# FINAL DRAINAGE REPORT

## GRANDVIEW RESERVE FILING NO. 1

El Paso County, Colorado

PREPARED FOR:
**D.R. Horton**
**9555 S. Kingston Court**
**Englewood, CO**

PREPARED BY:
**Galloway & Company, Inc.**
**1155 Kelly Johnson Blvd., Suite 305**
**Colorado Springs, CO 80920**

DATE:
**June 21, 2024**

*PCD Filing No.: SF2311*

## 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.*

Treven Edwards, PE #60124 — Date
For and on behalf of Galloway & Company, Inc.

## DEVELOPER'S CERTIFICATION

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

By:______________________________ ____________________
Date

Address: D.R. Horton
9555 S. Kingston Court
Englewood, CO

## EL PASO COUNTY CERTIFICATION

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

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

Conditions:

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# I. Purpose

The purpose of this Final Drainage Report is to identify on and offsite drainage patterns, locate and identify tributary or downstream drainage features and facilities that impact the site, and to identify which types of drainage facilities will be needed and where they will be located. This report will remain in general compliance with the approved MDDP prepared by HR Green, dated November 2020 and Preliminary Drainage Report (PDR) prepared by Galloway & Company, Inc., dated January 19, 2024.

# II. General Description

The Filing No. 1 project site is a single-family residential development located in the Falcon area of El Paso County, Colorado. The Filing No. 1 project site is located in a portion of the South half of Section 21, the North half of Section 28, Township 12 South, Range 64 West of the 6th Principal Meridian, County of El Paso, State of Colorado. The subject property includes Eastonville Road to the west, which was studied separately in the "*Eastonville Road Preliminary Drainage Report*", by HR Green, September 2023, EPC # CDR2321 (**E-PDR**), and is currently in review with El Paso County. The project site is bounded by undeveloped land proposed as future development to the east, and undeveloped land within the Waterbury Development to the south. A Vicinity Map is included in **Appendix A**..

This final drainage report is the basis for the drainage facility design in conformance with the previously approved MDDP for the site prepared by HR Green, "*Grandview Reserve Master Development Drainage Plan",* HR Green, November 2020, EPC # SKP201 (**MDDP**) and the approved preliminary drainage report, "*Preliminary Drainage Report - Grandview Reserve Filing No. 1",* Galloway & Company, Inc., January 19, 2024 (**PDR**). The site consists of approximately 37.564 acres and includes 119 dwelling units.

The existing soil types within the proposed site as determined by the NRCS Web Soil Survey for El Paso County Area consist of Columbine gravelly sandy loam (hydrologic soil group A) and Stapleton sandy loam (hydrologic soil group B). See the soils map included in **Appendix A**.

# III. Drainage Criteria

Hydrology calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

The drainage calculations were based on the criteria manual Figure 6-5 and IDF equations to determine the intensity and are listed in Table 1 below.

**Table 1 - Precipitation Data**

| Return Period | One Hour Depth (in). | Intensity (in/hr) |
|---|---|---|
| 5-year | 1.50 | 5.17 |
| 100-year | 2.52 | 8.68 |

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

Q = CIA

Where:

Q = Peak Discharge (cfs)
C = Runoff Coefficient
I = Runoff intensity (inches/hour)
A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the drainage criteria manual (Table 6-6). Composite percent impervious and C values were calculated using the residential, streets, roofs, and lawns coefficients found in Table 6-6 of the manual.

The 100-year event was used as the major storm event. The 5-year event was used as the minor event. The UD-Inlets v5.01 spreadsheet was utilized for the sizing of the proposed sump inlets.

The UD-Detention v4.04 spreadsheet was utilized for the design of the proposed on-site water quality ponds, Ponds D and E.

**Swales**

The proposed emergency overflow swales were analyzed using criteria with the City DCM Vol.1, Chapter 12, section 3. These swales were analyzed using Federal Highway Administration (FHWA) Hydraulic Toolbox for a 100-year major storm event. The FHWA Hydraulic Toolbox calculates the capacity and stability of swales. Stability is determined by ensuring that the permissible shear stress is greater than the maximum shear stress calculated in the swale. This software utilizes equations for shear stress from HEC 15.

In the instances when the maximum shear stress exceeds the permissible shear stress Pmax 300 lining from North American Green (NAG) is proposed. Swale stability in these scenarios were analyzed using NAG Erosion Control Materials Design Software (ECMDS). This software computes channel stability for the proposed swale utilizing an appropriate NAG lining.

Swale computations can be found in **Appendix D**.

# IV. Interim Drainage Conditions

## HISTORIC CONDITIONS

The site is contained fully within one major drainage basin; the Gieck Ranch Drainage Basin and is tributary to Black Squirrel Creek. The site generally drains from north to south with an average slope of 2% outside of the channel. The rational method was used to analyze the individual basins within the site because their size permits it.

## HISTORIC OFF-SITE FLOWS

As described in the approved "*Preliminary Drainage Report for Grandview Reserve Filing No. 1*", Galloway & Company, February 2024, EPC # *PUDSP2110* (**PDR**). There is one (1) major drainageway bordering the Grandview Reserve Filing No. 1 project site to the northeast that currently conveys existing on & off-site flows through and adjacent to the project site to the southeast; This is the Gieck Ranch Tributary #1 (Hereon referred to as Channel A), located along the northeastern boundary of the project site. Channel A drainageway generally flows to the southeast towards Highway 24, before crossing via existing drainage structures. This drainageway is analyzed in the report titled "Grandview Reserve CLOMR Report," Prepared by HR Green. This report is still in review – a discussion will be included in the report about the difference between FEMA flows and the Meridian Ranch MDDP. Subsequent Final Drainage Reports will be revised as necessary to incorporate any changes from the CLOMR report.

Existing upstream tributary analysis (the areas west of Eastonville Road) was performed as part of the **E-PDR** and includes basins EX1, EX2, EX3, EX4, EX5, EX6, and EX7. See the **E-PDR** in **Appendix F** for reference. A description of critical design points from the **E-PDR** that enter the site are summarized below.

**Channel A**: enters the site via an existing 18" (Public) CMP under Eastonville Rd. The flows at this point are associated with **Design Point 4** of the **E-PDR** and correlates to **Design Point G06** of "*The Sanctuary Filing 1 FDR (Meridian Ranch)",* Tech Contractors, August 2022; Per the **E-PDR**, the total upstream tributary area is 832.7 acres, and Channel A flows entering the existing pipe culvert at **Design Point 4** are: $Q_5$ = 22.4 cfs, $Q_{100}$ = 491.0 cfs.

**Design Point 5:** off-site flows enter the site via an existing 18" (Public) CMP crossing Eastonville Rd. The off-site flows are associated with **Design Point 5** of the **E-PDR**; Per the **E-PDR**, the total upstream tributary area is 22.35 acres, and flows entering the existing pipe culvert at **Design Point 5** are: $Q_5$ = 7.0 cfs, $Q_{100}$ = 43.3 cfs.

**Design Point 6:** off-site flows enter the site via an existing 18" (Public) CMP crossing Eastonville Rd. The off-site flows are associated with **Design Point 6** of the **E-PDR**; Per the **E-PDR**, the total upstream tributary area is 3.05 acres, and flows entering the existing pipe culvert at **Design Point 5** are: $Q_5$ = 1.2 cfs, $Q_{100}$ = 6.9 cfs.

Following the preliminary drainage report (PDR), the "existing" condition for this FDR will be after the preliminary / interim overlot grading on the site has taken place.

In the interim condition, overland grading operations will have taken place within the Grandview Reserve Subdivision in preparation for the ultimate proposed condition. While this activity is taking place within the proposed subdivision, no activity is anticipated west of Eastonville Road. The proposed project site lies completely within the Gieck Ranch Drainage Basin and is also situated within two (2) of the larger identified basins (D & E) which have been broken down into four (4) smaller sub-basins. More specifically, within the interim drainage condition, the project site is located within Basins EA-1, TSB-D1, TSB-E1, & TSB-E2. Site runoff will be collected via swales and diverted to one of the three proposed temporary sediment basins. All necessary calculations can be found within the appendices of this report.

## INTERIM OFF-SITE FLOWS

Existing upstream tributary analysis (the areas west of Eastonville Road) was performed as part of the **E-PDR** and was discussed earlier in the report under **Section IV – Off-Site Flows**. These design basins remain the same as the existing condition during the interim phase and discussion of them are not included in this section.

### INTERIM ON-SITE FLOWS

**Basin TSB-D1** (10.09 AC, $Q_5$ = 2.8 cfs, $Q_{100}$ = 20.0 cfs): Located at the north portion of the proposed site, Basin TSB-D1 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the east where it is intercepted by proposed TSB-D1 at **DP 18**. From there, treated runoff from TSB-D1 will be discharged downstream directly to existing Channel A.

**Basin TSB-E1** (8.21 AC, $Q_5$ = 2.5 cfs, $Q_{100}$ = 18.0 cfs): Located at the southern portion of the proposed site, Basin TSB-E1 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the east where it is intercepted by proposed TSB-E1 at **DP 19**. From there, treated runoff from TSB-E1 will be discharged downstream directly to **Basin TSB-E2**.

**Basin TSB-E2** (13.57 AC, $Q_5$ = 4.0 cfs, $Q_{100}$ = 28.3 cfs): Located at the southeastern portion of the site, Basin TSB-E2 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the east where it is intercepted by proposed TSB-E2 at **DP 20**. From there, treated runoff from TSB-E2 will be discharged downstream directly to existing Channel A.

**Design Point 20** ($Q_5$ = 6.5 cfs, $Q_{100}$ = 46.3 cfs): Located at the south portion of the site, this design point accounts for the total combined flows from **Basin TSB-E1** & **TSB-E2**. Flows from this design point are discharged directly into the existing Channel A.

**Basin EA-1** (2.50 AC, $Q_5$ = 0.7 cfs, $Q_{100}$ = 5.1 cfs): Located along the southeastern property line, Basin EA-1 consists primarily of un-developed disturbed area with a temporary diversion swale put in place to convey existing off-site flows from **DP 5 & 6** through the site to Channel A, as they had in the existing condition. Runoff from this basin will sheet flow into a temporary trapezoidal diversion swale (Swale OS-1) with a 4' bottom width and 3' deep. Flows will then be conveyed north and discharge directly into Channel A at **DP 21**.

Each of the temporary sediment basins (TSBs) has been sized according to the detail from City of Colorado Springs Stormwater Quality Manual, Figure SB-1 and the pond calculations in the Mile High Flood District (MHFD) spreadsheet. Riser pipes within each TSB will discharge flows downstream, following the interim grading patterns, which will adhere to historic drainage patterns and eventually enter respective drainageway (Channel A). Similarly, each TSB will have an overflow spillway which will discharge excess flows downstream in the same drainage pattern as the discharge from the riser pipes within the corresponding TSB. See **Appendix D** for calculation spreadsheets.

## V. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

### 1. Employ Runoff Reduction Practices

This step uses low impact development (LID) practices to reduce runoff at the source. Generally, rather than creating point discharges that are directly connected to impervious areas runoff is routed through pervious areas to promote infiltration. The Impervious Reduction Factor (IRF) method was used and calculations can be found in **Appendix E.**

### 2. Stabilize Channels

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Erosion protection in the form of riprap pads at all outfall points to the channel to prevent scouring of the channel from point discharges. The existing channel analysis and design for the Main Stem Tributary #2 (MST) is to be completed by others and a report for the channel improvements will be submitted for review separately.

### 3. Provide Water Quality Capture Volume (WQCV)

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. The EURV volume will release in 72 hours, while the WQCV will release in no less than 40 hours. On-site water quality control volume detention ponds will provide water quality treatment for all of the developed areas, prior to the runoff being released into either of the major drainage ways. Refer to the WQCV Plan in **Appendix F**.

### 4. Consider Need for Industrial and Commercial BMPs

As this project is all residential development and no commercial or industrial development is proposed, there will be no need for any specialized BMPs which would be associated with an industrial or commercial site.

## VI. Proposed Drainage Conditions

The proposed project site lies completely within the Gieck Ranch Drainage Basin and consists of two (2) larger basins (D & E) which have been broken down into fourteen (14) smaller sub-basins. Adjacent Off-site Basins (OS) were analyzed as part of the **E-PDR**. Site runoff for Grandview Reserve Filing No. 1 will be collected via inlets & pipes and diverted to one of the two proposed full spectrum detention ponds. No offsite flows enter the Grandview Reserve Filing No. 1 project site. All necessary calculations can be found within the appendices of this report.

There are no proposed major channel improvements for Channel A associated with this project site / development. The analysis for the channel was completed by HR Green (*Grandview Reserve CLOMR Report*, HR Green; March 22, 2023 (**CLOMR**). The Construction Drawings and Drainage Report for the channel improvements can be found under the project number CDR-22-008. A copy of the CLOMR Report is included in **Appendix G** for reference – the CLOMR Report is currently still in review. Final design values will be revised as necessary in subsequent Final Drainage Report submittals.

The project site will provide two (2) Full Spectrum Extended Detention Basins (EDBs). Ponds D & E will discharge treated runoff at historic rates directly into Gieck Ranch Tributary #1 (**MDDP**) / Channel A (**E-PDR**).

As has been mentioned previously, the project site is proposed to have a land use of single family residential. The project site will consist primarily of 1/8 Acre lots, with some 1/4 Acre and 1/3 Acre lots, public roadways, along with dedicated Tracts for amenity uses.

**Basin D-1** (2.73 AC, $Q_5$ = 2.6 cfs, $Q_{100}$ = 8.0 cfs): Located on the western portion of the project site, adjacent to Eastonville Road. This basin consists of residential lots and the west half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' sump inlet, located on the west side of Kate Meadow Lane **(DP D1)**, just north of the intersection of Kate Meadow Lane & Farm Close Court. In the major storm event, flows will overtop the roadway crown and will be split between basins D-1 and D-2. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point D4 within Farm Close Court.

**Basin D-2** (0.57 AC, $Q_5$ = 1.0 cfs, $Q_{100}$ = 2.5 cfs): Located on the western portion of the project site, this basin consists of residential lots and the eastern half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' sump inlet, located on the east side of Kate Meadow Lane **(DP D2)**, just north of the intersection of Kate Meadow Lane & Farm Close Court. In the major storm event, flows will overtop the roadway crown and will be split between basins D-1 and D-2. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point D4 within Farm Close Court.

**Basin D-3** (4.33 AC, $Q_5$ = 6.1 cfs, $Q_{100}$ = 16.3 cfs): Located in the west-central portion of the project site, this basin consists of residential lots, the western half of Farm Close Court, and a north portion of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' inlet in sump condition, located on the west side of Farm Close Court **(DP D4)**, southeast of the intersection of Kate Meadow Lane & Farm Close Court cul-de-sac. In the major storm event, flows will overtop the roadway crown and will be split between basins D-3 and D-4. Emergency overflows will overtop the crown and be routed downstream via an emergency overflow swale to the east which conveys runoff directly to Pond D.

**Basin D-4** (3.65 AC, $Q_5$ = 4.4 cfs, $Q_{100}$ = 11.8 cfs): Located in the north-central portion of the project site, this basin consists of residential lots and the eastern half of Farm Close Court. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' inlet in sump condition, located on the east side of Farm Close Court **(DP D6)**, just southeast of the intersection of Kate Meadow Lane & Farm Close Court cul-de-sac. In the major storm event, flows will overtop the roadway crown and will be split between basins D-3 and D-4. Emergency overflows will overtop curb & gutter and be routed downstream via a graded swale within the maintenance access path to Pond D.

**Basin D-5** (1.59 AC, $Q_5$ = 0.7 cfs, $Q_{100}$ = 3.0 cfs): Located along the northwest corner of the project site, adjacent to the Gieck Ranch Tributary #1 / Channel A drainageway. This basin consists partially of residential lots and the proposed (private) Full Spectrum Detention Pond D. Runoff from this basin will sheet flow directly to Pond D. Flows will then be routed to the outlet structure **(DP D7)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel (Channel A).

**Basin D-6** (0.92 AC, $Q_5$ = 0.2 cfs, $Q_{100}$ = 1.5 cfs): Located along the northwest corner of the project site, adjacent to the Gieck Ranch Tributary #1 / Channel A drainageway. This basin consists of the undeveloped area outside and downstream of the proposed (private) Full Spectrum Detention Pond D. Runoff from this basin will sheet flow directly to the Gieck Ranch Tributary #1 / Channel A drainageway. All roof drains (for lots 18-20) within this sub-basin will be directed toward Farm Close Court, no impervious surfaces will be allowed within the rear lot setbacks and runoff reduction will be implemented within this sub-basin.

**Basin E-1** (4.47 AC, $Q_5$ = 3.6 cfs, $Q_{100}$ = 11.2 cfs): Located in the southwestern portion of the project site, this basin consists of residential lots, the southern half of Brixham Drive, Starcross Court, and the southern half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located approximately 150-feet to the northeast of the intersection between Kate Meadow Lane and Starcross Court **(DP E1)**. Bypass flows are conveyed downstream via curb & gutter to **DP E4**.

**Basin E-2** (1.94 AC, $Q_5$ = 3.3 cfs, $Q_{100}$ = 8.4 cfs): Located on the southwestern portion of the project site, this basin consists of residential lots, a small portion of Mill Yard Circle, and the north half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located approximately 150-feet to the northeast of the intersection between Kate Meadow Lane and Starcross Court **(DP E2)**. Bypass flows are conveyed downstream via curb & gutter to **DP E4**.

**Basin E-3a** (2.90 AC, $Q_5$ = 4.3 cfs, $Q_{100}$ = 11.0 cfs): Located on the south-central portion of the project site, this basin consists of residential lots the western and southern half of Mill Yard Circle as well as a portion of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located just southeast from the intersection between Kate Meadow Lane and Mill Yard Circle **(DP E4)**. In the major storm event, flows will overtop the roadway crown and will be split between basins E-3a and E-4a. Bypass flows are conveyed downstream via curb & gutter to **DP E7**.

**Basin E-3b** (2.12 AC, $Q_5$ = 3.5 cfs, $Q_{100}$ = 8.9 cfs): Located on the southeastern portion of the project site, this basin consists of the rear portion of residential lots along Kate Meadow Lane and full residential lots and the western half of Mill Yard Circle near the cul-de-sac. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' sump inlet, located just northeast from the cul-de-sac of Mill Yard Circle **(DP E7)**. In the major storm event, flows will overtop the roadway crown and will be split between basins E-3b and E-4b. Emergency overflows will overtop the crown and be routed downstream via an emergency overflow swale to the southeast which conveys runoff directly to Pond E via a graded emergency overflow swale.

**Basin E-4a** (7.45 AC, $Q_5$ = 6.8 cfs, $Q_{100}$ = 20.3 cfs): Located in the central portion of the project site, this basin consists of residential lots and the northern and eastern half of Mill Yard Circle. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located just southeast from the intersection between Kate Meadow Lane and Mill Yard Circle **(DP E5)**. In the major storm event, flows will overtop the roadway crown and will be split between basins E-4a and E-3a. Bypass flows are conveyed downstream via curb & gutter to **DP E9**.

**Basin E-4b** (1.00 AC, $Q_5$ = 1.7 cfs, $Q_{100}$ = 4.2 cfs): Located on the southeastern corner of the project site, this basin consists of residential lots and the eastern half of Mill Yard Circle near the cul-de-sac. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' sump inlet, located just southeast from the intersection between Kate Meadow Lane and Mill Yard Circle **(DP E9)**. In the major storm event, flows will overtop the roadway crown and will be split between basins E-3b and E-4b. Emergency overflows will overtop the curb and be routed downstream via an emergency overflow swale to the southeast which conveys runoff directly to Pond E via a graded emergency overflow swale.

**Basin E-5** (1.43 AC, $Q_5$ = 0.3 cfs, $Q_{100}$ = 1.8 cfs): Located on the southeast corner of the project site, adjacent to the Gieck Ranch Tributary #1 / Channel A drainageway. This basin consists of the proposed (private) Full Spectrum Detention Pond E. Runoff from this basin will sheet flow directly to Pond E. Flows will then be routed to the outlet structure **(DP E10)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Gieck Ranch Tributary #1 / Channel A drainageway.

**Basin E-6** (2.40 AC, $Q_5$ = 0.7 cfs, $Q_{100}$ = 4.4 cfs): Located on the southeast corner of the project site, adjacent to the Gieck Ranch Tributary #1 / Channel A drainageway. This basin consists of the undeveloped area outside and downstream of the proposed (private) Full Spectrum Detention Pond E. Runoff from this basin will sheet flow directly to the Gieck Ranch Tributary #1 / Channel A drainageway and offsite to the east.

## VII. Storm Sewer System

All development is anticipated to be urban and will include storm sewer & street inlets. Storm sewers collect storm water runoff and convey the water to the water quality facilities prior to discharging. Storm sewer systems will be designed to the 100-year storm and checked with the 5-year storm. Inlets will be placed at sump areas and intersections where street flow is larger than street capacity. UDFCD Inlet spreadsheet has been used to determine the size of all sump inlets.

There will be two (2) proposed storm systems within the project site. Each of the two storm sewer systems will discharge storm water into its correlated WQCV pond.

Each system will consist of reinforced concrete pipe (RCP), CDOT Type 'R' inlets, and storm sewer manholes.

This Final drainage report includes details concerning sump and at-grade inlet locations, street capacity, storm sewer sizing, outlet protection and locations. The calculations can be found in **Appendix D**.

## VIII. Proposed Water Quality Detention Ponds

Two (2) Full Spectrum Detention Ponds will be provided for the proposed site. Both of these ponds (Ponds D & E) are private and will be maintained by the DISTRICT, once established. These detention ponds are proposed to be full spectrum and will provide water quality and detention. The WQCV and EURV release will be controlled with an orifice plate. The release rates for the WQCV and EURV will be 40-hours and 72-hours, respectively. All storm event volumes up to the 100-year event will be controlled by orifice and/or restrictor plate and will be designed to release at or below the pre-development flow rate. Outlet structures, forebays, trickle channels, etc. are included with this final drainage report. The required FSD pond volumes are as described below:

**Pond D:** Located centrally on the site, just west of the Gieck Ranch Tributary #1 / Channel A drainageway. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.227 Ac-Ft & 0.782 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.229 Ac-Ft & 0.787 Ac-Ft, respectively. The total required detention basin volume is 1.596 Ac-Ft. The total provided detention basin storage is 1.145 Ac-Ft. In the 100-year event, Pond D releases 90% of the predeveloped peak flow (6.8 cfs). The historic flow rate in this area is 8.6 cfs in the 100-year event. Please see the "Detention Basin Outlet Structure Design" for Pond D in **Appendix E** for more details.

**Pond E:** Located on the south side of the site, just west of Gieck Ranch Tributary #1 / Channel A drainageway. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.372 Ac-Ft & 1.263 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.373Ac-Ft & 1.265 Ac-Ft, respectively. The total required detention basin volume is 2.602 Ac-Ft. The total provided detention basin storage is 1.808 Ac-Ft. In the 100-year event, Pond E releases 90% of the predeveloped peak flow (14.8 cfs). The historic flow rate in this area is 16.0 cfs in the 100-year event. Please see the "Detention Basin Outlet Structure Design" for Pond E in **Appendix E** for more details.

**The ratio peak outflow to predevelopment flows exceeds 1.00 cfs for the 5-year flows in both proposed ponds. This cannot get close to 1.00 cfs without exceeding a 72-hour drain time for the 5-year storm to meet Colorado's revised statute 47-92-602 (8). Furthermore, the difference in flow is 0.1 cfs for Pond D and 0.2 cfs for Pond E. This should be considered a nominal increase.**

# IX. Proposed Channel Improvements

According to the **MDDP**, there is one (1) major drainageway that runs immediately adjacent to the project site. The Gieck Ranch Tributary #1 / Channel A drainageway (**E-PDR**) along the northeastern boundary of the project site conveying runoff from the northwest to the southeast. There are no proposed major channel improvements for Channel A as part of this project (to be determined with EPC # CDR-22-008; *Grandview Reserve Geick Basin Channel*). An analysis has been done for Channel A with both existing and future condition flows as described within the *Grandview Reserve CLOMR Report*, HR Green; March 22, 2023 (**CLOMR**). All HEC-RAS modelling, velocities, shear, depths, etc. are included within the CLOMR, which can be found in **Appendix E**. Both scenarios, throughout the channel fall within the channel stability criteria.

A majority of the developed runoff will be captured and conveyed to one of the corresponding water quality and detention facilities and release at or below historic levels. Ponds D and E will release directly into the Gieck Ranch Tributary #1 / Channel A drainageway. These basins are contained within the backs of lots and will provide water quality through runoff reduction; impervious areas will not be permitted in the back of these lots and roof drains are to drain to the front. Therefore, there will be no adverse impact to downstream facilities. The analysis for the drainageway (Channel A) and offsite upstream tributary capture was done by HR Green within the *Grandview Reserve CLOMR Report*, HR Green; March 22, 2023 (**CLOMR**) which will be submitted separately for review. A copy of this report is included in **Appendix E**.

# X. Maintenance

After completion of construction and upon the Board of County Commissioners acceptance, it is anticipated all drainage facilities within the public Right-of-Way are to be owned and maintained by El Paso County (i.e. Eastonville Road FSD).

Both private detention ponds are to be owned and maintained by the Grandview Reserve Metropolitan District No. 2 (DISTRICT), once established, unless an agreement is reached stating otherwise. The proposed Gieck Ranch Tributary #1 / Channel A drainageway is not proposed to be disturbed. Maintenance access for all full spectrum detention facilities will be provided from public Right-of-Way.

# XI. Wetlands Mitigation

There are two existing wetlands on site associated with the one (1) major channel, Gieck Ranch Tributary #1 / Channel A drainageway. The wetlands are contained within the existing channel with the wetland in Gieck Ranch Tributary #1 / Channel A drainageway being classified as jurisdictional. The wetlands USACE determination will be provided with the *Grandview Reserve CLOMR Report*, HR Green; March 22, 2023 (**CLOMR)**, which can be found in Appendix D. Wetlands maintenance will be the responsibility of the Grandview Reserve Metropolitan District No. 2 (DISTRICT).

# XII. Floodplain Statement

A portion of the project sit lies with Zone A Special Flood Hazard Area as defined by the FIRM Map number 08041C0552G effective December 7, 2018. A copy of the FIRM Panel is included in **Appendix A.** FEMA-approved floodplain elevations are required to be shown on final plats.

# XIII. Drainage Fees & Maintenance

Gieck Ranch Basin is not listed as part of the El Paso County drainage basin fee program. Unless otherwise instructed, no drainage fees will be assessed.

## COST OPINION

| Item | Quantity | Unit | Unit Cost | Cost |
|---|---|---|---|---|
| **Storm Drain Infrastructure (Public)** | | | | |
| 24" RCP | 655 | LF | $96.00 | $62,880.00 |
| 30" RCP | 305 | LF | $120.00 | $36,600.00 |
| 36" RCP | 440 | LF | $150.00 | $66,000.00 |
| 42" RCP | 165 | LF | $275.00 | $45,375.00 |
| CDOT TYPE R 5' Curb Inlet | 3 | EA | $5,500.00 | $16,500.00 |
| CDOT TYPE R 15' Curb Inlet | 7 | EA | $10,000.00 | $70,000.00 |
| CDOT Storm 5' DIA Manhole | 15 | EA | $7,500.00 | $112,500.00 |
| CDOT Storm 6' DIA Manhole | 1 | EA | $10,000.00 | $10,000.00 |
| **Subtotal** | | | | **$419,855.00** |
| **Total (Public)** | | | | **$419,855.00** |
| **Contingency** | | | **10%** | **$41,985.50** |
| **Grand Total (Public)** | | | | **$461,840.50** |
| **Storm Drain Infrastructure (Private)** | | | | |
| Trapezoidal Channel | 175 | LF | $12.00 | $2,100.00 |
| Triangular Channel | 150 | LF | $8.00 | $1,200.00 |
| Channel RECP (North American Green) | 4,538 | SY | $8.00 | $36,304.00 |
| 18" Flared End Section | 2 | EA | $2,750.00 | $5,500.00 |
| **Subtotal** | | | | **$45,104.00** |
| **Pond D Improvements (Private)** | | | | |
| Earthwork | 7,435 | CY | $20.00 | $148,700.00 |
| Forebay | 1 | EA | $10,000.00 | $10,000.00 |
| Hand Rail Fence (Forebays) | 180 | LF | $6.00 | $1,080.00 |
| Type L Rip-Rap (Emergency Spillway) | 75 | CY | $120.00 | $9,000.00 |
| Trickle Channel | 325 | LF | $15.00 | $4,875.00 |
| Outlet Structure w/ Micropool | 1 | EA | $15,000.00 | $15,000.00 |
| 18" RCP Storm Pipe | 100 | LF | $80.00 | $8,000.00 |
| Gravel Maintenance Access | 39 | CY | $45.00 | $1,755.00 |
| **Subtotal** | | | | **$198,410.00** |
| **Pond E Improvements (Private)** | | | | |
| Earthwork | 5,775 | CY | $20.00 | $115,500.00 |
| Forebay | 1 | EA | $10,000.00 | $10,000.00 |
| Hand Rail Fence (Forebays) | 180 | LF | $6.00 | $1,080.00 |
| Type L Rip-Rap (Emergency Spillway) | 75 | CY | $120.00 | $9,000.00 |
| Trickle Channel | 450 | LF | $15.00 | $6,750.00 |
| Outlet Structure w/ Micropool | 1 | EA | $15,000.00 | $15,000.00 |
| 18" RCP Storm Pipe | 70 | LF | $80.00 | $5,600.00 |
| Gravel Maintenance Access | 26 | CY | $45.00 | $1,170.00 |
| **Subtotal** | | | | **$164,100.00** |
| **Total (Private)** | | | | **$407,614.00** |
| **Contingency** | | | **10%** | **$40,761.40** |
| **Grand Total (Private)** | | | | **$448,375.40** |

# XIV. Conclusion

The Grandview Reserve residential subdivision lies within the Gieck Ranch Drainage Basin. Water quality for the project site is provided in two (2) on-site Full Spectrum Detention Ponds; Ponds D & E. All drainage facilities within this report were sized according to the El Paso County Drainage Criteria Manuals. The proposed facilities are adequate to protect the site from generated runoff. The site runoff will not adversely affect the downstream facilities and surrounding developments. There is one (1) major drainageway bordering the Grandview Reserve Filing No. 1 project site to the northeast, which will be addressed by the report titled “Grandview Reserve CLOMR Report,” Prepared by HR Green. The two (2) WQCV ponds will be maintained by a newly established Grandview Reserve Metropolitan District No. 2 (DISTRICT).

# XV. References


1. *El Paso County Drainage Criteria Manual*, 1990.
2. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, 2002.
3. *El Paso County Drainage Criteria Manual Update*, 2015.
4. *El Paso County Engineering Criteria Manual*, 2020.
5. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
6. *Gieck Ranch Drainage Basin Study (DBPS),* Drexel Barrell, October 2010 (Not adopted by County).
7. *Grandview Reserve Master Development Drainage Plan (MDDP),* HR Green, November 2020.
8. *Grandview Reserve CLOMR Report*, HR Green; March 22, 2023.
9. *Meridian Ranch MDDP,* January 2018, updated 2021*.*
10. *Eastonville Road Preliminary Drainage Report*", HR Green, September 2023.
11. *The Sanctuary Filing 1 FDR (Meridian Ranch),* Tech Contractors, August 2022.

