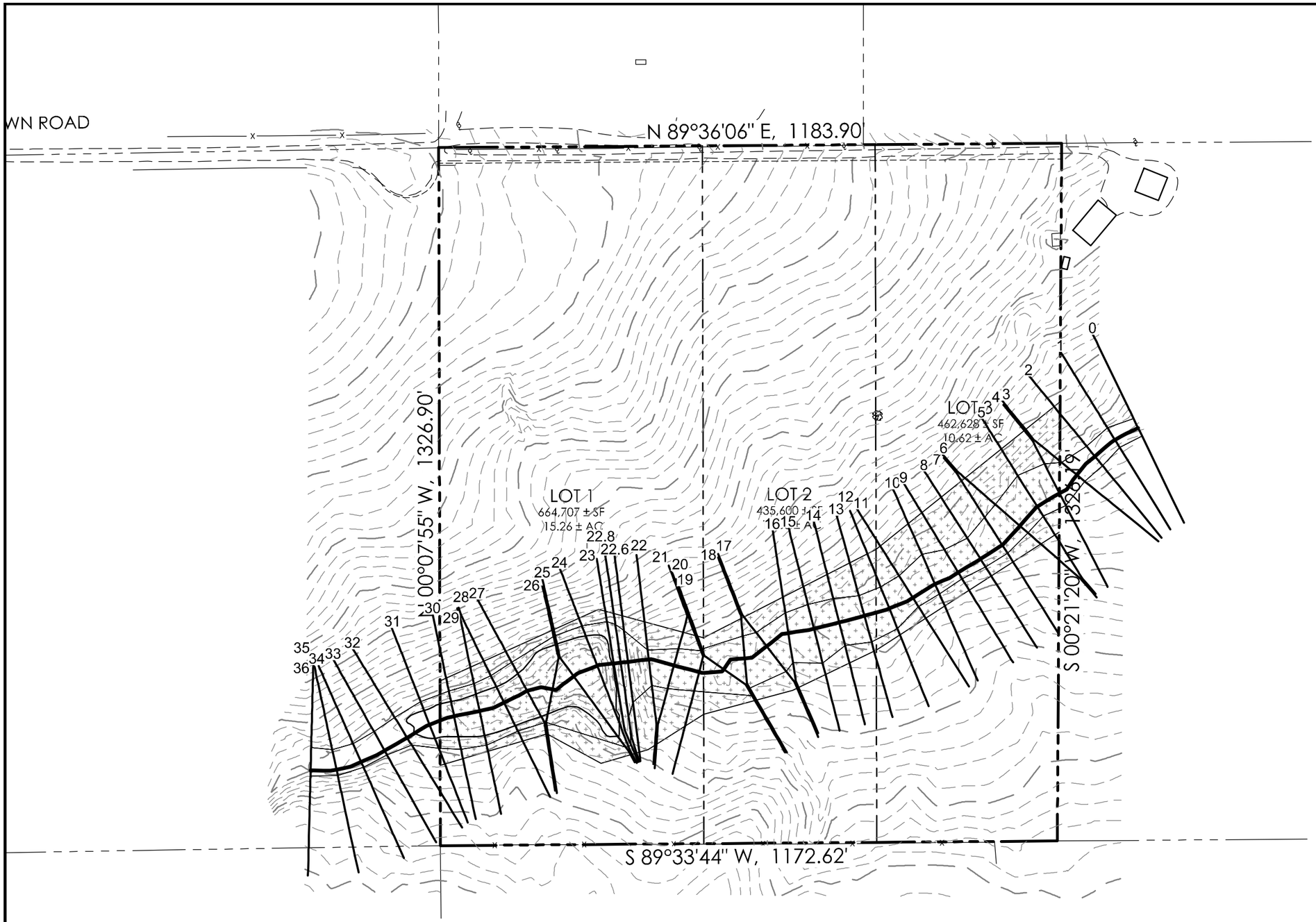
Basin Model: Boyd - Developed
Meteorologic Model: 100-yr
Control Specifications: 24-hr

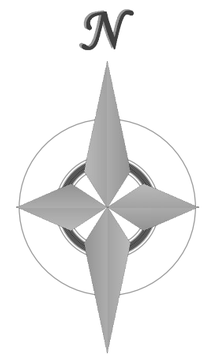
Show Elements: All Elements Volume Units: (•) IN ( ) ACRE-FT Sorting: Hydrologic

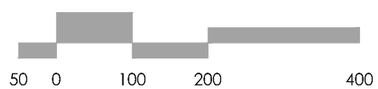
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-OS2	0.153	163.2	01Jan2000, 12:05	1.45
Subbasin-OS1	0.094	81.0	01Jan2000, 12:10	1.45
Junction-1	0.247	236.9	01Jan2000, 12:06	1.45
Reach-1	0.247	234.9	01Jan2000, 12:08	1.45
Subbasin-OS4	0.059	50.8	01Jan2000, 12:10	1.45
Subbasin-OS3	0.011	8.5	01Jan2000, 12:13	1.45
Junction-2	0.317	293.4	01Jan2000, 12:09	1.45
Reach-2	0.317	293.2	01Jan2000, 12:12	1.45
Subbasin-OS5	0.143	81.9	01Jan2000, 12:25	1.47
Junction-3	0.460	354.4	01Jan2000, 12:13	1.45
Reach-3	0.460	353.9	01Jan2000, 12:14	1.45
Subbasin-B	0.091	72.1	01Jan2000, 12:13	1.48
Junction-4	0.551	425.8	01Jan2000, 12:14	1.46

11 Hydraulic Calculations

HEC-RAS Cross Section Map
HEC-RAS Profile
HEC-RAS Summary Table
HEC-RAS Cross Sections
HEC-RAS Detailed Report







1" = 200' 1:2,400

FLOODPLAIN STATEMENT

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBER 08041C0305 G, EFFECTIVE DECEMBER 7, 2018.

MONUMENT VALLEY ENGINEERS INC.
*** ENGINEERS *** SURVEYORS ***
1903 LELARAY ST., COLORADO SPRINGS, COLORADO 80909
(719) 635-5736

HEC_RAS_CROSS_SECTIONS

HEC-RAS HEC-RAS 5.0.7 March 2019
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X     X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X      X    X        X
X     X  X        X    X      X   X     X    X        X
X     X  XXXXXX    XXXX       X    X    X    X   XXXXX
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PROJECT DATA
Project Title: HEC-RAS Model
Project File : 61170-No Build Area.prj
Run Date and Time: 8/17/2022 12:23:56 PM

Project in English units

Project Description:
CRS Info=<SpatialReference> <CoordinateSystem Code="2232"
Unit="US_survey_Foot" AcadCode="CO83-CF" /></SpatialReference>

PLAN DATA

Plan Title: Default Scenario
Plan File : Z:\61170\Documents\Drainage\Calcs\Hydrology\61170-No Build Area.p01

Geometry Title: Default Geometry
Geometry File : Z:\61170\Documents\Drainage\Calcs\Hydrology\61170-No Build Area.g01

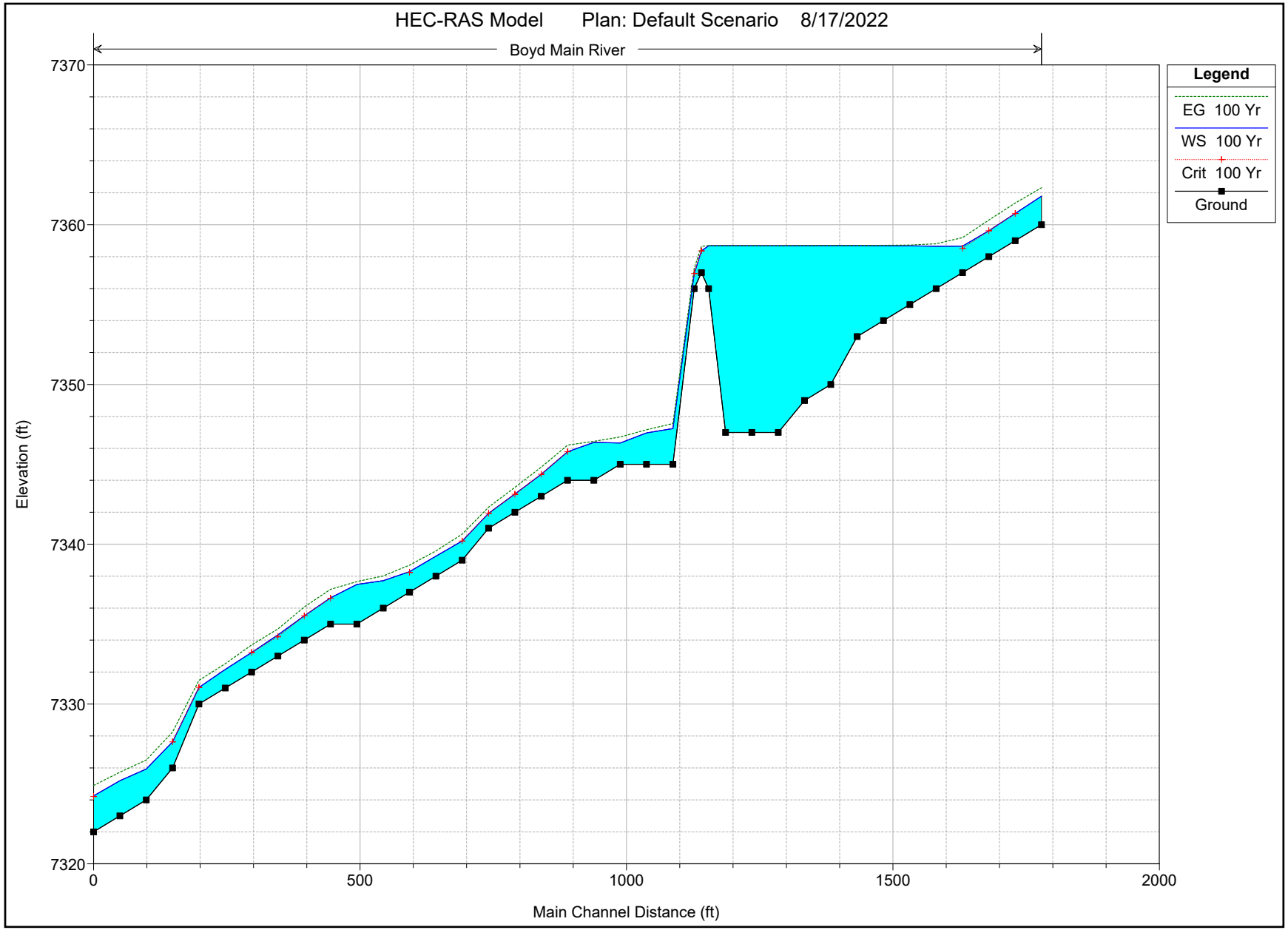
Flow Title   : Default Steady Flow
Flow File   : Z:\61170\Documents\Drainage\Calcs\Hydrology\61170-No Build Area.f01

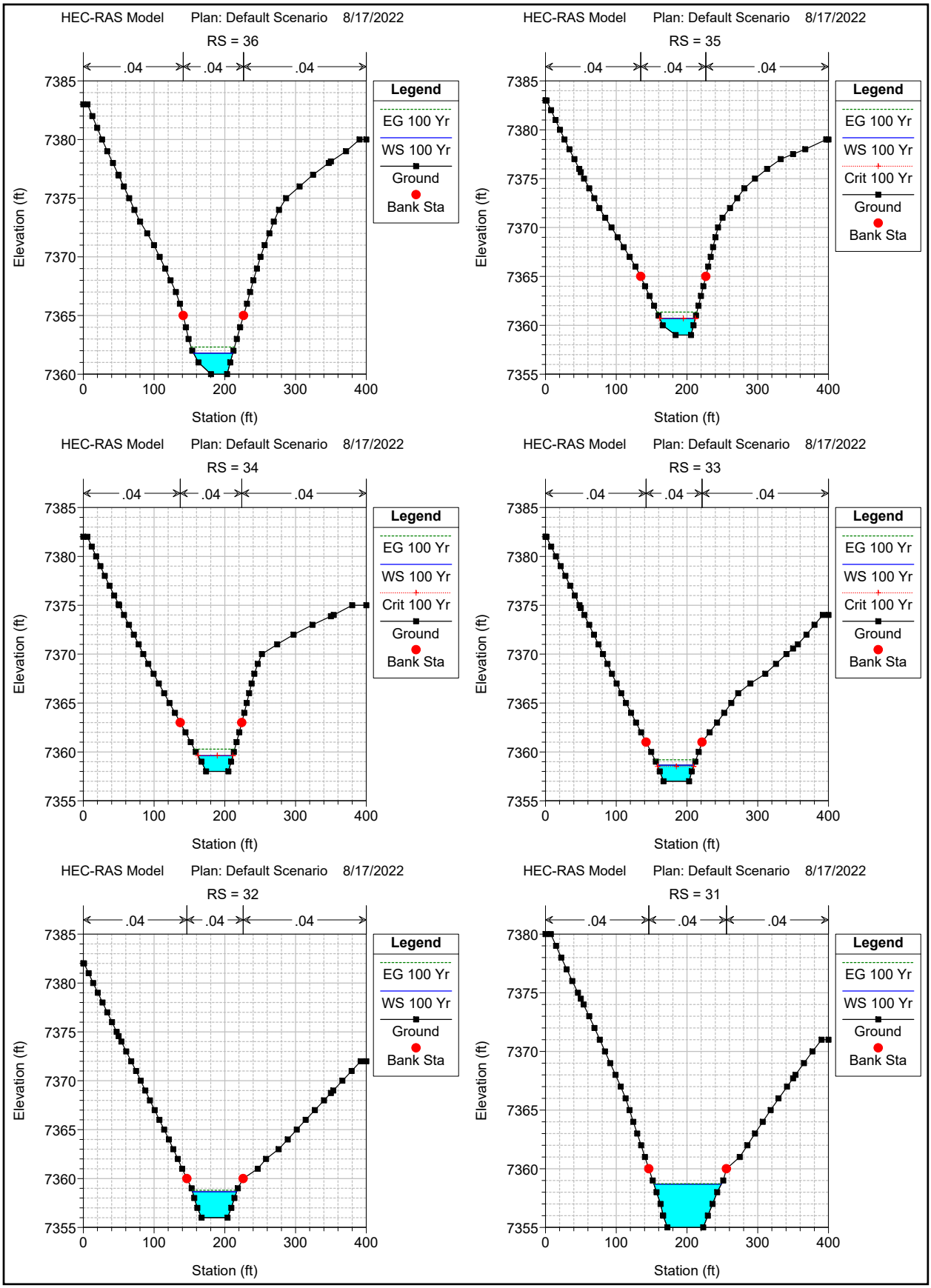
Plan Description:
Default Scenario

Plan Summary Information:
Number of: Cross Sections =   39   Multiple Openings =   0
Culverts   =   0   Inline Structures =   0
Bridges   =   0   Lateral Structures =   0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations   = 20
Maximum difference tolerance   = 0.33
Flow tolerance factor   = 0.001