# APPENDIX A

# Exhibits and Figures


GRANDVIEW RESERVE
FILING NO. 1

EASTONVILLE RD
SCALE: 1"=2,000'

VICINITY MAP

| | |
|---|---|
| Project No: | HRG02 |
| Drawn By: | JDM |
| Checked By: | CMWJ |
| Date: | 03/15/2024 |

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220 • GallowayUS.com

# NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

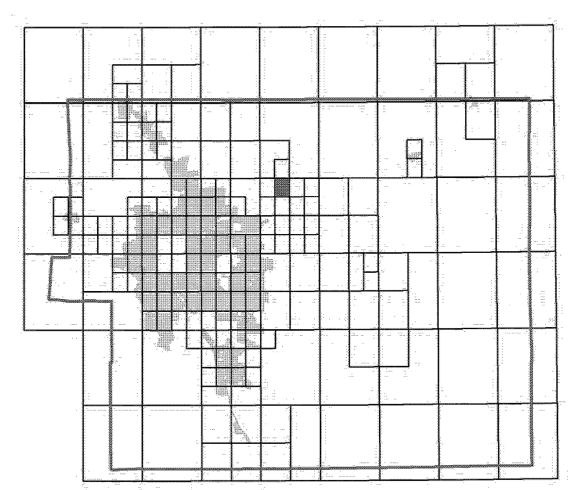
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

**El Paso County Vertical Datum Offset Table**

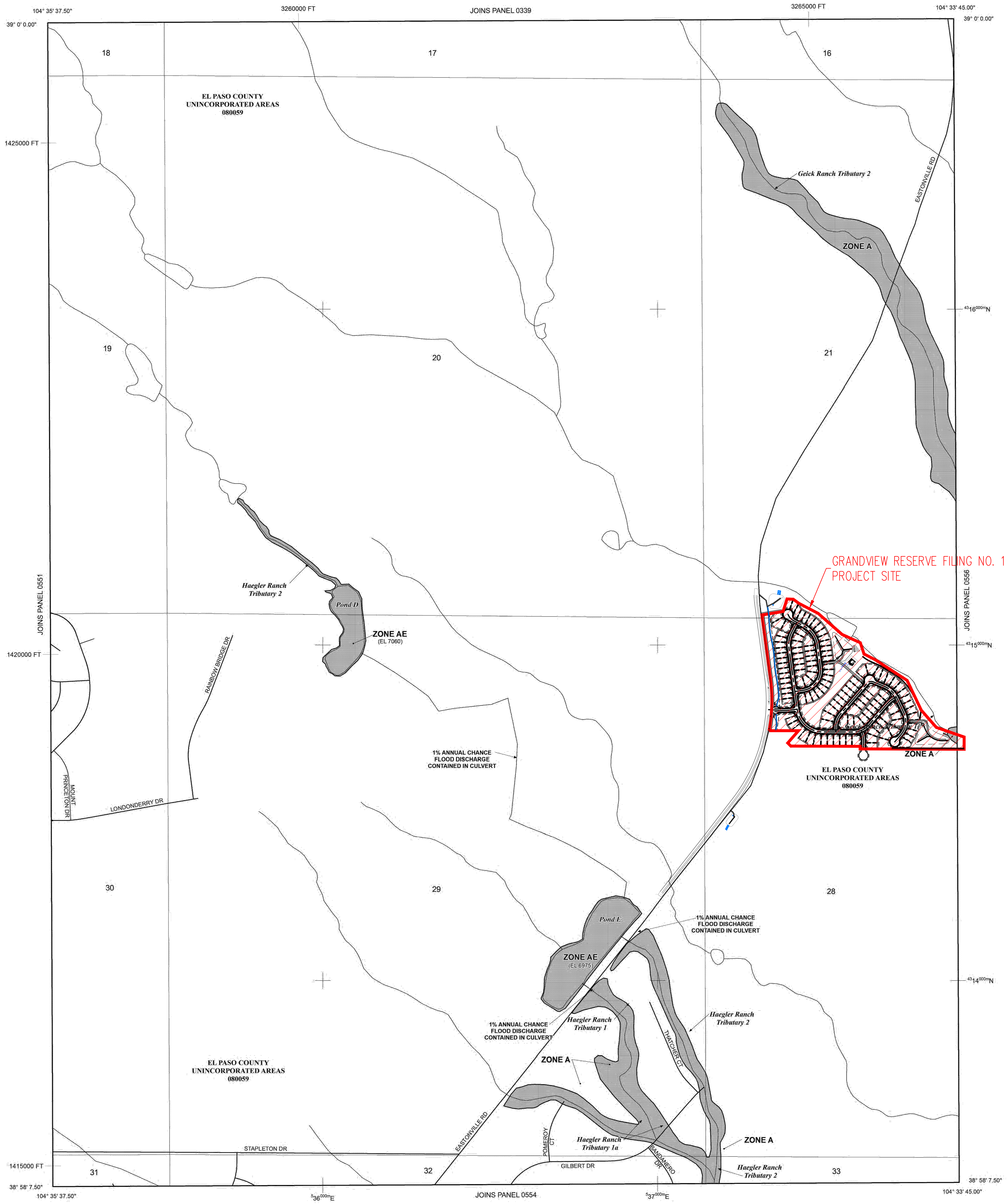
| Flooding Source | Vertical Datum Offset (ft) |
|---|---|
| REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION | |

**Panel Location Map**



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

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




NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST.

# LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

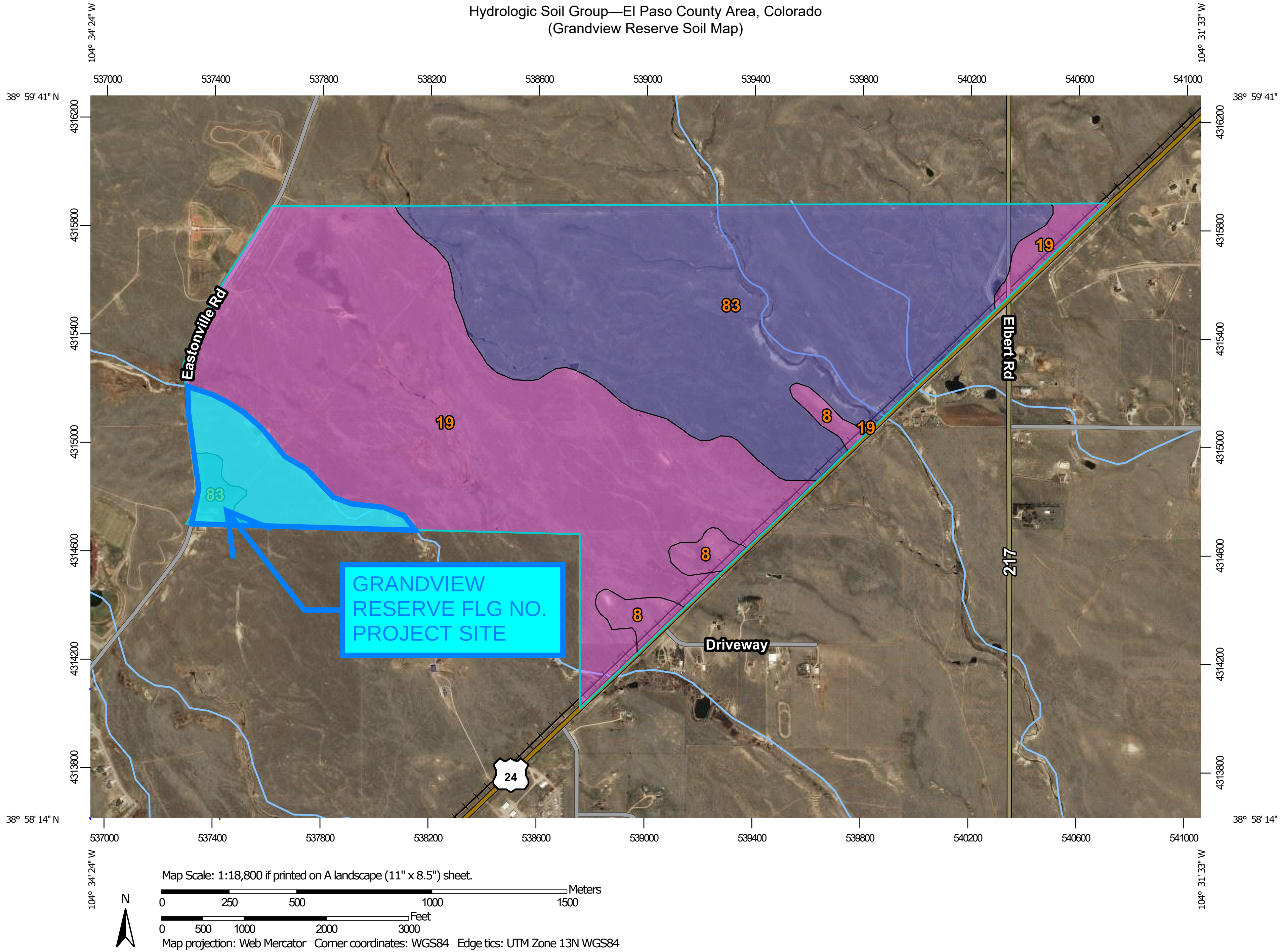
**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~~ 513 ~~~ Base Flood Elevation line and value; elevation in feet*
(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

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

(A)——(A) Cross section line
(23)- - - -(23) Transect line
97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

**MAP SCALE 1" = 500'**

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0552G**

# FIRM
## FLOOD INSURANCE RATE MAP
## EL PASO COUNTY, COLORADO
### AND INCORPORATED AREAS

**PANEL 552 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| EL PASO COUNTY | 080059 | 0552 | G |

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

**MAP NUMBER**
**08041C0552G**

**MAP REVISED**
**DECEMBER 7, 2018**

**Federal Emergency Management Agency**
~~~


104° 34' 24" W
104° 31' 33" W
38° 59' 41" N
38° 58' 14" N
537000
537400
537800
538200
538600
539000
539400
539800
540200
540600
541000
4316200
4315800
4315400
4315000
4314600
4314200
4313800
Eastonville Rd
Elbert Rd
217
Driveway
24
19
83
8
GRANDVIEW RESERVE FLG NO. PROJECT SITE
Map Scale: 1:18,800 if printed on A landscape (11" x 8.5") sheet.
Meters
0 250 500 1000 1500
Feet
0 500 1000 2000 3000
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

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

**Soil Rating Lines**

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

**Soil Rating Points**

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

**Water Features**

Streams and Canals

**Transportation**

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

**Background**

Aerial Photography

## MAP INFORMATION

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

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 17, Sep 13, 2019

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.

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 8 | Blakeland loamy sand, 1 to 9 percent slopes | A | 22.4 | 2.6% |
| 19 | Columbine gravelly sandy loam, 0 to 3 percent slopes | A | 450.7 | 52.5% |
| 83 | Stapleton sandy loam, 3 to 8 percent slopes | B | 385.4 | 44.9% |
| **Totals for Area of Interest** | | | **858.5** | **100.0%** |

## Description

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

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

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

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

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

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

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

**NOAA Atlas 14, Volume 8, Version 2**
**Location name: Peyton, Colorado, USA***
**Latitude: 38.985°, Longitude: -104.565°**
**Elevation: 6975.71 ft****
* source: ESRI Maps
** source: USGS

## POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.239 (0.189-0.303) | 0.291 (0.231-0.370) | 0.381 (0.301-0.486) | 0.461 (0.361-0.589) | 0.576 (0.440-0.768) | 0.671 (0.499-0.904) | 0.770 (0.554-1.06) | 0.875 (0.604-1.24) | 1.02 (0.678-1.48) | 1.14 (0.733-1.67) |
| 10-min | 0.350 (0.277-0.444) | 0.426 (0.338-0.542) | 0.558 (0.441-0.711) | 0.674 (0.529-0.863) | 0.844 (0.644-1.13) | 0.982 (0.731-1.32) | 1.13 (0.811-1.56) | 1.28 (0.884-1.81) | 1.49 (0.992-2.17) | 1.66 (1.07-2.44) |
| 15-min | 0.426 (0.338-0.541) | 0.520 (0.412-0.660) | 0.681 (0.537-0.867) | 0.823 (0.645-1.05) | 1.03 (0.785-1.37) | 1.20 (0.891-1.62) | 1.37 (0.988-1.90) | 1.56 (1.08-2.21) | 1.82 (1.21-2.65) | 2.03 (1.31-2.98) |
| 30-min | 0.608 (0.482-0.771) | 0.740 (0.586-0.940) | 0.968 (0.764-1.23) | 1.17 (0.916-1.49) | 1.46 (1.11-1.94) | 1.70 (1.26-2.29) | 1.94 (1.40-2.68) | 2.21 (1.52-3.12) | 2.57 (1.71-3.73) | 2.86 (1.85-4.19) |
| 60-min | 0.775 (0.615-0.984) | 0.933 (0.739-1.19) | 1.21 (0.956-1.54) | 1.46 (1.15-1.87) | 1.84 (1.41-2.47) | 2.16 (1.61-2.92) | 2.49 (1.80-3.45) | 2.85 (1.97-4.05) | 3.37 (2.24-4.90) | 3.78 (2.44-5.55) |
| 2-hr | 0.943 (0.754-1.19) | 1.13 (0.898-1.42) | 1.46 (1.16-1.84) | 1.76 (1.39-2.23) | 2.22 (1.72-2.97) | 2.62 (1.97-3.52) | 3.04 (2.21-4.19) | 3.50 (2.45-4.95) | 4.16 (2.80-6.03) | 4.70 (3.06-6.85) |
| 3-hr | 1.03 (0.829-1.29) | 1.22 (0.978-1.53) | 1.57 (1.25-1.97) | 1.90 (1.51-2.40) | 2.41 (1.88-3.22) | 2.86 (2.17-3.84) | 3.35 (2.45-4.60) | 3.88 (2.73-5.48) | 4.66 (3.15-6.74) | 5.29 (3.46-7.69) |
| 6-hr | 1.20 (0.968-1.49) | 1.40 (1.13-1.74) | 1.78 (1.44-2.22) | 2.16 (1.73-2.70) | 2.76 (2.18-3.66) | 3.28 (2.52-4.39) | 3.86 (2.86-5.29) | 4.51 (3.21-6.34) | 5.46 (3.73-7.86) | 6.24 (4.12-9.01) |
| 12-hr | 1.38 (1.13-1.70) | 1.61 (1.31-1.98) | 2.05 (1.67-2.53) | 2.48 (2.00-3.07) | 3.15 (2.51-4.15) | 3.74 (2.89-4.96) | 4.39 (3.28-5.96) | 5.12 (3.67-7.13) | 6.17 (4.25-8.82) | 7.04 (4.69-10.1) |
| 24-hr | 1.60 (1.31-1.95) | 1.87 (1.54-2.28) | 2.38 (1.94-2.91) | 2.85 (2.32-3.51) | 3.60 (2.88-4.67) | 4.24 (3.29-5.56) | 4.94 (3.71-6.63) | 5.71 (4.12-7.87) | 6.82 (4.73-9.66) | 7.73 (5.20-11.0) |
| 2-day | 1.85 (1.54-2.24) | 2.18 (1.80-2.63) | 2.76 (2.28-3.35) | 3.29 (2.70-4.01) | 4.11 (3.30-5.27) | 4.80 (3.76-6.22) | 5.54 (4.19-7.36) | 6.35 (4.62-8.68) | 7.50 (5.25-10.5) | 8.44 (5.73-11.9) |
| 3-day | 2.03 (1.69-2.44) | 2.39 (1.98-2.87) | 3.02 (2.50-3.64) | 3.60 (2.97-4.36) | 4.47 (3.60-5.69) | 5.20 (4.09-6.70) | 5.98 (4.55-7.90) | 6.83 (4.99-9.28) | 8.03 (5.65-11.2) | 9.00 (6.15-12.7) |
| 4-day | 2.18 (1.82-2.61) | 2.56 (2.13-3.06) | 3.22 (2.68-3.87) | 3.82 (3.16-4.62) | 4.73 (3.83-6.00) | 5.49 (4.33-7.04) | 6.30 (4.81-8.30) | 7.18 (5.26-9.72) | 8.43 (5.95-11.7) | 9.43 (6.46-13.3) |
| 7-day | 2.58 (2.17-3.07) | 2.98 (2.50-3.54) | 3.68 (3.08-4.39) | 4.32 (3.60-5.18) | 5.29 (4.31-6.65) | 6.09 (4.84-7.76) | 6.96 (5.34-9.09) | 7.89 (5.82-10.6) | 9.21 (6.55-12.8) | 10.3 (7.10-14.4) |
| 10-day | 2.93 (2.48-3.47) | 3.37 (2.84-3.98) | 4.13 (3.47-4.90) | 4.81 (4.02-5.74) | 5.83 (4.76-7.29) | 6.68 (5.32-8.45) | 7.58 (5.85-9.86) | 8.55 (6.34-11.4) | 9.92 (7.09-13.7) | 11.0 (7.65-15.4) |
| 20-day | 3.91 (3.33-4.58) | 4.51 (3.84-5.29) | 5.52 (4.68-6.50) | 6.39 (5.39-7.55) | 7.63 (6.25-9.37) | 8.62 (6.90-10.8) | 9.64 (7.47-12.4) | 10.7 (7.98-14.1) | 12.2 (8.74-16.6) | 13.3 (9.31-18.4) |
| 30-day | 4.70 (4.02-5.47) | 5.44 (4.65-6.34) | 6.65 (5.66-7.78) | 7.66 (6.49-9.00) | 9.06 (7.44-11.0) | 10.1 (8.15-12.5) | 11.2 (8.74-14.3) | 12.3 (9.24-16.2) | 13.8 (9.98-18.7) | 15.0 (10.5-20.6) |
| 45-day | 5.67 (4.88-6.57) | 6.55 (5.63-7.60) | 7.97 (6.82-9.27) | 9.12 (7.77-10.7) | 10.7 (8.79-12.9) | 11.9 (9.56-14.5) | 13.0 (10.2-16.4) | 14.2 (10.6-18.4) | 15.6 (11.3-21.0) | 16.7 (11.9-23.0) |
| 60-day | 6.49 (5.60-7.48) | 7.46 (6.43-8.62) | 9.01 (7.74-10.4) | 10.3 (8.77-11.9) | 11.9 (9.82-14.3) | 13.1 (10.6-16.0) | 14.3 (11.2-18.0) | 15.5 (11.7-20.0) | 16.9 (12.3-22.6) | 18.0 (12.8-24.6) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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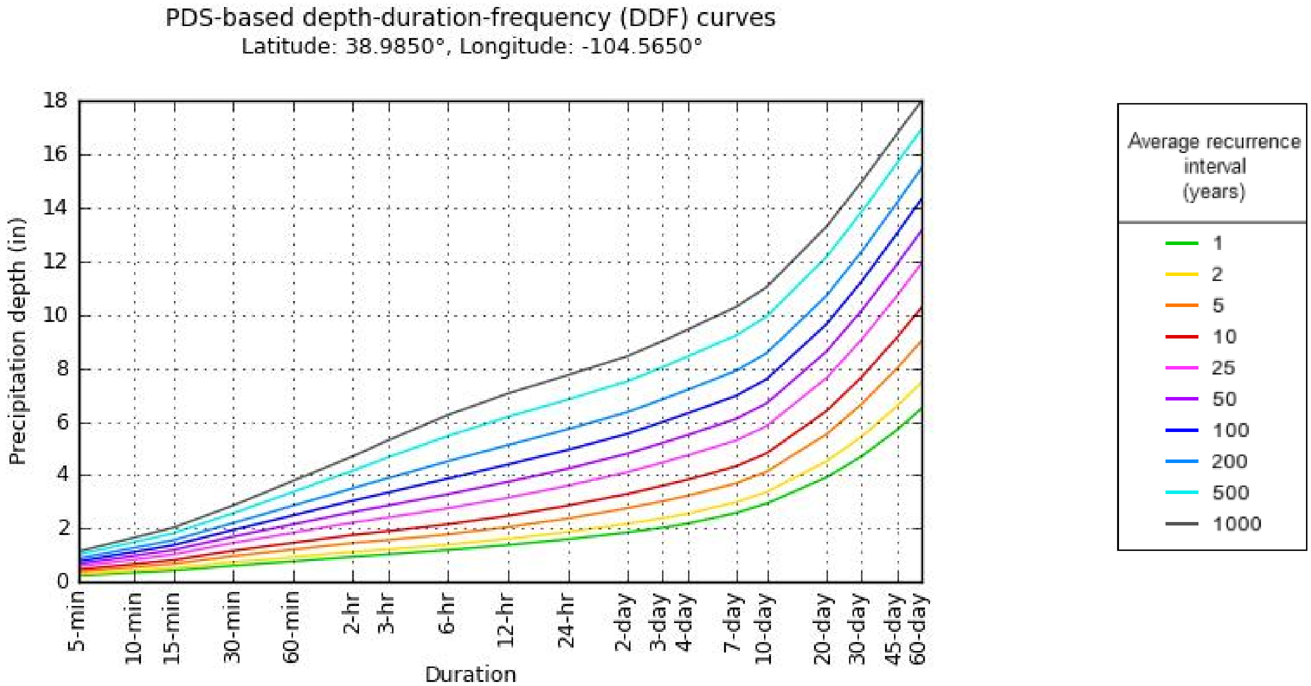
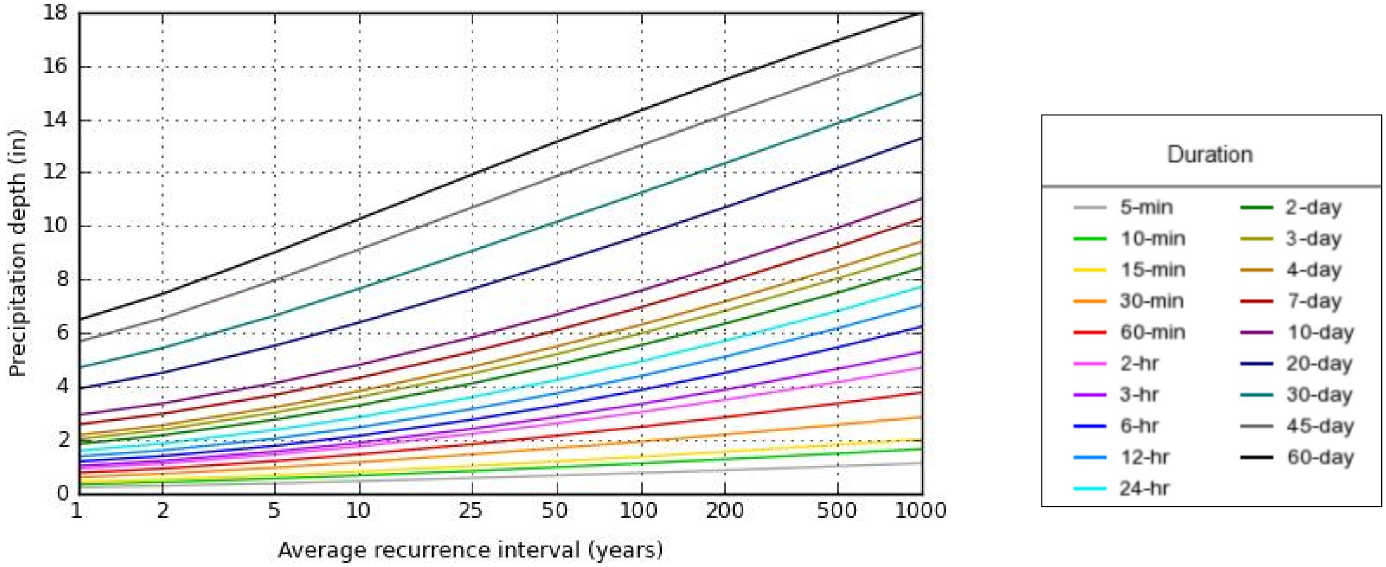
## PF graphical




NOAA Atlas 14, Volume 8, Version 2 Created (GMT): Thu Dec 2 17:16:51 2021

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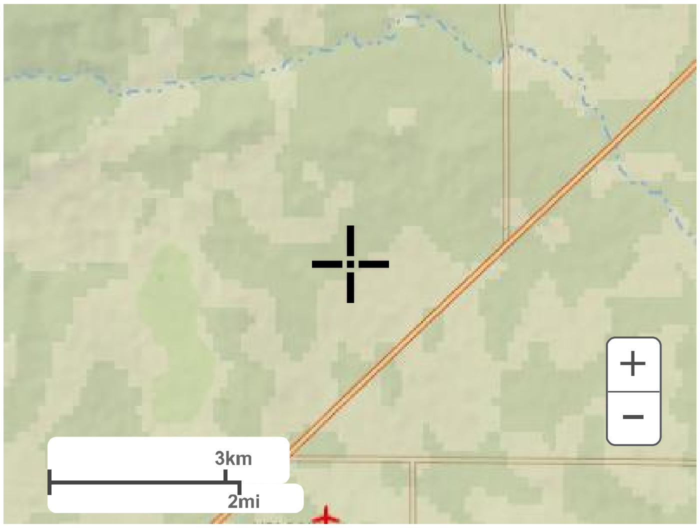
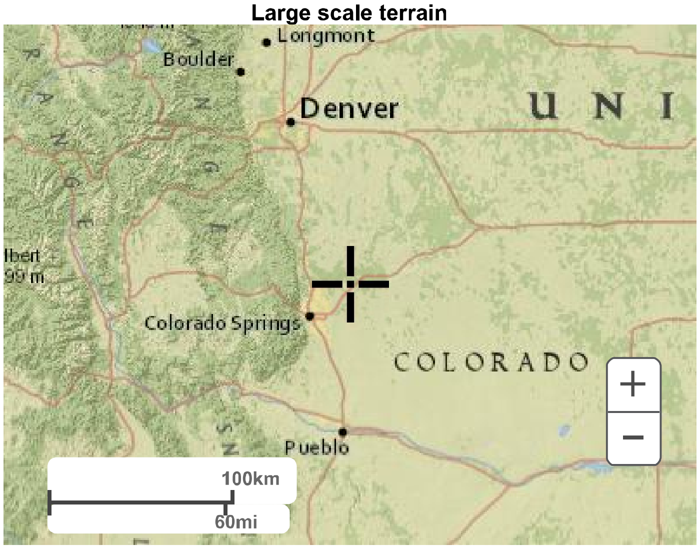
## Maps & aerials

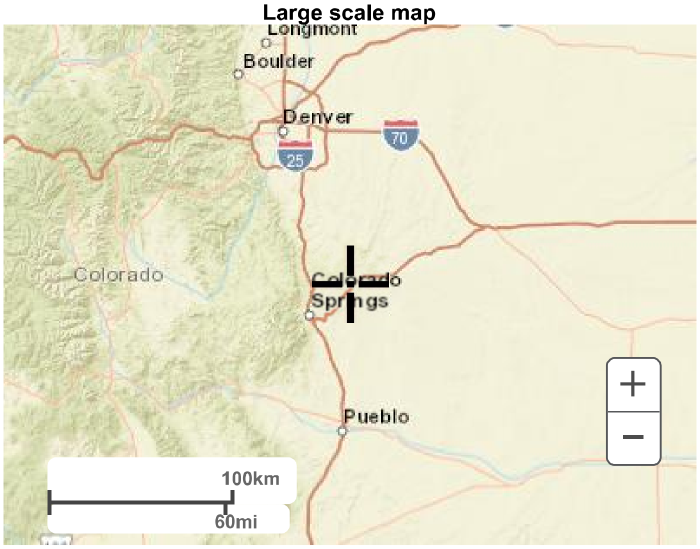
**Small scale terrain**



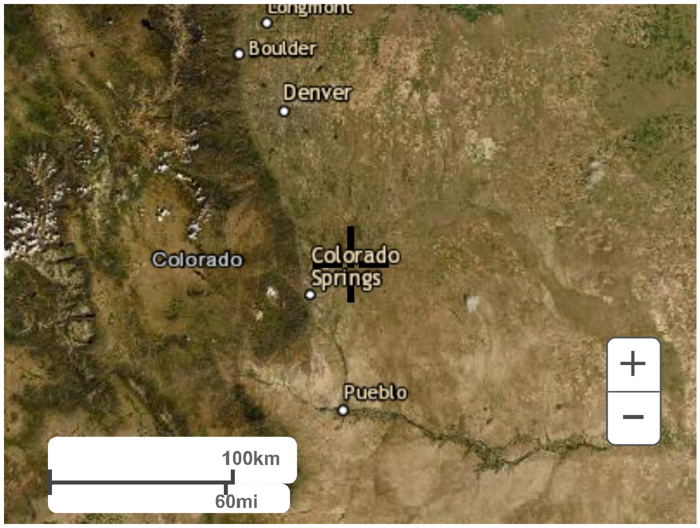

Large scale terrain




Large scale map




Large scale aerial

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

Disclaimer

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# APPENDIX C

# Hydrologic Computations

# COMPOSITE % IMPERVIOUS CALCULATIONS: EXISTING & INTERIM

**Subdivision:** Grandview Reserve
**Location:** CO, El Paso County

**Project Name:** Grandview Subdivision PDR - Interim Conditions
**Project No.:** HRG01
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 12/21/23

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin ID | Total Area (ac) | Paved/Gravel Roads | | | Lawns/Undeveloped | | | Residential - 1/8 Acre | | | Residential - 1/4 Acre | | | Residential - 1/3 Acre | | | Residential - 1/2 Acre | | | Residential - 1 Acre | | | Basins Total Weighted % Imp. |
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| **EXISTING** | | | | | | | | | | | | | | | | | | | | | | | |
| **For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | | | | | | | |
| ES-1 | 16.37 | 100 | 0 | 0 | 2 | 16.37 | 2 | 65 | 0 | 0 | 40 | 0 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 2 |
| ES-2 | 46.05 | 100 | 0 | 0 | 2 | 46.05 | 2 | 65 | 0 | 0 | 40 | 0 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 2 |
| ES-3 | 64.3 | 100 | 0 | 0 | 2 | 64.3 | 2 | 65 | 0 | 0 | 40 | 0 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 2 |
| ES-4 | 2.68 | 100 | 0 | 0 | 2 | 2.68 | 2 | 65 | 0 | 0 | 40 | 0 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 2 |
| ES-5 | 26.15 | 100 | 0 | 0 | 2 | 26.15 | 2 | 65 | 0 | 0 | 40 | 0 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 2 |
| ES-6 | 31.26 | 100 | 0 | 0 | 2 | 31.26 | 2 | 65 | 0 | 0 | 40 | 0 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 2 |
| **INTERIM** | | | | | | | | | | | | | | | | | | | | | | | |
| **For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | | | | | | | |
| A-1 | 2.29 | 100 | 0.00 | 0.0 | 2 | 2.29 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| A-2 | 3.96 | 100 | 0.00 | 0.0 | 2 | 3.96 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| EA-1 | 2.50 | 100 | 0.00 | 0.0 | 2 | 2.50 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-A1 | 10.67 | 100 | 0.00 | 0.0 | 2 | 10.67 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-A2 | 4.56 | 100 | 0.00 | 0.0 | 2 | 4.56 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-A3 | 13.72 | 100 | 0.00 | 0.0 | 2 | 13.72 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-B1 | 14.03 | 100 | 0.00 | 0.0 | 2 | 14.03 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-B2 | 14.48 | 100 | 0.00 | 0.0 | 2 | 14.48 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-C1 | 11.26 | 100 | 0.00 | 0.0 | 2 | 11.26 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-C2 | 11.92 | 100 | 0.00 | 0.0 | 2 | 11.92 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-C3 | 15.29 | 100 | 0.00 | 0.0 | 2 | 15.29 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-D1 | 10.09 | 100 | 0.00 | 0.0 | 2 | 10.09 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-E1 | 8.21 | 100 | 0.00 | 0.0 | 2 | 8.21 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |
| TSB-E2 | 13.57 | 100 | 0.00 | 0.0 | 2 | 13.57 | 2.0 | 65.0 | 0.00 | 0.0 | 40 | 0.00 | 0.0 | 30 | 0.00 | 0.0 | 25 | 0.00 | 0.0 | 20 | 0.00 | 0.0 | 2.0 |

| *Lot Type Identification:* | |
|---|---|
| *Lot Size (SF)* | *Lot Size (Acre)* |
| 0 - 8,167 | 1/8 Acre |
| 8,168 - 12,704 | 1/4 Acre |
| 12,705 - 18,149 | 1/3 Acre |
| 18,150 - 32,670 | 1/2 Acre |
| 32,671 - 43,560 | 1 Acre |

**NOTES:**
*% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)*

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: EXISTING & INTERIM

**Subdivision:** Grandview Reserve
**Location:** CO, El Paso County

**Project Name:** Grandview Subdivision PDR - Interim Conditions
**Project No.:** HRG01
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 12/21/23

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin ID | Total Area (ac) | Paved/Gravel Roads | | | Lawns/Undeveloped | | | Roofs | | | Residential - 1/8 Acre | | | Residential - 1/4 Acre | | | Residential - 1/3 Acre | | | Residential - 1/2 Acre | | | Residential - 1 Acre | | | Composite $C_5$ | Composite $C_{100}$ |
| | | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | | |
| **EXISTING** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ES-1 | 16.37 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 16.37 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| ES-2 | 46.05 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 46.05 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| ES-3 | 64.30 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 64.30 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| ES-4 | 2.68 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 2.68 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| ES-5 | 26.15 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 26.15 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| ES-6 | 31.26 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 31.26 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| **INTERIM** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A-1 | 2.29 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 2.29 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| A-2 | 3.96 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 3.96 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| EA-1 | 2.50 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 2.50 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-A1 | 10.67 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 10.67 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-A2 | 4.56 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 4.56 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-A3 | 13.72 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 13.72 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-B1 | 14.03 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 14.03 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-B2 | 14.48 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 14.48 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-C1 | 11.26 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 11.26 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-C2 | 11.92 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 11.92 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-C3 | 15.29 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 15.29 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-D1 | 10.09 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 10.09 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-E1 | 8.21 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 8.21 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |
| TSB-E2 | 13.57 | 0.90 | 0.96 | 0.00 | 0.09 | 0.36 | 13.57 | 0.73 | 0.81 | 0.00 | 0.45 | 0.59 | 0.00 | 0.30 | 0.50 | 0.00 | 0.25 | 0.47 | 0.00 | 0.22 | 0.46 | 0.00 | 0.20 | 0.44 | 0.00 | 0.09 | 0.36 |

| *Lot Type Identification:* | |
|---|---|
| *Lot Size (SF)* | *Lot Size (Acre)* |
| 0 - 8,167 | </= 1/8 Acre |
| 8,168 - 12,704 | 1/4 Acre |
| 12,705 - 18,149 | 1/3 Acre |
| 18,150 - 32,670 | 1/2 Acre |
| 32,671 - 43,560 | 1 Acre |

**NOTES:**
*C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)*
*Coeffficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map*

# STANDARD FORM SF-2: EXISTING & INTERIM
# TIME OF CONCENTRATION

**Subdivision:** Grandview Reserve
**Location:** CO, El Paso County

**Project Name:** Grandview Subdivision PDR - Interim Conditions
**Project No.:** HRG01
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 12/21/23

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SUB-BASIN DATA** | | | | | | **INITIAL/OVERLAND ($T_i$)** | | | **TRAVEL TIME ($T_t$)** | | | | | **Tc CHECK ($T_c$)** | | | **FINAL** |
| **BASIN ID** | **D.A. (AC)** | **Hydrologic Soils Group** | **Impervious (%)** | **$C_5$** | **$C_{100}$** | **L (FT)** | **S (%)** | **$T_i$ (MIN)** | **L (FT)** | **S (%)** | **Cv** | **VEL. (FPS)** | **$T_t$ (MIN)** | **COMP. $T_c$ (MIN)** | **TOTAL LENGTH(FT)** | **Calculated $T_c$ (MIN)** | **$T_c$ (MIN)** |
| **EXISTING** | | | | | | | | | | | | | | | | | |
| **For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | |
| ES-1 | 16.37 | A | 2.0 | 0.09 | 0.36 | 300 | 3.3 | 21.6 | 1433 | 2.5 | 15 | 2.4 | 10.0 | 31.6 | 1732.7 | 19.6 | 31.6 |
| ES-2 | 46.05 | A | 2.0 | 0.09 | 0.36 | 300 | 2.5 | 23.6 | 3127 | 2.0 | 15 | 2.1 | 24.7 | 48.3 | 3427.0 | 29.0 | 48.3 |
| ES-3 | 64.30 | A | 2.0 | 0.09 | 0.36 | 300 | 3.2 | 21.7 | 3964 | 2.1 | 15 | 2.2 | 30.4 | 52.1 | 4263.6 | 33.7 | 52.1 |
| ES-4 | 2.68 | A | 2.0 | 0.09 | 0.36 | 300 | 2.5 | 23.8 | 462 | 2.4 | 15 | 2.3 | 3.3 | 27.1 | 762.3 | 14.2 | 27.1 |
| ES-5 | 26.15 | A | 2.0 | 0.09 | 0.36 | 300 | 3.1 | 22.1 | 2121 | 2.3 | 15 | 2.3 | 15.6 | 37.7 | 2420.8 | 23.4 | 37.7 |
| ES-6 | 31.26 | A | 2.0 | 0.09 | 0.36 | 300 | 3.6 | 20.9 | 1488 | 2.1 | 15 | 2.2 | 11.4 | 32.3 | 1788.5 | 19.9 | 32.3 |
| **INTERIM** | | | | | | | | | | | | | | | | | |
| **For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | |
| A-1 | 2.29 | A | 2.0 | 0.09 | 0.36 | 40 | 2.0 | 9.3 | 927 | 2.9 | 10 | 1.7 | 9.1 | 18.4 | 967.0 | 15.4 | 15.4 |
| A-2 | 3.96 | A | 2.0 | 0.09 | 0.36 | 56 | 2.0 | 11.0 | 828 | 2.5 | 10 | 1.6 | 8.7 | 19.7 | 884.0 | 14.9 | 14.9 |
| EA-1 | 2.50 | A | 2.0 | 0.09 | 0.36 | 160 | 5.0 | 13.7 | 1254 | 0.5 | 10 | 0.7 | 29.6 | 43.2 | 1414.0 | 17.9 | 17.9 |
| TSB-A1 | 10.67 | A | 2.0 | 0.09 | 0.36 | 136 | 2.0 | 17.1 | 865 | 3.0 | 10 | 1.7 | 8.4 | 25.5 | 1001.0 | 15.6 | 15.6 |
| TSB-A2 | 4.56 | A | 2.0 | 0.09 | 0.36 | 163 | 2.0 | 18.7 | 749 | 3.8 | 10 | 1.9 | 6.4 | 25.1 | 912.0 | 15.1 | 15.1 |
| TSB-A3 | 13.72 | A | 2.0 | 0.09 | 0.36 | 159 | 2.0 | 18.5 | 1220 | 2.3 | 10 | 1.5 | 13.4 | 31.9 | 1379.0 | 17.7 | 17.7 |
| TSB-B1 | 14.03 | A | 2.0 | 0.09 | 0.36 | 212 | 2.0 | 21.4 | 1035 | 3.2 | 10 | 1.8 | 9.6 | 31.0 | 1247.0 | 16.9 | 16.9 |
| TSB-B2 | 14.48 | A | 2.0 | 0.09 | 0.36 | 60 | 2.0 | 11.4 | 1245 | 2.8 | 10 | 1.7 | 12.4 | 23.7 | 1305.0 | 17.3 | 17.3 |
| TSB-C1 | 11.26 | A | 2.0 | 0.09 | 0.36 | 300 | 2.0 | 25.4 | 1105 | 2.0 | 10 | 1.4 | 12.9 | 38.3 | 1405.0 | 17.8 | 17.8 |
| TSB-C2 | 11.92 | A | 2.0 | 0.09 | 0.36 | 50 | 2.0 | 10.4 | 1151 | 3.1 | 10 | 1.8 | 10.9 | 21.3 | 1201.0 | 16.7 | 16.7 |
| TSB-C3 | 15.29 | A | 2.0 | 0.09 | 0.36 | 181 | 2.0 | 19.7 | 1745 | 2.6 | 10 | 1.6 | 18.2 | 38.0 | 1926.0 | 20.7 | 20.7 |
| TSB-D1 | 10.09 | A | 2.0 | 0.09 | 0.36 | 155 | 2.0 | 18.3 | 1450 | 2.0 | 10 | 1.4 | 17.1 | 35.4 | 1605.0 | 18.9 | 18.9 |
| TSB-E1 | 8.21 | A | 2.0 | 0.09 | 0.36 | 150 | 2.0 | 18.0 | 842 | 4.1 | 10 | 2.0 | 6.9 | 24.9 | 992.0 | 15.5 | 15.5 |
| TSB-E2 | 13.57 | A | 2.0 | 0.09 | 0.36 | 300 | 2.0 | 25.4 | 989 | 2.0 | 10 | 1.4 | 11.7 | 37.1 | 1289.0 | 17.2 | 17.2 |

**NOTES:**

$T_i = (0.395*(1.1 - C_5)*(L)^{0.5})/((S)^{0.33})$, S in ft/ft

$T_t$=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum $T_c$ of 5.0 minutes is required.

For non-urbanized basins a minimum $T_c$ of 10.0 minutes is required

# STANDARD FORM SF-3: EXISTING & INTERIM
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** Grandview Reserve
**Location:** CO, El Paso County
**Design Storm:** 5-Year

**Project Name:** Grandview Subdivision PDR - Interim Conditions
**Project No.:** HRG01
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 12/21/23

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| **EXISTING** | | | | | | | | | | | | | | | | | | | | | |
| | 1 | **EX1** | **321.53** | | | | | **28.3** | | | | **28.3** | | | | | | | | | ****SEE NOTE** |
| | 2 | **EX2** | **18.88** | | | | | **1.7** | | | | **1.7** | | | | | | | | | ****SEE NOTE** |
| | **3** | **EX3** | **131.26** | | | | | **6.1** | | | | **6.1** | | | | | | | | | ****SEE NOTE** |
| | **4** | **EX4** | **832.70** | | | | | **22.4** | | | | **22.4** | | | | | | | | | ****SEE NOTE** |
| | **5** | **EX5** | **22.35** | | | | | **7.0** | | | | **7.0** | | | | | | | | | ****SEE NOTE** |
| | **6** | **EX6** | **3.05** | | | | | **1.2** | | | | **1.2** | | | | | | | | | ****SEE NOTE** |
| | **7** | **EX7** | **1.47** | | | | | **0.9** | | | | **0.9** | | | | | | | | | ****SEE NOTE** |
| | X1 | ES-1 | 16.37 | 0.09 | 31.6 | 1.47 | 2.35 | 3.5 | | | | 4.7 | | | | | | | | | Sheet flow to Channel A<br>Total Flow from DP 6 & Basin ES-1 |
| | X2 | ES-2 | 46.05 | 0.09 | 48.3 | 4.14 | 1.82 | 7.5 | | | | 36.9 | | | | | | | | | Sheet flow to Channel A<br>Total Flow from DP 4, DP 5 & Basin ES-2 |
| | X3 | ES-3 | 64.30 | 0.09 | 52.1 | 5.79 | 1.73 | 10.0 | | | | 10.0 | | | | | | | | | Sheet flow offsite - outfalls to Channel B |
| | X4 | ES-4 | 2.68 | 0.09 | 27.1 | 0.24 | 2.57 | 0.6 | | | | 0.6 | | | | | | | | | Sheet flow offsite - outfalls to Channel B |
| | X5 | ES-5 | 26.15 | 0.09 | 37.7 | 2.35 | 2.12 | 5.0 | | | | 5.0 | | | | | | | | | Sheet flow offsite - outfalls to Channel B |
| | X6 | ES-6 | 31.26 | 0.09 | 32.3 | 2.81 | 2.32 | 6.5 | | | | 40.9 | | | | | | | | | Sheet flow offsite - outfalls to Channel B<br>Total Flow from DP 1, DP 3 & ES-6 |
| | X7 | | | | | | | | | | | 56.5 | | | | | | | | | Total Existing Flow offsite - outfalls to Channel B |
| ****For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | | | | | |
| **INTERIM** | | | | | | | | | | | | | | | | | | | | | |