Computation Options


HEC-RAS Model Plan: Default Scenario 8/17/2022
Boyd Main River
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Elevation (ft)
7370
7360
7350
7340
7330
7320
0
500
1000
1500
2000
Main Channel Distance (ft)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RS = 36
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 35
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 34
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Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 33
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 32
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
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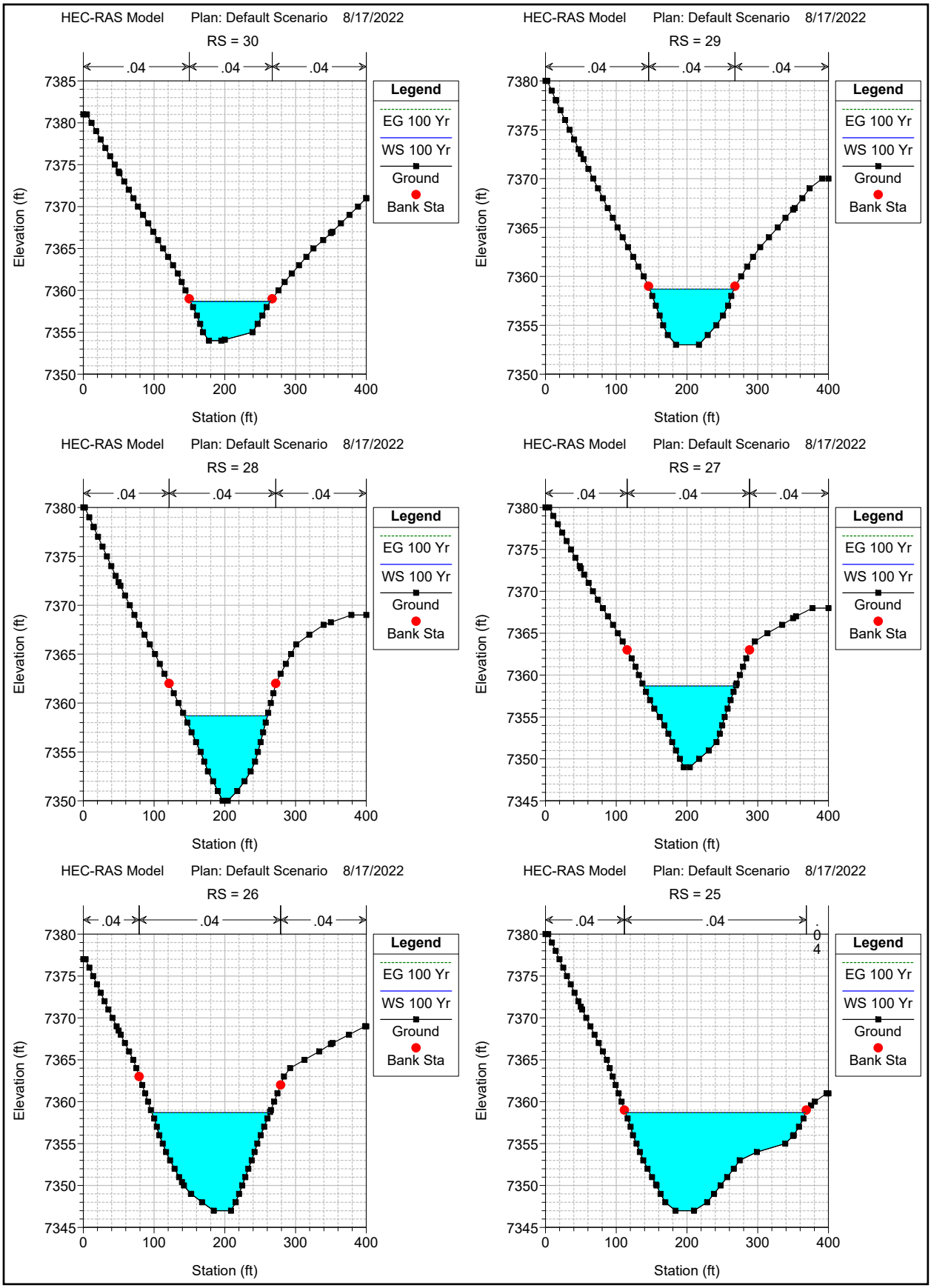
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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WS 100 Yr
Ground
Bank Sta
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Station (ft)
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EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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RS = 26
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 25
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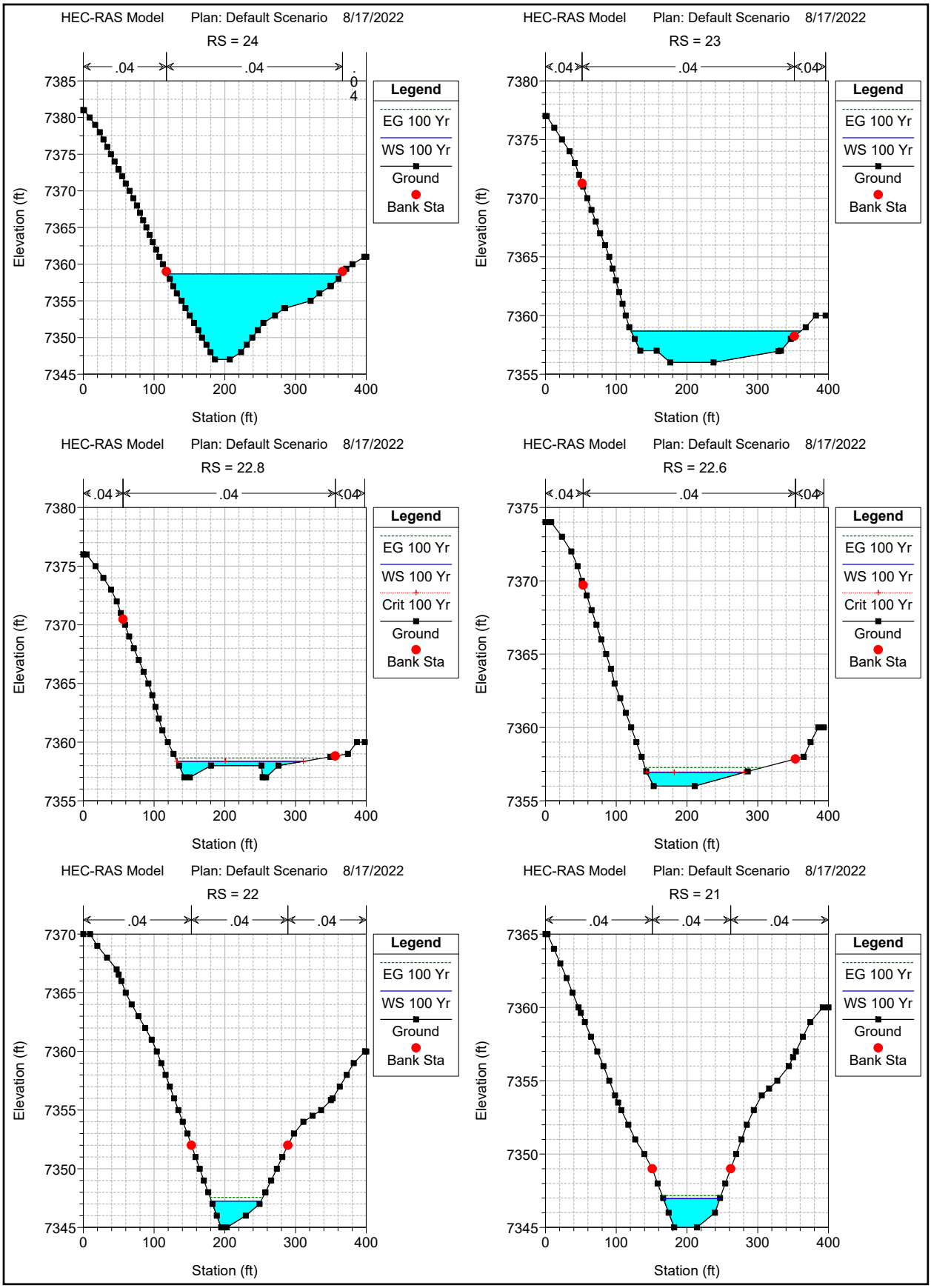
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 23
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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RS = 22.8
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Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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RS = 22.6
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 22
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
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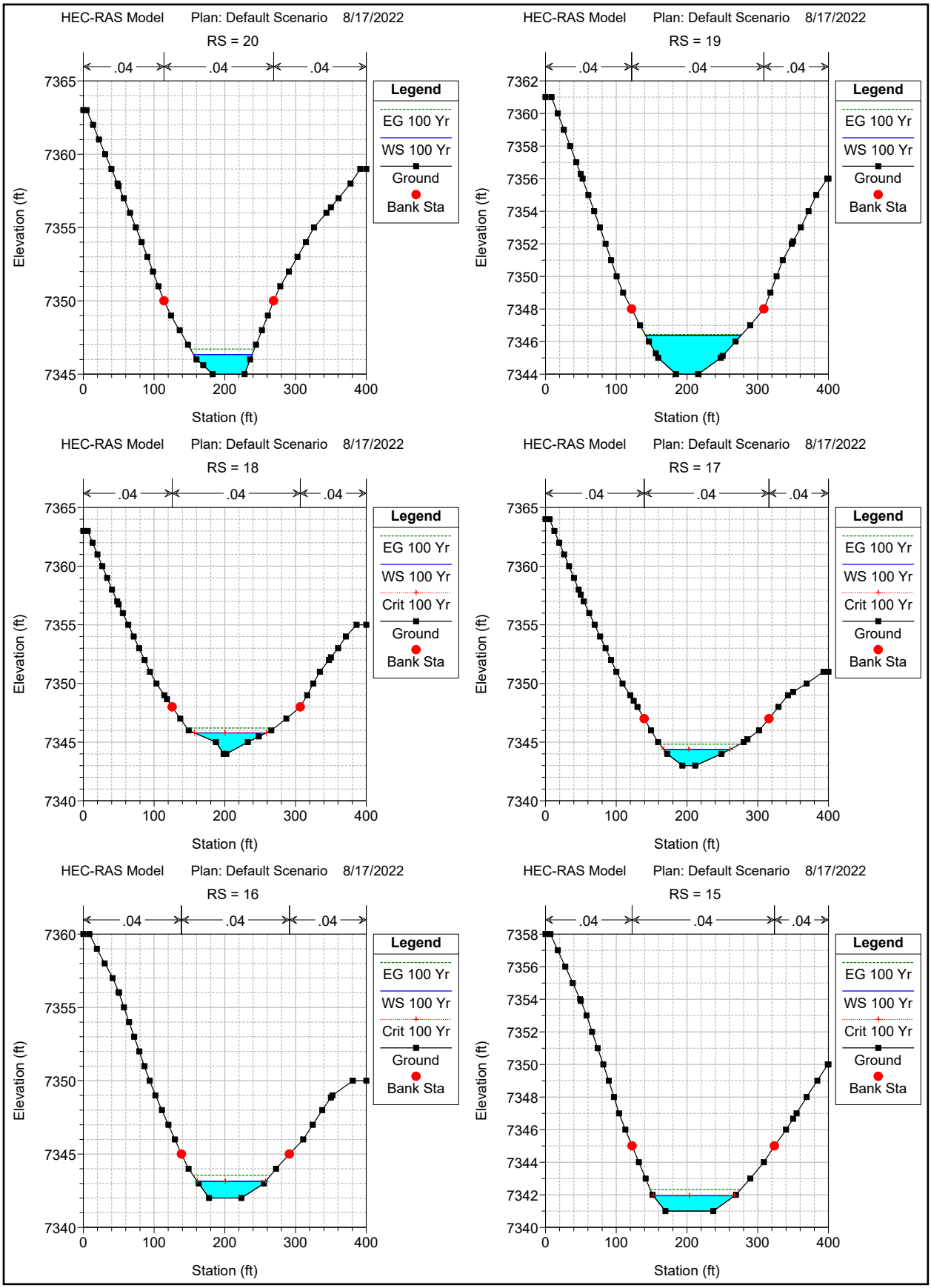
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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RS = 20
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Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 19
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 18
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 17
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 16
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Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 15
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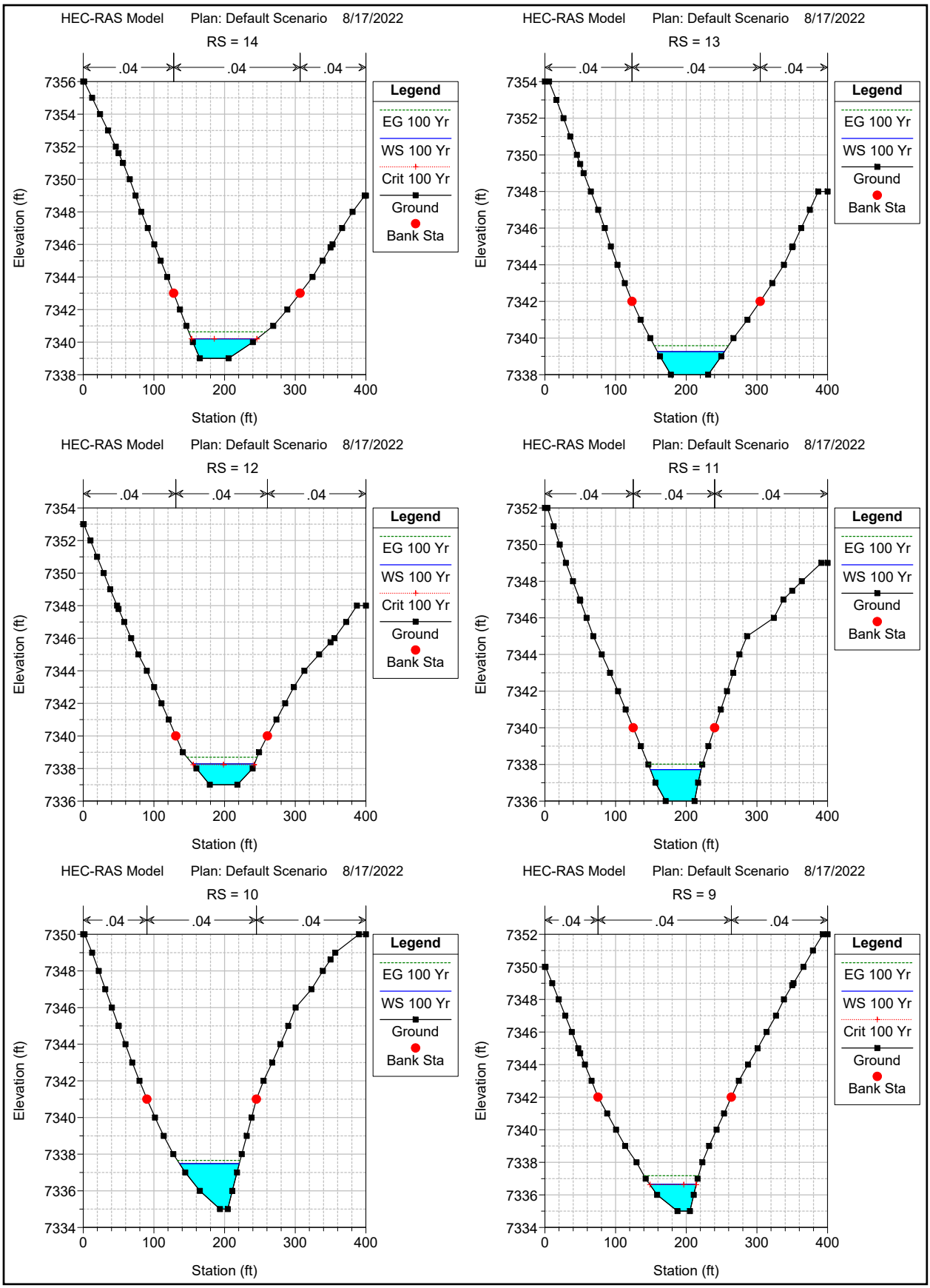
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 13
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 12
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Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 11
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 10
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Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
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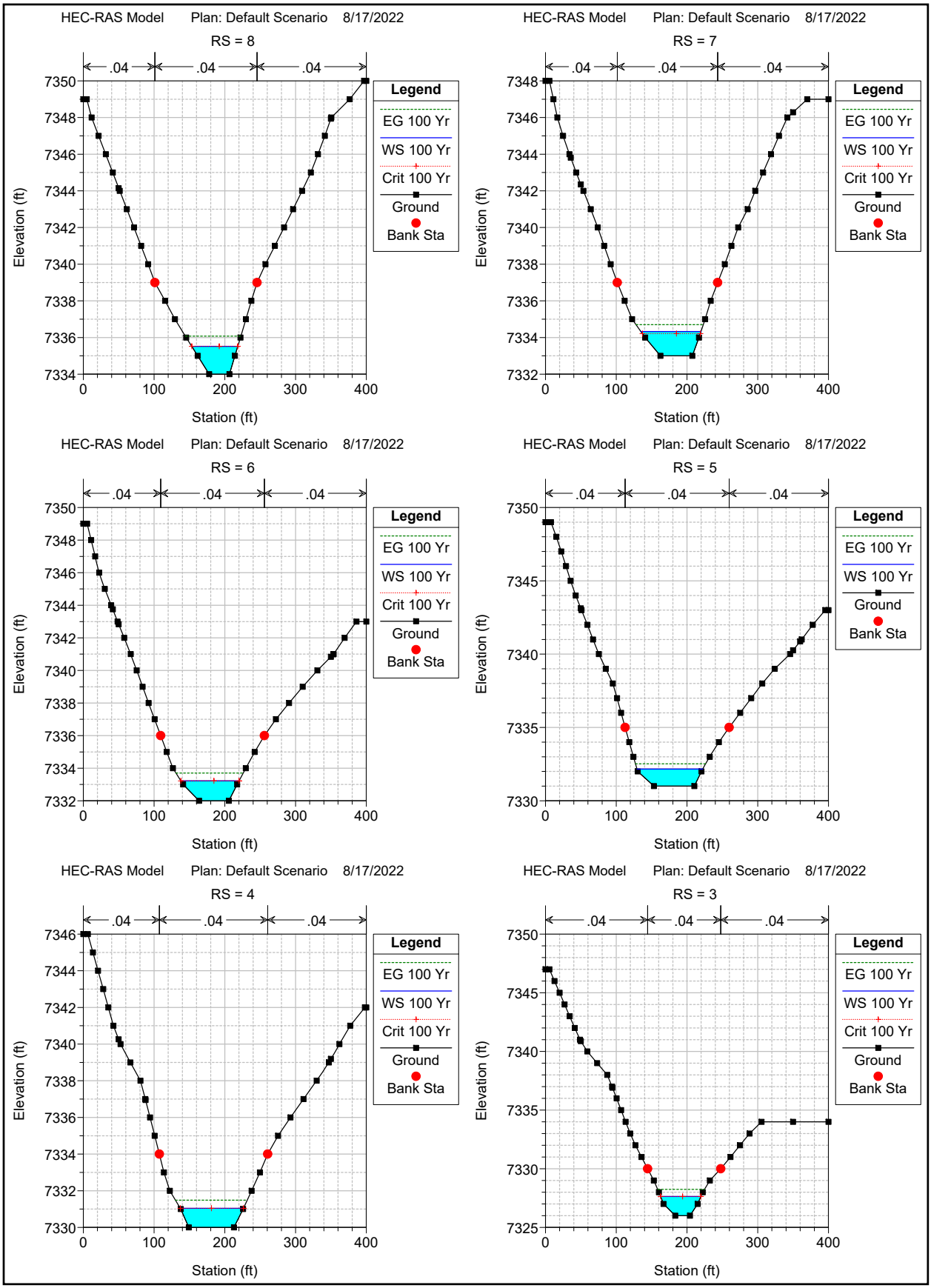
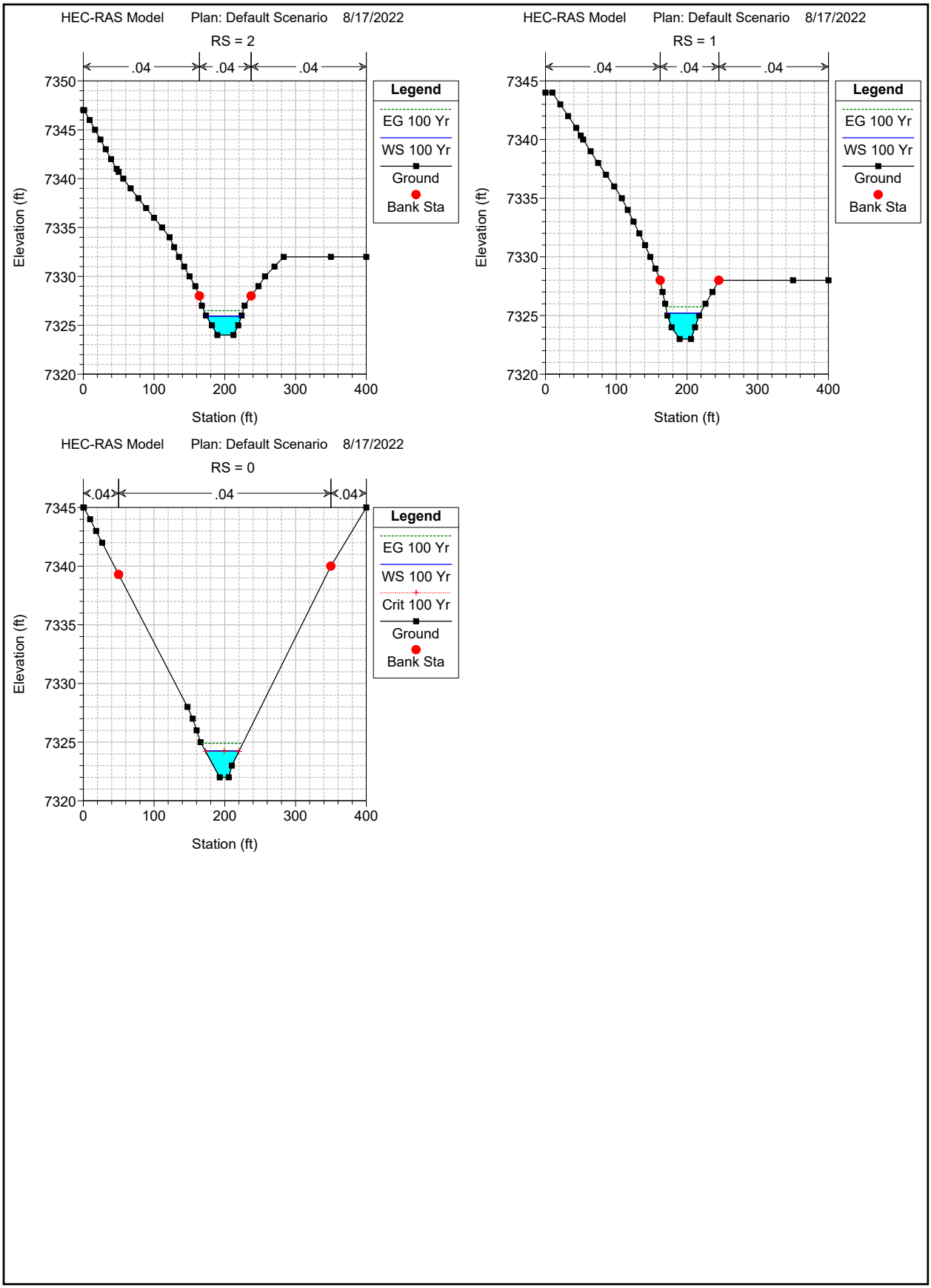
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 8
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 7
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 6
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 5
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 4
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 3
.04 .04 .04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 2
.04
.04
.04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 1
.04
.04
.04
Legend
EG 100 Yr
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario 8/17/2022
RS = 0
.04
.04
.04
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Plan: Default Scenario River: Boyd Reach: Main River Profile: 100 Yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Main River	36	100 Yr	425.80	7360.00	7361.79		7362.31	0.016972	5.81	73.28	55.43	0.89	1.39
Main River	35	100 Yr	425.80	7359.00	7360.70	7360.69	7361.36	0.021544	6.49	65.61	50.21	1.00	1.75
Main River	34	100 Yr	425.80	7358.00	7359.62	7359.62	7360.29	0.021703	6.55	65.00	49.32	1.01	1.77
Main River	33	100 Yr	425.80	7357.00	7358.65	7358.52	7359.19	0.016196	5.87	72.55	52.10	0.88	1.40
Main River	32	100 Yr	425.80	7356.00	7358.65		7358.81	0.002692	3.18	133.71	62.40	0.38	0.36
Main River	31	100 Yr	425.80	7355.00	7358.69		7358.73	0.000471	1.59	267.06	95.41	0.17	0.08
Main River	30	100 Yr	425.80	7354.00	7358.69		7358.71	0.000183	1.12	379.56	113.10	0.11	0.04
Main River	29	100 Yr	425.80	7353.00	7358.69		7358.70	0.000093	0.90	474.64	118.78	0.08	0.02
Main River	28	100 Yr	425.80	7350.00	7358.69		7358.69	0.000039	0.69	615.05	117.31	0.05	0.01
Main River	27	100 Yr	425.80	7349.00	7358.69		7358.69	0.000023	0.57	753.60	130.16	0.04	0.01