| | 8 | A-1 | 2.29 | 0.09 | 15.4 | 0.21 | 3.42 | 0.7 | | | | 0.7 | | | | | | | | | Flows offsite through Pr. Swale A-1 |
| | 9 | TSB-A1 | 10.67 | 0.09 | 15.6 | 0.96 | 3.40 | 3.3 | | | | 3.3 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 10 | A-2 | 3.96 | 0.09 | 14.9 | 0.36 | 3.47 | 1.2 | | | | 10.6 | | | | | | | | | Flows offsite through Pr. Swale A-2<br>Combined flow of Basin A-2, DP 3 & DP 9 |
| | 11 | TSB-A2 | 4.56 | 0.09 | 15.1 | 0.41 | 3.46 | 1.4 | | | | 1.4 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 12 | TSB-A3 | 13.72 | 0.09 | 17.7 | 1.23 | 3.21 | 3.9 | | | | 5.4 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-A3 & DP 11 |
| | 13 | TSB-B1 | 14.03 | 0.09 | 16.9 | 1.26 | 3.27 | 4.1 | | | | 4.1 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 14 | TSB-B2 | 14.48 | 0.09 | 17.3 | 1.30 | 3.24 | 4.2 | | | | 8.3 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-B2 & DP13 |
| | 15 | TSB-C1 | 11.26 | 0.09 | 17.8 | 1.01 | 3.19 | 3.2 | | | | 3.2 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 16 | TSB-C2 | 11.92 | 0.09 | 16.7 | 1.07 | 3.30 | 3.5 | | | | 3.5 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 17 | TSB-C3 | 15.29 | 0.09 | 20.7 | 1.38 | 2.96 | 4.1 | | | | 7.3 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-C3 & DP 15 |
| | 18 | TSB-D1 | 10.09 | 0.09 | 18.9 | 0.91 | 3.10 | 2.8 | | | | 2.8 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 19 | TSB-E1 | 8.21 | 0.09 | 15.5 | 0.74 | 3.41 | 2.5 | | | | 2.5 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 20 | TSB-E2 | 13.57 | 0.09 | 17.2 | 1.22 | 3.25 | 4.0 | | | | 6.5 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-E2 & DP 19 |
| | 21 | EA-1 | 2.50 | 0.09 | 17.9 | 0.23 | 3.19 | 0.7 | | | | 8.9 | | | | | | | | | Existing Eastonville Road<br>Combined flow of Basin EA-1, DP 5 & DP 6 |

# STANDARD FORM SF-3: EXISTING & INTERIM

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

**Project Name:** Grandview Subdivision PDR - Interim Conditions
**Subdivision:** Grandview Reserve
**Project No.:** HRG01
**Location:** CO, El Paso County
**Calculated By:** TJE
**Design Storm:** 100-Year
**Checked By:** BAS
**Date:** 12/21/23

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| **EXISTING** | | | | | | | | | | | | | | | | | | | | | |
| | 1 | **EX1** | **321.53** | | | | | **365.2** | | | | **365.2** | | | | | | | | | ****SEE NOTE** |
| | 2 | **EX2** | **18.88** | | | | | **18.8** | | | | **18.8** | | | | | | | | | ****SEE NOTE** |
| | 3 | **EX3** | **131.26** | | | | | **112.1** | | | | **112.1** | | | | | | | | | ****SEE NOTE** |
| | 4 | **EX4** | **832.70** | | | | | **491.0** | | | | **491.0** | | | | | | | | | ****SEE NOTE** |
| | 5 | **EX5** | **22.35** | | | | | **43.3** | | | | **43.3** | | | | | | | | | ****SEE NOTE** |
| | 6 | **EX6** | **3.05** | | | | | **6.9** | | | | **6.9** | | | | | | | | | ****SEE NOTE** |
| | 7 | **EX7** | **1.47** | | | | | **4.2** | | | | **4.2** | | | | | | | | | ****SEE NOTE** |
| | X1 | ES-1 | 16.37 | 0.36 | 31.6 | 5.89 | 4.19 | 24.7 | | | | 31.6 | | | | | | | | | Sheet flow to Channel A<br>Total Flow from DP 6 & Basin ES-1 |
| | X2 | ES-2 | 46.05 | 0.36 | 48.3 | 16.58 | 3.24 | 53.7 | | | | 588.0 | | | | | | | | | Sheet flow to Channel A<br>Total Flow from DP 4, DP 5 & Basin ES-2 |
| | X3 | ES-3 | 64.30 | 0.36 | 52.1 | 23.15 | 3.09 | 71.5 | | | | 71.5 | | | | | | | | | Sheet flow offsite - outfalls to Channel B |
| | X4 | ES-4 | 2.68 | 0.36 | 27.1 | 0.96 | 4.57 | 4.4 | | | | 4.4 | | | | | | | | | Sheet flow offsite - outfalls to Channel B |
| | X5 | ES-5 | 26.15 | 0.36 | 37.7 | 9.41 | 3.77 | 35.5 | | | | 35.5 | | | | | | | | | Sheet flow offsite - outfalls to Channel B |
| | X6 | ES-6 | 31.26 | 0.36 | 32.3 | 11.25 | 4.13 | 46.5 | | | | 523.8 | | | | | | | | | Sheet flow offsite - outfalls to Channel B<br>Total Flow from DP 1, DP 3 & ES-6 |
| | X7 | | | | | | | | | | | 635.2 | | | | | | | | | Total Existing Flow offsite - outfalls to Channel B |
| ****For Existing Western Offsite Sub-basin analysis, see Rational Calcs Included, from titled "Eastonville Road Preliminary Drainage Report", by HR Green, September 2023** | | | | | | | | | | | | | | | | | | | | | |
| **INTERIM** | | | | | | | | | | | | | | | | | | | | | |
| | 8 | A-1 | 2.29 | 0.36 | 15.4 | 0.82 | 6.09 | 5.0 | | | | 5.0 | | | | | | | | | Flows offsite through Pr. Swale A-1 |
| | 9 | TSB-A1 | 10.67 | 0.36 | 15.6 | 3.84 | 6.06 | 23.3 | | | | 23.3 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 10 | A-2 | 3.96 | 0.36 | 14.9 | 1.43 | 6.18 | 8.8 | | | | 144.2 | | | | | | | | | Flows offsite through Pr. Swale A-2<br>Combined flow of Basin A-2, DP 3 & DP 9 |
| | 11 | TSB-A2 | 4.56 | 0.36 | 15.1 | 1.64 | 6.15 | 10.1 | | | | 10.1 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 12 | TSB-A3 | 13.72 | 0.36 | 17.7 | 4.94 | 5.71 | 28.2 | | | | 38.3 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-A3 & DP 11 |
| | 13 | TSB-B1 | 14.03 | 0.36 | 16.9 | 5.05 | 5.82 | 29.4 | | | | 29.4 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 14 | TSB-B2 | 14.48 | 0.36 | 17.3 | 5.21 | 5.77 | 30.1 | | | | 59.5 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-B2 & DP13 |
| | 15 | TSB-C1 | 11.26 | 0.36 | 17.8 | 4.05 | 5.68 | 23.0 | | | | 23.0 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 16 | TSB-C2 | 11.92 | 0.36 | 16.7 | 4.29 | 5.87 | 25.2 | | | | 25.2 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 17 | TSB-C3 | 15.29 | 0.36 | 20.7 | 5.50 | 5.27 | 29.0 | | | | 52.0 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-C3 & DP 15 |
| | 18 | TSB-D1 | 10.09 | 0.36 | 18.9 | 3.63 | 5.52 | 20.0 | | | | 20.0 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 19 | TSB-E1 | 8.21 | 0.36 | 15.5 | 2.96 | 6.07 | 18.0 | | | | 18.0 | | | | | | | | | Residential Undeveloped-Overland Graded |
| | 20 | TSB-E2 | 13.57 | 0.36 | 17.2 | 4.89 | 5.79 | 28.3 | | | | 46.3 | | | | | | | | | Residential Undeveloped-Overland Graded<br>Combined flow of Basin TSB-E2 & DP 19 |
| | 21 | EA-1 | 2.50 | 0.36 | 17.9 | 0.90 | 5.68 | 5.1 | | | | 55.3 | | | | | | | | | Existing Eastonville Road<br>Combined flow of Basin EA-1, DP 5 & DP 6 |

## COMPOSITE % IMPERVIOUS CALCULATIONS

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| | | Paved Roads | | | Lawns / Undeveloped | | | Residential - 1/8 Acre | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin ID | Total Area (ac) | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | Basins Total Weighted % Imp. |
| D-1 | 2.73 | 100 | | 0.0 | 2 | 0.80 | 0.6 | 65 | 1.93 | 46.0 | 46.6 |
| D-2 | 0.57 | 100 | | 0.0 | 2 | | 0.0 | 65 | 0.57 | 65.0 | 65.0 |
| D-3 | 4.33 | 100 | | 0.0 | 2 | 0.36 | 0.2 | 65 | 3.97 | 59.6 | 59.8 |
| D-4 | 3.65 | 100 | 0.11 | 3.0 | 2 | 0.48 | 0.3 | 65 | 3.06 | 54.5 | 57.8 |
| D-5 | 1.59 | 100 | | 0.0 | 2 | 1.07 | 1.3 | 65 | 0.52 | 21.3 | 22.6 |
| D-6 | 0.92 | 100 | | 0.0 | 2 | 0.75 | 1.6 | 65 | 0.17 | 12.0 | 13.6 |
| E-1 | 4.47 | 100 | 0.21 | 4.7 | 2 | 1.72 | 0.8 | 65 | 2.54 | 36.9 | 42.4 |
| E-2 | 1.94 | 100 | | 0.0 | 2 | | 0.0 | 65 | 1.94 | 65.0 | 65.0 |
| E-3a | 2.90 | 100 | | 0.0 | 2 | | 0.0 | 65 | 2.90 | 65.0 | 65.0 |
| E-3b | 2.12 | 100 | | 0.0 | 2 | | 0.0 | 65 | 2.12 | 65.0 | 65.0 |
| E-4a | 7.45 | 100 | | 0.0 | 2 | 1.92 | 0.5 | 65 | 5.53 | 48.2 | 48.7 |
| E-4b | 1.00 | 100 | | 0.0 | 2 | | 0.0 | 65 | 1.00 | 65.0 | 65.0 |
| E-5 | 1.43 | 100 | | 0.0 | 2 | 1.18 | 1.7 | 65 | 0.25 | 11.4 | 13.1 |
| E-6 | 2.40 | 100 | 0.25 | 10.4 | 2 | 2.00 | 1.7 | 65 | 0.15 | 4.1 | 16.2 |



Galloway

## STANDARD FORM SF-2
## TIME OF CONCENTRATION

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| SUB-BASIN DATA | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | Tc CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN ID | D.A. (AC) | Hydrologic Soils Group | Impervious (%) | $C_{100}$ | $C_5$ | L (FT) | S (%) | $T_i$ (MIN) | L (FT) | S (%) | Cv | VEL. (FPS) | $T_t$ (MIN) | COMP. $T_c$ (MIN) | TOTAL LENGTH (FT) | Urbanized $T_c$ (MIN) | $T_c$ (MIN) |
| D-1 | 2.73 | A | 46.6 | 0.47 | 0.32 | 64 | 4.8 | 6.8 | 425 | 2.2 | 20.0 | 3.0 | 2.4 | 9.2 | 489.0 | 12.7 | 9.2 |
| D-2 | 0.57 | A | 65.0 | 0.62 | 0.50 | 18 | 2.0 | 3.7 | 313 | 1.0 | 20.0 | 2.0 | 2.6 | 6.3 | 331.0 | 11.8 | 6.3 |
| D-3 | 4.33 | A | 59.8 | 0.58 | 0.45 | 25 | 2.0 | 4.7 | 522 | 1.5 | 20.0 | 2.4 | 3.6 | 8.3 | 547.0 | 13.0 | 8.3 |
| D-4 | 3.65 | A | 57.8 | 0.56 | 0.43 | 70 | 4.0 | 6.5 | 679 | 1.5 | 20.0 | 2.4 | 4.6 | 11.1 | 749.0 | 14.2 | 11.1 |
| D-5 | 1.59 | A | 22.6 | 0.29 | 0.13 | 72 | 25.0 | 5.2 | 238 | 0.5 | 20.0 | 1.4 | 2.8 | 8.0 | 310.0 | 11.7 | 8.0 |
| D-6 | 0.92 | A | 13.6 | 0.22 | 0.07 | 40 | 33.3 | 3.7 | | | | 0.0 | 0.0 | 3.7 | 40.0 | 10.2 | 5.0 |
| E-1 | 4.47 | A | 42.4 | 0.44 | 0.29 | 55 | 3.0 | 7.6 | 804 | 3.0 | 20.0 | 3.5 | 3.9 | 11.5 | 859.0 | 14.8 | 11.5 |
| E-2 | 1.94 | A | 65.0 | 0.62 | 0.50 | 31 | 2.0 | 4.9 | 346 | 3.0 | 20.0 | 3.5 | 1.7 | 6.5 | 377.0 | 12.1 | 6.5 |
| E-3a | 2.90 | A | 65.0 | 0.62 | 0.50 | 55 | 4.0 | 5.1 | 644 | 1.5 | 20.0 | 2.4 | 4.4 | 9.5 | 699.0 | 13.9 | 9.5 |
| E-3b | 2.12 | A | 65.0 | 0.62 | 0.50 | 55 | 4.0 | 5.1 | 248 | 1.0 | 20.0 | 2.0 | 2.1 | 7.2 | 303.0 | 11.7 | 7.2 |
| E-4a | 7.45 | A | 48.7 | 0.49 | 0.34 | 55 | 4.0 | 6.5 | 813 | 1.5 | 20.0 | 2.4 | 5.5 | 12.0 | 868.0 | 14.8 | 12.0 |
| E-4b | 1.00 | A | 65.0 | 0.62 | 0.50 | 55 | 4.0 | 5.1 | 248 | 1.0 | 20.0 | 2.0 | 2.1 | 7.2 | 303.0 | 11.7 | 7.2 |
| E-5 | 1.43 | A | 13.1 | 0.21 | 0.06 | 75 | 15.0 | 6.7 | 318 | 0.5 | 20.0 | 1.4 | 3.7 | 10.4 | 393.0 | 12.2 | 10.4 |
| E-6 | 2.40 | A | 16.2 | 0.24 | 0.08 | 50 | 33.3 | 4.1 | | | | 0.0 | 0.0 | 4.1 | 50.0 | 10.3 | 5.0 |

**NOTES:**

$T_i$ = (0.395*(1.1 - $C_5$)*(L)^0.5)/((S)^0.33), S in ft/ft

$T_t$=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum $T_c$ of 5.0 minutes is required.

For non-urbanized basins a minimum $T_c$ of 10.0 minutes is required



Galloway

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

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)
**Design Storm:** 5-Year

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| STREET | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| | D1 | D-1 | 2.73 | 0.32 | 9.2 | 0.87 | 3.03 | 2.6 | | | | | | | 2.6 | | | | | | CDOT TYPE 'R' INLET (SUMP) |
| | D2 | D-2 | 0.57 | 0.50 | 6.3 | 0.29 | 3.46 | 1.0 | | | | | | | 1.0 | | | | | | CDOT TYPE 'R' INLET (SUMP) |
| | D3 | | | | | | | | | | | | | | 3.6 | | | | | | DP D1 + D2 |
| | D4 | D-3 | 4.33 | 0.45 | 8.3 | 1.95 | 3.15 | 6.1 | | | | | | | 6.1 | | | | | | CDOT TYPE 'R' INLET (SUMP) |
| | D5 | | | | | | | | | | | | | | 9.8 | | | | | | DP D3 + D4 |
| | D6 | D-4 | 3.65 | 0.43 | 11.1 | 1.57 | 2.80 | 4.4 | | | | | | | 14.2 | | | | | | CDOT TYPE 'R' INLET (SUMP) -> BASIN D-4 + DP D5 |
| | D7 | D-5 | 1.59 | 0.13 | 8.0 | 0.21 | 3.19 | 0.7 | | | | | | | 14.8 | | | | | | TOTAL FLOW ENTERING POND D |
| | D8 | | | | | | | | | | | | | | 0.2 | | | | | | DISCHARGE FROM POND D (MHFD - DETENTION) |
| | | D-6 | 0.92 | 0.07 | 5.0 | 0.06 | 3.70 | 0.2 | | | | | | | | | | | | | FLOWS OFF SITE TO CHANNEL B |
| | | | | | | | | | | | | | | | | | | | | | |
| | E1 | E-1 | 4.47 | 0.29 | 11.5 | 1.30 | 2.75 | 3.6 | | | | | 3.0 | 0.0 | 3.6 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE) Qcap=3.6 cfs, Qco=0 cfs to DP E4 |
| | E2 | E-2 | 1.94 | 0.50 | 6.5 | 0.97 | 3.42 | 3.3 | | | | | 3.0 | 0.0 | 3.3 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE) Qcap=3.3 cfs, Qco=0 cfs to DP E4 |
| | E3 | | | | | | | | | | | | | | 6.9 | | | | | | DP E1 + E2 |
| | E4 | E-3a | 2.9 | 0.50 | 9.5 | 1.45 | 2.98 | 4.3 | | | | | 1.5 | 0.0 | 4.3 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE) Qcap=4.3 cfs, Qco=0 cfs to DP E7 |
| | E5 | E-4a | 7.45 | 0.34 | 12.0 | 2.53 | 2.70 | 6.8 | | | | | 1.5 | 0.2 | 6.6 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE) Qcap=6.6 cfs, Qco=0.2 cfs to DP E9 |
| | E6 | | | | | | | | | | | | | | 17.8 | | | | | | DP E3 + E4 + E5 |
| | E7 | E-3b | 2.12 | 0.50 | 7.2 | 1.06 | 3.31 | 3.5 | | | | | | | 3.5 | | | | | | CDOT TYPE 'R' INLET (SUMP) |
| | E8 | | | | | | | | | | | | | | 21.3 | | | | | | DP E6 + E7 |
| | E9 | E-4b | 1.00 | 0.50 | 7.2 | 0.50 | 3.31 | 1.7 | 12.0 | 0.59 | 2.70 | 1.7 | | | 1.7 | | | | | | CDOT TYPE 'R' INLET (SUMP) -> BASIN E-4b + DP E8 |
| | E10 | E-5 | 1.43 | 0.06 | 10.4 | 0.09 | 2.87 | 0.3 | | | | | | | 2.0 | | | | | | TOTAL FLOW ENTERING POND E |
| | E11 | | | | | | | | | | | | | | 0.4 | | | | | | DISCHARGE FROM POND E (MHFD - DETENTION) |
| | | E-6 | 2.40 | 0.08 | 5.0 | 0.19 | 3.70 | 0.7 | | | | | | | | | | | | | FLOWS OFF SITE TO CHANNEL B |


Galloway

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

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)
**Design Storm:** 100-Year

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | D1 | D-1 | 2.73 | 0.47 | 9.2 | 1.28 | 6.23 | 8.0 | | | | | | | 5.3 | | | | | | FLOWS OVERTOP CROWN -> Q=(8.0+2.5)/2=5.3 CFS<br>CDOT TYPE 'R' INLET (SUMP) |
| | D2 | D-2 | 0.57 | 0.62 | 6.3 | 0.35 | 7.11 | 2.5 | | | | | | | 5.3 | | | | | | FLOWS OVERTOP CROWN -> Q=(8.0+2.5)/2=5.3 CFS<br>CDOT TYPE 'R' INLET (SUMP) |
| | D3 | | | | | | | | | | | | | | 10.5 | | | | | | DP D1 + D2 |
| | D4 | D-3 | 4.33 | 0.58 | 8.3 | 2.51 | 6.48 | 16.3 | | | | | | | 14.1 | | | | | | FLOWS OVERTOP CROWN -> Q=(16.3+11.8)/2=14.1 CFS<br>CDOT TYPE 'R' INLET (SUMP) |
| | D5 | | | | | | | | | | | | | | 24.6 | | | | | | DP D3 + D4 |
| | D6 | D-4 | 3.65 | 0.56 | 11.1 | 2.04 | 5.76 | 11.8 | | | | | | | 25.8 | | | | | | FLOWS OVERTOP CROWN -> Q=(16.3+11.8)/2=14.1 CFS<br>CDOT TYPE 'R' INLET (SUMP) -> BASIN D-4 + DP D5 |
| | D7 | D-5 | 1.59 | 0.29 | 8.0 | 0.46 | 6.57 | 3.0 | | | | | | | 28.8 | | | | | | TOTAL FLOW ENTERING POND D |
| | D8 | | | | | | | | | | | | | | 8.0 | | | | | | DISCHARGE FROM POND D (MHFD - DETENTION) |
| | | D-6 | 0.92 | 0.22 | 5.0 | 0.20 | 7.62 | 1.5 | | | | | | | | | | | | | FLOWS OFF SITE TO CHANNEL B |
| | | | | | | | | | | | | | | | | | | | | | |
| | E1 | E-1 | 4.47 | 0.44 | 11.5 | 1.97 | 5.66 | 11.2 | | | | | 3.0 | 1.9 | 9.3 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE)<br>Qcap=9.3 cfs, Qco=1.9 cfs to DP E4 |
| | E2 | E-2 | 1.94 | 0.62 | 6.5 | 1.20 | 7.04 | 8.4 | | | | | 3.0 | 0.6 | 7.8 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE)<br>Qcap=7.8 cfs, Qco=0.6 cfs to DP E4 |
| | E3 | | | | | | | | | | | | | | 17.1 | | | | | | DP E1 + E2 |
| | E4 | E-3a | 2.9 | 0.62 | 9.5 | 1.80 | 6.13 | 11.0 | 11.5 | 2.22 | 5.66 | 12.6 | 1.5 | 5.1 | 11.7 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE)<br>Qcap=11.7 cfs, Qco=5.1 cfs to DP E7 |
| | E5 | E-4a | 7.45 | 0.49 | 12.0 | 3.65 | 5.55 | 20.3 | | | | 11.6 | 1.5 | 0.0 | 11.6 | | | | | | CDOT TYPE 'R' INLET (AT-GRADE)<br>Qcap=11.6 cfs, Qco=0 cfs to DP E9 |
| | E6 | | | | | | | | | | | | | | 40.4 | | | | | | DP E3 + E4 + E5 |
| | E7 | E-3b | 2.12 | 0.62 | 7.2 | 1.31 | 6.81 | 8.9 | 9.5 | 2.21 | 6.13 | 13.6 | | | 11.0 | | | | | | FLOWS OVERTOP CROWN -> Q=(13.5+8.5)/2=11.0 CFS<br>CDOT TYPE 'R' INLET (SUMP) |
| | E8 | | | | | | | | | | | | | | 51.4 | | | | | | DP E6 + E7 |
| | E9 | E-4b | 1 | 0.62 | 7.2 | 0.62 | 6.81 | 4.2 | 12.0 | 0.62 | 5.55 | 3.4 | | | 62.4 | | | | | | FLOWS OVERTOP CROWN -> Q=(13.5+8.5)/2=11.0 CFS<br>CDOT TYPE 'R' INLET (SUMP) -> BASIN E-4b + DP E8 |
| | E10 | E-5 | 1.43 | 0.21 | 10.4 | 0.30 | 5.91 | 1.8 | | | | | | | 64.2 | | | | | | TOTAL FLOW ENTERING POND E |
| | E11 | | | | | | | | | | | | | | 14.9 | | | | | | DISCHARGE FROM POND E (MHFD - DETENTION) |
| | | E-6 | 2.40 | 0.24 | 5.0 | 0.58 | 7.62 | 4.4 | | | | | | | | | | | | | FLOWS OFF SITE TO CHANNEL B |

# APPENDIX D

# Hydraulic Computations

*MHFD-Inlet, Version 5.03 (August 2023)*

# INLET MANAGEMENT

Worksheet Protected

| **INLET NAME** | Inlet D1 (Basin D-1) | Inlet D2 (Basin D-2) | Inlet D4 (Basin D-3) | Inlet D6 (Basin D-4) |
|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | In Sump | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

## USER-DEFINED INPUT

**User-Defined Design Flows**

| | | | | |
|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 2.6 | 1.0 | 6.1 | 4.4 |
| Major $Q_{Known}$ (cfs) | 5.3 | 5.3 | 14.1 | 14.1 |

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

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

**Watershed Characteristics**

| | | | | |
|---|---|---|---|---|
| Subcatchment Area (acres) | | | | |
| Percent Impervious | | | | |
| NRCS Soil Type | | | | |

**Watershed Profile**

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

**Minor Storm Rainfall Input**

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

**Major Storm Rainfall Input**

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

## CALCULATED OUTPUT

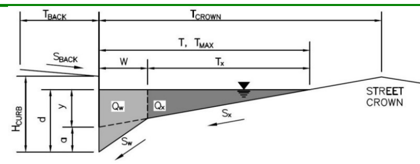
| | | | | |
|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **2.6** | **1.0** | **6.1** | **4.4** |
| **Major Total Design Peak Flow, Q (cfs)** | **5.3** | **5.3** | **14.1** | **14.1** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | N/A | N/A | N/A |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | N/A | N/A | N/A |

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

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

**Project: Grandview Reserve Filing No. 1**

**Inlet ID: Inlet D1 (Basin D-1)**




**Gutter Geometry:**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

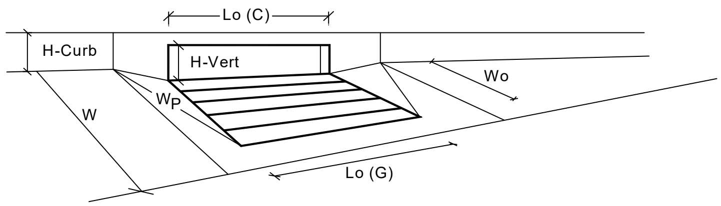
| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - ($W * S_x * 12$)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is not applicable to Sump Condition<br>MAJOR STORM Allowable Capacity is not applicable to Sump Condition | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 5.03 (August 2023)*




| Design Information (Input) — CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 7.7 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 0.83 | 0.83 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |

| Grate Flow Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | $Q_{Grate}$ = | **N/A** | **N/A** | **cfs** |

| Curb Opening Flow Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Clogging Coefficient for Multiple Units | Coef = | 1.00 | 1.00 | |
| Clogging Factor for Multiple Units | Clog = | 0.10 | 0.10 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 3.8 | 10.1 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 3.4 | 9.1 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 8.4 | 11.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 7.6 | 9.9 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 5.3 | 9.8 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 4.7 | 8.8 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | $Q_{Curb}$ = | **3.4** | **8.8** | **cfs** |

| Resultant Street Conditions | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Length | L = | 5.00 | 5.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.7 | 29.5 | ft. >T-Crown |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 3.2 | inches |

WATER FLOWS OVER CROWN IN 100-YR EVENT, BUT MEETS CRITERIA OF 0 FLOW OVER CROWN IN 5-YR EVENT

| Low Head Performance Reduction (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.57 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Interception Capacity (assumes clogged condition) | $Q_a$ = | **3.4** | **8.8** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 2.6 | 5.3 | cfs |

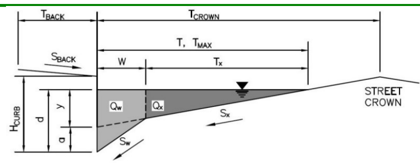
MHFD-Inlet, Version 5.03 (August 2023)

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

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

**Project: Grandview Reserve Filing No. 1**

**Inlet ID: Inlet D2 (Basin D-2)**




**Gutter Geometry:**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

**Maximum Capacity for 1/2 Street based On Allowable Spread**

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C - (W * S_x * 12)$) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

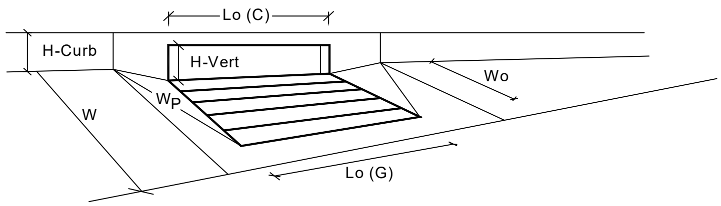
**Maximum Capacity for 1/2 Street based on Allowable Depth**

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\ TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$ | $Q_{X\ TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d - Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$ | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is not applicable to Sump Condition<br>MAJOR STORM Allowable Capacity is not applicable to Sump Condition | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 5.03 (August 2023)*