Main River	26	100 Yr	425.80	7347.00	7358.69		7358.69	0.000006	0.34	1269.67	166.69	0.02	0.00
Main River	25	100 Yr	425.80	7347.00	7358.69		7358.69	0.000003	0.24	1741.06	254.48	0.02	0.00
Main River	24	100 Yr	425.80	7347.00	7358.69		7358.69	0.000005	0.28	1516.68	245.66	0.02	0.00
Main River	23	100 Yr	425.80	7356.00	7358.68		7358.69	0.000212	0.88	483.85	240.00	0.11	0.03
Main River	22.8	100 Yr	425.80	7357.00	7358.36	7358.36	7358.65	0.029910	4.32	98.63	178.64	1.02	1.03
Main River	22.6	100 Yr	425.80	7356.00	7356.94	7356.94	7357.27	0.027023	4.65	91.64	138.01	1.01	1.12
Main River	22	100 Yr	425.80	7345.00	7347.24		7347.55	0.009797	4.49	94.86	70.08	0.68	0.83
Main River	21	100 Yr	425.80	7345.00	7346.96		7347.16	0.005500	3.58	118.83	79.89	0.52	0.51
Main River	20	100 Yr	425.80	7345.00	7346.34		7346.71	0.016248	4.90	86.97	82.61	0.84	1.07
Main River	19	100 Yr	425.80	7344.00	7346.38		7346.44	0.001557	1.99	213.88	135.03	0.28	0.15
Main River	18	100 Yr	425.80	7344.00	7345.79	7345.79	7346.21	0.025612	5.17	82.39	101.58	1.01	1.30
Main River	17	100 Yr	425.80	7343.00	7344.38	7344.38	7344.82	0.025340	5.32	79.98	93.56	1.02	1.35
Main River	16	100 Yr	425.80	7342.00	7343.15	7343.13	7343.56	0.023513	5.14	82.91	96.79	0.98	1.26
Main River	15	100 Yr	425.80	7341.00	7341.94	7341.94	7342.32	0.026422	4.97	85.73	114.87	1.01	1.23
Main River	14	100 Yr	425.80	7339.00	7340.20	7340.20	7340.63	0.024371	5.29	80.55	92.48	1.00	1.32
Main River	13	100 Yr	425.80	7338.00	7339.26		7339.58	0.015450	4.57	93.26	94.77	0.81	0.95
Main River	12	100 Yr	425.80	7337.00	7338.28	7338.23	7338.69	0.020524	5.13	82.99	87.59	0.93	1.21
Main River	11	100 Yr	425.80	7336.00	7337.72		7338.01	0.008995	4.33	98.23	71.75	0.65	0.77
Main River	10	100 Yr	425.80	7335.00	7337.48		7337.66	0.004873	3.38	126.10	84.61	0.49	0.45
Main River	9	100 Yr	425.80	7335.00	7336.65	7336.62	7337.18	0.021816	5.85	72.75	65.85	0.98	1.50
Main River	8	100 Yr	425.80	7334.00	7335.52	7335.52	7336.08	0.022966	5.97	71.30	65.12	1.01	1.57
Main River	7	100 Yr	425.80	7333.00	7334.33	7334.21	7334.70	0.016712	4.88	87.23	85.01	0.85	1.07
Main River	6	100 Yr	425.80	7332.00	7333.22	7333.22	7333.70	0.024506	5.55	76.75	82.27	1.01	1.43
Main River	5	100 Yr	425.80	7331.00	7332.16		7332.52	0.017899	4.81	88.57	93.01	0.87	1.06
Main River	4	100 Yr	425.80	7330.00	7331.04	7331.04	7331.49	0.024418	5.37	79.34	89.15	1.00	1.36
Main River	3	100 Yr	425.80	7326.00	7327.63	7327.63	7328.24	0.022541	6.26	68.01	57.01	1.01	1.67
Main River	2	100 Yr	425.80	7324.00	7325.93		7326.50	0.016649	6.04	70.44	49.45	0.89	1.47
Main River	1	100 Yr	425.80	7323.00	7325.20		7325.73	0.014056	5.85	72.74	47.13	0.83	1.34
Main River	0	100 Yr	425.80	7322.00	7324.25	7324.21	7324.90	0.019971	6.47	65.86	47.87	0.97	1.70

```
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow



FLOW DATA

Flow Title: Default Steady Flow
Flow File : Z:\61170\Documents\Drainage\Calcs\Hydrology\61170-No Build Area.f01

Flow Data (cfs)

  River           Reach           RS                 100 Yr
  Boyd            Main River      36                  425.8


Boundary Conditions

  River           Reach           Profile                      Upstream                 Downstream

  Boyd            Main River      100 Yr                  Normal S = 0.01996       Normal S = 0.01996



GEOMETRY DATA

Geometry Title: Default Geometry
Geometry File : Z:\61170\Documents\Drainage\Calcs\Hydrology\61170-No Build Area.g01

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 36

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7383    5.78    7383   12.72    7382   19.63    7381   26.52    7380
   33.88    7379    41.8    7378   49.56    7377      50 7376.94   57.29    7376
   64.85    7375   72.26    7374   80.25    7373    90.3    7372   99.87    7371
   107.9    7370  115.67    7369  123.33    7368  130.78    7367  136.44    7366
  141.17    7365  145.03    7364  148.69    7363  153.96    7362  162.75    7361
  180.44    7360  203.12    7360  207.68    7361  212.24    7362  216.84    7363
  221.56    7364  226.49    7365   231.4    7366  235.71    7367  240.43    7368
   245.4    7369  250.34    7370  256.22    7371  262.93    7372  269.21    7373
  276.59    7374  286.58    7375  305.68    7376  324.84    7377   346.9    7378
     350 7378.13  371.32    7379  390.46    7380     400    7380

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  141.17     .04  226.49     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        141.17  226.49            49.41   49.41   49.41             .1       .3
```