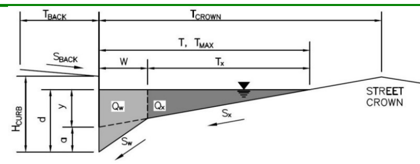

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| Design Information (Input) — CDOT Type R Curb Opening | | MINOR | MAJOR | |
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 7.7 | inches |
| Grate Information | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| Curb Opening Information | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 0.83 | 0.83 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| Grate Flow Analysis (Calculated) | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| Grate Capacity as a Weir (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| Grate Capacity as Mixed Flow | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| Curb Opening Flow Analysis (Calculated) | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.00 | 1.00 | |
| Clogging Factor for Multiple Units | Clog = | 0.10 | 0.10 | |
| Curb Capacity as a Weir (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 3.8 | 10.1 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 3.4 | 9.1 | cfs |
| Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 8.4 | 11.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 7.6 | 9.9 | cfs |
| Curb Opening Capacity as Mixed Flow | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 5.3 | 9.8 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 4.7 | 8.8 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **3.4** | **8.8** | **cfs** |
| Resultant Street Conditions | | MINOR | MAJOR | |
| Total Inlet Length | L = | 5.00 | 5.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.7 | 29.5 | ft. >T-Crown |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 3.2 | inches |
| Low Head Performance Reduction (Calculated) | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.57 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **3.4** | **8.8** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 1.0 | 5.3 | cfs |

WATER FLOWS OVER CROWN IN 100-YR EVENT, BUT MEETS CRITERIA OF 0 FLOW OVER CROWN IN 5-YR EVENT

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

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

**Project: Grandview Reserve Filing No. 1**
**Inlet ID: Inlet D4 (Basin D-3)**




**Gutter Geometry:**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

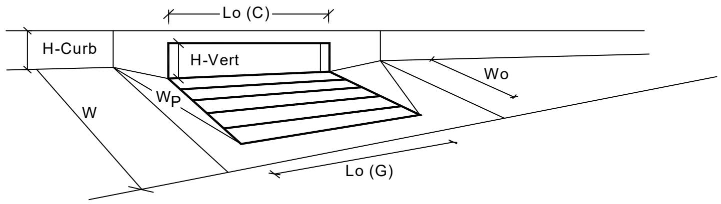
| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C - (W * S_x * 12)$) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d - Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is not applicable to Sump Condition<br>MAJOR STORM Allowable Capacity is not applicable to Sump Condition | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 5.03 (August 2023)*




| Design Information (Input) | CDOT Type R Curb Opening | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 7.7 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 15.00 | 15.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 0.83 | 0.83 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |

| Grate Flow Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | $Q_{Grate}$ = | **N/A** | **N/A** | **cfs** |

| Curb Opening Flow Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Clogging Coefficient for Multiple Units | Coef = | 1.31 | 1.31 | |
| Clogging Factor for Multiple Units | Clog = | 0.04 | 0.04 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 6.5 | 22.6 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 6.2 | 21.6 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 25.3 | 33.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 24.2 | 31.5 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 11.9 | 25.4 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 11.4 | 24.3 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | $Q_{Curb}$ = | **6.2** | **21.6** | **cfs** |

WATER FLOWS OVER CROWN IN 100-YR EVENT, BUT MEETS CRITERIA OF 0 FLOW OVER CROWN IN 5-YR EVENT

| Resultant Street Conditions | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Length | L = | 15.00 | 15.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.7 | 29.5 | ft. >T-Crown |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 3.2 | inches |

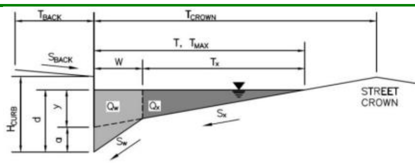
| Low Head Performance Reduction (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.57 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.67 | 0.88 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Interception Capacity (assumes clogged condition) | $Q_a$ = | **6.2** | **21.6** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 6.1 | 14.1 | cfs |

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

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

**Project: Grandview Reserve Filing No. 1**
**Inlet ID: Inlet D6 (Basin D-4)**




**Gutter Geometry:**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

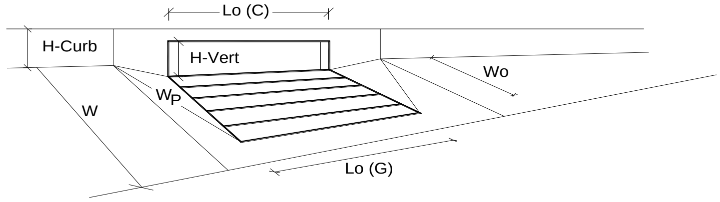
| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - ($W * S_x * 12$)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\ TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$ | $Q_{X\ TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is not applicable to Sump Condition<br>MAJOR STORM Allowable Capacity is not applicable to Sump Condition | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 5.03 (August 2023)*




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| Design Information (Input) — CDOT Type R Curb Opening | | | | |
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 7.7 | inches |
| Grate Information | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| Curb Opening Information | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 15.00 | 15.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 0.83 | 0.83 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| Grate Flow Analysis (Calculated) | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| Grate Capacity as a Weir (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| Grate Capacity as Mixed Flow | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| Curb Opening Flow Analysis (Calculated) | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.31 | 1.31 | |
| Clogging Factor for Multiple Units | Clog = | 0.04 | 0.04 | |
| Curb Capacity as a Weir (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 6.5 | 22.6 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 6.2 | 21.6 | cfs |
| Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study) | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 25.3 | 33.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 24.2 | 31.5 | cfs |
| Curb Opening Capacity as Mixed Flow | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 11.9 | 25.4 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 11.4 | 24.3 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **6.2** | **21.6** | **cfs** |
| Resultant Street Conditions | | MINOR | MAJOR | |
| Total Inlet Length | L = | 15.00 | 15.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.7 | 29.5 | ft. >T-Crown |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 3.2 | inches |
| Low Head Performance Reduction (Calculated) | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.57 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.67 | 0.88 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **6.2** | **21.6** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 4.4 | 14.1 | cfs |

WATER FLOWS OVER CROWN IN 100-YR EVENT, BUT MEETS CRITERIA OF 0 FLOW OVER CROWN IN 5-YR EVENT

*MHFD-Inlet, Version 5.03 (August 2023)*

# INLET MANAGEMENT

Worksheet Protected

| **INLET NAME** | Inlet E1 (Basin E-1) | Inlet E2 (Basin E-2) | Inlet E4 (Basin E-3a) | Inlet E5 (Basin E-4a) | Inlet E7 (Basin E-3b) | Inlet E9 (Basin E-4b) |
|---|---|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET | STREET | STREET |
| Hydraulic Condition | On Grade | On Grade | On Grade | On Grade | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

**USER-DEFINED INPUT**

**User-Defined Design Flows**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 3.6 | 3.3 | 4.3 | 6.8 | 3.5 | 1.7 |
| Major $Q_{Known}$ (cfs) | 11.2 | 8.4 | 11.0 | 20.3 | 8.9 | 4.2 |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | User-Defined | No Bypass Flow Received | User-Defined | User-Defined |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 2.5 | 0.0 | 3.1 | 7.4 |

**Watershed Characteristics**

| | | | | | | |
|---|---|---|---|---|---|---|
| Subcatchment Area (acres) | | | | | | |
| Percent Impervious | | | | | | |
| NRCS Soil Type | | | | | | |

**Watershed Profile**

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

**Minor Storm Rainfall Input**

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

**Major Storm Rainfall Input**

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

**CALCULATED OUTPUT**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **3.6** | **3.3** | **4.3** | **6.8** | **3.5** | **1.9** |
| **Major Total Design Peak Flow, Q (cfs)** | **11.2** | **8.4** | **13.5** | **20.3** | **12.0** | **11.6** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.2 | N/A | N/A |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | 1.9 | 0.6 | 3.1 | 7.4 | N/A | N/A |

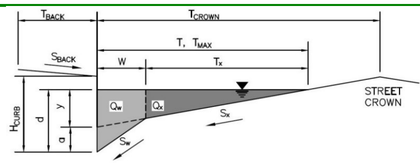
*MHFD-Inlet, Version 5.03 (August 2023)*

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

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

**Project:**

**Inlet ID: Inlet E1 (Basin E-1)**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.030 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - ($W * S_x * 12$)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 12.6 | 12.6 | cfs |
| Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$) | $Q_W$ = | 2.2 | 2.2 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **14.8** | **14.8** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 7.9 | 7.9 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 2.9 | 2.9 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 12.0 | 68.6 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 12.0 | 59.4 | cfs |
| Discharge within the Gutter Section ($Q_d - Q_X$) | $Q_W$ = | 2.1 | 5.8 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 1.3 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 14.1 | 66.6 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 7.8 | 11.6 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 2.8 | 7.4 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$ | R = | 1.00 | 0.60 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **14.1** | **40.2** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 4.40 | 6.34 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 1.88 | inches |

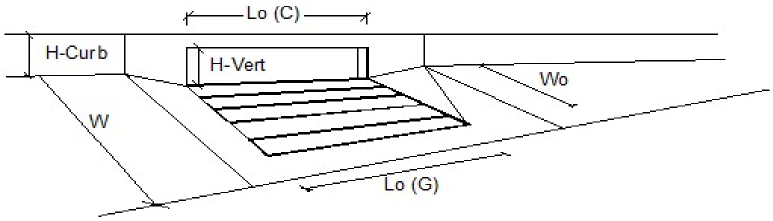
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion<br>MAJOR STORM Allowable Capacity is based on Spread Criterion | **$Q_{allow}$ =** | **14.1** | **14.8** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.60 cfs on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design peak flow of 11.20 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 5.03 (August 2023)*




| Design Information (Input) | CDOT Type R Curb Opening | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |

| Street Hydraulics: OK - Q < Allowable Street Capacity' | | MINOR | MAJOR | |
|---|---|---|---|---|
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 3.6 | 11.2 | cfs |
| Water Spread Width | T = | 9.3 | 14.4 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 2.9 | 4.1 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.263 | 0.166 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 2.7 | 9.3 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 0.9 | 1.9 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.17 | 0.25 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 5.6 | 7.3 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 5.9 | 7.1 | inches |

| Grate Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Length of Inlet Grate Opening | L = | N/A | N/A | ft |
| Ratio of Grate Flow to Design Flow | $E_{o-GRATE}$ = | N/A | N/A | |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Interception Capacity | $Q_i$ = | N/A | N/A | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | N/A | N/A | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | N/A | N/A | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | N/A | N/A | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Actual Interception Capacity | **$Q_a$ =** | **N/A** | **N/A** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **N/A** | **N/A** | **cfs** |

| Curb Opening or Slotted Inlet Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Equivalent Slope $S_e$ | $S_e$ = | 0.116 | 0.080 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 10.77 | 22.70 | ft |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 10.77 | 15.00 | ft |
| Interception Capacity | $Q_i$ = | 3.6 | 9.6 | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.31 | 1.31 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.04 | 0.04 | |
| Effective (Unclogged) Length | $L_e$ = | 10.77 | 14.35 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **3.6** | **9.3** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **1.9** | **cfs** |

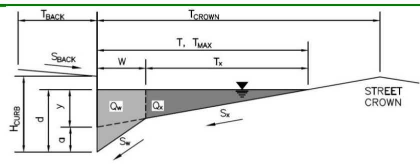
| Summary | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Interception Capacity | **Q =** | **3.6** | **9.3** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **1.9** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **83** | **%** |

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

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

**Project:**

**Inlet ID: Inlet E2 (Basin E-2)**




| Gutter Geometry: | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.030 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 12.6 | 12.6 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 2.2 | 2.2 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **14.8** | **14.8** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 7.9 | 7.9 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 2.9 | 2.9 | |

| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\ TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$ | $Q_{X\ TH}$ = | 12.0 | 68.6 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 12.0 | 59.4 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 2.1 | 5.8 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 1.3 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 14.1 | 66.6 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 7.8 | 11.6 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 2.8 | 7.4 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | 1.00 | 0.60 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **14.1** | **40.2** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 4.40 | 6.34 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 1.88 | inches |

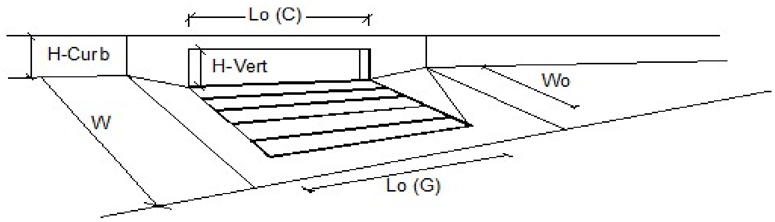
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Spread Criterion | **$Q_{allow}$ =** | **14.1** | **14.8** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.30 cfs on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.40 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 5.03 (August 2023)*

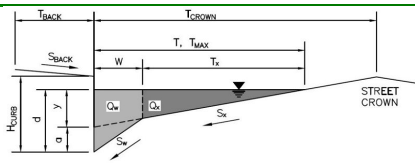



| | | | | |
|---|---|---|---|---|
| Design Information (Input) — CDOT Type R Curb Opening | | MINOR | MAJOR | |
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity' | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 3.3 | 8.4 | cfs |
| Water Spread Width | T = | 9.0 | 12.9 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 2.8 | 3.7 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.272 | 0.187 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 2.4 | 6.8 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 0.9 | 1.6 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.16 | 0.23 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 5.5 | 6.8 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 5.8 | 6.7 | inches |
| Grate Analysis (Calculated) | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | N/A | N/A | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | N/A | N/A | |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Interception Capacity | $Q_i$ = | N/A | N/A | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | N/A | N/A | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | N/A | N/A | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | N/A | N/A | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Actual Interception Capacity | **$Q_a$ =** | **N/A** | **N/A** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **N/A** | **N/A** | **cfs** |
| Curb Opening or Slotted Inlet Analysis (Calculated) | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.119 | 0.088 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 10.17 | 18.82 | ft |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 10.17 | 15.00 | ft |
| Interception Capacity | $Q_i$ = | 3.3 | 7.9 | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.31 | 1.31 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.04 | 0.04 | |
| Effective (Unclogged) Length | $L_e$ = | 10.17 | 14.35 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **3.3** | **7.8** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **0.6** | **cfs** |
| Summary | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **Q =** | **3.3** | **7.8** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **0.6** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **92** | **%** |

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

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

**Project:**
**Inlet ID: Inlet E4 (Basin E-3a)**




| Gutter Geometry: | | | | |
|---|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | | ft |
| Gutter Width | W = | 0.83 | | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.015 | | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | | |
| | | Minor Storm | Major Storm | |
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☑ | |

| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 8.9 | 8.9 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 1.6 | 1.6 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **10.5** | **10.5** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 5.6 | 5.6 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 2.1 | 2.1 | |

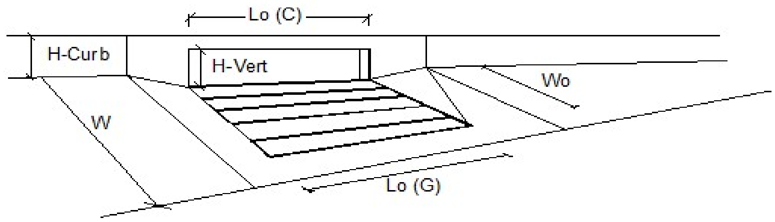
| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\ TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$ | $Q_{X\ TH}$ = | 8.5 | 48.5 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 8.5 | 42.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 1.5 | 4.1 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.9 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 10.0 | 47.1 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 5.5 | 8.2 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 2.0 | 5.3 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | 1.00 | 1.00 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **10.0** | **47.1** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 4.40 | 7.70 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 3.23 | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Depth Criterion | **$Q_{allow}$ =** | **10.0** | **47.1** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.30 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.50 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 5.03 (August 2023)*

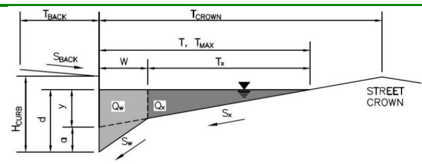



| Design Information (Input) | CDOT Type R Curb Opening | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity' | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 4.3 | 13.5 | cfs |
| Water Spread Width | T = | 11.4 | 16.0 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 3.4 | 4.9 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.4 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.212 | 0.134 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 3.4 | 11.7 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 0.9 | 1.8 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.20 | 0.31 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 4.5 | 5.9 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 6.4 | 7.9 | inches |
| Grate Analysis (Calculated) | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | N/A | N/A | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | N/A | N/A | |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Interception Capacity | $Q_i$ = | N/A | N/A | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | N/A | N/A | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | N/A | N/A | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | N/A | N/A | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Actual Interception Capacity | **$Q_a$ =** | **N/A** | **N/A** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **N/A** | **N/A** | **cfs** |
| Curb Opening or Slotted Inlet Analysis (Calculated) | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.097 | 0.069 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 12.28 | 25.77 | ft |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 12.28 | 15.00 | ft |
| Interception Capacity | $Q_i$ = | 4.3 | 10.7 | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.31 | 1.31 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.04 | 0.04 | |
| Effective (Unclogged) Length | $L_e$ = | 12.28 | 14.35 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **4.3** | **10.4** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **3.1** | **cfs** |
| Summary | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **Q =** | **4.3** | **10.4** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **3.1** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **77** | **%** |

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

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

**Project:**
**Inlet ID: Inlet E5 (Basin E-4a)**




| Gutter Geometry: | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.015 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☑ | |

| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - ($W * S_x * 12$)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 8.9 | 8.9 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 1.6 | 1.6 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **10.5** | **10.5** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 5.6 | 5.6 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 2.1 | 2.1 | |

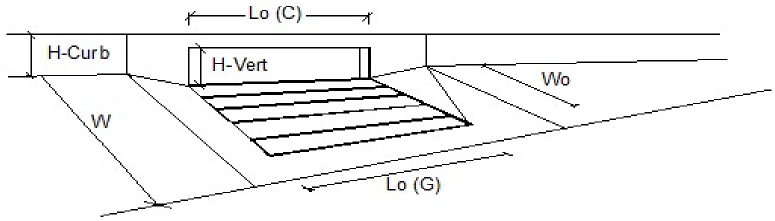
| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X TH}$ | $Q_{X TH}$ = | 8.5 | 48.5 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 8.5 | 42.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 1.5 | 4.1 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.9 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 10.0 | 47.1 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 5.5 | 8.2 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 2.0 | 5.3 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | 1.00 | 1.00 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **10.0** | **47.1** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 4.40 | 7.70 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 3.23 | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Depth Criterion | **$Q_{allow}$ =** | **10.0** | **47.1** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 6.80 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 20.30 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 5.03 (August 2023)*

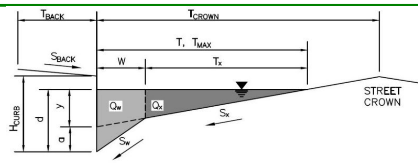



| Design Information (Input) | CDOT Type R Curb Opening | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity' | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 6.8 | 20.3 | cfs |
| Water Spread Width | T = | 13.6 | 16.0 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 3.9 | 5.6 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 1.1 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.176 | 0.115 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 5.6 | 18.0 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 1.2 | 2.3 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.24 | 0.36 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 5.0 | 6.5 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 6.9 | 8.6 | inches |
| Grate Analysis (Calculated) | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | N/A | N/A | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | N/A | N/A | |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Interception Capacity | $Q_i$ = | N/A | N/A | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | N/A | N/A | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | N/A | N/A | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | N/A | N/A | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Actual Interception Capacity | **$Q_a$ =** | **N/A** | **N/A** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **N/A** | **N/A** | **cfs** |
| Curb Opening or Slotted Inlet Analysis (Calculated) | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.084 | 0.062 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 16.57 | 33.35 | ft |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 15.00 | 15.00 | ft |
| Interception Capacity | $Q_i$ = | 6.7 | 13.4 | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.31 | 1.31 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.04 | 0.04 | |
| Effective (Unclogged) Length | $L_e$ = | 14.35 | 14.35 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **6.6** | **12.9** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.2** | **7.4** | **cfs** |
| Summary | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **Q =** | **6.6** | **12.9** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.2** | **7.4** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **97** | **64** | **%** |

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

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

**Project:**
**Inlet ID:** **Inlet E7 (Basin E-3b)**




**Gutter Geometry:**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

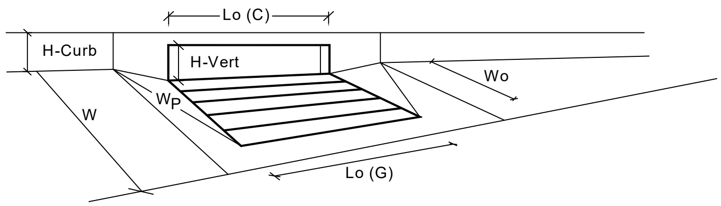
| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - ($W * S_x * 12$)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is not applicable to Sump Condition<br>MAJOR STORM Allowable Capacity is not applicable to Sump Condition | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 5.03 (August 2023)*




| Design Information (Input) | CDOT Type R Curb Opening | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 7.7 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 0.83 | 0.83 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |

| Grate Flow Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |

| Curb Opening Flow Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Clogging Coefficient for Multiple Units | Coef = | 1.25 | 1.25 | |
| Clogging Factor for Multiple Units | Clog = | 0.06 | 0.06 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 5.5 | 17.9 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 5.2 | 16.8 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 16.9 | 22.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 15.8 | 20.6 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 9.0 | 18.5 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 8.4 | 17.3 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **5.2** | **16.8** | **cfs** |

WATER FLOWS OVER CROWN IN 100-YR EVENT, BUT MEETS CRITERIA OF 0 FLOW OVER CROWN IN 5-YR EVENT

| Resultant Street Conditions | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Length | L = | 10.00 | 10.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.7 | 29.5 | ft. >T-Crown |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 3.2 | inches |

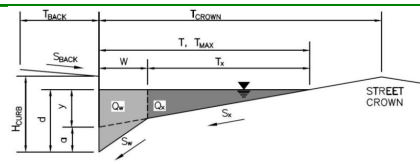
| Low Head Performance Reduction (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.57 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.82 | 1.00 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **5.2** | **16.8** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 3.5 | 12.0 | cfs |

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

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

**Project:**
**Inlet ID:** **Inlet E9 (Basin E-4b)**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 16.0 | ft |
| Gutter Width | W = | 0.83 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 16.0 | 16.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 7.7 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression ($T * S_x * 12$) | y = | 3.84 | 3.84 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$) | $d_C$ = | 0.8 | 0.8 | inches |
| Gutter Depression ($d_C$ - ($W * S_x * 12$)) | a = | 0.63 | 0.63 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.47 | 4.47 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 15.2 | 15.2 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.149 | 0.149 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

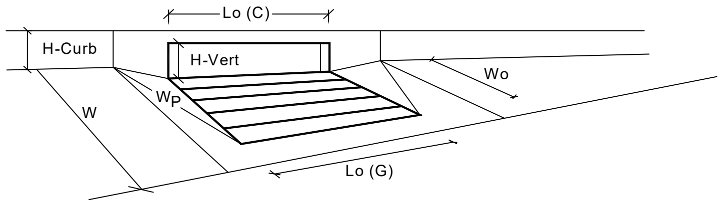
## Maximum Capacity for 1/2 Street based on Allowable Depth

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 15.7 | 29.5 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\ TH}$ = | 14.9 | 28.6 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.152 | 0.079 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$ | $Q_{X\ TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is not applicable to Sump Condition<br>MAJOR STORM Allowable Capacity is not applicable to Sump Condition | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 5.03 (August 2023)*




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** — CDOT Type R Curb Opening | | MINOR | MAJOR | |
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 7.7 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 15.00 | 15.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 0.83 | 0.83 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.31 | 1.31 | |
| Clogging Factor for Multiple Units | Clog = | 0.04 | 0.04 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 6.5 | 22.6 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 6.2 | 21.6 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 25.3 | 33.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 24.2 | 31.5 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 11.9 | 25.4 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 11.4 | 24.3 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **6.2** | **21.6** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 15.00 | 15.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.7 | 29.5 | ft. >T-Crown |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 3.2 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.57 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.67 | 0.88 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **6.2** | **21.6** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 1.9 | 11.6 | cfs |

WATER FLOWS OVER CROWN IN 100-YR EVENT, BUT MEETS CRITERIA OF 0 FLOW OVER CROWN IN 5-YR EVENT

# Hydraulic Analysis Report

## Project Data

Project Title:

Designer:

Project Date: Thursday, June 20, 2024

Project Units:  U.S. Customary Units

Notes:

## Channel Analysis: Pond D

Notes:

### Input Parameters

Channel Type:  Triangular

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 2.0000 ft/ft

Manning's n:  0.0111

Flow 14.1000 cfs

### Result Parameters

Depth 0.3015 ft

Area of Flow 0.2726 ft^2

Wetted Perimeter 1.9066 ft

Hydraulic Radius 0.1430 ft

Average Velocity 51.7166 ft/s

Top Width 1.8088 ft

Froude Number:  23.4747

Critical Depth 1.0653 ft

Critical Velocity 4.1414 ft/s

Critical Slope: 0.0024 ft/ft

Critical Top Width 6.39 ft

Calculated Max Shear Stress 37.6226 lb/ft^2

Calculated Avg Shear Stress 17.8459 lb/ft^2

## Channel Analysis: Pond E

Notes:

### Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 2.0000 ft/ft

Manning's n: 0.0114

Flow 11.6000 cfs

### Result Parameters

Depth 0.2829 ft

Area of Flow 0.2401 ft^2

Wetted Perimeter 1.7891 ft

Hydraulic Radius 0.1342 ft

Average Velocity 48.3224 ft/s

Top Width 1.6972 ft

Froude Number: 22.6432

Critical Depth 0.9853 ft

Critical Velocity 3.9829 ft/s

Critical Slope: 0.0026 ft/ft

Critical Top Width 5.91 ft

Calculated Max Shear Stress 35.3028 lb/ft^2

Calculated Avg Shear Stress 16.7456 lb/ft^2

## Channel Lining Analysis: Pond D Design Analysis

Notes:

### Lining Input Parameters

Channel Lining Type: Vegetation

Specific Weight of Water: 62.4 lb/ft^3

Height of Vegetation: 0.333 ft

Vegetation Condition is good

Growth Form of Vegetation is mixed

Cf: 0.75

See HEC-15, Table 4.5 (default: 0.75 for Good cover factor and Mixed growth form)

soil is noncohesive

D75: 2.54 mm

Safety Factor: 1

### Lining Results

Cn: 0.165205

Permissible Soil Shear Stress: 0.04 lb/ft^2

Mean Boundary Shear Stress: 17.8459 lb/ft^2

Maximum Shear Stress on the Channel Bottom: 37.6226 lb/ft^2

Manning's n: 0.0111119

Soil Grain Roughness: 0.0177136

Effective Shear Stress: 19.5009 lb/ft^2

Permissible Shear Stress on Vegetation: 0.0629623 lb/ft^2

This value is compared with the maximum shear stress times the safety factor to determine lining stability

This value is compared with the maximum shear stress times the safety factor to determine lining stability

Channel bottom is NOT stable

Channel Lining Stability Results 2

The channel is NOT stable

### Channel Summary

Name of Selected Channel: Pond D

## Channel Lining Analysis: Pond E Design Analysis

Notes:

### Lining Input Parameters

Channel Lining Type: Vegetation

Specific Weight of Water: 62.4 lb/ft^3

Height of Vegetation: 0.333 ft

Vegetation Condition is good

Growth Form of Vegetation is mixed

Cf: 0.75

See HEC-15, Table 4.5 (default: 0.75 for Good cover factor and Mixed growth form)

soil is noncohesive

D75: 2.54 mm

Safety Factor: 1

### Lining Results

Cn: 0.165205

Permissible Soil Shear Stress: 0.04 lb/ft^2

Mean Boundary Shear Stress: 16.7456 lb/ft^2

Maximum Shear Stress on the Channel Bottom: 35.3028 lb/ft^2

Manning's n: 0.0113984

Soil Grain Roughness: 0.0177136

Effective Shear Stress: 17.3902 lb/ft^2

Permissible Shear Stress on Vegetation: 0.0662509 lb/ft^2

This value is compared with the maximum shear stress times the safety factor to determine lining stability

This value is compared with the maximum shear stress times the safety factor to determine lining stability

Channel bottom is NOT stable

Channel Lining Stability Results 2

The channel is NOT stable

## Channel Summary

Name of Selected Channel: Pond E

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ECMDS v7.0

# CHANNEL ANALYSIS

> > > Pond D Emergency Overflow Swale

| | |
|---|---|
| Name | Pond D Emergency Overflow Swale |
| Discharge | 14.1 |
| Channel Slope | 0.02 |
| Channel Bottom Width | 0 |
| Left Side Slope | 3 |
| Right Side Slope | 3 |
| Low Flow Liner | |
| Retardence Class | D 2-6 in |
| Vegetation Type | Mix (Sod and Bunch) |
| Vegetation Density | Good 65-79% |
| Soil Type | Sandy Loam (GM) |

## Shoremax

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| Shoremax w/ P300 Unvegetated | Straight | 14.1 cfs | 4.37 ft/s | 1.04 ft | 0.03 | 8.5 lbs/ft2 | 1.29 lbs/ft2 | 6.57 | STABLE | F |
| Underlying Substrate | Straight | 14.1 cfs | 4.37 ft/s | 1.04 ft | 0.03 | 5.68 lbs/ft2 | 0.61 lbs/ft2 | 9.25 | STABLE | F |
| Shoremax w/ P300 Reinforced Vegetation | Straight | 14.1 cfs | 4.37 ft/s | 1.04 ft | 0.03 | 14 lbs/ft2 | 1.29 lbs/ft2 | 10.81 | STABLE | F |
| Underlying Substrate | Straight | 14.1 cfs | 4.37 ft/s | 1.04 ft | 0.03 | 8.5 lbs/ft2 | 0.61 lbs/ft2 | 13.84 | STABLE | F |

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# CHANNEL ANALYSIS

> > > Pond E Emergency Overflow Swale

| | |
|---|---|
| Name | Pond E Emergency Overflow Swale |
| Discharge | 11.6 |
| Channel Slope | 0.02 |
| Channel Bottom Width | 0 |
| Left Side Slope | 3 |
| Right Side Slope | 3 |
| Low Flow Liner | |
| Retardence Class | D 2-6 in |
| Vegetation Type | Mix (Sod and Bunch) |
| Vegetation Density | Good 65-79% |
| Soil Type | Sandy Loam (GM) |

## Shoremax

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| Shoremax w/ P300 Unvegetated | Straight | 11.6 cfs | 4.16 ft/s | 0.96 ft | 0.03 | 8.5 lbs/ft2 | 1.2 lbs/ft2 | 7.06 | STABLE | F |
| Underlying Substrate | Straight | 11.6 cfs | 4.16 ft/s | 0.96 ft | 0.03 | 5.68 lbs/ft2 | 0.57 lbs/ft2 | 9.95 | STABLE | F |
| Shoremax w/ P300 Reinforced Vegetation | Straight | 11.6 cfs | 4.16 ft/s | 0.96 ft | 0.03 | 14 lbs/ft2 | 1.2 lbs/ft2 | 11.63 | STABLE | F |
| Underlying Substrate | Straight | 11.6 cfs | 4.16 ft/s | 0.96 ft | 0.03 | 8.5 lbs/ft2 | 0.57 lbs/ft2 | 14.89 | STABLE | F |

# OUTFALL RIPRAP SIZING CALCULATIONS

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)

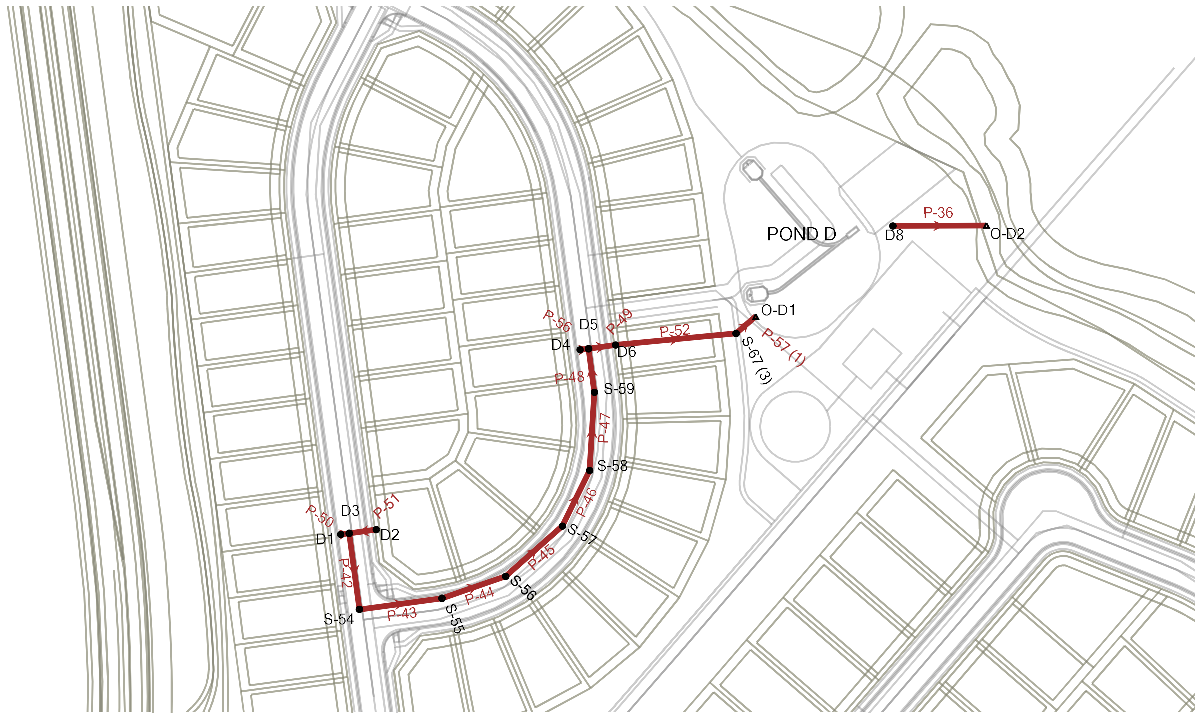
**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| | STORM DRAIN SYSTEM | | |
|---|---|---|---|
| | Pond D FES | Pond E FES | |
| Q100 (cfs) | 8.0 | 14.9 | |
| D or H (in) | 18 | 18 | |
| W (ft) | | | |
| Slope (%) | 1 | 1 | |
| Yn (in) | 18.00 | 18.00 | |
| Yt (ft) | unknown | unknown | If "unknown" Yt/D=0.4 |
| Yt/D, Yt/H | 0.40 | 0.40 | |
| Supercritical | Yes | Yes | |
| Q/D^2.5, Q/WH^1.5 | 2.90 | 5.41 | |
| Q/D^1.5, Q/WH^0.5 | | | |
| Da, Ha (in) * | 18.00 | 18.00 | Da=0.5(D+Yn), Ha=0.5(H+Yn) |
| Q/Da^1.5, Q/WHa^0.5 * | 4.35 | 8.11 | |
| d50 (in), Required | 3.77 | 7.01 | |
| d50 (in) | 9 | 9 | |
| RipRap Size | **Type L** | **Type L** | |
| 1/(2 tan q) | 4.50 | 2.25 | Fig. 9-35 OR Fig 9-36 |
| Erosive Soils | Yes | Yes | |
| At | 1.45 | 2.71 | At=Q/5.5 |
| L | 4.2 | 6.8 | L=(1/(2 tan q))(At/Yt - D) |
| Min L | 4.5 | 4.5 | Min L=3D or 3H |
| Max L | 15.0 | 15.0 | Max L=10D or 10H |
| Length (ft) | 4.5 | 7.0 | |
| Bottom Width (ft) | 4.5 | 4.5 | Width=3D (Minimum) |
| Riprap Depth (in) | 18 | 18 | Depth=2(d50) |
| Type II Base Depth (in) | 6 | 6 | |
| Cutoff Wall | Yes | Yes | |
| Cutoff Wall Depth (ft) | 3.0 | 3.0 | Depth of Riprap and Base |
| Cutoff Wall Width (ft) | 6.2 | 6.2 | |

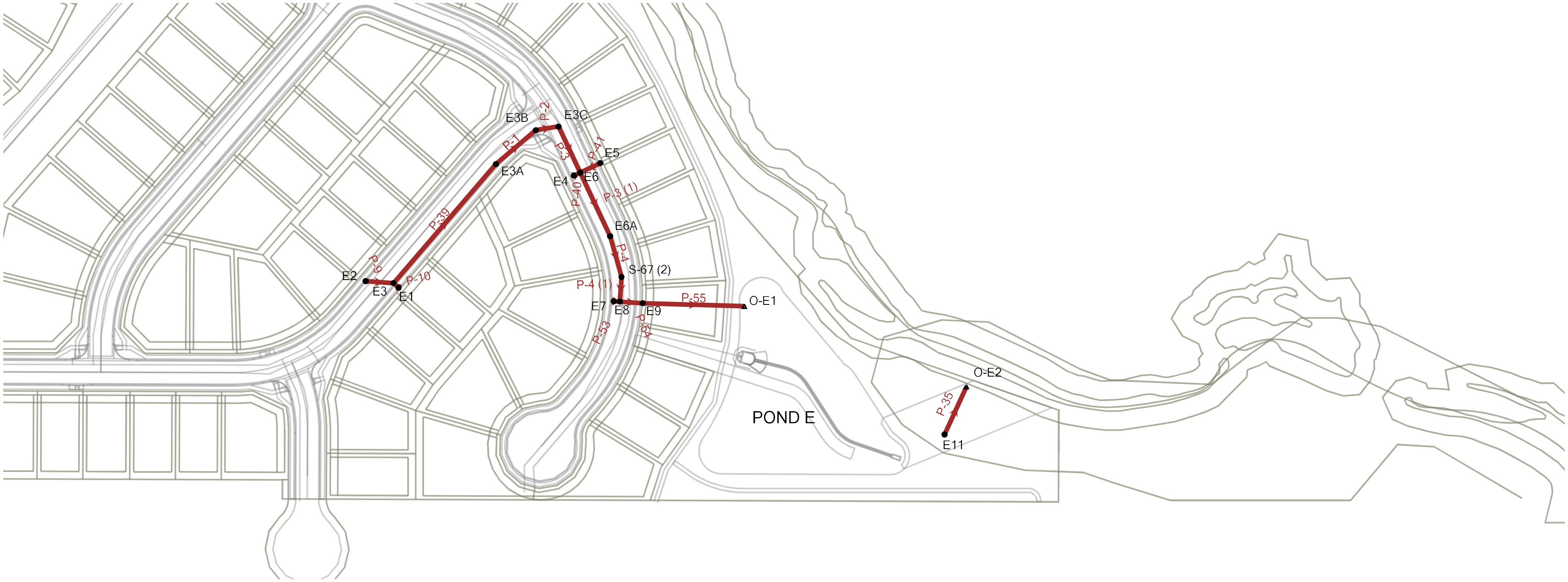


Galloway

# Grandview Reserve Filing No. 1
# D Basin Schematic



# Grandview Reserve Filing No. 1
## E Basin Schematic



# Grandview Reserve Filing No. 1
# FlexTable: Conduit Table
# Active Scenario: 5-YR Event

| Label | Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (User Defined) (ft) | Slope (Calculated) (ft/ft) | Diameter (in) | Manning's n | Material | Flow (cfs) | Velocity (ft/s) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | E3A | E3B | 6,955.27 | 6,954.75 | 68.6 | 0.007 | 30.0 | 0.012 | Concrete | 6.90 | 5.93 | 6,956.14 | 6,955.47 |
| P-2 | E3B | E3C | 6,954.55 | 6,954.32 | 30.2 | 0.007 | 30.0 | 0.012 | Concrete | 6.90 | 5.93 | 6,955.42 | 6,955.44 |
| P-3 | E3C | E6 | 6,953.82 | 6,953.32 | 66.7 | 0.007 | 36.0 | 0.012 | Concrete | 6.90 | 5.82 | 6,955.37 | 6,955.39 |
| P-3 (1) | E6 | E6A | 6,953.22 | 6,952.53 | 92.0 | 0.007 | 36.0 | 0.012 | Concrete | 17.80 | 7.63 | 6,954.57 | 6,953.64 |
| P-4 | E6A | S-67 (2) | 6,952.43 | 6,952.01 | 55.4 | 0.007 | 36.0 | 0.012 | Concrete | 17.80 | 7.63 | 6,953.78 | 6,953.14 |
| P-4 (1) | S-67 (2) | E8 | 6,951.92 | 6,951.67 | 32.3 | 0.007 | 36.0 | 0.012 | Concrete | 17.80 | 7.63 | 6,953.27 | 6,953.40 |
| P-9 | E2 | E3 | 6,958.38 | 6,957.40 | 35.4 | 0.027 | 24.0 | 0.012 | Concrete | 3.30 | 7.78 | 6,959.01 | 6,958.26 |
| P-10 | E1 | E3 | 6,957.65 | 6,957.40 | 9.0 | 0.027 | 24.0 | 0.012 | Concrete | 3.60 | 7.98 | 6,958.32 | 6,958.26 |
| P-35 | E11 | O-E2 | 6,945.69 | 6,945.01 | 66.2 | 0.010 | 18.0 | 0.012 | Concrete | 0.40 | 3.05 | 6,945.92 | 6,945.21 |
| P-36 | D8 | O-D2 | 6,964.99 | 6,964.01 | 98.7 | 0.010 | 18.0 | 0.012 | Concrete | 0.20 | 2.45 | 6,965.16 | 6,964.15 |
| P-39 | E3 | E3A | 6,956.91 | 6,955.36 | 205.8 | 0.007 | 30.0 | 0.012 | Concrete | 6.90 | 5.93 | 6,957.78 | 6,956.08 |
| P-40 | E4 | E6 | 6,954.51 | 6,954.32 | 9.2 | 0.020 | 24.0 | 0.012 | Concrete | 4.30 | 7.51 | 6,955.24 | 6,955.39 |