CROSS SECTION

RIVER: Boyd
REACH: Main River RS: 35

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7383	1.53	7383	7.88	7382	14.21	7381	20.51	7380
26.76	7379	33.77	7378	40.87	7377	47.72	7376	50	7375.66
54.47	7375	61.74	7374	68.93	7373	76.1	7372	84.36	7371
93.24	7370	101.95	7369	110.56	7368	118.96	7367	127.1	7366
134.68	7365	140.65	7364	147.15	7363	153.45	7362	159.74	7361
165.64	7360	183.85	7359	205.64	7359	209.22	7360	212.76	7361
216.27	7362	219.73	7363	223.18	7364	226.61	7365	230.04	7366
233.47	7367	236.87	7368	240.24	7369	243.82	7370	250.31	7371
260.85	7372	271.05	7373	281.07	7374	296.19	7375	313.16	7376
332.43	7377	350	7377.51	367.18	7378	396.82	7379	400	7379

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	134.68	.04	226.61	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134.68	226.61	49.41	49.41	.1	.3

CROSS SECTION

RIVER: Boyd
REACH: Main River RS: 34

INPUT
Description:
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7382	5.72	7382	11.92	7381	18.08	7380	24.2	7379
30.29	7378	36.96	7377	43.53	7376	50	7375.08	50.54	7375
57.52	7374	64.47	7373	71.37	7372	78.23	7371	84.75	7370
91.84	7369	99.3	7368	106.78	7367	114.31	7366	121.85	7365
129.4	7364	136.97	7363	144.47	7362	151.79	7361	158.94	7360
167.03	7359	173.51	7358	205.05	7358	208.93	7359	212.8	7360
216.63	7361	220.37	7362	223.93	7363	227.45	7364	230.94	7365
234.4	7366	237.83	7367	241.68	7368	246.61	7369	252.39	7370
274.07	7371	297.11	7372	324.01	7373	350	7373.87	353.98	7374
380.13	7375	400	7375						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	136.97	.04	223.93	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.97	223.93	49.41	49.41	.1	.3

CROSS SECTION

RIVER: Boyd
REACH: Main River RS: 33

```
INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7382    1.42    7382    8.07    7381   14.74    7380   21.42    7379
   28.11    7378   34.78    7377   41.43    7376   48.07    7375      50 7374.72
    54.9    7374   61.73    7373   68.46    7372   74.84    7371   81.22    7370
   87.61    7369   94.01    7368  100.44    7367     107    7366   113.8    7365
  120.91    7364  128.02    7363  135.14    7362  142.25    7361  149.37    7360
  155.97    7359  161.41    7358  166.85    7357  202.95    7357  206.69    7358
  211.67    7359  216.59    7360  221.35    7361  232.01    7362  242.47    7363
  252.63    7364  262.62    7365  272.32    7366  289.64    7367  310.69    7368
  325.79    7369  340.59    7370     350 7370.58  356.74    7371  368.87    7372
  380.28    7373   391.9    7374     400    7374

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  142.25     .04  221.35     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        142.25  221.35            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 32

INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7382    1.05    7382    7.52    7381   13.85    7380   20.45    7379
   27.16    7378   33.83    7377   40.47    7376   47.11    7375      50 7374.56
   53.74    7374   60.56    7373   67.59    7372    74.6    7371    81.1    7370
   87.55    7369   94.12    7368  100.89    7367  107.61    7366  114.32    7365
  120.93    7364  127.16    7363  133.48    7362  139.76    7361  146.44    7360
  153.05    7359  156.73    7358  161.07    7357  167.17    7356  203.81    7356
  209.24    7357  213.63    7358  218.41    7359     226    7360   246.6    7361
  258.36    7362  276.09    7363  288.98    7364  301.61    7365  314.29    7366
  327.28    7367  340.27    7368     350 7368.75  353.24    7369  366.19    7370
  379.25    7371  391.88    7372     400    7372

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  146.44     .04     226     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        146.44     226            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 31

INPUT
Description:
Station Elevation Data    num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
       0    7380     7.6    7380   14.85    7379   22.22    7378   29.82    7377
   37.79    7376   45.84    7375      50 7374.49   53.95    7374   61.81    7373
   69.22    7372   76.66    7371    84.1    7370   91.53    7369   98.97    7368
  106.39    7367   113.3    7366  118.69    7365  124.16    7364  129.64    7363
  135.13    7362   140.6    7361  146.06    7360  151.53    7359  156.99    7358
  162.59    7357  166.32    7356  172.38    7355  222.88    7355  229.49    7356
  236.13    7357  242.79    7358  251.33    7359  255.76    7360  274.57    7361
  285.36    7362   296.1    7363  306.97    7364   318.2    7365  329.35    7366
  341.43    7367     350 7367.71   353.5    7368  365.35    7369  377.45    7370
  390.24    7371     400    7371

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  146.06     .04  255.76     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        146.06  255.76            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 30

INPUT
Description:
Station Elevation Data    num=      51
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7381    5.07    7381   11.61    7380   18.12    7379   24.63    7378
   31.09    7377   37.82    7376   44.52    7375      50 7374.18   51.17    7374
   57.77    7373   64.31    7372   70.82    7371    77.3    7370   84.35    7369
   91.84    7368   98.81    7367  105.76    7366  112.72    7365  119.69    7364
  126.74    7363  133.67    7362  139.03    7361  144.37    7360  149.73    7359
  155.09    7358  160.39    7357  165.14    7356  169.15    7355  177.52    7354
  194.96    7354     200 7354.11   239.2    7355  246.48    7356   253.1    7357
  259.18    7358  266.93    7359  275.89    7360  284.65    7361  294.61    7362
  304.93    7363  315.21    7364   325.3    7365  339.08    7366     350 7366.84
  352.08    7367   364.2    7368  376.22    7369  388.33    7370   399.9    7371
     400    7371

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  149.73     .04  266.93     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        149.73  266.93            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 29

INPUT
Description:
Station Elevation Data    num=      51
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7380     2.5    7380    8.72    7379   14.65 7378.05   14.95    7378
    21.3    7377   27.64    7376   33.99    7375   40.34    7374    46.9    7373
      50 7372.55   53.78    7372   60.63    7371   67.46    7370   74.28    7369
   81.08    7368   87.89    7367   95.17    7366  101.82    7365   109.1    7364
```

```
   116.5    7363  123.88    7362  131.28    7361  138.78    7360  145.78    7359
  150.89    7358  155.95    7357  161.25    7356  166.36    7355  172.85    7354
  184.61    7353  216.92    7353  229.28    7354  241.52    7355  250.98    7356
  258.18    7357  262.69    7358  267.76    7359  276.52    7360  285.02    7361
  293.36    7362  303.52    7363  315.95    7364  328.26    7365  339.14    7366
     350 7366.83  352.23    7367  363.15    7368  373.38    7369  391.17    7370
     400    7370

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  145.78     .04  267.76     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        145.78  267.76            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 28

INPUT
Description:
Station Elevation Data    num=      56
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7380    2.16    7380    8.38    7379   14.57 7378.01   14.62    7378
   20.84    7377   27.06    7376   33.29    7375   39.55    7374   45.75    7373
      50 7372.36   52.38    7372   59.02    7371   65.66    7370   72.25    7369
   78.97    7368    86.5    7367   93.96    7366  101.32    7365  108.02    7364
  114.54    7363  121.21    7362  127.88    7361  134.49    7360  141.04    7359
  147.08    7358  152.92    7357  159.38    7356  165.75    7355  170.79    7354
  176.04    7353  183.34    7352  190.05    7351  196.78    7350  204.26    7350
  217.64    7351  227.82    7352  236.47    7353  242.67    7354  246.73    7355
  250.51    7356  254.14    7357  257.76    7358  261.38    7359     265    7360
  268.61    7361  272.09    7362  278.92    7363  286.22    7364  293.65    7365
  300.93    7366  319.44    7367  339.78    7368     350 7368.26  378.85    7369
     400    7369

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  121.21     .04  272.09     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        121.21  272.09            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 27

INPUT
Description:
Station Elevation Data    num=      57
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7380    5.15    7380   11.11    7379   17.37    7378   23.66    7377
   29.88    7376   36.03    7375   42.22    7374   48.42    7373      50 7372.75
   54.63    7372   60.96    7371   67.07    7370   73.97    7369   81.15    7368
   88.34    7367   95.48    7366   102.4    7365  109.05    7364  115.34    7363
   121.7    7362  127.31    7361  132.05    7360  137.07    7359  141.99    7358
  147.75    7357   153.8    7356  161.47    7355  167.95    7354   173.7    7353
```

```
  179.06    7352  184.45    7351  189.94    7350  195.51    7349  204.06    7349
  217.18    7350  230.76    7351   241.7    7352  246.42    7353  249.77    7354
  253.27    7355  257.48    7356  261.67    7357  265.86    7358  269.12 7358.77
  270.15    7359  274.66    7360  279.24    7361  283.83    7362  288.48    7363
  296.03    7364  313.69    7365  334.44    7366     350 7366.79  354.06    7367
  377.42    7368     400    7368

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  115.34     .04  288.48     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        115.34  288.48            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 26

INPUT
Description:
Station Elevation Data    num=      61
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7377    3.25    7377    8.57    7376    13.9    7375   19.23    7374
   24.57    7373   29.91    7372   35.36    7371   41.18    7370   47.01    7369
      50 7368.49   52.86    7368   58.73    7367   64.63    7366   70.48    7365
   74.82    7364   78.95    7363   83.23    7362   87.38    7361   91.41    7360
   95.44    7359  100.09    7358  103.87    7357  107.37    7356  112.16    7355
  116.95    7354  122.59    7353  128.97    7352  135.32    7351   139.4 7350.42
  142.27    7350   152.1    7349   152.5    7349  167.77    7348  184.43    7347
  208.74    7347  215.32    7348  220.08    7349   224.7    7350  228.99    7351
  233.09    7352  237.98    7353  242.08    7354  245.86    7355  250.73    7356
  255.59    7357  260.36    7358     264 7358.78  265.09    7359  269.68    7360
  274.29    7361  278.88    7362  283.56    7363  292.22    7364  312.57    7365
  333.48    7366     350 7366.87  352.43    7367   375.3    7368  398.31    7369
     400    7369

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   78.95     .04  278.88     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         78.95  278.88            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 25

INPUT
Description:
Station Elevation Data    num=      55
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7380    3.77    7380    9.08    7379    14.4    7378   19.73    7377
   25.06    7376   30.39    7375   35.73    7374   41.07    7373   46.41    7372
      50 7371.33   51.79    7371   57.59    7370   63.43    7369   69.28    7368
   75.17    7367   81.07    7366   86.74    7365   90.79    7364   94.92    7363
   99.19    7362  103.42    7361  107.46    7360  111.49    7359  116.03    7358
  120.22    7357   123.7    7356  128.66    7355  133.41    7354  138.26    7353
```

```
  144.26    7352  150.63    7351   156.2 7350.11   156.9    7350  162.63    7349
  169.41    7348  183.75    7347  209.81    7347  228.43    7348  238.11    7349
  247.49    7350  256.76    7351   266.2    7352  274.53    7353  298.84    7354
   338.8    7355     350 7355.92  350.99    7356  358.34    7357  364.65    7358
  368.62    7359  375.28 7359.55  380.78    7360  397.24    7361     400    7361

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  111.49     .04  368.62     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        111.49  368.62             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 24

INPUT
Description:
Station Elevation Data    num=      56
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7381    1.03    7381    8.94    7380   16.83    7379   23.36    7378
   28.55    7377   33.78    7376   39.02    7375   44.26    7374    49.5    7373
      50  7372.9   54.76    7372   60.04    7371   65.37    7370    70.7    7369
   75.77    7368   80.15    7367   84.62    7366   89.09    7365   93.62    7364
   98.19    7363   102.8    7362  107.49    7361  112.39    7360  117.34    7359
   122.3    7358   127.2    7357  132.24    7356  138.87    7355  144.32    7354
  150.34    7353  156.45    7352  162.54    7351  167.63    7350  173.98    7349
  179.69    7348  186.14    7347  207.01    7347  222.97    7348  231.06    7349
  238.81    7350  246.72    7351  254.43    7352  270.83    7353  284.14    7354
  285.23    7354  321.27    7355  333.65    7356  349.28    7357     350 7357.06
  360.64    7358  366.31    7359  371.63 7359.38  380.42    7360   397.1    7361
     400    7361

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  117.34     .04  366.31     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        117.34  366.31              31.7    31.7    31.7             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 23

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7377    1.69    7377   12.41    7376   23.24    7375   34.08    7374
   41.51    7373   47.36    7372    51.7 7371.26   53.24    7371   59.14    7370
   65.05    7369   70.97    7368   77.22    7367    84.2    7366   90.07    7365
   94.81    7364   99.49    7363  104.14    7362  108.81    7361  113.46    7360
  118.48    7359  126.16    7358  133.95    7357  157.07    7357  176.46    7356
  237.44    7356  329.21 7356.96  332.76    7357  346.71    7358   351.7 7358.24
  367.84    7359  382.19    7360  395.91    7360
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04    51.7     .04   351.7     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          51.7   351.7            13.55   13.55   13.55             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 22.8

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7376    4.65    7376   17.32    7375   28.34    7374    39.2    7373
   47.22    7372   53.04    7371   56.14 7370.47   58.91    7370   64.86    7369
   71.37    7368    78.4    7367   85.34    7366   92.02    7365   97.45    7364
  102.08    7363  106.71    7362  111.66    7361  119.37    7360  127.49    7359
  135.31    7358  142.78    7357  150.66    7357  180.44    7358  251.81    7358
  253.41    7357  258.31    7357  275.84    7358  349.08 7358.75  356.14 7358.82
  374.06    7359  386.78    7360  397.86    7360

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   56.14     .04  356.14     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         56.14  356.14            13.56   13.56   13.56             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 22.6

INPUT
Description:
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7374    8.08    7374   23.35    7373   36.55    7372   45.43    7371
   51.35    7370   53.34 7369.71   58.21    7369   65.18    7368   72.07    7367
   78.93    7366   85.76    7365   92.48    7364   97.69    7363  105.75    7362
  113.49    7361  121.08    7360  128.49    7359  135.77    7358  142.43    7357
  153.01    7356   210.9    7356  285.96    7357  353.34 7357.85  364.96    7358
  374.68    7359  385.52    7360  393.49    7360

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   53.34     .04  353.34     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         53.34  353.34            40.01   40.01   40.01             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 22
```

```
INPUT
Description:
Station Elevation Data    num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7370    9.53    7370   19.77    7369   33.42    7368   47.04    7367
      50 7366.56   53.71    7366   59.99    7365   68.35    7364   77.95    7363
   87.51    7362   96.61    7361  103.85    7360  110.21    7359  116.22    7358
  122.27    7357  128.26    7356  134.37    7355  140.48    7354  147.29    7353
  152.78    7352  158.58    7351  164.49    7350  170.43    7349  176.47    7348
  182.51    7347  188.61    7346  194.75    7345  202.92    7345  229.64    7346
  249.15    7347  257.44    7348  265.57    7349  273.58    7350  281.23    7351
  289.09    7352  297.69    7353  311.07    7354  324.15 7354.52  336.17    7355
     350 7355.85  352.43    7356  362.43    7357  372.36    7358   382.3    7359
  398.23    7360     400    7360

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  152.78     .04  289.09     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        152.78  289.09            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 21

INPUT
Description:
Station Elevation Data    num=      43
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7365    2.82    7365   11.82    7364    20.9    7363    29.8    7362
   38.11    7361   46.78    7360      50 7359.63   55.54    7359   64.35    7358
   73.18    7357   81.91    7356   90.11    7355   98.26    7354  102.73 7353.52
  107.17    7353  117.05    7352  126.86    7351  139.74    7350  150.85    7349
   158.5    7348  166.25    7347  174.08    7346  181.92    7345  214.04    7345
  239.49    7346  246.68    7347  254.18    7348  261.82    7349  269.46    7350
  277.07    7351   284.6    7352  294.49    7353  305.73    7354  316.05 7354.47
  327.69    7355  344.07    7356     350  7356.6  354.01    7357   363.9    7358
   374.4    7359  391.99    7360     400    7360

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  150.85     .04  261.82     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        150.85  261.82            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 20

INPUT
Description:
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7363    4.75    7363   13.71    7362   22.16    7361   30.89    7360
```

```
   39.66    7359   48.46    7358      50 7357.83    57.3    7357   66.06    7356
   74.26    7355   82.42    7354   90.48    7353   98.49    7352   106.4    7351
  114.11    7350  124.02    7349  136.17    7348  147.98    7347  159.96    7346
  169.48 7345.61  182.99    7345  228.01    7345  235.69    7346  243.98    7347
  252.36    7348  260.74    7349  269.07    7350  278.32    7351  290.59    7352
  302.74    7353   314.5    7354  326.07    7355  343.48    7356     350 7356.38
  360.73    7357  377.76    7358  391.39    7359     400    7359

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  114.11     .04  269.07     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        114.11  269.07             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 19

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7361     8.5    7361   17.24    7360   26.01    7359    34.8    7358
   43.63    7357      50 7356.28   52.44    7356   60.68    7355   68.83    7354
   76.88    7353   84.88    7352   92.79    7351  100.53    7350   109.7    7349
  121.82    7348  133.64    7347  146.15    7346  155.89 7345.27  159.32    7345
  184.65    7344  215.82    7344  247.81    7345  250.37 7345.12  268.73    7346
  289.25    7347  308.64    7348  317.97    7349  326.57    7350  335.39    7351
  348.07    7352     350 7352.15  360.94    7353  371.92    7354  382.79    7355
  398.37    7356     400    7356

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  121.82     .04  308.64     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        121.82  308.64             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 18

INPUT
Description:
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7363    6.21    7363   13.12    7362   20.01    7361   26.88    7360
   33.73    7359   40.56    7358   47.88    7357      50 7356.73   55.71    7356
   63.45    7355   71.17    7354   78.88    7353   86.56    7352   94.07    7351
  103.36    7350  114.38    7349  118.25 7348.66  125.64    7348  137.03    7347
  148.92    7346  187.44    7345  198.29    7344  202.23    7344  232.52    7345
  248.12 7345.48  265.61    7346  287.01    7347  306.68    7348  316.42    7349
  325.01    7350   334.4    7351  347.22    7352     350 7352.22  360.07    7353
  371.19    7354  386.24    7355     400    7355

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  125.64     .04  306.68     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        125.64  306.68             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 17

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7364    5.65    7364   12.57    7363   19.48    7362   26.37    7361
   33.25    7360   40.12    7359   46.97    7358      50 7357.58    54.1    7357
   61.86    7356   69.58    7355   77.29    7354      85    7353   92.67    7352
  100.19    7351   108.8    7350  119.83    7349  124.68 7348.53  129.93    7348
  139.53    7347  149.23    7346   159.2    7345  172.27    7344  193.42    7343
   211.8    7343  248.75    7344   280.3    7345  285.35 7345.24   301.9    7346
  315.95    7347  329.25    7348  342.72    7349     350 7349.28  369.18    7350
  392.89    7351     400    7351

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  139.53     .04  315.95     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        139.53  315.95             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 16

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7360    8.56    7360   19.04    7359   30.21    7358   41.41    7357
      50 7356.04   50.35    7356    57.5    7355   64.71    7354   71.94    7353
   79.19    7352   86.46    7351   93.76    7350  101.91    7349  111.04    7348
  120.25    7347  129.49    7346  138.75    7345  148.71    7344  163.09    7343
  177.69    7342  223.52    7342  255.22    7343  272.42    7344  291.29    7345
  292.09 7345.04  310.95    7346  324.28    7347  337.65    7348     350 7348.86
  352.09    7349  380.86    7350     400    7350

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  138.75     .04  291.29     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        138.75  291.29             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
```

```
REACH: Main River         RS: 15

INPUT
Description:
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7358    6.97    7358   17.44    7357    27.9    7356   38.45    7355
   49.12    7354      50  7353.9   58.01    7353   65.87    7352   73.76    7351
   81.66    7350   89.47    7349   96.78    7348  103.96    7347  112.91    7346
  122.46    7345  132.02    7344  141.61    7343  151.22    7342  169.59    7341
  237.13    7341  269.11    7342   289.5    7343  308.66    7344  323.67    7345
  340.11    7346     350 7346.67  354.95    7347  369.26    7348  384.21    7349
  398.95    7350     400    7350

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  122.46     .04  323.67     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        122.46  323.67             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 14

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7356    1.34    7356   12.64    7355   23.74    7354   35.01    7353
   46.04    7352      50 7351.61   56.13    7351   65.87    7350   73.97    7349
   82.06    7348   91.22    7347  100.48    7346  109.62    7345  118.79    7344
  128.04    7343  136.91    7342  145.84    7341  155.11    7340  165.01    7339
  205.75    7339  239.97    7340  268.78    7341  288.85    7342   306.8    7343
  324.51    7344  338.68    7345     350 7345.81   352.7    7346  366.28    7347
  381.09    7348  398.32    7349     400    7349

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  128.04     .04   306.8     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        128.04   306.8              49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 13

INPUT
Description:
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7354    5.92    7354    16.3    7353   26.22    7352   35.82    7351
    45.3    7350      50  7349.5   54.71    7349   64.95    7348   75.45    7347
    84.7    7346   93.34    7345  102.71    7344     113    7343  123.26    7342
  135.26    7341  149.08    7340   162.8    7339  178.21    7338  231.04    7338
  249.59    7339  266.76    7340  286.53    7341  304.69    7342  321.78    7343
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```
   338.2    7344     350 7344.96  350.51    7345  362.71    7346  374.83    7347
  386.84    7348     400    7348

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  123.26     .04  304.69     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        123.26  304.69            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 12

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7353     .72    7353   10.17    7352   19.57    7351   28.95    7350
   38.15    7349   47.98    7348      50  7347.8   57.95    7347   67.92    7346
   77.91    7345   90.02    7344  100.37    7343  110.66    7342  120.89    7341
  130.94    7340  140.91    7339  160.06    7338  179.09    7337  218.06    7337
  239.64    7338  248.74    7339  260.72    7340  273.31    7341  285.77    7342
  298.07    7343  312.92    7344  333.76    7345     350 7345.75  355.42    7346
  371.96    7347  387.34    7348     400    7348

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  130.94     .04  260.72     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        130.94  260.72            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 11

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7352     3.5    7352   12.35    7351   21.02    7350   29.63    7349
   39.68    7348   49.44    7347      50 7346.94   58.88    7346   68.56    7345
   80.44    7344   92.19    7343  103.53    7342  114.26    7341  125.01    7340
  135.74    7339  146.45    7338  156.49    7337   170.8    7336  211.65    7336
  216.76    7337  222.62    7338  231.35    7339  240.16    7340  248.92    7341
  257.66    7342  266.44    7343  275.23    7344  286.09    7345   323.9    7346
  337.53    7347     350 7347.48  363.43    7348  391.27    7349     400    7349

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  125.01     .04  240.16     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        125.01  240.16            49.41   49.41   49.41             .1       .3

CROSS SECTION
```

```
RIVER: Boyd
REACH: Main River         RS: 10

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7350     1.9    7350   12.64    7349   21.91    7348    31.2    7347
   40.59    7346      50 7345.01   50.14    7345   59.74    7344    69.4    7343
   79.59    7342   90.17    7341  101.47    7340  113.97    7339  127.53    7338
  144.32    7337  164.92    7336  193.47    7335  204.44    7335  210.82    7336
  217.53    7337  224.35    7338  231.28    7339  238.21    7340  245.08    7341
  255.17    7342  267.27    7343  278.86    7344  290.05    7345  300.54    7346
  322.93    7347  339.08    7348     350 7348.62  356.65    7349  390.28    7350
     400    7350

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   90.17     .04  245.08     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         90.17  245.08            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 9

INPUT
Description:
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7350     .76    7350    10.4    7349    19.6    7348   28.82    7347
   38.03    7346   47.23    7345      50  7344.7   56.58    7344   65.93    7343
   75.21    7342   88.16    7341  100.69    7340  113.53    7339   129.7    7338
  142.54    7337  158.85    7336  187.67    7335  205.26    7335  210.58    7336
  216.06    7337  222.76    7338  232.34    7339  242.81    7340  253.36    7341
  263.86    7342  274.34    7343  287.39    7344  301.06    7345  313.72    7346
  326.95    7347  338.13    7348     350 7348.87  351.79    7349  365.81    7350
   379.2    7351  393.31    7352     400    7352

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   75.21     .04  263.86     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         75.21  263.86            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 8

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
       0    7349    4.91    7349    11.7    7348   21.55    7347   31.84    7346
   41.67    7345      50 7344.14   51.36    7344   61.42    7343   71.72    7342
   81.78    7341   91.56    7340  101.12    7339  115.51    7338  129.54    7337
  145.44    7336  161.61    7335  177.87    7334  206.51    7334  214.27    7335
  222.04    7336   229.8    7337  237.53    7338  245.55    7339  257.39    7340
  270.76    7341  283.69    7342  296.47    7343  309.17    7344  321.68    7345
  331.69    7346  341.31    7347     350 7347.94  350.56    7348  376.55    7349
  396.77    7350     400    7350

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  101.12     .04  245.55     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        101.12  245.55             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 7

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7348    5.53    7348    11.2    7347   16.81    7346   24.77    7345
   33.91    7344   35.75 7343.81   43.35    7343      50 7342.35   53.58    7342
   63.95    7341   73.85    7340    82.9    7339   92.09    7338  101.59    7337
  111.97    7336   122.5    7335   140.8    7334  162.44    7333   207.6    7333
  216.91    7334  225.56    7335  233.58    7336  243.44    7337  253.51    7338
  262.88    7339  272.35    7340  285.71    7341  296.54    7342  307.54    7343
  318.72    7344  330.02    7345  341.89    7346     350 7346.29  370.03    7347
     400    7347

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  101.59     .04  243.44     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        101.59  243.44             49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 6

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7349    5.37    7349   11.07    7348   16.74    7347   22.37    7346
   30.25    7345   39.38    7344   41.63 7343.75   48.49    7343      50 7342.84
    57.8    7342   66.94    7341   75.32    7340    83.8    7339   92.29    7338
  100.82    7337  109.37    7336  117.96    7335  126.62    7334  141.04    7333
  163.61    7332  205.67    7332  217.45    7333  229.59    7334  242.24    7335
  255.92    7336  272.19    7337  290.77    7338  310.13    7339  330.83    7340
     350 7340.84  353.45 7340.99  353.73    7341  369.28    7342  386.02    7343
     400    7343
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  109.37     .04  255.92     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        109.37  255.92            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 5

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7349    7.75    7349   15.29    7348   22.26    7347   28.98    7346
   35.56    7345   42.78    7344      50 7343.12      51    7343   59.27    7342
   67.14    7341   75.46    7340   85.27    7339   95.15    7338  101.14    7337
  106.84    7336  112.58    7335  118.37    7334  124.31    7333  130.36    7332
  153.19    7331  210.35    7331  220.48    7332  232.18    7333  245.11    7334
  259.61    7335  275.13    7336  290.78    7337  306.33    7338  324.01    7339
  345.71    7340     350 7340.26  359.94 7340.87  362.09    7341   377.7    7342
  395.54    7343     400    7343

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  112.58     .04  259.61     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        112.58  259.61            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 4

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7346    6.42    7346   13.64    7345   20.84    7344   28.06    7343
    35.3    7342   42.56    7341      50 7340.26   52.61    7340   66.43    7339
   80.66    7338   87.64    7337   87.98 7336.95   94.25    7336  100.89    7335
  107.53    7334  113.82    7333  122.34    7332  137.69    7331  149.14    7330
  212.95    7330   225.8    7331  237.84    7332  249.58    7333  260.71    7334
  275.23    7335   292.8    7336   311.2    7337  329.83    7338  347.11    7339
     350 7339.19  361.97    7340   377.3    7341  398.06    7342     400    7342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  107.53     .04  260.71     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        107.53  260.71            49.41   49.41   49.41             .1       .3

CROSS SECTION
```