| P-41 | E5 | E6 | 6,954.62 | 6,954.32 | 29.1 | 0.010 | 24.0 | 0.012 | Concrete | 6.60 | 6.62 | 6,955.53 | 6,955.39 |
| P-42 | D3 | S-54 | 6,980.35 | 6,976.60 | 82.0 | 0.046 | 24.0 | 0.012 | Concrete | 3.60 | 9.55 | 6,981.02 | 6,976.96 |
| P-43 | S-54 | S-55 | 6,976.31 | 6,975.42 | 89.0 | 0.010 | 24.0 | 0.012 | Concrete | 1.32 | 4.16 | 6,976.70 | 6,975.73 |
| P-44 | S-55 | S-56 | 6,975.31 | 6,974.70 | 72.0 | 0.009 | 24.0 | 0.012 | Concrete | 1.32 | 3.93 | 6,975.71 | 6,975.03 |
| P-45 | S-56 | S-57 | 6,974.60 | 6,973.91 | 81.0 | 0.009 | 24.0 | 0.012 | Concrete | 1.32 | 3.93 | 6,974.99 | 6,974.23 |
| P-46 | S-57 | S-58 | 6,973.81 | 6,973.24 | 66.0 | 0.009 | 24.0 | 0.012 | Concrete | 1.32 | 3.93 | 6,974.20 | 6,973.57 |
| P-47 | S-58 | S-59 | 6,973.14 | 6,972.43 | 83.5 | 0.009 | 24.0 | 0.012 | Concrete | 1.32 | 3.93 | 6,973.54 | 6,972.75 |
| P-48 | S-59 | D5 | 6,972.33 | 6,971.92 | 47.0 | 0.009 | 24.0 | 0.012 | Concrete | 1.32 | 3.93 | 6,972.72 | 6,972.47 |
| P-49 | D5 | D6 | 6,970.93 | 6,970.51 | 27.7 | 0.015 | 36.0 | 0.012 | Concrete | 9.80 | 8.25 | 6,971.92 | 6,971.63 |
| P-50 | D3 | D1 | 6,980.66 | 6,980.75 | 9.2 | -0.010 | 24.0 | 0.012 | Concrete | 2.60 | 5.08 | 6,981.31 | 6,981.39 |
| P-51 | D3 | D2 | 6,980.66 | 6,980.80 | 29.2 | -0.005 | 24.0 | 0.012 | Concrete | 1.00 | 3.00 | 6,981.38 | 6,981.39 |
| P-52 | D6 | S-67 (3) | 6,970.41 | 6,968.49 | 127.8 | 0.015 | 36.0 | 0.012 | Concrete | 14.20 | 9.18 | 6,971.61 | 6,969.31 |
| P-53 | E7 | E8 | 6,951.72 | 6,951.67 | 8.2 | 0.005 | 36.0 | 0.012 | Concrete | 3.50 | 4.14 | 6,953.40 | 6,953.40 |
| P-54 | E8 | E9 | 6,951.17 | 6,951.02 | 30.2 | 0.005 | 42.0 | 0.012 | Concrete | 21.30 | 6.85 | 6,952.59 | 6,952.31 |
| P-55 | E9 | O-E1 | 6,950.92 | 6,950.26 | 131.8 | 0.005 | 42.0 | 0.012 | Concrete | 1.70 | 3.27 | 6,951.31 | 6,951.30 |
| P-56 | D4 | D5 | 6,972.06 | 6,971.92 | 13.2 | 0.010 | 24.0 | 0.012 | Concrete | 6.10 | 6.58 | 6,972.94 | 6,972.66 |
| P-57 (1) | S-67 (3) | O-D1 | 6,968.29 | 6,968.01 | 27.8 | 0.010 | 36.0 | 0.012 | Concrete | 14.20 | 7.94 | 6,969.49 | 6,968.99 |

# Grandview Reserve Filing No. 1

## FlexTable: Manhole Table

## Active Scenario: 5-YR Event

| Label | Notes | Elevation (Ground) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert Out) (ft) | Flow (Total Out) (cfs) | Headloss Coefficient (Standard) | Headloss Method | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|
| D1 | CDOT-TYPE R INLET (5') | 6,985.58 | (N/A) | 6,980.75 | 2.60 | 0.000 | Standard | 6,981.31 | 6,981.31 |
| D2 | CDOT-TYPE R INLET (5') | 6,985.58 | (N/A) | 6,980.80 | 1.00 | 0.000 | Standard | 6,981.38 | 6,981.38 |
| D3 | MH-ECCENTRIC (5' %%C) | 6,985.25 | 6,980.66 | 6,980.35 | 3.60 | 1.520 | Standard | 6,981.39 | 6,981.02 |
| D4 | CDOT-TYPE R INLET (15') - (PUB) | 6,977.69 | (N/A) | 6,972.06 | 6.10 | 0.000 | Standard | 6,972.94 | 6,972.94 |
| D5 | MH-ECCENTRIC (6' %%C) | 6,977.36 | 6,971.92 | 6,970.93 | 9.80 | 1.520 | Standard | 6,972.47 | 6,971.92 |
| D6 | CDOT-TYPE R INLET (15') - (PUB) | 6,977.69 | 6,970.51 | 6,970.41 | 14.20 | 0.050 | Standard | 6,971.63 | 6,971.61 |
| D8 | MODIFIED CDOT TYPE DPOND D OUTLET STRUCTURE(SEE GEC PLAN) | 6,969.69 | (N/A) | 6,964.99 | 0.20 | 0.000 | Standard | 6,965.16 | 6,965.16 |
| E1 | CDOT-TYPE R INLET (15') - (PUB) | 6,962.81 | (N/A) | 6,957.65 | 3.60 | 0.000 | Standard | 6,958.32 | 6,958.32 |
| E2 | CDOT-TYPE R INLET (15') - (PUB) | 6,963.03 | (N/A) | 6,958.38 | 3.30 | 0.000 | Standard | 6,959.01 | 6,959.01 |
| E3 | 5' %%C SDMH - (PUB) | 6,962.47 | 6,957.40 | 6,956.91 | 6.90 | 1.520 | Standard | 6,958.26 | 6,957.78 |
| E3A | 5' %%C SDMH - (PUB) | 6,960.42 | 6,955.36 | 6,955.27 | 6.90 | 0.100 | Standard | 6,956.17 | 6,956.14 |
| E3B | 5' %%C SDMH - (PUB) | 6,959.71 | 6,954.75 | 6,954.55 | 6.90 | 0.100 | Standard | 6,955.45 | 6,955.42 |
| E3C | 5' %%C SDMH - (PUB) | 6,959.59 | 6,954.32 | 6,953.82 | 6.90 | 1.320 | Standard | 6,955.44 | 6,955.37 |
| E4 | CDOT-TYPE R INLET (15') - (PUB) | 6,959.26 | (N/A) | 6,954.51 | 4.30 | 0.000 | Standard | 6,955.24 | 6,955.24 |
| E5 | CDOT-TYPE R INLET (15') - (PUB) | 6,959.26 | (N/A) | 6,954.62 | 6.60 | 0.000 | Standard | 6,955.53 | 6,955.53 |
| E6 | 6' %%C SDMH - (PUB) | 6,958.92 | 6,953.32 | 6,953.22 | 17.80 | 1.570 | Standard | 6,955.39 | 6,954.57 |
| E6A | 5' %%C SDMH - (PUB) | 6,958.00 | 6,952.53 | 6,952.43 | 17.80 | 0.100 | Standard | 6,953.83 | 6,953.78 |
| E7 | CDOT-TYPE R INLET (10') | 6,957.60 | (N/A) | 6,951.72 | 3.50 | 0.000 | Standard | 6,953.40 | 6,953.40 |
| E8 | MH-ECCENTRIC (6' %%C) | 6,957.24 | 6,951.67 | 6,951.17 | 21.30 | 1.520 | Standard | 6,953.40 | 6,952.59 |
| E9 | CDOT-TYPE R INLET (15') | 6,957.59 | 6,951.02 | 6,950.92 | 1.70 | 0.050 | Standard | 6,951.32 | 6,951.31 |
| E11 | MODIFIED CDOT TYPE DPOND E OUTLET STRUCTURE(SEE GEC PLAN) | 6,951.93 | (N/A) | 6,945.69 | 0.40 | 0.050 | Standard | 6,945.93 | 6,945.92 |
| S-54 | MH-ECCENTRIC (5' %%C) | 6,986.15 | 6,976.60 | 6,976.31 | 1.32 | 0.000 | Standard | 6,976.70 | 6,976.70 |
| S-55 | MH-ECCENTRIC (5' %%C) | 6,984.27 | 6,975.42 | 6,975.31 | 1.32 | 0.100 | Standard | 6,975.72 | 6,975.71 |
| S-56 | MH-ECCENTRIC (5' %%C) | 6,981.04 | 6,974.70 | 6,974.60 | 1.32 | 0.400 | Standard | 6,975.05 | 6,974.99 |
| S-57 | MH-ECCENTRIC (5' %%C) | 6,979.22 | 6,973.91 | 6,973.81 | 1.32 | 0.400 | Standard | 6,974.26 | 6,974.20 |
| S-58 | MH-ECCENTRIC (5' %%C) | 6,978.52 | 6,973.24 | 6,973.14 | 1.32 | 0.400 | Standard | 6,973.59 | 6,973.54 |
| S-59 | MH-ECCENTRIC (5' %%C) | 6,977.64 | 6,972.43 | 6,972.33 | 1.32 | 0.400 | Standard | 6,972.78 | 6,972.72 |
| S-67 (2) | MH-ECCENTRIC (5' %%C) | 6,957.45 | 6,952.01 | 6,951.92 | 17.80 | 0.100 | Standard | 6,953.32 | 6,953.27 |
| S-67 (3) | MH-ECCENTRIC (5' %%C) | 6,973.84 | 6,968.49 | 6,968.29 | 14.20 | 0.400 | Standard | 6,969.67 | 6,969.49 |

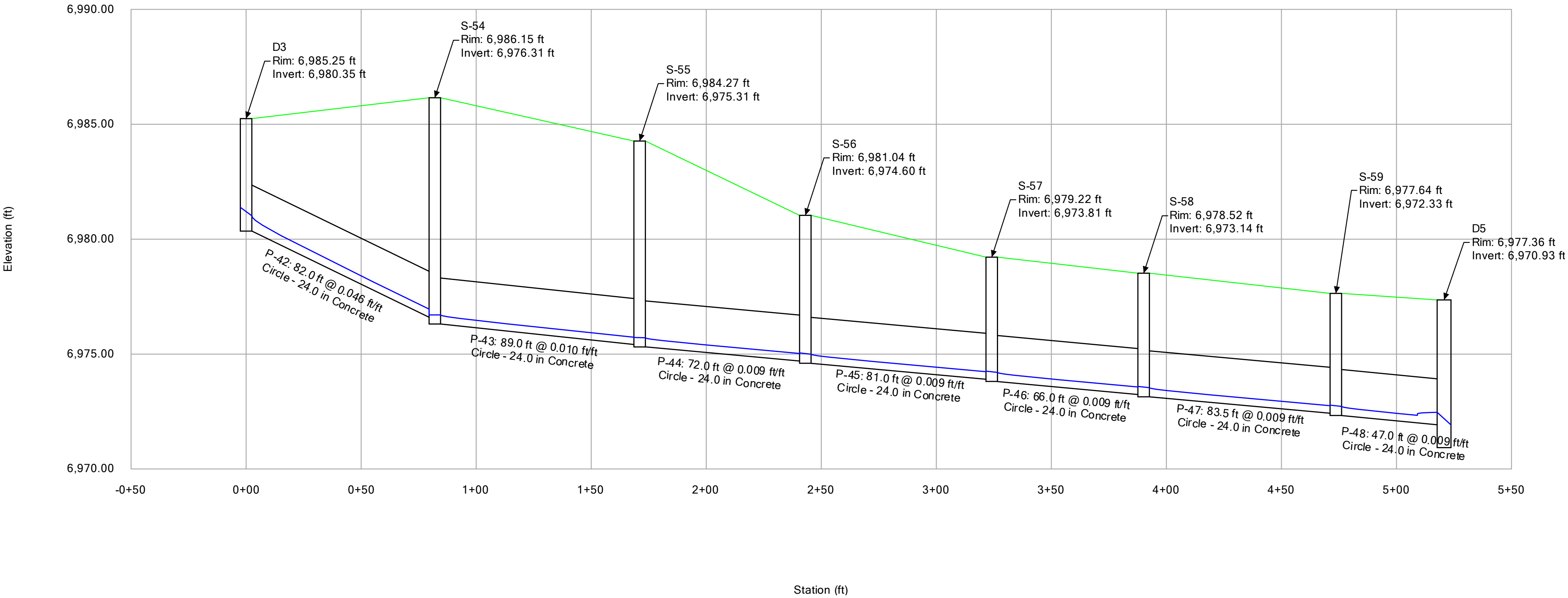
# Grandview Reserve Filing No. 1

## FlexTable: Outfall Table

## Active Scenario: 5-YR Event

| Label | Elevation (Ground) (ft) | Elevation (Invert) (ft) | Boundary Condition Type | Elevation (User Defined Tailwater) (ft) | Hydraulic Grade (ft) | Flow (Total Out) (cfs) |
|---|---|---|---|---|---|---|
| O-D2 | 6,966.22 | 6,964.01 | Free Outfall | | 6,964.15 | 0.20 |
| O-E2 | 6,947.22 | 6,945.01 | Free Outfall | | 6,945.21 | 0.40 |
| O-D1 | 6,973.84 | 6,968.01 | User Defined Tailwater | 6,969.15 | 6,968.99 | 14.20 |
| O-E1 | 6,957.59 | 6,950.26 | User Defined Tailwater | 6,951.26 | 6,951.26 | 1.70 |

# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - D3 to D5 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 5-YR Event

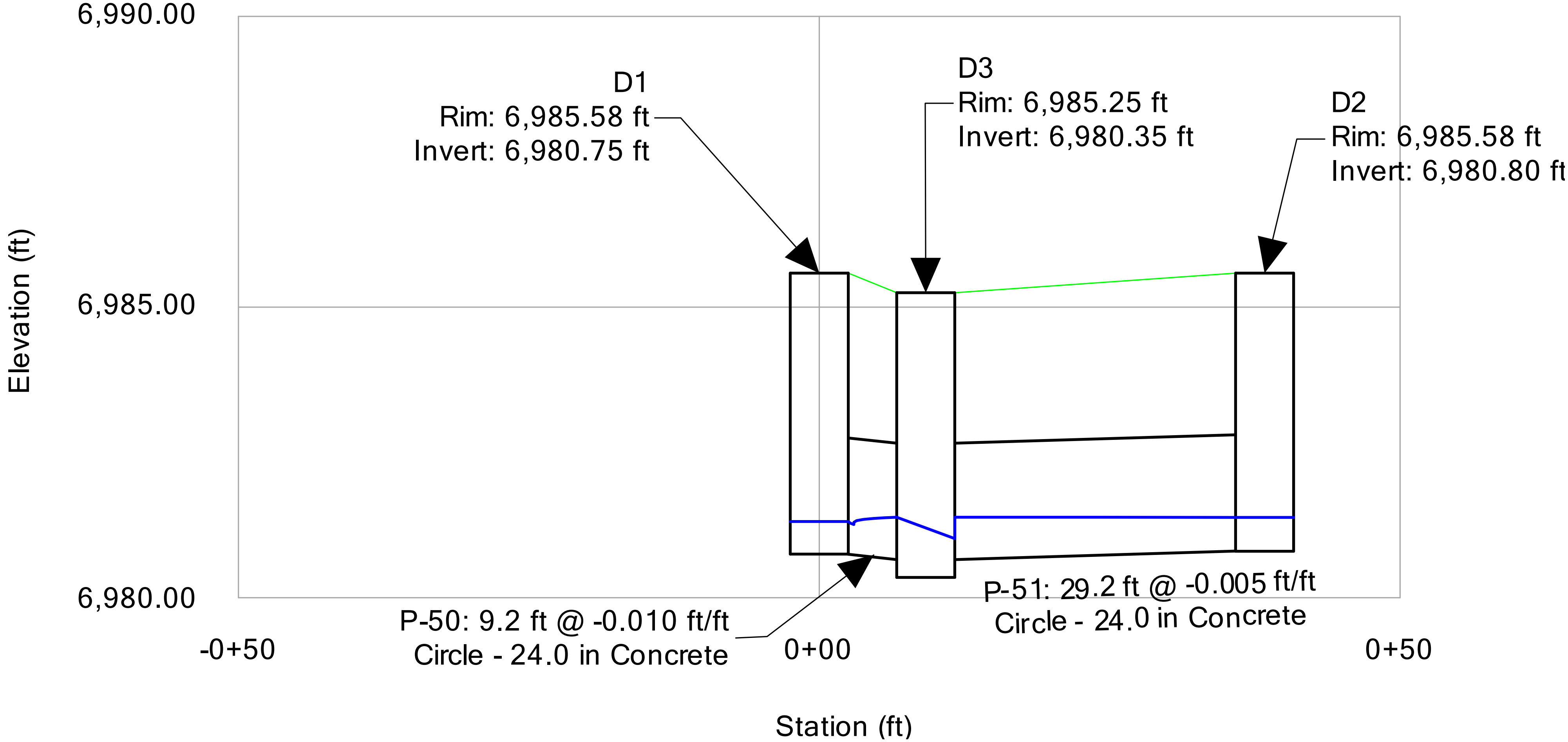


# Grandview Reserve Filing No. 1

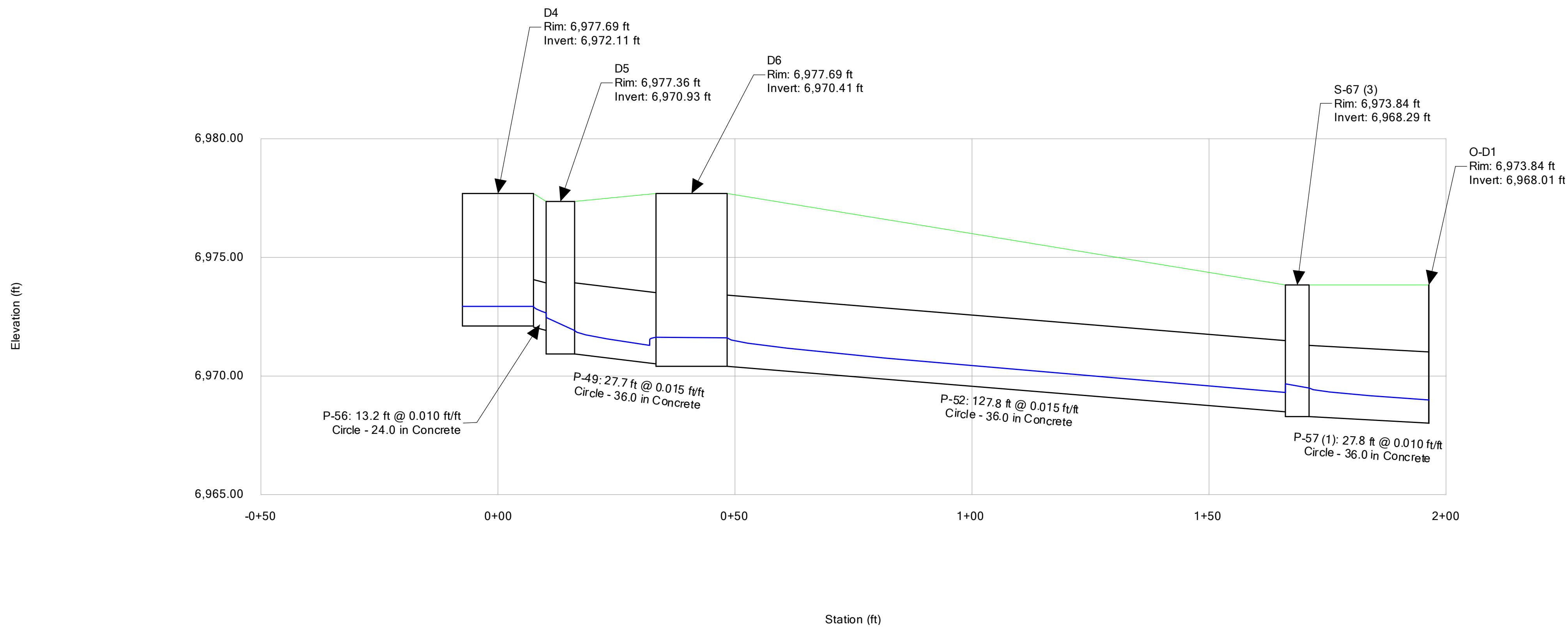
## Profile Report

## Engineering Profile - D1 to D2 (HRG02_FDR Storm Analysis.stsw)

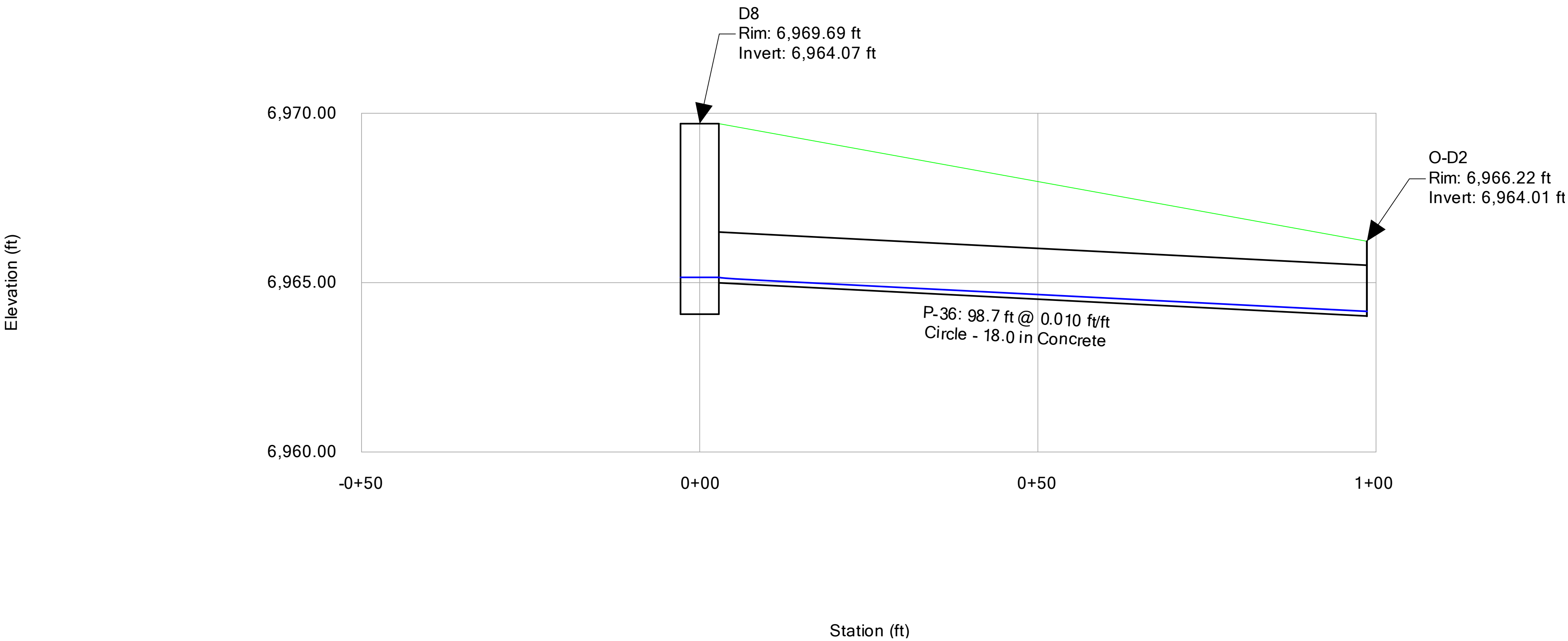
## Active Scenario: 5-YR Event



# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - D4 to O-D1 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 5-YR Event



# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - D7 to O-D2 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 5-YR Event

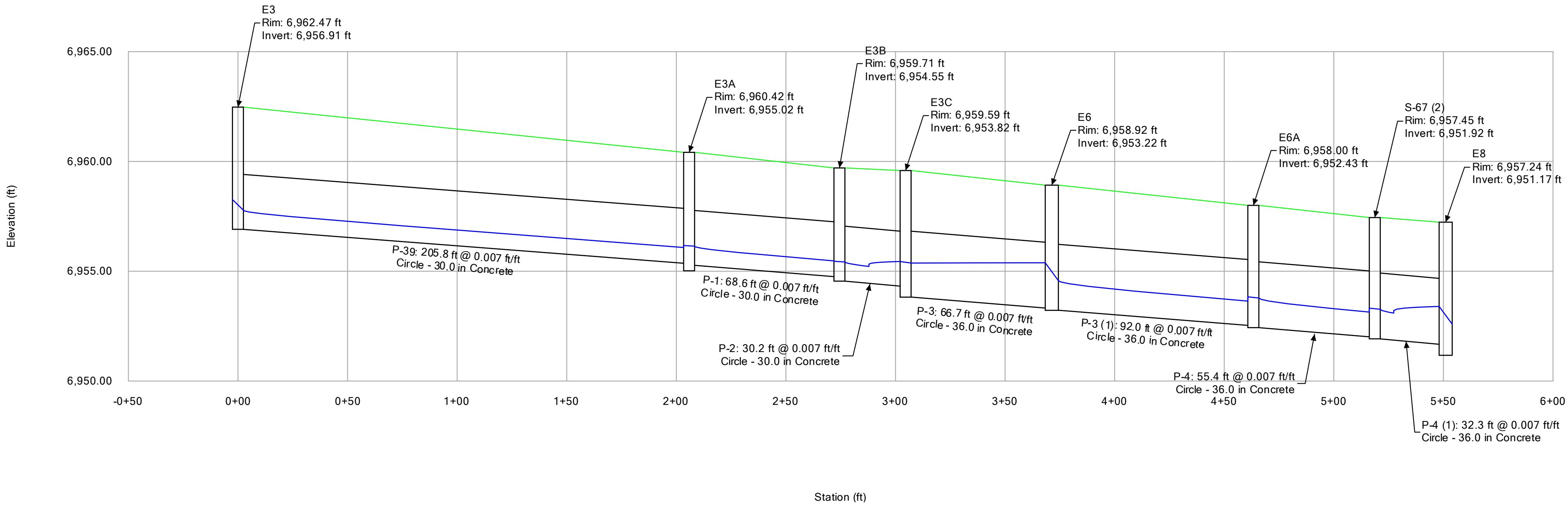


# Grandview Reserve Filing No. 1

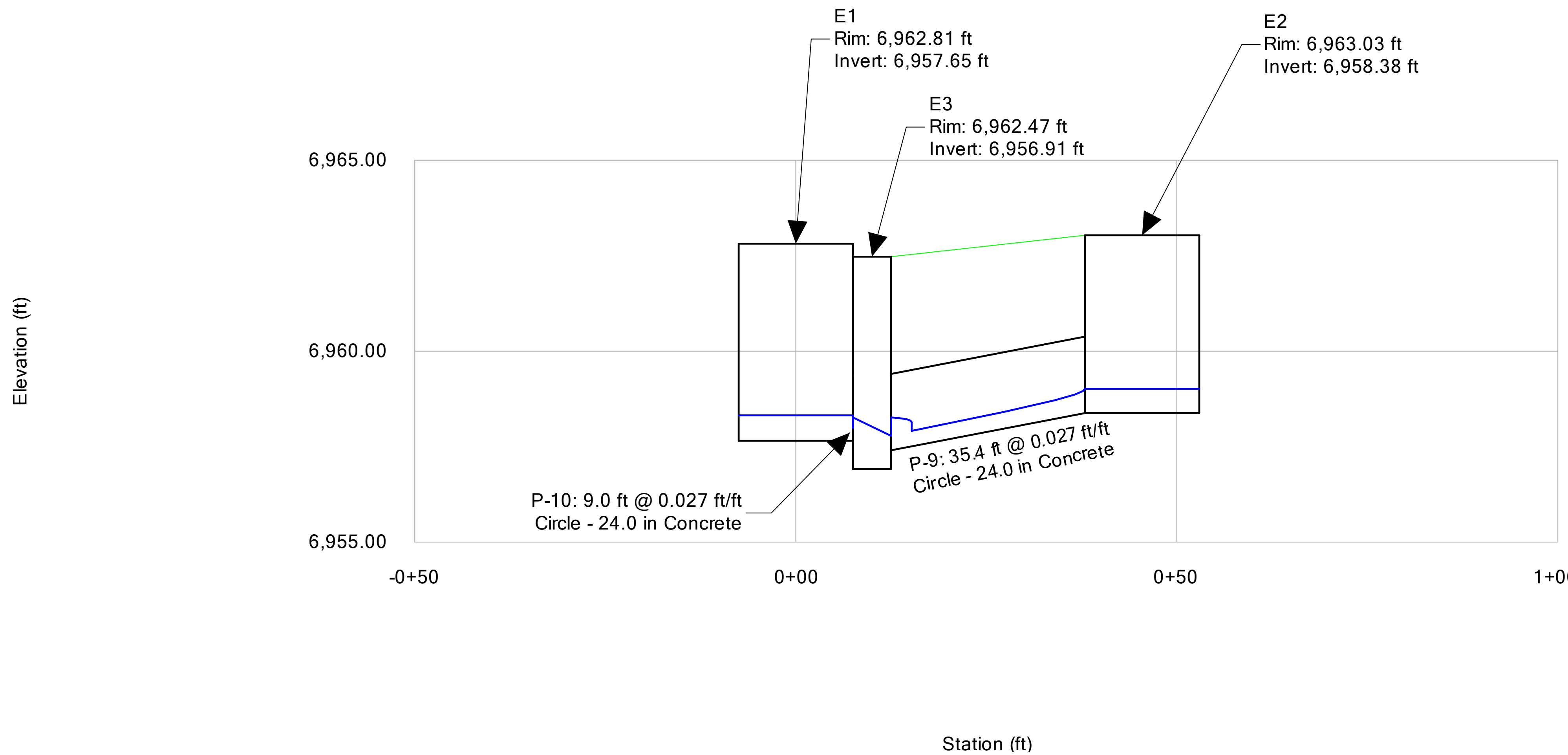
# Profile Report

# Engineering Profile - E3 to E8 (HRG02_FDR Storm Analysis.stsw)

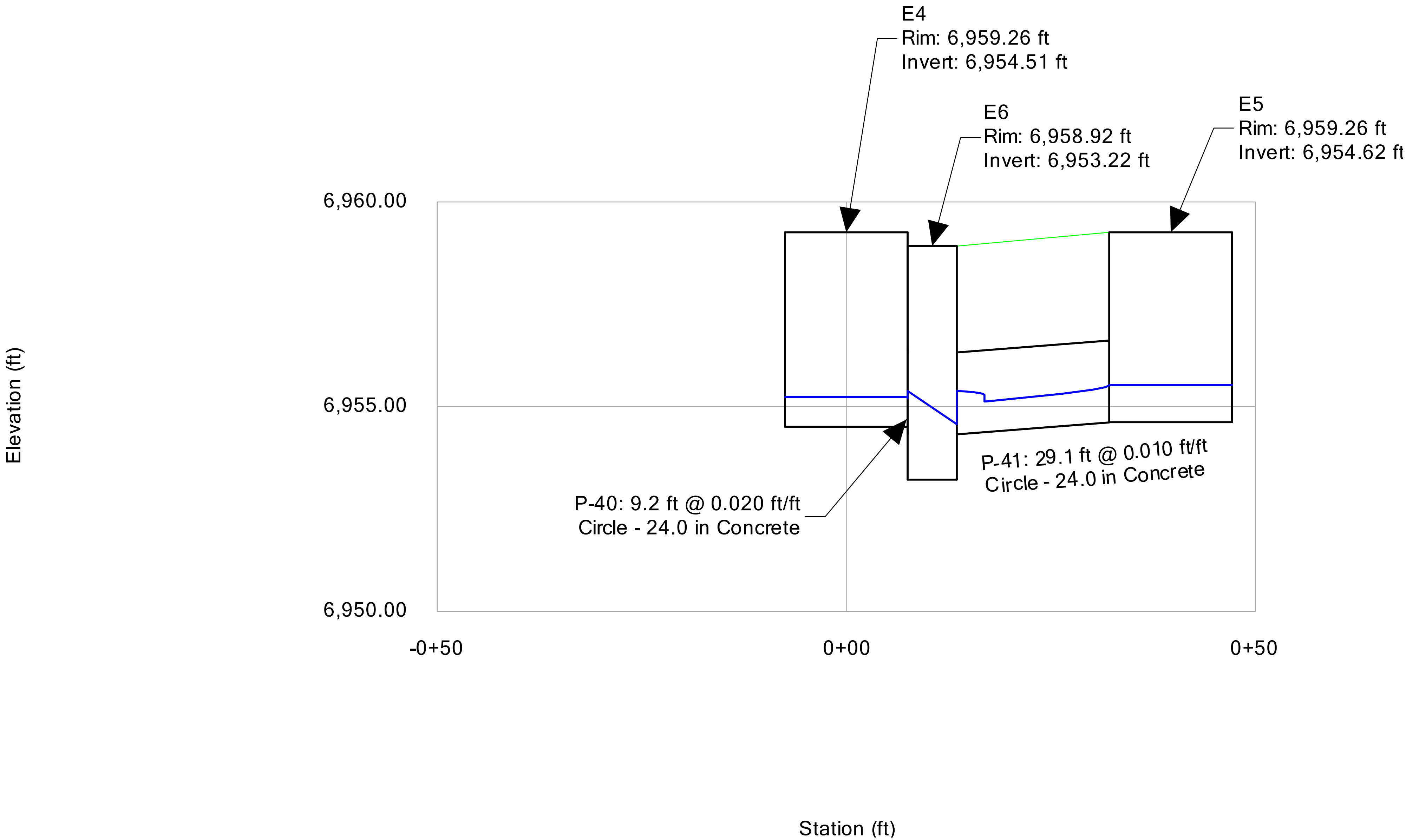
# Active Scenario: 5-YR Event



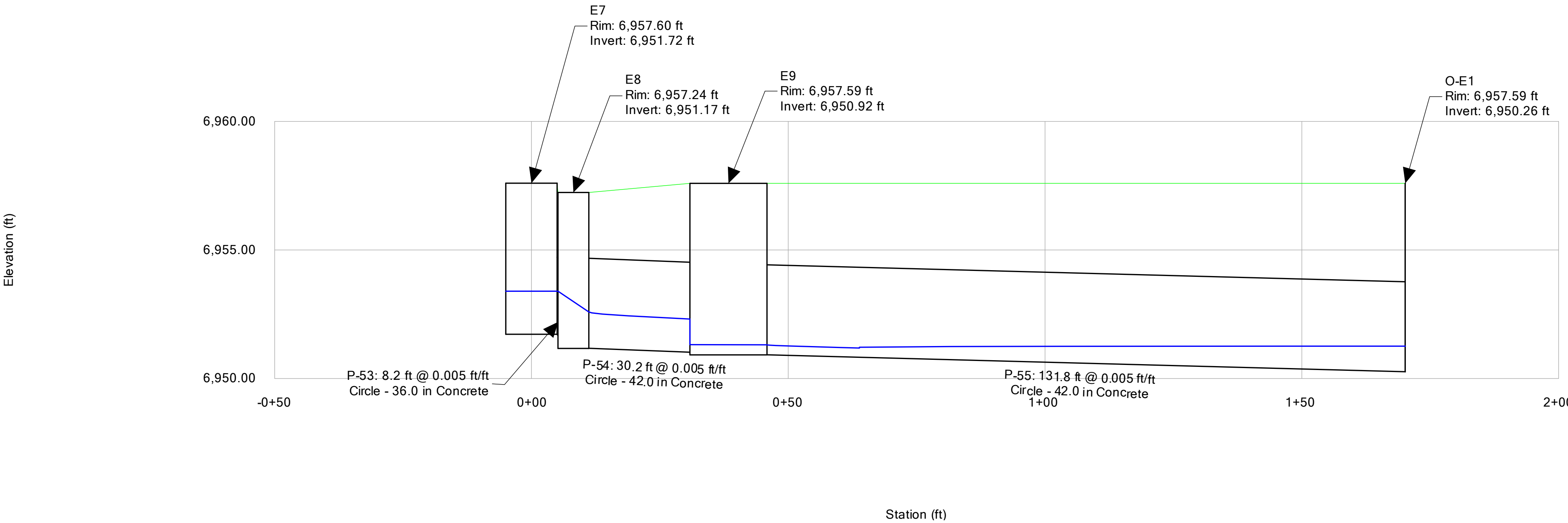
# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - E1 to E2 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 5-YR Event



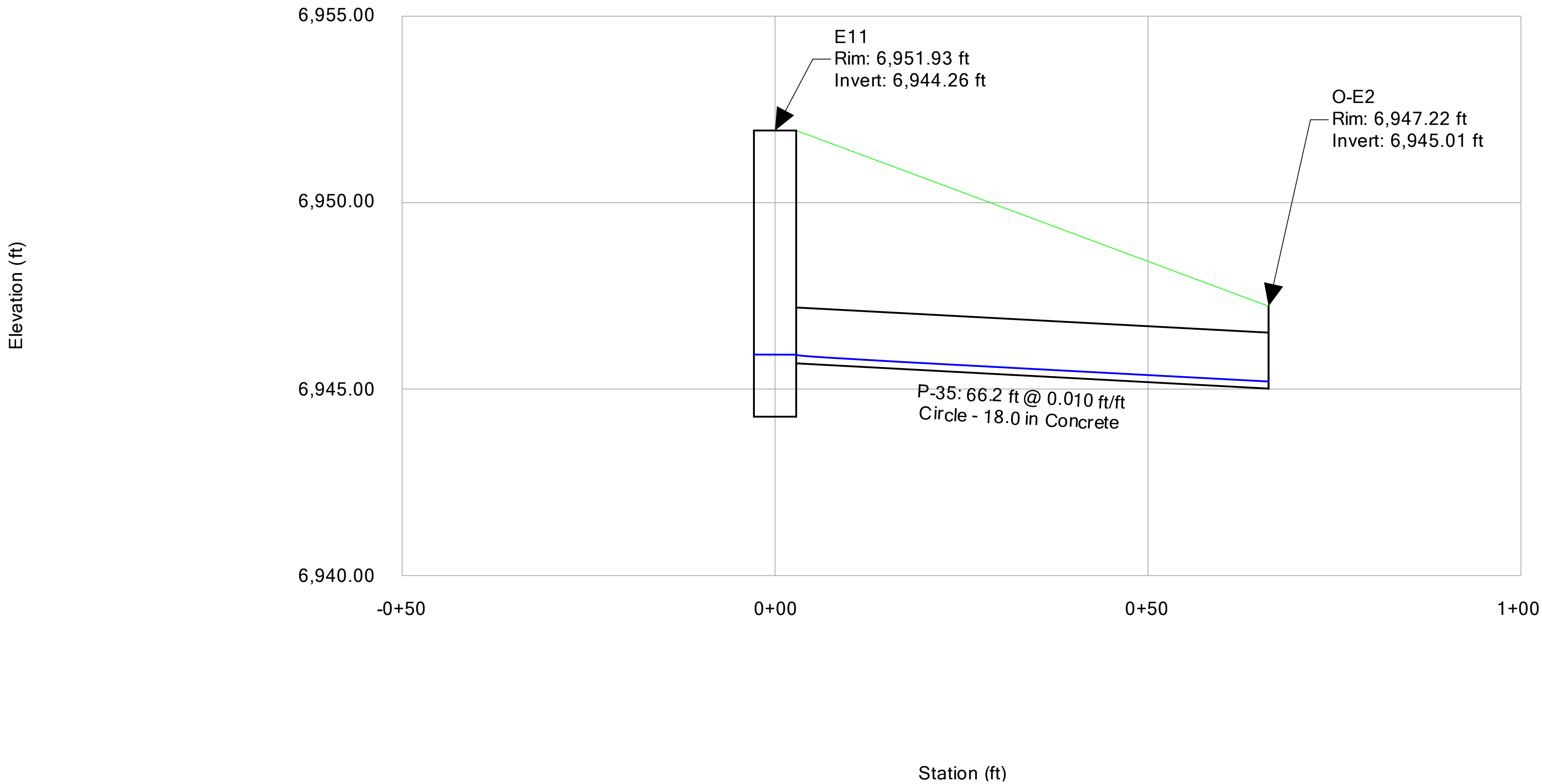
# Grandview Reserve Filing No. 1
## Profile Report
## Engineering Profile - E4 to E5 (HRG02_FDR Storm Analysis.stsw)
## Active Scenario: 5-YR Event



# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - E7 to O-E1 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 5-YR Event



# Grandview Reserve Filing No. 1
## Profile Report
## Engineering Profile - E10 to O-E2 (HRG02_FDR Storm Analysis.stsw)
## Active Scenario: 5-YR Event



# Grandview Reserve Filing No. 1

## FlexTable: Conduit Table

## Active Scenario: 100-YR Event

| Label | Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (User Defined) (ft) | Slope (Calculated) (ft/ft) | Diameter (in) | Manning's n | Material | Flow (cfs) | Velocity (ft/s) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | E3A | E3B | 6,955.27 | 6,954.75 | 68.6 | 0.007 | 30.0 | 0.012 | Concrete | 17.10 | 7.61 | 6,956.93 | 6,956.98 |
| P-2 | E3B | E3C | 6,954.55 | 6,954.32 | 30.2 | 0.007 | 30.0 | 0.012 | Concrete | 17.10 | 7.61 | 6,956.96 | 6,956.92 |
| P-3 | E3C | E6 | 6,953.82 | 6,953.32 | 66.7 | 0.007 | 36.0 | 0.012 | Concrete | 17.10 | 7.54 | 6,956.80 | 6,956.77 |
| P-3 (1) | E6 | E6A | 6,953.22 | 6,952.53 | 92.0 | 0.007 | 36.0 | 0.012 | Concrete | 40.40 | 9.41 | 6,955.29 | 6,955.21 |
| P-4 | E6A | S-67 (2) | 6,952.43 | 6,952.01 | 55.4 | 0.007 | 36.0 | 0.012 | Concrete | 40.40 | 9.41 | 6,955.15 | 6,955.04 |
| P-4 (1) | S-67 (2) | E8 | 6,951.92 | 6,951.67 | 32.3 | 0.007 | 36.0 | 0.012 | Concrete | 40.40 | 5.72 | 6,954.99 | 6,954.89 |
| P-9 | E2 | E3 | 6,958.38 | 6,957.40 | 35.4 | 0.027 | 24.0 | 0.012 | Concrete | 7.80 | 9.98 | 6,959.37 | 6,959.17 |
| P-10 | E1 | E3 | 6,957.65 | 6,957.40 | 9.0 | 0.027 | 24.0 | 0.012 | Concrete | 9.30 | 10.49 | 6,959.12 | 6,959.17 |
| P-35 | E11 | O-E2 | 6,945.69 | 6,945.01 | 66.2 | 0.010 | 18.0 | 0.012 | Concrete | 14.90 | 8.43 | 6,947.60 | 6,946.42 |
| P-36 | D8 | O-D2 | 6,964.99 | 6,964.01 | 98.7 | 0.010 | 18.0 | 0.012 | Concrete | 8.00 | 6.95 | 6,966.09 | 6,964.94 |
| P-39 | E3 | E3A | 6,956.91 | 6,955.36 | 205.8 | 0.007 | 30.0 | 0.012 | Concrete | 17.10 | 7.61 | 6,958.31 | 6,956.97 |
| P-40 | E4 | E6 | 6,954.51 | 6,954.32 | 9.2 | 0.020 | 24.0 | 0.012 | Concrete | 11.70 | 3.72 | 6,956.79 | 6,956.77 |
| P-41 | E5 | E6 | 6,954.62 | 6,954.32 | 29.1 | 0.010 | 24.0 | 0.012 | Concrete | 11.60 | 3.69 | 6,956.83 | 6,956.77 |
| P-42 | D3 | S-54 | 6,980.35 | 6,976.60 | 82.0 | 0.046 | 24.0 | 0.012 | Concrete | 10.50 | 13.03 | 6,981.51 | 6,977.22 |
| P-43 | S-54 | S-55 | 6,976.31 | 6,975.42 | 89.0 | 0.010 | 24.0 | 0.012 | Concrete | 10.50 | 7.50 | 6,977.47 | 6,976.34 |
| P-44 | S-55 | S-56 | 6,975.31 | 6,974.70 | 72.0 | 0.009 | 24.0 | 0.012 | Concrete | 10.50 | 7.08 | 6,976.48 | 6,975.95 |
| P-45 | S-56 | S-57 | 6,974.60 | 6,973.91 | 81.0 | 0.009 | 24.0 | 0.012 | Concrete | 10.50 | 7.08 | 6,975.76 | 6,975.16 |
| P-46 | S-57 | S-58 | 6,973.81 | 6,973.24 | 66.0 | 0.009 | 24.0 | 0.012 | Concrete | 10.50 | 7.08 | 6,974.97 | 6,974.49 |
| P-47 | S-58 | S-59 | 6,973.14 | 6,972.43 | 83.5 | 0.009 | 24.0 | 0.012 | Concrete | 10.50 | 7.08 | 6,974.30 | 6,973.68 |
| P-48 | S-59 | D5 | 6,972.33 | 6,971.92 | 47.0 | 0.009 | 24.0 | 0.012 | Concrete | 10.50 | 7.08 | 6,973.49 | 6,973.50 |
| P-49 | D5 | D6 | 6,970.93 | 6,970.51 | 27.7 | 0.015 | 36.0 | 0.012 | Concrete | 24.60 | 10.72 | 6,972.53 | 6,971.76 |
| P-50 | D3 | D1 | 6,980.66 | 6,980.75 | 9.2 | -0.010 | 24.0 | 0.012 | Concrete | 5.30 | 6.23 | 6,982.24 | 6,982.24 |
| P-51 | D3 | D2 | 6,980.66 | 6,980.80 | 29.2 | -0.005 | 24.0 | 0.012 | Concrete | 5.30 | 4.85 | 6,982.25 | 6,982.24 |
| P-52 | D6 | S-67 (3) | 6,970.41 | 6,968.49 | 127.8 | 0.015 | 36.0 | 0.012 | Concrete | 25.80 | 10.86 | 6,972.05 | 6,970.30 |
| P-53 | E7 | E8 | 6,951.72 | 6,951.67 | 8.2 | 0.005 | 36.0 | 0.012 | Concrete | 11.00 | 1.56 | 6,954.89 | 6,954.89 |
| P-54 | E8 | E9 | 6,951.17 | 6,951.02 | 30.2 | 0.005 | 42.0 | 0.012 | Concrete | 51.40 | 8.58 | 6,953.42 | 6,953.46 |
| P-55 | E9 | O-E1 | 6,950.92 | 6,950.26 | 131.8 | 0.005 | 42.0 | 0.012 | Concrete | 62.40 | 8.92 | 6,953.40 | 6,952.65 |
| P-56 | D4 | D5 | 6,972.06 | 6,971.92 | 13.2 | 0.010 | 24.0 | 0.012 | Concrete | 14.10 | 8.21 | 6,973.41 | 6,973.50 |
| P-57 (1) | S-67 (3) | O-D1 | 6,968.29 | 6,968.01 | 27.8 | 0.010 | 36.0 | 0.012 | Concrete | 25.80 | 9.37 | 6,970.09 | 6,970.23 |

# Grandview Reserve Filing No. 1
## FlexTable: Manhole Table
## Active Scenario: 100-YR Event

| Label | Notes | Elevation (Ground) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert Out) (ft) | Flow (Total Out) (cfs) | Headloss Coefficient (Standard) | Headloss Method | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|
| D1 | CDOT-TYPE R INLET (5') | 6,985.58 | (N/A) | 6,980.75 | 5.30 | 0.000 | Standard | 6,982.24 | 6,982.24 |
| D2 | CDOT-TYPE R INLET (5') | 6,985.58 | (N/A) | 6,980.80 | 5.30 | 0.000 | Standard | 6,982.25 | 6,982.25 |
| D3 | MH-ECCENTRIC (5' %%C) | 6,985.25 | 6,980.66 | 6,980.35 | 10.50 | 1.520 | Standard | 6,982.24 | 6,981.51 |
| D4 | CDOT-TYPE R INLET (15') - (PUB) | 6,977.69 | (N/A) | 6,972.06 | 14.10 | 0.000 | Standard | 6,973.41 | 6,973.41 |
| D5 | MH-ECCENTRIC (6' %%C) | 6,977.36 | 6,971.92 | 6,970.93 | 24.60 | 1.520 | Standard | 6,973.50 | 6,972.53 |
| D6 | CDOT-TYPE R INLET (15') - (PUB) | 6,977.69 | 6,970.51 | 6,970.41 | 25.80 | 0.050 | Standard | 6,972.08 | 6,972.05 |
| D8 | MODIFIED CDOT TYPE DPOND D OUTLET STRUCTURE(SEE GEC PLAN) | 6,969.69 | (N/A) | 6,964.99 | 8.00 | 0.000 | Standard | 6,966.09 | 6,966.09 |
| E1 | CDOT-TYPE R INLET (15') - (PUB) | 6,962.81 | (N/A) | 6,957.65 | 9.30 | 0.000 | Standard | 6,959.12 | 6,959.12 |
| E2 | CDOT-TYPE R INLET (15') - (PUB) | 6,963.03 | (N/A) | 6,958.38 | 7.80 | 0.000 | Standard | 6,959.37 | 6,959.37 |
| E3 | 5' %%C SDMH - (PUB) | 6,962.47 | 6,957.40 | 6,956.91 | 17.10 | 1.520 | Standard | 6,959.17 | 6,958.31 |
| E3A | 5' %%C SDMH - (PUB) | 6,960.42 | 6,955.36 | 6,955.27 | 17.10 | 0.100 | Standard | 6,956.97 | 6,956.93 |
| E3B | 5' %%C SDMH - (PUB) | 6,959.71 | 6,954.75 | 6,954.55 | 17.10 | 0.100 | Standard | 6,956.98 | 6,956.96 |
| E3C | 5' %%C SDMH - (PUB) | 6,959.59 | 6,954.32 | 6,953.82 | 17.10 | 1.320 | Standard | 6,956.92 | 6,956.80 |
| E4 | CDOT-TYPE R INLET (15') - (PUB) | 6,959.26 | (N/A) | 6,954.51 | 11.70 | 0.000 | Standard | 6,956.79 | 6,956.79 |
| E5 | CDOT-TYPE R INLET (15') - (PUB) | 6,959.26 | (N/A) | 6,954.62 | 11.60 | 0.000 | Standard | 6,956.83 | 6,956.83 |
| E6 | 6' %%C SDMH - (PUB) | 6,958.92 | 6,953.32 | 6,953.22 | 40.40 | 1.570 | Standard | 6,956.77 | 6,955.29 |
| E6A | 5' %%C SDMH - (PUB) | 6,958.00 | 6,952.53 | 6,952.43 | 40.40 | 0.100 | Standard | 6,955.21 | 6,955.15 |
| E7 | CDOT-TYPE R INLET (10') | 6,957.60 | (N/A) | 6,951.72 | 11.00 | 0.000 | Standard | 6,954.89 | 6,954.89 |
| E8 | MH-ECCENTRIC (6' %%C) | 6,957.24 | 6,951.67 | 6,951.17 | 51.40 | 1.520 | Standard | 6,954.89 | 6,953.42 |
| E9 | CDOT-TYPE R INLET (15') | 6,957.59 | 6,951.02 | 6,950.92 | 62.40 | 0.050 | Standard | 6,953.46 | 6,953.40 |
| E11 | MODIFIED CDOT TYPE DPOND E OUTLET STRUCTURE(SEE GEC PLAN) | 6,951.93 | (N/A) | 6,945.69 | 14.90 | 0.050 | Standard | 6,947.66 | 6,947.60 |
| S-54 | MH-ECCENTRIC (5' %%C) | 6,986.15 | 6,976.60 | 6,976.31 | 10.50 | 0.000 | Standard | 6,977.47 | 6,977.47 |
| S-55 | MH-ECCENTRIC (5' %%C) | 6,984.27 | 6,975.42 | 6,975.31 | 10.50 | 0.100 | Standard | 6,976.52 | 6,976.48 |
| S-56 | MH-ECCENTRIC (5' %%C) | 6,981.04 | 6,974.70 | 6,974.60 | 10.50 | 0.400 | Standard | 6,975.95 | 6,975.76 |
| S-57 | MH-ECCENTRIC (5' %%C) | 6,979.22 | 6,973.91 | 6,973.81 | 10.50 | 0.400 | Standard | 6,975.16 | 6,974.97 |
| S-58 | MH-ECCENTRIC (5' %%C) | 6,978.52 | 6,973.24 | 6,973.14 | 10.50 | 0.400 | Standard | 6,974.49 | 6,974.30 |
| S-59 | MH-ECCENTRIC (5' %%C) | 6,977.64 | 6,972.43 | 6,972.33 | 10.50 | 0.400 | Standard | 6,973.68 | 6,973.49 |
| S-67 (2) | MH-ECCENTRIC (5' %%C) | 6,957.45 | 6,952.01 | 6,951.92 | 40.40 | 0.100 | Standard | 6,955.04 | 6,954.99 |
| S-67 (3) | MH-ECCENTRIC (5' %%C) | 6,973.84 | 6,968.49 | 6,968.29 | 25.80 | 0.400 | Standard | 6,970.30 | 6,970.09 |

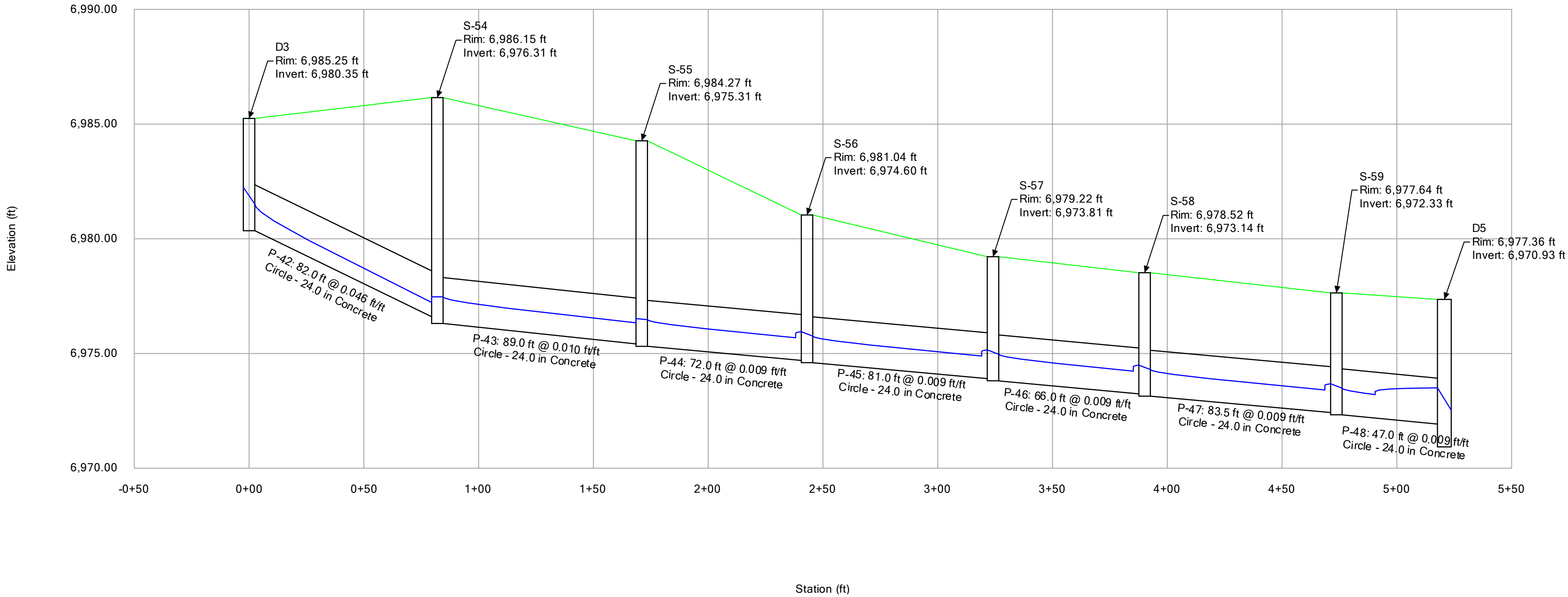
# Grandview Reserve Filing No. 1

## FlexTable: Outfall Table

## Active Scenario: 100-YR Event

| Label | Elevation (Ground) (ft) | Elevation (Invert) (ft) | Boundary Condition Type | Elevation (User Defined Tailwater) (ft) | Hydraulic Grade (ft) | Flow (Total Out) (cfs) |
|---|---|---|---|---|---|---|
| O-D2 | 6,966.22 | 6,964.01 | Free Outfall | | 6,964.94 | 8.00 |
| O-E2 | 6,947.22 | 6,945.01 | Free Outfall | | 6,946.42 | 14.90 |
| O-D1 | 6,973.84 | 6,968.01 | User Defined Tailwater | 6,970.23 | 6,970.23 | 25.80 |
| O-E1 | 6,957.59 | 6,950.26 | User Defined Tailwater | 6,952.57 | 6,952.65 | 62.40 |

# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - D3 to D5 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 100-YR Event

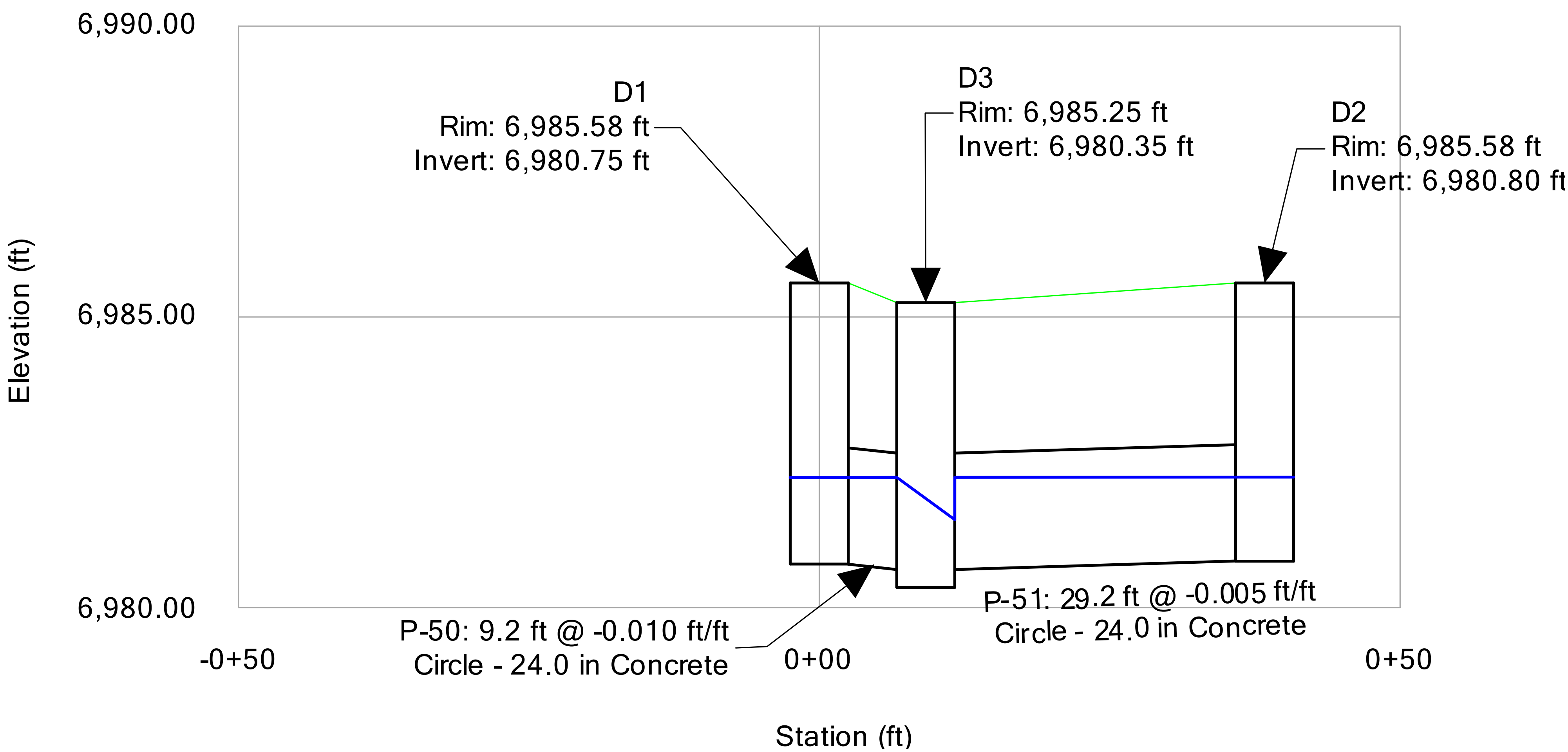


**Grandview Reserve Filing No. 1**

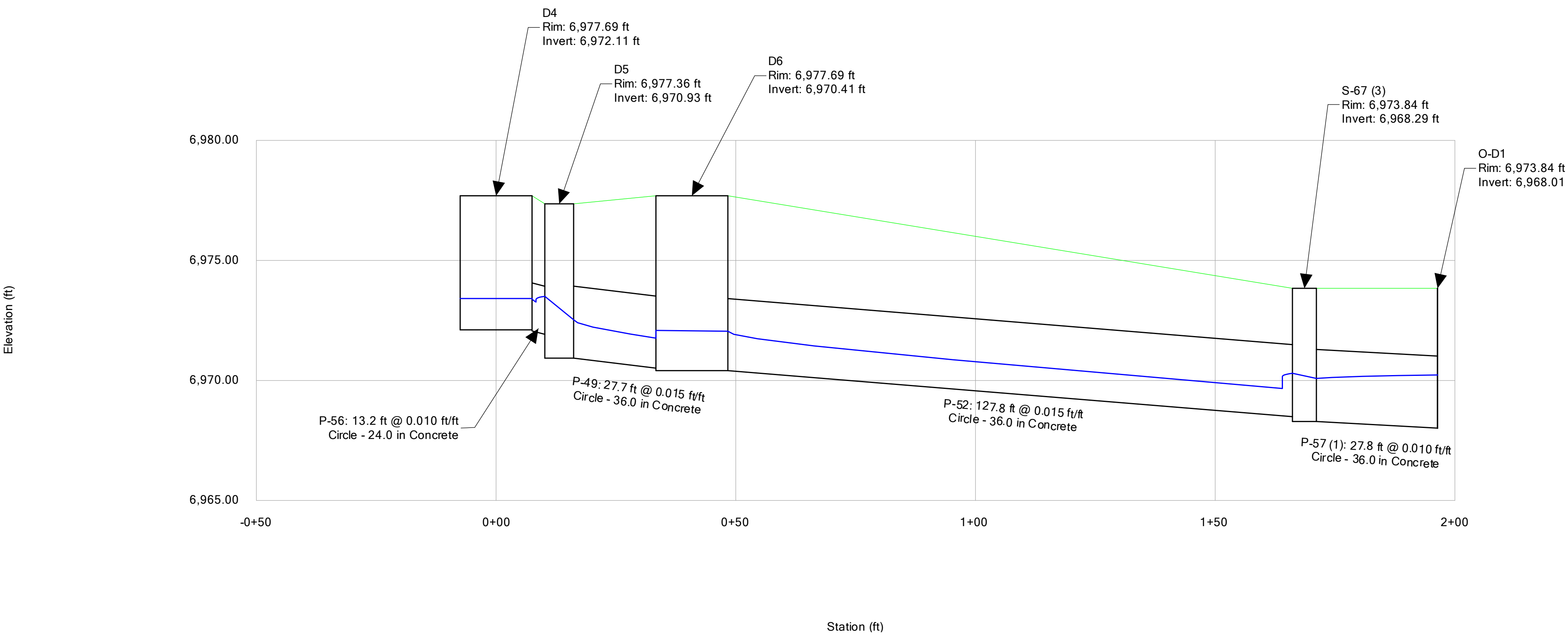
**Profile Report**

**Engineering Profile - D1 to D2 (HRG02_FDR Storm Analysis.stsw)**

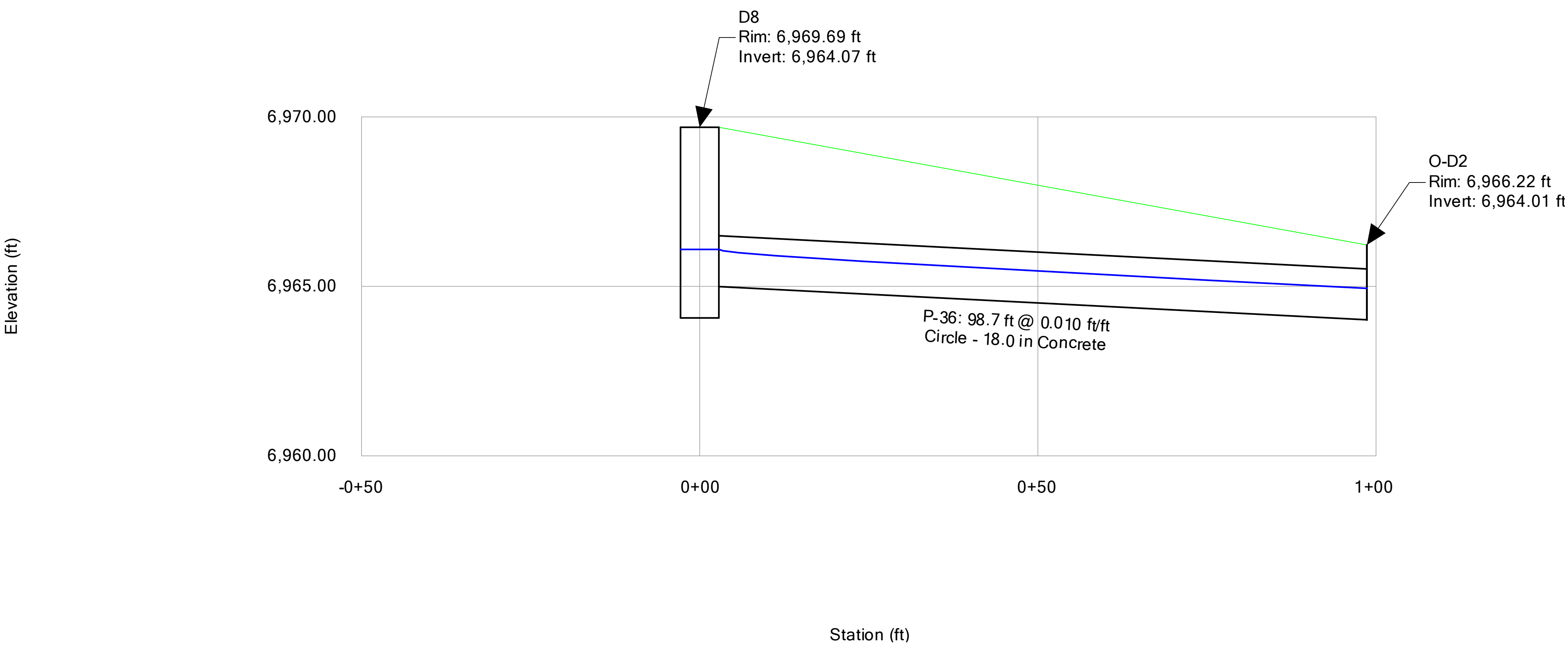
**Active Scenario: 100-YR Event**



# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - D4 to O-D1 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 100-YR Event



# Grandview Reserve Filing No. 1
## Profile Report
## Engineering Profile - D7 to O-D2 (HRG02_FDR Storm Analysis.stsw)
## Active Scenario: 100-YR Event

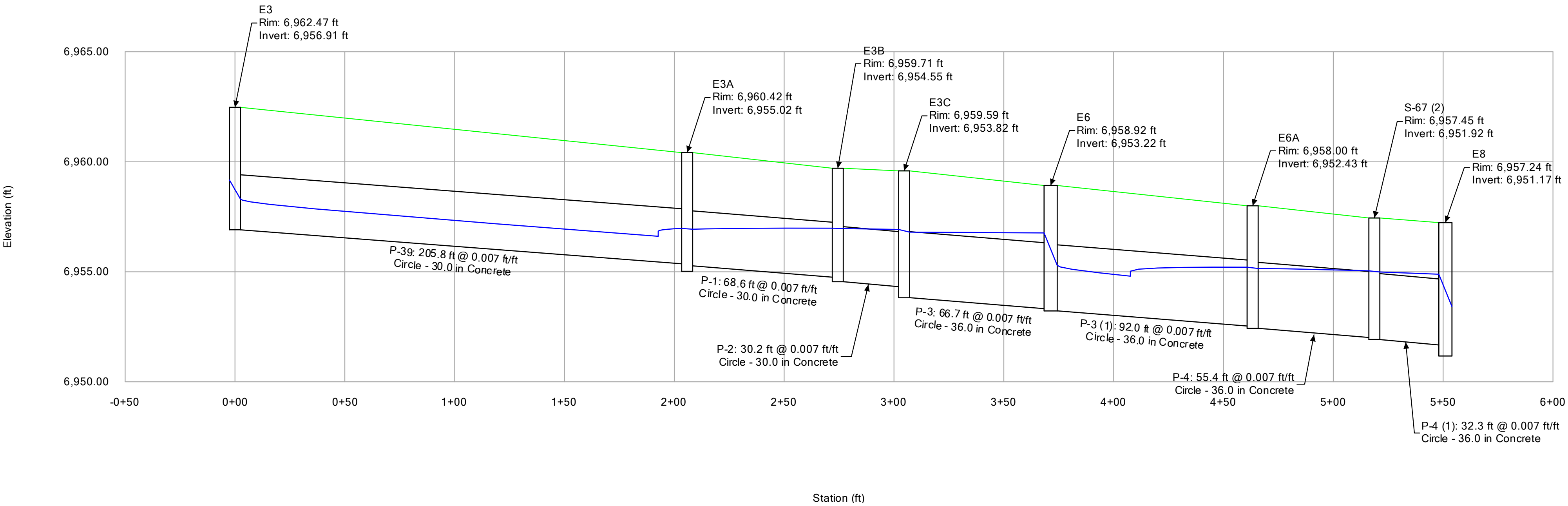


# Grandview Reserve Filing No. 1

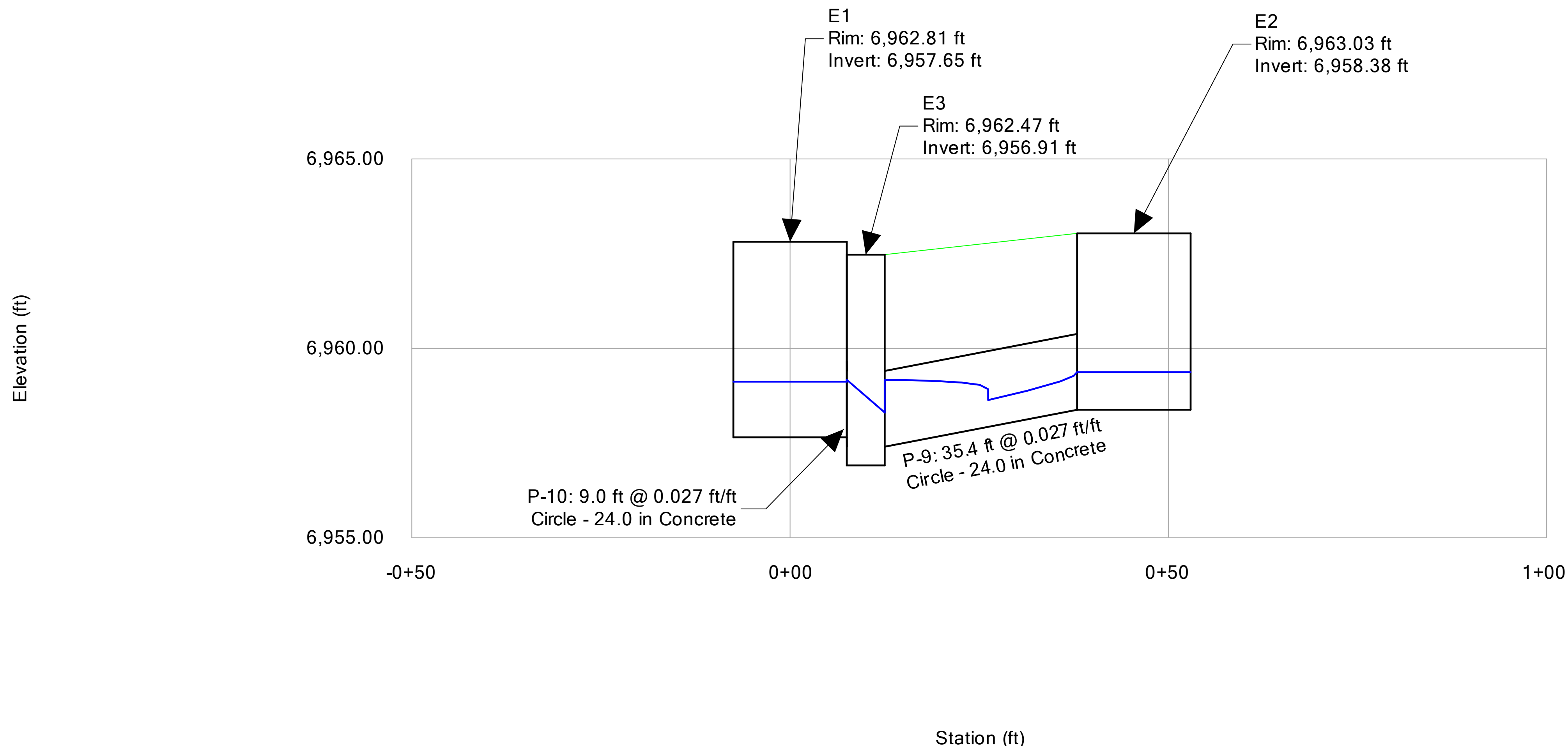
# Profile Report

# Engineering Profile - E3 to E8 (HRG02_FDR Storm Analysis.stsw)

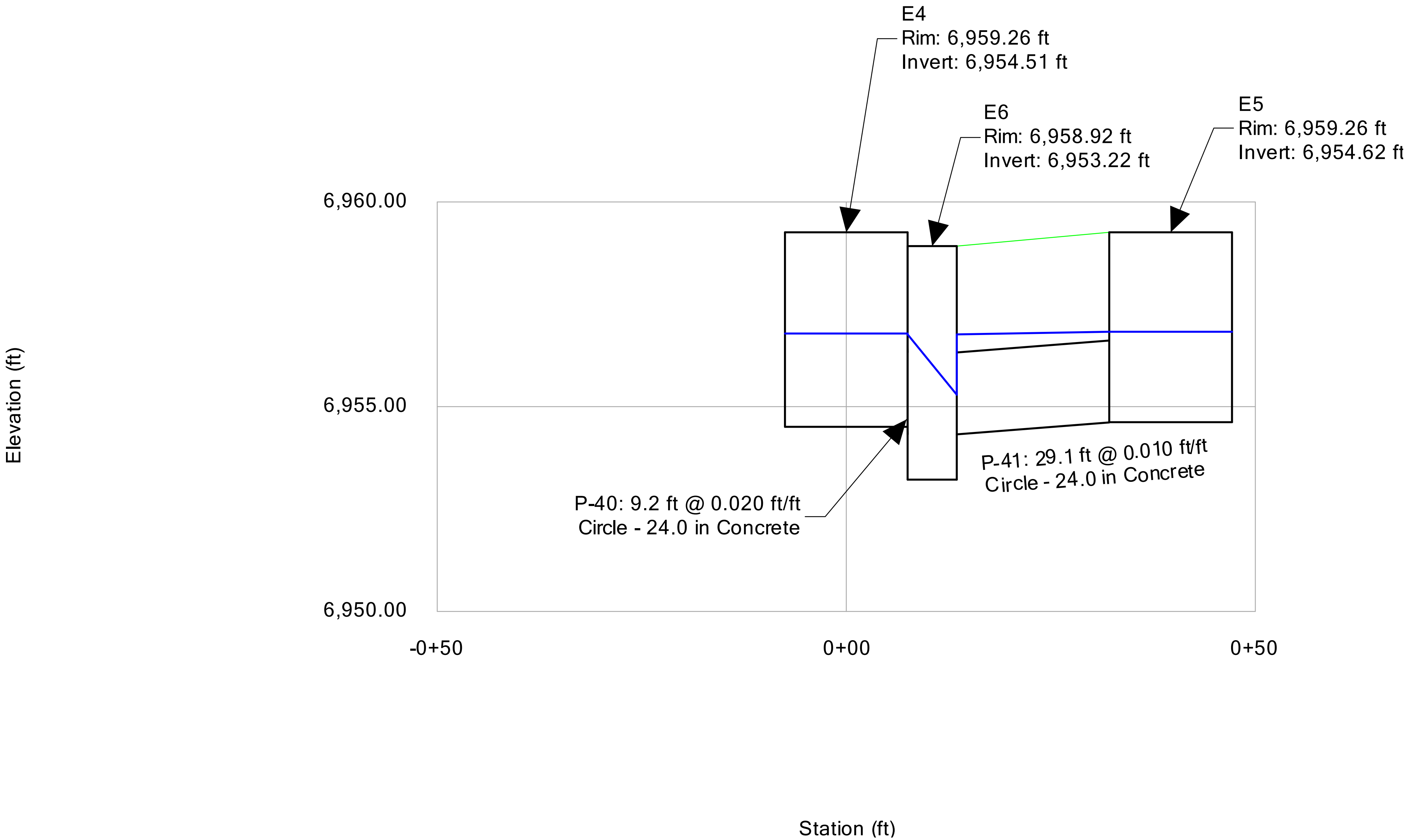
# Active Scenario: 100-YR Event



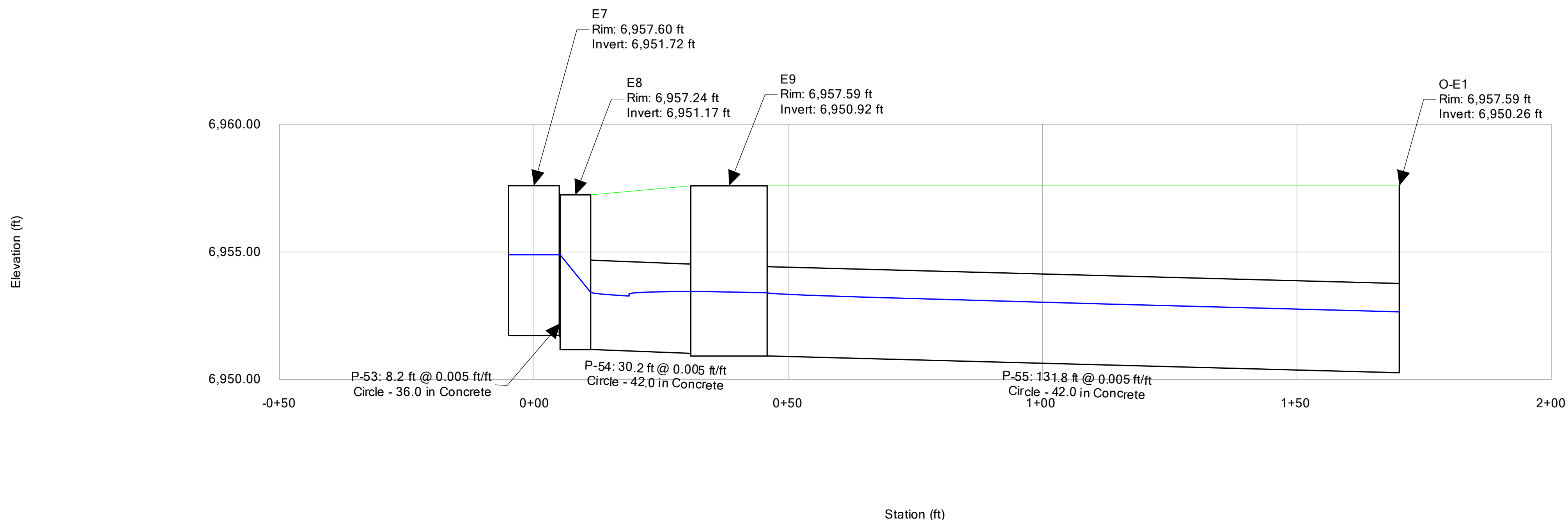
# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - E1 to E2 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 100-YR Event



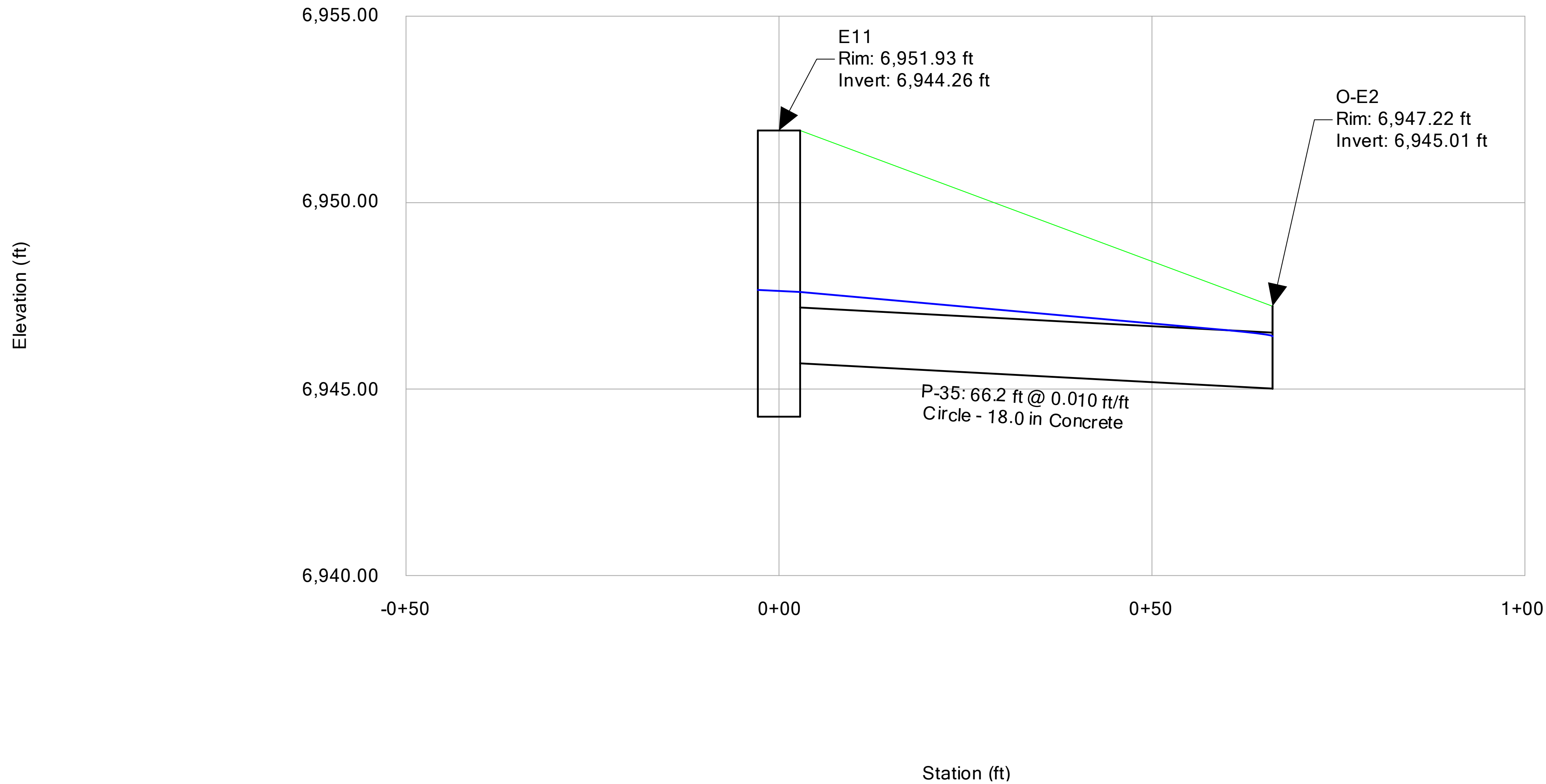
# Grandview Reserve Filing No. 1
## Profile Report
## Engineering Profile - E4 to E5 (HRG02_FDR Storm Analysis.stsw)
## Active Scenario: 100-YR Event



# Grandview Reserve Filing No. 1
# Profile Report
# Engineering Profile - E7 to O-E1 (HRG02_FDR Storm Analysis.stsw)
# Active Scenario: 100-YR Event



# Grandview Reserve Filing No. 1
# Profile Report
## Engineering Profile - E10 to O-E2 (HRG02_FDR Storm Analysis.stsw)
## Active Scenario: 100-YR Event



# APPENDIX E
# Water Quality Computations

## DETENTION POND TRIBUTARY AREAS

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

**Pond 'D'**

| Basin | Area | % Imp |
|---|---|---|
| D-1 | 2.73 | 46.6 |
| D-2 | 0.57 | 65.0 |
| D-3 | 4.33 | 59.8 |
| D-4 | 3.65 | 57.8 |
| D-5 | 1.59 | 22.6 |
| **Total** | **12.87** | **52.1** |

**Pond 'E'**

| Basin | Area | % Imp |
|---|---|---|
| E-1 | 4.47 | 42.4 |
| E-2 | 1.94 | 65.0 |
| E-3a | 2.90 | 65.0 |
| E-3b | 2.12 | 65.0 |
| E-4a | 7.45 | 48.7 |
| E-4b | 1.00 | 65.0 |
| E-5 | 1.43 | 13.1 |
| **Total** | **21.31** | **51.1** |

## FOREBAY TRIBUTARY AREAS

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

**Forebay D-1**

| Basin | Area | % Imp |
|---|---|---|
| D-1 | 2.73 | 46.6 |
| D-2 | 0.57 | 65.0 |
| D-3 | 4.33 | 59.8 |
| D-4 | 3.65 | 57.8 |
| **Total** | **11.28** | **56.2** |

**Forebay E-1**

| Basin | Area | % Imp |
|---|---|---|
| E-1 | 4.47 | 42.4 |
| E-2 | 1.94 | 65.0 |
| E-3a | 2.90 | 65.0 |
| E-3b | 2.12 | 65.0 |
| E-4a | 7.45 | 48.7 |
| E-4b | 1.00 | 65.0 |
| **Total** | **19.88** | **53.8** |



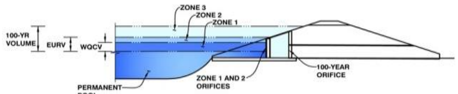
Galloway

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

**Project:** Grandview Reserve Filing No. 1 - Final Drainage Report

**Basin ID:** Pond D




**Example Zone Configuration (Retention Pond)**

Watershed Information

| | | | | |
|---|---|---|---|---|
| Selected BMP Type = | **EDB** | | | |
| Watershed Area = | 12.87 | acres | | |
| Watershed Length = | 900 | ft | | |
| Watershed Length to Centroid = | 450 | ft | | |
| Watershed Slope = | 0.020 | ft/ft | | |
| Watershed Imperviousness = | 52.10% | percent | | |
| Percentage Hydrologic Soil Group A = | 100.0% | percent | | |
| Percentage Hydrologic Soil Group B = | 0.0% | percent | | |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent | | |
| Target WQCV Drain Time = | 40.0 | hours | | |
| Location for 1-hr Rainfall Depths = | User Input | | | |

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

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.227 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.782 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.93 in.) = | 0.430 | acre-feet | 0.93 | inches |