RIVER: Boyd
REACH: Main River RS: 3

INPUT
Description:
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7347	5.49	7347	12.67	7346	19.87	7345	27.04	7344
34.21	7343	41.42	7342	48.76	7341	50	7340.88	59.2	7340
72.99	7339	87.22	7338	94.12	7337	94.71	7336.91	100.51	7336
106.91	7335	113.31	7334	119.74	7333	127.09	7332	135.72	7331
144.43	7330	153.17	7329	160.28	7328	166.79	7327	183.38	7326
204.22	7326	215.14	7327	222.29	7328	232.25	7329	247.75	7330
261.42	7331	274.82	7332	288.37	7333	305.28	7334	350	7334
400	7334								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	144.43	.04	247.75	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
144.43	247.75	49.41	49.41	.1	.3

CROSS SECTION

RIVER: Boyd
REACH: Main River RS: 2

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7347	1.21	7347	8.93	7346	16.66	7345	24.14	7344
31.66	7343	39.26	7342	47.1	7341	50	7340.69	56.41	7340
66.86	7339	77.69	7338	88.71	7337	99.87	7336	111.21	7335
121.94	7334	128.33	7333	135.15	7332	142.55	7331	150.11	7330
158.29	7329	164.14	7328	167.43	7327	173.43	7326	181.73	7325
189.43	7324	212.21	7324	219	7325	223.77	7326	228.04	7327
237.17	7328	247.55	7329	256.73	7330	270.14	7331	283.24	7332
350	7332	400	7332						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	164.14	.04	237.17	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
164.14	237.17	49.41	49.41	.1	.3

CROSS SECTION

RIVER: Boyd
REACH: Main River RS: 1

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7344	9.68	7344	20.88	7343	32.07	7342	43.42	7341
50	7340.33	53.28	7340	63.75	7339	74.39	7338	85.61	7337

```
   97.09    7336  107.81    7335  116.32    7334  124.52    7333  132.74    7332
  140.67    7331  147.99    7330  155.27    7329  162.14    7328  165.44    7327
  169.23    7326  172.39    7325  178.23    7324  189.58    7323  205.75    7323
  211.31    7324  217.04    7325  226.18    7326  236.09    7327  245.08    7328
     350    7328     400    7328

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  162.14     .04  245.08     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        162.14  245.08            49.41   49.41   49.41             .1       .3

CROSS SECTION


RIVER: Boyd
REACH: Main River         RS: 0

INPUT
Description:
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    7345     .88    7345    9.52    7344   18.15    7343   26.63    7342
      50 7339.29  147.21    7328  154.59    7327   160.1    7326  165.62    7325
  192.75    7322  205.48    7322  209.96    7323     350    7340     400    7345

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04      50     .04     350     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            50     350               0       0       0             .1       .3



SUMMARY OF MANNING'S N VALUES

River:Boyd

      Reach          River Sta.       n1        n2        n3

 Main River           36                .04       .04       .04
 Main River           35                .04       .04       .04
 Main River           34                .04       .04       .04
 Main River           33                .04       .04       .04
 Main River           32                .04       .04       .04
 Main River           31                .04       .04       .04
 Main River           30                .04       .04       .04
 Main River           29                .04       .04       .04
 Main River           28                .04       .04       .04
 Main River           27                .04       .04       .04
 Main River           26                .04       .04       .04
 Main River           25                .04       .04       .04
 Main River           24                .04       .04       .04
 Main River           23                .04       .04       .04
 Main River           22.8              .04       .04       .04
 Main River           22.6              .04       .04       .04
 Main River           22                .04       .04       .04
 Main River           21                .04       .04       .04
 Main River           20                .04       .04       .04
```

Main River	19	.04	.04	.04
Main River	18	.04	.04	.04
Main River	17	.04	.04	.04
Main River	16	.04	.04	.04
Main River	15	.04	.04	.04
Main River	14	.04	.04	.04
Main River	13	.04	.04	.04
Main River	12	.04	.04	.04
Main River	11	.04	.04	.04
Main River	10	.04	.04	.04
Main River	9	.04	.04	.04
Main River	8	.04	.04	.04
Main River	7	.04	.04	.04
Main River	6	.04	.04	.04
Main River	5	.04	.04	.04
Main River	4	.04	.04	.04
Main River	3	.04	.04	.04
Main River	2	.04	.04	.04
Main River	1	.04	.04	.04
Main River	0	.04	.04	.04

SUMMARY OF REACH LENGTHS

River: Boyd

Reach	River Sta.	Left	Channel	Right
Main River	36	49.41	49.41	49.41
Main River	35	49.41	49.41	49.41
Main River	34	49.41	49.41	49.41
Main River	33	49.41	49.41	49.41
Main River	32	49.41	49.41	49.41
Main River	31	49.41	49.41	49.41
Main River	30	49.41	49.41	49.41
Main River	29	49.41	49.41	49.41
Main River	28	49.41	49.41	49.41
Main River	27	49.41	49.41	49.41
Main River	26	49.41	49.41	49.41
Main River	25	49.41	49.41	49.41
Main River	24	31.7	31.7	31.7
Main River	23	13.55	13.55	13.55
Main River	22.8	13.56	13.56	13.56
Main River	22.6	40.01	40.01	40.01
Main River	22	49.41	49.41	49.41
Main River	21	49.41	49.41	49.41
Main River	20	49.41	49.41	49.41
Main River	19	49.41	49.41	49.41
Main River	18	49.41	49.41	49.41
Main River	17	49.41	49.41	49.41
Main River	16	49.41	49.41	49.41
Main River	15	49.41	49.41	49.41
Main River	14	49.41	49.41	49.41
Main River	13	49.41	49.41	49.41
Main River	12	49.41	49.41	49.41
Main River	11	49.41	49.41	49.41
Main River	10	49.41	49.41	49.41
Main River	9	49.41	49.41	49.41
Main River	8	49.41	49.41	49.41

Main River	7	49.41	49.41	49.41
Main River	6	49.41	49.41	49.41
Main River	5	49.41	49.41	49.41
Main River	4	49.41	49.41	49.41
Main River	3	49.41	49.41	49.41
Main River	2	49.41	49.41	49.41
Main River	1	49.41	49.41	49.41
Main River	0	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Boyd

Reach	River Sta.	Contr.	Expan.
Main River	36	.1	.3
Main River	35	.1	.3
Main River	34	.1	.3
Main River	33	.1	.3
Main River	32	.1	.3
Main River	31	.1	.3
Main River	30	.1	.3
Main River	29	.1	.3
Main River	28	.1	.3
Main River	27	.1	.3
Main River	26	.1	.3
Main River	25	.1	.3
Main River	24	.1	.3
Main River	23	.1	.3
Main River	22.8	.1	.3
Main River	22.6	.1	.3
Main River	22	.1	.3
Main River	21	.1	.3
Main River	20	.1	.3
Main River	19	.1	.3
Main River	18	.1	.3
Main River	17	.1	.3
Main River	16	.1	.3
Main River	15	.1	.3
Main River	14	.1	.3
Main River	13	.1	.3
Main River	12	.1	.3
Main River	11	.1	.3
Main River	10	.1	.3
Main River	9	.1	.3
Main River	8	.1	.3
Main River	7	.1	.3
Main River	6	.1	.3
Main River	5	.1	.3
Main River	4	.1	.3
Main River	3	.1	.3
Main River	2	.1	.3
Main River	1	.1	.3
Main River	0	.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Main River	36	100 Yr	425.80	7360.00	7361.79		7362.31	0.016972	5.81	73.28	55.43	0.89
Main River	35	100 Yr	425.80	7359.00	7360.70	7360.69	7361.36	0.021544	6.49	65.61	50.21	1.00
Main River	34	100 Yr	425.80	7358.00	7359.62	7359.62	7360.29	0.021703	6.55	65.00	49.32	1.01
Main River	33	100 Yr	425.80	7357.00	7358.65	7358.52	7359.19	0.016196	5.87	72.55	52.10	0.88
Main River	32	100 Yr	425.80	7356.00	7358.65		7358.81	0.002692	3.18	133.71	62.40	0.38
Main River	31	100 Yr	425.80	7355.00	7358.69		7358.73	0.000471	1.59	267.06	95.41	0.17
Main River	30	100 Yr	425.80	7354.00	7358.69		7358.71	0.000183	1.12	379.56	113.10	0.11
Main River	29	100 Yr	425.80	7353.00	7358.69		7358.70	0.000093	0.90	474.64	118.78	0.08
Main River	28	100 Yr	425.80	7350.00	7358.69		7358.69	0.000039	0.69	615.05	117.31	0.05
Main River	27	100 Yr	425.80	7349.00	7358.69		7358.69	0.000023	0.57	753.60	130.16	0.04
Main River	26	100 Yr	425.80	7347.00	7358.69		7358.69	0.000006	0.34	1269.67	166.69	0.02
Main River	25	100 Yr	425.80	7347.00	7358.69		7358.69	0.000003	0.24	1741.06	254.48	0.02
Main River	24	100 Yr	425.80	7347.00	7358.69		7358.69	0.000005	0.28	1516.68	245.66	0.02
Main River	23	100 Yr	425.80	7356.00	7358.68		7358.69	0.000212	0.88	483.85	240.00	0.11
Main River	22.8	100 Yr	425.80	7357.00	7358.36	7358.36	7358.65	0.029910	4.32	98.63	178.64	1.02
Main River	22.6	100 Yr	425.80	7356.00	7356.94	7356.94	7357.27	0.027023	4.65	91.64	138.01	1.01
Main River	22	100 Yr	425.80	7345.00	7347.24		7347.55	0.009797	4.49	94.86	70.08	0.68
Main River	21	100 Yr	425.80	7345.00	7346.96		7347.16	0.005500	3.58	118.83	79.89	0.52
Main River	20	100 Yr	425.80	7345.00	7346.34		7346.71	0.016248	4.90	86.97	82.61	0.84
Main River	19	100 Yr	425.80	7344.00	7346.38		7346.44	0.001557	1.99	213.88	135.03	0.28
Main River	18	100 Yr	425.80	7344.00	7345.79	7345.79	7346.21	0.025612	5.17	82.39	101.58	1.01
Main River	17	100 Yr	425.80	7343.00	7344.38	7344.38	7344.82	0.025340	5.32	79.98	93.56	1.02
Main River	16	100 Yr	425.80	7342.00	7343.15	7343.13	7343.56	0.023513	5.14	82.91	96.79	0.98
Main River	15	100 Yr	425.80	7341.00	7341.94	7341.94	7342.32	0.026422	4.97	85.73	114.87	1.01
Main River	14	100 Yr	425.80	7339.00	7340.20	7340.20	7340.63	0.024371	5.29	80.55	92.48	1.00
Main River	13	100 Yr	425.80	7338.00	7339.26		7339.58	0.015450	4.57	93.26	94.77	0.81
Main River	12	100 Yr	425.80	7337.00	7338.28	7338.23	7338.69	0.020524	5.13	82.99	87.59	0.93
Main River	11	100 Yr	425.80	7336.00	7337.72		7338.01	0.008995	4.33	98.23	71.75	0.65
Main River	10	100 Yr	425.80	7335.00	7337.48		7337.66	0.004873	3.38	126.10	84.61	0.49
Main River	9	100 Yr	425.80	7335.00	7336.65	7336.62	7337.18	0.021816	5.85	72.75	65.85	0.98
Main River	8	100 Yr	425.80	7334.00	7335.52	7335.52	7336.08	0.022966	5.97	71.30	65.12	1.01
Main River	7	100 Yr	425.80	7333.00	7334.33	7334.21	7334.70	0.016712	4.88	87.23	85.01	0.85
Main River	6	100 Yr	425.80	7332.00	7333.22	7333.22	7333.70	0.024506	5.55	76.75	82.27	1.01
Main River	5	100 Yr	425.80	7331.00	7332.16		7332.52	0.017899	4.81	88.57	93.01	0.87
Main River	4	100 Yr	425.80	7330.00	7331.04	7331.04	7331.49	0.024418	5.37	79.34	89.15	1.00
Main River	3	100 Yr	425.80	7326.00	7327.63	7327.63	7328.24	0.022541	6.26	68.01	57.01	1.01
Main River	2	100 Yr	425.80	7324.00	7325.93		7326.50	0.016649	6.04	70.44	49.45	0.89
Main River	1	100 Yr	425.80	7323.00	7325.20		7325.73	0.014056	5.85	72.74	47.13	0.83
Main River	0	100 Yr	425.80	7322.00	7324.25	7324.21	7324.90	0.019971	6.47	65.86	47.87	0.97

Table 2. Permissible Shear and Velocity for Selected Lining Materials[1]

Boundary Category	Boundary Type	Permissible Shear Stress (lb/sq ft)	Permissible Velocity (ft/sec)	Citation(s)
Soils	Fine colloidal sand	0.02 - 0.03	1.5	A
	Sandy loam (noncolloidal)	0.03 - 0.04	1.75	A
	Alluvial silt (noncolloidal)	0.045 - 0.05	2	A
	Silty loam (noncolloidal)	0.045 - 0.05	1.75 – 2.25	A
	Firm loam	0.075	2.5	A
	Fine gravels	0.075	2.5	A
	Stiff clay	0.26	3 – 4.5	A, F
	Alluvial silt (colloidal)	0.26	3.75	A
	Graded loam to cobbles	0.38	3.75	A
	Graded silts to cobbles	0.43	4	A
	Shales and hardpan	0.67	6	A
Gravel/Cobble	1-in.	0.33	2.5 – 5	A
	2-in.	0.67	3 – 6	A
	6-in.	2.0	4 – 7.5	A
	12-in.	4.0	5.5 – 12	A
Vegetation	Class A turf	3.7	6 – 8	E, N
	Class B turf	2.1	4 - 7	E, N
	Class C turf	1.0	3.5	E, N
	Long native grasses	1.2 – 1.7	4 – 6	G, H, L, N
	Short native and bunch grass	0.7 - 0.95	3 – 4	G, H, L, N
	Reed plantings	0.1-0.6	N/A	E, N
	Hardwood tree plantings	0.41-2.5	N/A	E, N
Temporary Degradable RECPs	Jute net	0.45	1 – 2.5	E, H, M
	Straw with net	1.5 – 1.65	1 – 3	E, H, M
	Coconut fiber with net	2.25	3 – 4	E, M
	Fiberglass roving	2.00	2.5 – 7	E, H, M
Non-Degradable RECPs	Unvegetated	3.00	5 – 7	E, G, M
	Partially established	4.0-6.0	7.5 – 15	E, G, M
	Fully vegetated	8.00	8 – 21	F, L, M
Riprap	6 – in. d_{50}	2.5	5 – 10	H
	9 – in. d_{50}	3.8	7 – 11	H
	12 – in. d_{50}	5.1	10 – 13	H
	18 – in. d_{50}	7.6	12 – 16	H
	24 – in. d_{50}	10.1	14 – 18	E
Soil Bioengineering	Wattles	0.2 – 1.0	3	C, I, J, N
	Reed fascine	0.6-1.25	5	E
	Coir roll	3 - 5	8	E, M, N
	Vegetated coir mat	4 - 8	9.5	E, M, N
	Live brush mattress (initial)	0.4 – 4.1	4	B, E, I
	Live brush mattress (grown)	3.90-8.2	12	B, C, E, I, N
	Brush layering (initial/grown)	0.4 – 6.25	12	E, I, N
	Live fascine	1.25-3.10	6 – 8	C, E, I, J
	Live willow stakes	2.10-3.10	3 – 10	E, N, O
Hard Surfacing	Gabions	10	14 – 19	D
	Concrete	12.5	>18	H

[1] Ranges of values generally reflect multiple sources of data or different testing conditions.

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USACE TR EL 97-8

12 Report Maps

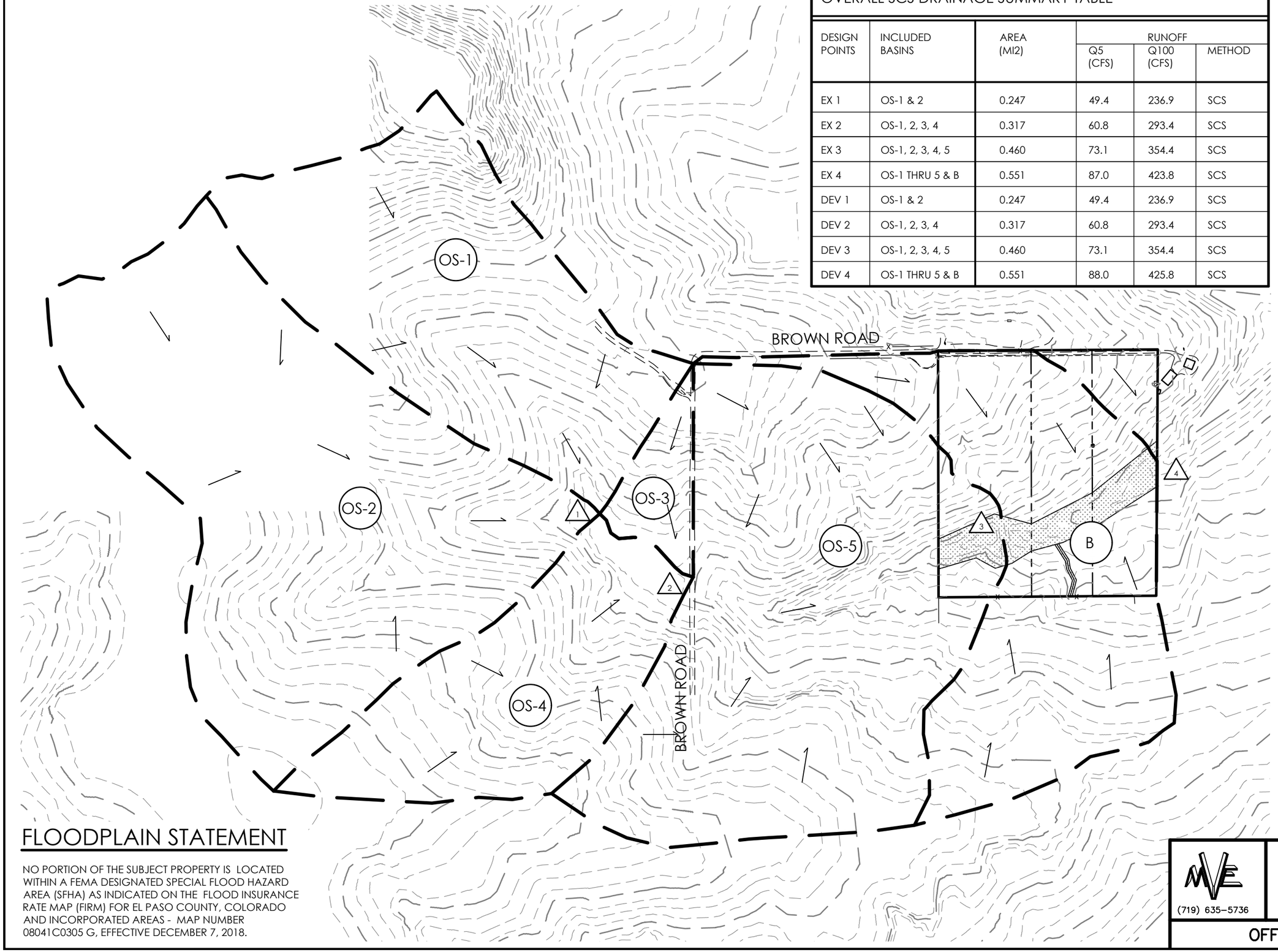
Off-Site Basin Map for HEC-HMS Calculations
Existing Condition Hydraulic Analysis Map (Map Pocket)
Proposed Condition Hydraulic Analysis Map (Map Pocket)

OVERALL SCS DRAINAGE SUMMARY TABLE

DESIGN POINTS	INCLUDED BASINS	AREA (MI2)	RUNOFF		
			Q5 (CFS)	Q100 (CFS)	METHOD
EX 1	OS-1 & 2	0.247	49.4	236.9	SCS
EX 2	OS-1, 2, 3, 4	0.317	60.8	293.4	SCS
EX 3	OS-1, 2, 3, 4, 5	0.460	73.1	354.4	SCS
EX 4	OS-1 THRU 5 & B	0.551	87.0	423.8	SCS
DEV 1	OS-1 & 2	0.247	49.4	236.9	SCS
DEV 2	OS-1, 2, 3, 4	0.317	60.8	293.4	SCS
DEV 3	OS-1, 2, 3, 4, 5	0.460	73.1	354.4	SCS
DEV 4	OS-1 THRU 5 & B	0.551	88.0	425.8	SCS

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE
- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- GENERAL FLOW/DIRECTION
- OS-1 BASIN LABEL
- 1 DESIGN POINT



N

100 0 200 500 1,000

1" = 500' 1:6,000

FLOODPLAIN STATEMENT

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBER 08041C0305 G, EFFECTIVE DECEMBER 7, 2018.

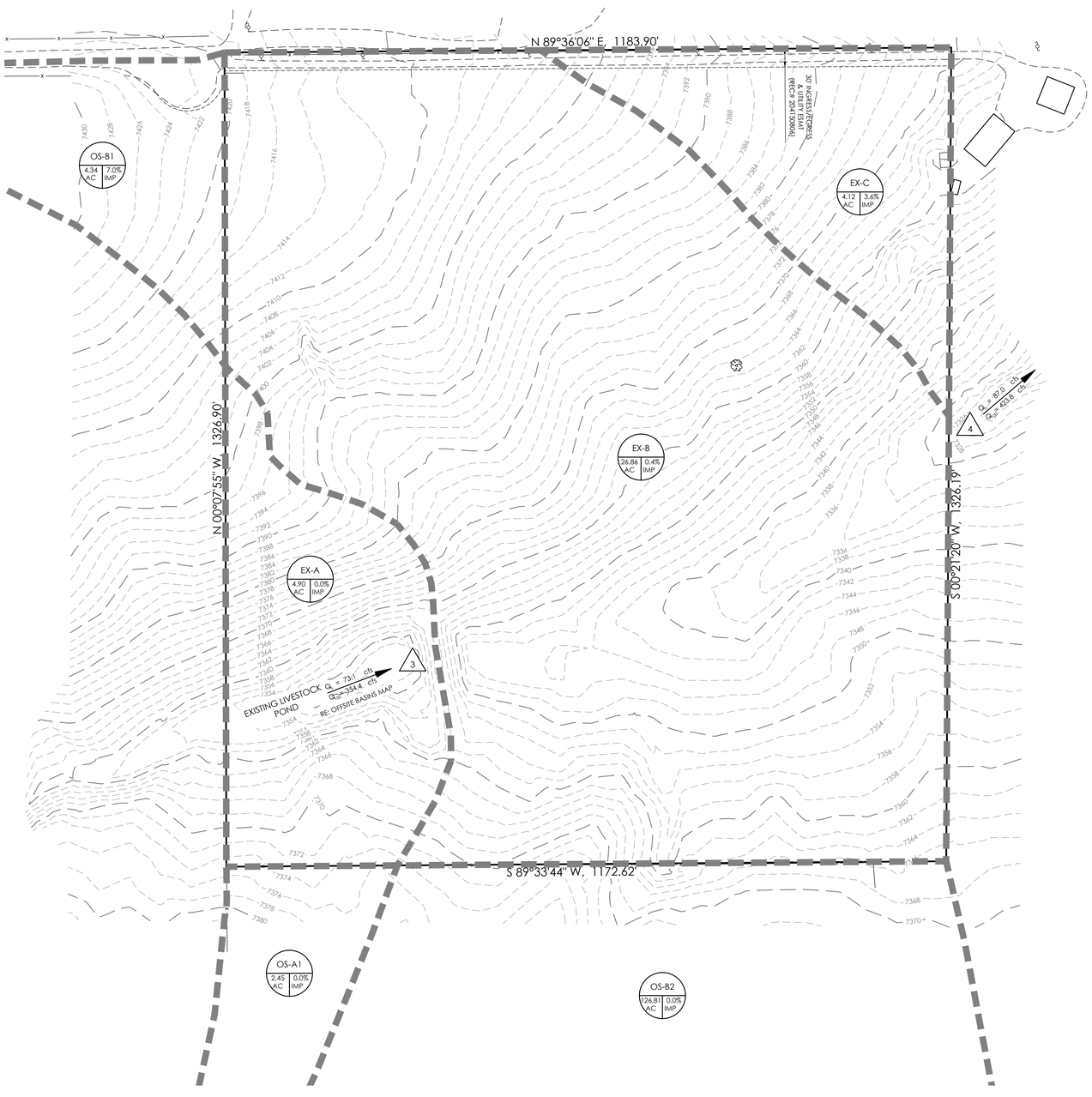
(719) 635-5736

MONUMENT VALLEY ENGINEERS INC.

*** ENGINEERS *** SURVEYORS ***

1903 LELARAY ST., COLORADO SPRINGS, COLORADO 80909

OFF-SITE_BASIN_MAP



LEGEND

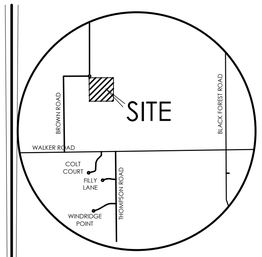
- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR

PROPOSED

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- Q5 = 19.0 cfs, Q100 = 60.0 cfs — GENERAL FLOW/DIRECTION
- 1.5% — SLOPE DIRECTION AND GRADE
- A1 / 1.0 AC / 50% IMP — BASIN LABEL: AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT



VICINITY MAP

NOT TO SCALE

BENCHMARK

N

10 0 50 100 200

1" = 100' 1:1,200

EXISTING DRAINAGE SUMMARY TABLE						
DESIGN POINTS	INCLUDED BASINS	AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)	METHOD
	OS-A1	2.45	12.8	0.7	5.4	RATIONAL
	OS-B1	4.34	15.8	1.5	9.5	RATIONAL
	OS-B2	26.81	17.6	7.0	51.6	RATIONAL
	EX-A	4.90	13.4	1.4	10.6	RATIONAL
	EX-B	26.86	19.2	7.0	50.0	RATIONAL
	EX-C	4.12	14.3	1.5	9.1	RATIONAL
3		0.46 MI2		73.1	354.4	HEC-HMS
4		0.55 MI2		87.0	423.8	HEC-HMS

FLOODPLAIN STATEMENT

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAPS (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBERS 08041C0305 G, EFFECTIVE DECEMBER 7, 2018.

NOTE: SEE BASIN MAP FOR OFFSITE BASIN DETAILS

MVE, INC. ENGINEERS / SURVEYORS
1903 lelaray street, suite 200 colorado springs co 80909 719.635.5736

REVISIONS

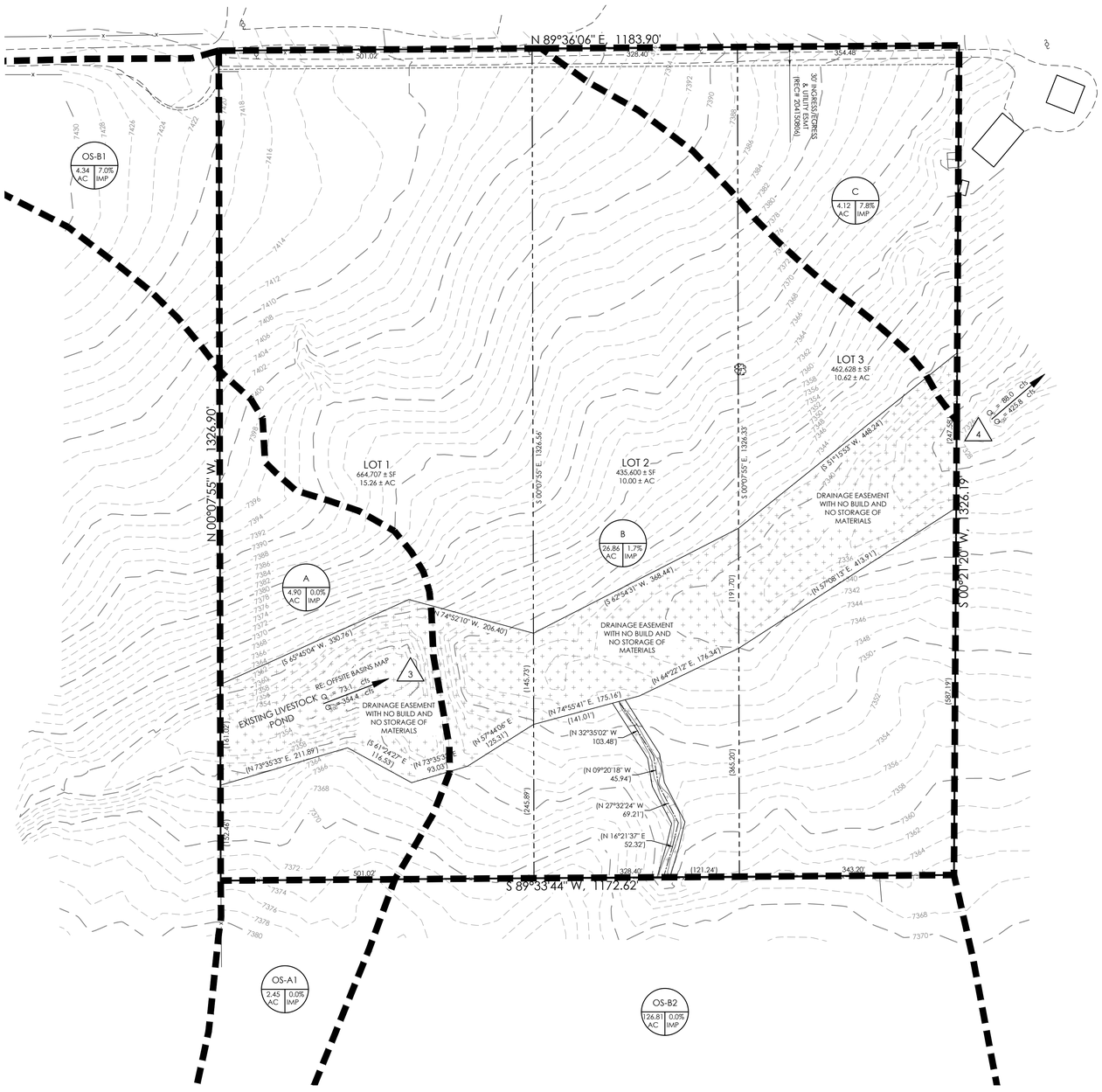
DESIGNED BY
DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

18735 BROWN ROAD

EXISTING DRAINAGE MAP

MVE PROJECT **61170**
MVE DRAWING **EX-DRN**

AUGUST 18, 2022
SHEET 1 OF 1



LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR

PROPOSED

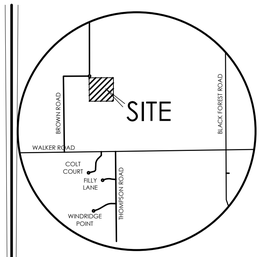
- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- Q_5 = 19.0 cfs, Q_{100} = 60.0 cfs — GENERAL FLOW/DIRECTION
- 1.5% — SLOPE DIRECTION AND GRADE
- A1 / 1.0 AC / 50% IMP — BASIN LABEL: AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT

DEVELOPED DRAINAGE SUMMARY TABLE						
DESIGN POINTS	INCLUDED BASINS	AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)	METHOD
	OS-A1	2.45	12.8	0.7	5.4	RATIONAL
	OS-B1	4.34	15.8	1.5	9.5	RATIONAL
	OS-B2	26.81	17.6	7.0	51.6	RATIONAL
	A	4.90	13.4	1.4	10.6	RATIONAL
	B	26.86	19.2	7.8	50.9	RATIONAL
	C	4.12	14.3	2.0	9.6	RATIONAL
3		0.46 MI2		73.1	354.4	SCS
4		0.55 MI2		88.0	425.8	SCS

FLOODPLAIN STATEMENT

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAPS (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBERS 08041C0305 G, EFFECTIVE DECEMBER 7, 2018.

NOTE: SEE BASIN MAP FOR OFFSITE BASIN DETAILS



VICINITY MAP

NOT TO SCALE

BENCHMARK

N

10 0 50 100 200

1" = 100' 1:1,200

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REVISIONS

DESIGNED BY
DRAWN BY
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AS-BUILTS BY
CHECKED BY

18735 BROWN ROAD

DEVELOPED DRAINAGE MAP

MVE PROJECT **61170**
MVE DRAWING **PP-DRN**

AUGUST 18, 2022
SHEET 1 OF 1