| 5-yr Runoff Volume (P1 = 1.21 in.) = | 0.575 | acre-feet | 1.21 | inches |
| 10-yr Runoff Volume (P1 = 1.46 in.) = | 0.724 | acre-feet | 1.46 | inches |
| 25-yr Runoff Volume (P1 = 1.84 in.) = | 0.987 | acre-feet | 1.84 | inches |
| 50-yr Runoff Volume (P1 = 2.16 in.) = | 1.266 | acre-feet | 2.16 | inches |
| 100-yr Runoff Volume (P1 = 2.49 in.) = | 1.596 | acre-feet | 2.49 | inches |
| 500-yr Runoff Volume (P1 = 3.37 in.) = | 2.464 | acre-feet | 3.37 | inches |
| Approximate 2-yr Detention Volume = | 0.395 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.534 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.673 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.906 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 1.053 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 1.215 | acre-feet | | |

Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.227 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.555 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.433 | acre-feet |
| Total Detention Basin Volume = | 1.215 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | $ft^3$ |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | user | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | **user** | acre-feet |

Depth Increement = ft

| | Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| **6965.85** | **Top of Micropool** | -- | 0.00 | -- | -- | -- | 90 | 0.002 | | |
| **6966.35** | **Trickel Channel Inv** | -- | 0.50 | -- | -- | -- | 90 | 0.002 | 45 | 0.001 |
| | **6967** | -- | 1.15 | -- | -- | -- | 532 | 0.012 | 247 | 0.006 |
| | **6968** | -- | 2.15 | -- | -- | -- | 8,902 | 0.204 | 4,964 | 0.114 |
| | **6969** | -- | 3.15 | -- | -- | -- | 21,787 | 0.500 | 20,308 | 0.466 |
| | **6970** | -- | 4.15 | -- | -- | -- | 25,444 | 0.584 | 43,924 | 1.008 |
| | **6971** | -- | 5.15 | -- | -- | -- | 28,426 | 0.653 | 70,859 | 1.627 |
| **6971.50** | **Spillway Invert** | -- | 5.65 | -- | -- | -- | 29,894 | 0.686 | 85,439 | 1.961 |
| | **6972** | -- | 6.15 | -- | -- | -- | 31,395 | 0.721 | 100,761 | 2.313 |
| **6973.00** | **Top of Pond** | -- | 7.15 | -- | -- | -- | 34,492 | 0.792 | 133,705 | 3.069 |
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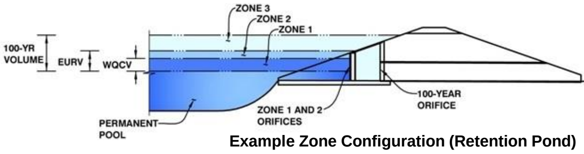
# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.06 (July 2022)*

**Project:** **Grandview Reserve Filing No. 1 - Final Drainage Report**

**Basin ID:** **Pond D**




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.58 | 0.227 | Orifice Plate |
| Zone 2 (EURV) | 3.76 | 0.555 | Rectangular Orifice |
| Zone 3 (100-year) | 4.50 | 0.433 | Weir&Pipe (Restrict) |
| Total (all zones) | | 1.215 | |

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

| | | | | | |
|---|---|---|---|---|---|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) | Underdrain Orifice Area = | N/A | $ft^2$ |
| Underdrain Orifice Diameter = | N/A | inches | Underdrain Orifice Centroid = | N/A | feet |

(Calculated Parameters for Underdrain)

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

| | | | Calculated Parameters for Plate | | |
|---|---|---|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 5.451E-03 | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 2.58 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 0.785 | sq. inches (diameter = 1 inch) | Elliptical Slot Area = | N/A | $ft^2$ |

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 1.00 | 2.25 | | | | | |
| Orifice Area (sq. inches) | 0.785 | 0.785 | 0.785 | | | | | |

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

**User Input: Vertical Orifice (Circular or Rectangular)**

| | Zone 2 Rectangular | Not Selected | | Calculated Parameters for Vertical Orifice | Zone 2 Rectangular | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | 2.75 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | 0.04 | N/A | $ft^2$ |
| Depth at top of Zone using Vertical Orifice = | 3.76 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | 0.09 | N/A | feet |
| Vertical Orifice Height = | 2.25 | N/A | inches | | | | |
| Vertical Orifice Width = | 2.75 | | inches | | | | |

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

| | Zone 3 Weir | Not Selected | | Calculated Parameters for Overflow Weir | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 3.83 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 3.83 | N/A | feet |
| Overflow Weir Front Edge Length = | 3.00 | N/A | feet | Overflow Weir Slope Length = | 6.00 | N/A | feet |
| Overflow Weir Grate Slope = | 0.00 | N/A | H:V | Grate Open Area / 100-yr Orifice Area = | 22.40 | N/A | |
| Horiz. Length of Weir Sides = | 6.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 14.24 | N/A | $ft^2$ |
| Overflow Grate Type = | Close Mesh Grate | N/A | | Overflow Grate Open Area w/ Debris = | 7.12 | N/A | $ft^2$ |
| Debris Clogging % = | 50% | N/A | % | | | | |

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

| | Zone 3 Restrictor | Not Selected | | Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.87 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 0.64 | N/A | $ft^2$ |
| Outlet Pipe Diameter = | 18.00 | N/A | inches | Outlet Orifice Centroid = | 0.34 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 7.00 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 1.35 | N/A | radians |

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

| | | | Calculated Parameters for Spillway | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 5.65 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 0.33 | feet |
| Spillway Crest Length = | 50.00 | feet | Stage at Top of Freeboard = | 7.15 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 0.79 | acres |
| Freeboard above Max Water Surface = | 1.17 | feet | Basin Volume at Top of Freeboard = | 3.07 | acre-ft |

**Routed Hydrograph Results**

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

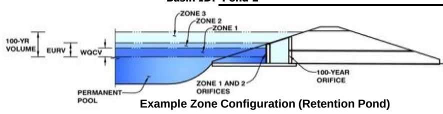
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.93 | 1.21 | 1.46 | 1.84 | 2.16 | 2.49 | 3.37 |
| CUHP Runoff Volume (acre-ft) = | 0.227 | 0.782 | 0.430 | 0.575 | 0.724 | 0.987 | 1.266 | 1.596 | 2.464 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.430 | 0.575 | 0.724 | 0.987 | 1.266 | 1.596 | 2.464 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.0 | 0.1 | 0.2 | 1.1 | 4.5 | 8.6 | 18.7 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.00 | 0.01 | 0.01 | 0.08 | 0.35 | 0.67 | 1.46 |
| Peak Inflow Q (cfs) = | N/A | N/A | 7.0 | 9.2 | 11.6 | 17.0 | 22.7 | 29.8 | 46.0 |
| Peak Outflow Q (cfs) = | 0.1 | 0.3 | 0.2 | 0.3 | 0.3 | 1.4 | 4.5 | 6.8 | 7.5 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 2.4 | 1.6 | 1.3 | 1.0 | 0.8 | 0.4 |
| Structure Controlling Flow = | Plate | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Outlet Plate 1 |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | N/A | 0.1 | 0.3 | 0.4 | 0.5 |
| Max Velocity through Grate 2 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Time to Drain 97% of Inflow Volume (hours) = | 40 | 71 | 59 | 65 | 70 | 75 | 73 | 71 | 67 |
| Time to Drain 99% of Inflow Volume (hours) = | **42** | 75 | 62 | 68 | 74 | 80 | 79 | 79 | 78 |
| Maximum Ponding Depth (ft) = | 2.58 | 3.76 | 3.02 | 3.30 | 3.56 | 3.94 | 4.10 | 4.38 | 5.42 |
| Area at Maximum Ponding Depth (acres) = | 0.33 | 0.55 | 0.46 | 0.51 | 0.53 | 0.57 | 0.58 | 0.60 | 0.67 |
| Maximum Volume Stored (acre-ft) = | 0.229 | 0.787 | 0.404 | 0.537 | 0.678 | 0.882 | 0.973 | 1.145 | 1.805 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

**Project:** Grandview Reserve Filing No. 1 - Final Drainage Report

**Basin ID:** Pond E




**Example Zone Configuration (Retention Pond)**

Watershed Information

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Selected BMP Type = | **EDB** | | | |
| Watershed Area = | 21.31 | acres | | |
| Watershed Length = | 1,165 | ft | | |
| Watershed Length to Centroid = | 500 | ft | | |
| Watershed Slope = | 0.030 | ft/ft | | |
| Watershed Imperviousness = | 51.10% | percent | | |
| Percentage Hydrologic Soil Group A = | 100.0% | percent | | |
| Percentage Hydrologic Soil Group B = | 0.0% | percent | | |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent | | |
| Target WQCV Drain Time = | 40.0 | hours | | |
| Location for 1-hr Rainfall Depths = | User Input | | | |
| Water Quality Capture Volume (WQCV) = | 0.372 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 1.263 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.93 in.) = | 0.692 | acre-feet | 0.93 | inches |
| 5-yr Runoff Volume (P1 = 1.21 in.) = | 0.926 | acre-feet | 1.21 | inches |
| 10-yr Runoff Volume (P1 = 1.46 in.) = | 1.167 | acre-feet | 1.46 | inches |
| 25-yr Runoff Volume (P1 = 1.84 in.) = | 1.598 | acre-feet | 1.84 | inches |
| 50-yr Runoff Volume (P1 = 2.16 in.) = | 2.056 | acre-feet | 2.16 | inches |
| 100-yr Runoff Volume (P1 = 2.49 in.) = | 2.602 | acre-feet | 2.49 | inches |
| 500-yr Runoff Volume (P1 = 3.37 in.) = | 4.037 | acre-feet | 3.37 | inches |
| Approximate 2-yr Detention Volume = | 0.638 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.863 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 1.088 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 1.466 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 1.705 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 1.973 | acre-feet | | |

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

Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.372 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.892 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.709 | acre-feet |
| Total Detention Basin Volume = | 1.973 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | $ft^3$ |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | user | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | **user** | acre-feet |

Depth Increment = ft

| | Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| **6947.25** | **Top of Micropool** | -- | 0.00 | -- | -- | -- | 102 | 0.002 | | |
| **6947.75** | **Trickle Channel Inv** | -- | 0.50 | -- | -- | -- | 102 | 0.002 | 51 | 0.001 |
| | **6948** | -- | 0.75 | -- | -- | -- | 87 | 0.002 | 75 | 0.002 |
| | **6949** | -- | 1.75 | -- | -- | -- | 2,819 | 0.065 | 1,528 | 0.035 |
| | **6950** | -- | 2.75 | -- | -- | -- | 14,292 | 0.328 | 10,083 | 0.231 |
| | **6951** | -- | 3.75 | -- | -- | -- | 27,045 | 0.621 | 30,751 | 0.706 |
| | **6952** | -- | 4.75 | -- | -- | -- | 31,693 | 0.728 | 60,120 | 1.380 |
| | **6953** | -- | 5.75 | -- | -- | -- | 35,219 | 0.809 | 93,576 | 2.148 |
| **6953.5** | **Spillway Invert** | -- | 6.25 | -- | -- | -- | 36,987 | 0.849 | 111,628 | 2.563 |
| | **6954** | -- | 6.75 | -- | -- | -- | 38,781 | 0.890 | 130,570 | 2.997 |
| **6955** | **Top of Pond** | -- | 7.75 | -- | -- | -- | 42,466 | 0.975 | 171,193 | 3.930 |
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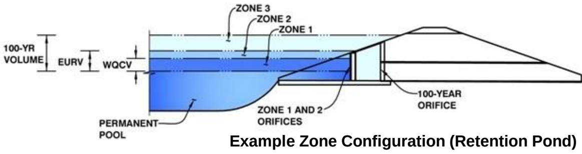
# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.06 (July 2022)*

**Project:** **Grandview Reserve Filing No. 1 - Final Drainage Report**

**Basin ID:** **Pond E**




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 3.12 | 0.372 | Orifice Plate |
| Zone 2 (EURV) | 4.59 | 0.892 | Rectangular Orifice |
| Zone 3 (100-year) | 5.54 | 0.709 | Weir&Pipe (Restrict) |
| Total (all zones) | | 1.973 | |

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

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

Calculated Parameters for Underdrain

| | | |
|---|---|---|
| Underdrain Orifice Area = | N/A | $ft^2$ |
| Underdrain Orifice Centroid = | N/A | feet |

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

| | | |
|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Orifice Plate = | 3.12 | ft (relative to basin bottom at Stage = 0 ft) |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches |
| Orifice Plate: Orifice Area per Row = | 0.994 | sq. inches (diameter = 1-1/8 inches) |

Calculated Parameters for Plate

| | | |
|---|---|---|
| WQ Orifice Area per Row = | 6.903E-03 | $ft^2$ |
| Elliptical Half-Width = | N/A | feet |
| Elliptical Slot Centroid = | N/A | feet |
| Elliptical Slot Area = | N/A | $ft^2$ |

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 1.00 | 2.00 | | | | | |
| Orifice Area (sq. inches) | 0.994 | 0.994 | 0.994 | | | | | |

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

User Input: Vertical Orifice (Circular or Rectangular)

| | Zone 2 Rectangular | Not Selected | |
|---|---|---|---|
| Invert of Vertical Orifice = | 3.125 | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Vertical Orifice = | 4.59 | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Vertical Orifice Height = | 2.00 | N/A | inches |
| Vertical Orifice Width = | 3.25 | | inches |

Calculated Parameters for Vertical Orifice

| | Zone 2 Rectangular | Not Selected | |
|---|---|---|---|
| Vertical Orifice Area = | 0.05 | N/A | $ft^2$ |
| Vertical Orifice Centroid = | 0.08 | N/A | feet |

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

| | Zone 3 Weir | Not Selected | |
|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 4.67 | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length = | 6.00 | N/A | feet |
| Overflow Weir Grate Slope = | 0.00 | N/A | H:V |
| Horiz. Length of Weir Sides = | 3.00 | N/A | feet |
| Overflow Grate Type = | Close Mesh Grate | N/A | |
| Debris Clogging % = | 50% | N/A | % |

Calculated Parameters for Overflow Weir

| | Zone 3 Weir | Not Selected | |
|---|---|---|---|
| Height of Grate Upper Edge, $H_t$ = | 4.67 | N/A | feet |
| Overflow Weir Slope Length = | 3.00 | N/A | feet |
| Grate Open Area / 100-yr Orifice Area = | 11.65 | N/A | |
| Overflow Grate Open Area w/o Debris = | 14.24 | N/A | $ft^2$ |
| Overflow Grate Open Area w/ Debris = | 7.12 | N/A | $ft^2$ |

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

| | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 1.58 | N/A | ft (distance below basin bottom at Stage = 0 ft) |
| Outlet Pipe Diameter = | 18.00 | N/A | inches |
| Restrictor Plate Height Above Pipe Invert = | 11.75 | | inches |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

| | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|
| Outlet Orifice Area = | 1.22 | N/A | $ft^2$ |
| Outlet Orifice Centroid = | 0.55 | N/A | feet |
| Half-Central Angle of Restrictor Plate on Pipe = | 1.88 | N/A | radians |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

| | | |
|---|---|---|
| Spillway Invert Stage= | 6.25 | ft (relative to basin bottom at Stage = 0 ft) |
| Spillway Crest Length = | 70.00 | feet |
| Spillway End Slopes = | 4.00 | H:V |
| Freeboard above Max Water Surface = | 1.11 | feet |

Calculated Parameters for Spillway

| | | |
|---|---|---|
| Spillway Design Flow Depth= | 0.39 | feet |
| Stage at Top of Freeboard = | 7.75 | feet |
| Basin Area at Top of Freeboard = | 0.97 | acres |
| Basin Volume at Top of Freeboard = | 3.93 | acre-ft |

Routed Hydrograph Results

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

| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.93 | 1.21 | 1.46 | 1.84 | 2.16 | 2.49 | 3.37 |
| CUHP Runoff Volume (acre-ft) = | 0.372 | 1.263 | 0.692 | 0.926 | 1.167 | 1.598 | 2.056 | 2.602 | 4.037 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.692 | 0.926 | 1.167 | 1.598 | 2.056 | 2.602 | 4.037 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.0 | 0.2 | 0.4 | 2.0 | 8.3 | 16.0 | 34.8 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.00 | 0.01 | 0.02 | 0.09 | 0.39 | 0.75 | 1.63 |
| Peak Inflow Q (cfs) = | N/A | N/A | 12.2 | 16.0 | 20.1 | 29.6 | 40.0 | 52.8 | 82.0 |
| Peak Outflow Q (cfs) = | 0.1 | 0.4 | 0.3 | 0.4 | 0.4 | 2.3 | 7.0 | 14.8 | 25.9 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 1.9 | 1.2 | 1.1 | 0.8 | 0.9 | 0.7 |
| Structure Controlling Flow = | Plate | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | N/A | 0.1 | 0.5 | 1.0 | 1.1 |
| Max Velocity through Grate 2 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Time to Drain 97% of Inflow Volume (hours) = | 40 | 69 | 55 | 62 | 68 | 73 | 71 | 69 | 64 |
| Time to Drain 99% of Inflow Volume (hours) = | **42** | 74 | 58 | 66 | 72 | 79 | 78 | 77 | 75 |
| Maximum Ponding Depth (ft) = | 3.12 | 4.59 | 3.66 | 4.01 | 4.36 | 4.82 | 5.03 | 5.32 | 6.38 |
| Area at Maximum Ponding Depth (acres) = | 0.44 | 0.71 | 0.59 | 0.65 | 0.68 | 0.73 | 0.75 | 0.77 | 0.86 |
| Maximum Volume Stored (acre-ft) = | 0.373 | 1.265 | 0.645 | 0.871 | 1.098 | 1.431 | 1.587 | 1.808 | 2.674 |

# FOREBAY SIZING CALCULATIONS

**Subdivision:** Grandview Reserve Filing No. 1
**Location:** CO, Falcon (El Paso County)

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| | Forebay D-1 | Forebay E-1 | | |
|---|---|---|---|---|
| Impervious % (I) | 56.2% | 53.80% | | Total impervious area of contributing upstream basins |
| WQCV Drain Time Coeff (a) | 1 | 1 | | a = 1 for 40 Hr WQCV Drain Time |
| Tributary Area (Ac) | 11.28 | 19.88 | | |
| Forebay Depth (Ft) | 1.50 | 1.50 | | (see Table EDB-4 of the USDCM Volume 3 for depth requirement) |
| % of WQCV for Forebay Volume | 3.0% | 3.0% | | (see Table EDB-4 of the USDCM Volume 3 for requirement) |
| 100-year Discharge (Q) | 25.80 | 62.40 | | 100-Year Flow entering Forebay (un-detained) |
| WQCV Depth (in) | 0.22 | 0.22 | | WQCV Depth = $a(0.91*I^3 - 1.19*I^2 + 0.78*I)$ |
| WQCV Volume (Ac-Ft) | 0.21 | 0.36 | | |
| Forebay Volume (Cu. Ft.) | 275 | 470 | | |
| Forebay Discharge (Q) | 0.52 | 1.25 | | (Release 2% of 100-year discharge via notch or berm/pipe configuration) |
| Forebay Notch Height (in) | 15.00 | 15.00 | | (3" depression @ top of forebay assumed per COS DCM Volume 1, 13-30) |
| **Forebay Deisgn Results** | | | | |
| **Minimum Forebay Area (Sq. Ft.)** | **183** | **313** | | |
| **Forebay Notch width (in)** | **3** | **3** | | From $Q=C_w*W*H^{1.5}$ assuming $C_w$=3.33 for sharp-crested weir - **If notch width <3", use 3" minimum.** |



Galloway

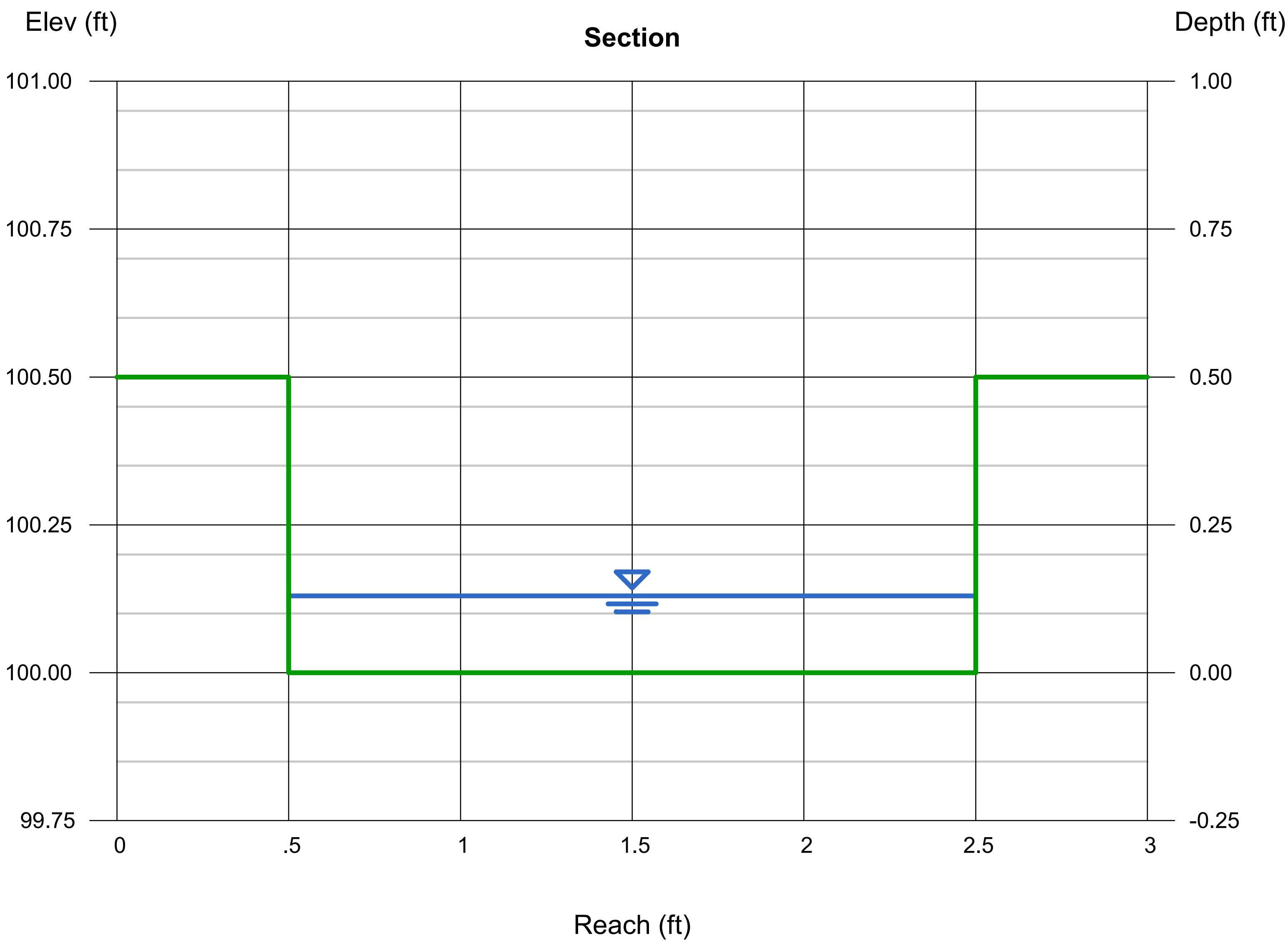
# Channel Report



## Pond D Trickle Channel

| **Rectangular** | |
|---|---|
| Bottom Width (ft) | = 2.00 |
| Total Depth (ft) | = 0.50 |
| | |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.012 |
| | |
| **Calculations** | |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.52 |

| **Highlighted** | |
|---|---|
| Depth (ft) | = 0.13 |
| Q (cfs) | = 0.520 |
| Area (sqft) | = 0.26 |
| Velocity (ft/s) | = 2.00 |
| Wetted Perim (ft) | = 2.26 |
| Crit Depth, Yc (ft) | = 0.13 |
| Top Width (ft) | = 2.00 |
| EGL (ft) | = 0.19 |

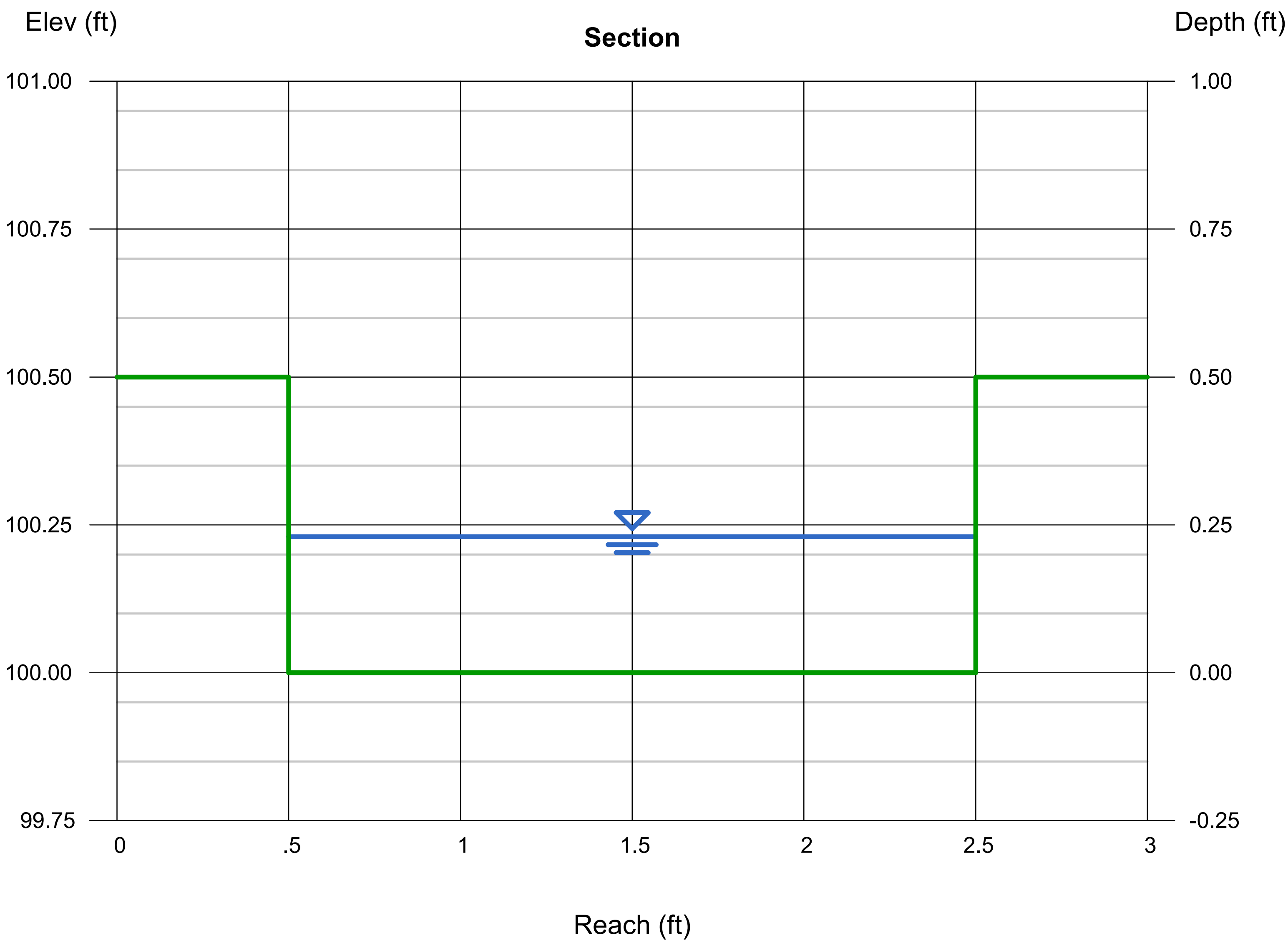


# Channel Report



## Pond E Trickle Channel

| | | | |
|---|---|---|---|
| **Rectangular** | | **Highlighted** | |
| Bottom Width (ft) | = 2.00 | Depth (ft) | = 0.23 |
| Total Depth (ft) | = 0.50 | Q (cfs) | = 1.260 |
| | | Area (sqft) | = 0.46 |
| Invert Elev (ft) | = 100.00 | Velocity (ft/s) | = 2.74 |
| Slope (%) | = 0.50 | Wetted Perim (ft) | = 2.46 |
| N-Value | = 0.012 | Crit Depth, Yc (ft) | = 0.24 |
| | | Top Width (ft) | = 2.00 |
| **Calculations** | | EGL (ft) | = 0.35 |
| Compute by: | Known Q | | |
| Known Q (cfs) | = 1.26 | | |



# Micropool/ISV SIZING CALCULATIONS

**Project Name:** Grandview Reserve Filing No. 1
**Project No.:** HRG02.20
**Calculated By:** TJE
**Checked By:** BAS
**Date:** 6/21/24

| | Pond D | Pond E | |
|---|---|---|---|
| WQCV Volume (Ac-Ft) | 0.227 | 0.372 | From MHFD-Detention Spreadsheet |
| Provided ISV Depth (in) | 6.00 | 6.00 | 4" Min. per USDCM, Volume 3 |
| Provided Micropool/ISV Area (Sq. Ft.) | 90.00 | 102.00 | |
| Provided ISV Volume (Cu. Ft.) | 45.00 | 51.00 | |
| **Micropool/ISV Deisgn Results** | | | |
| **Minimum Micropool Area (Sq. Ft.)** | **59** | **97** | Assuming ISV above - Min. 10 $ft^2$ per USDCM, Volume 3 |
| **Required ISV Volume (Cu. Ft.)** | **30** | **49** | 0.3% of WQCV, per USDCM, Volume 3 |
| **Is Required Micropool Area Met?** | **YES** | **YES** | |
| **Is Required ISV Volume Met?** | **YES** | **YES** | |



Galloway

**Figure 13-12c. Emergency Spillway Protection**

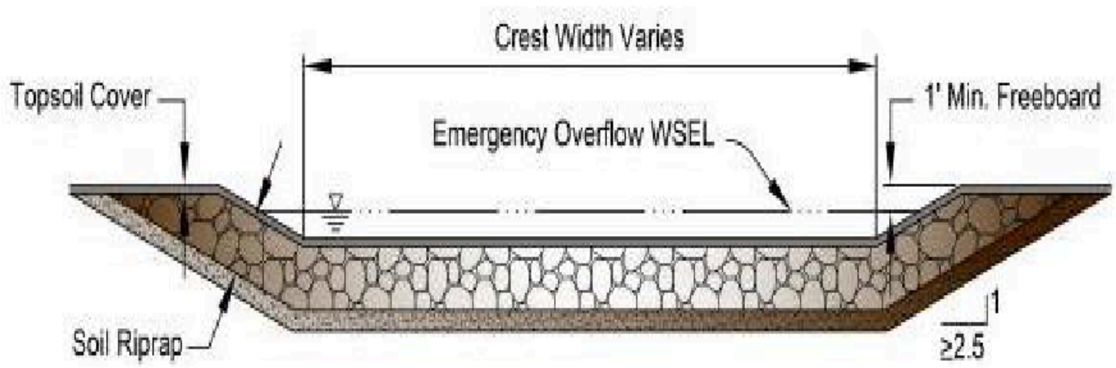
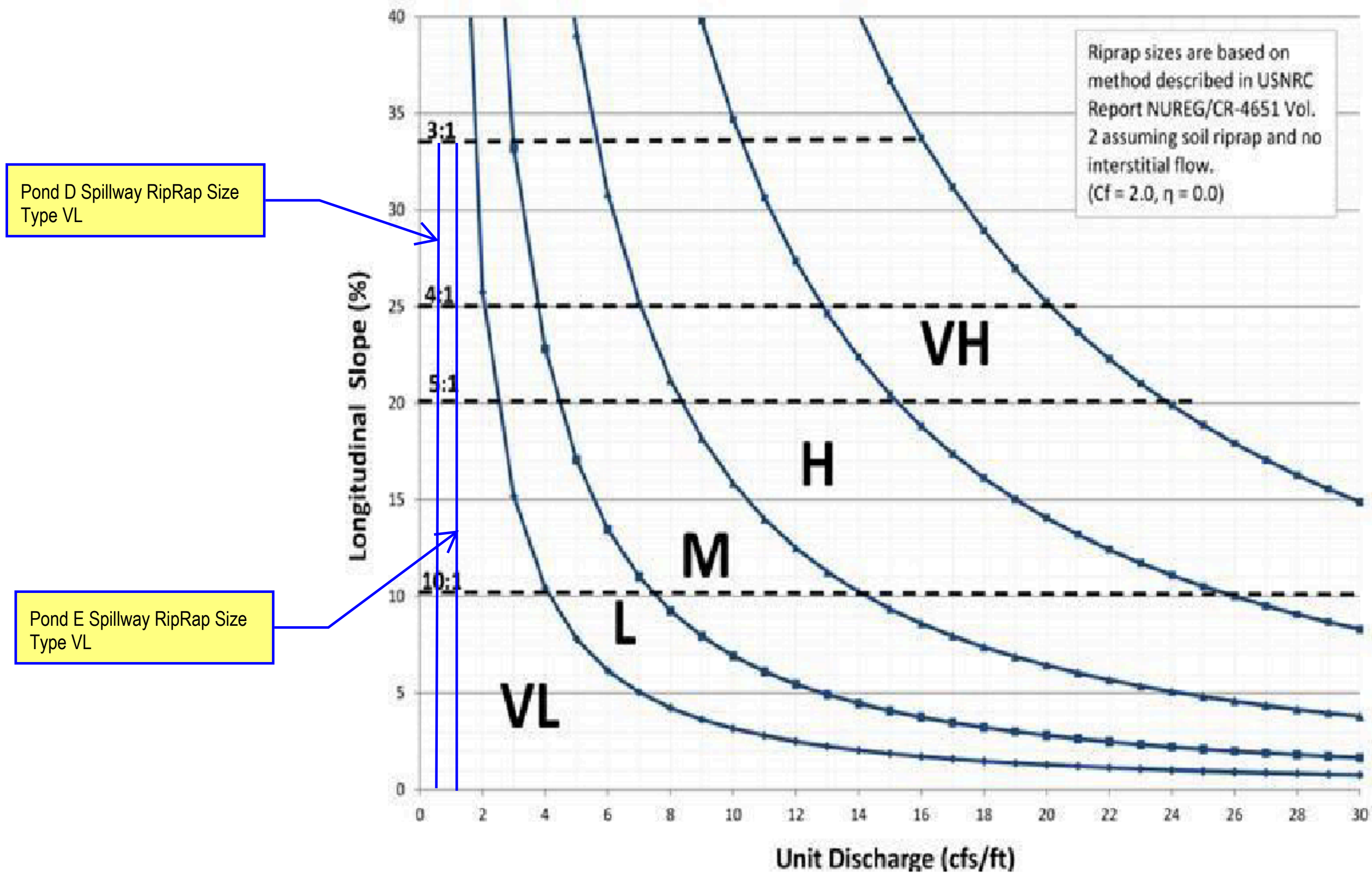



**Figure 13-12d. Riprap Types for Emergency Spillway Protection**




Pond D Unit Discharge = 28.8 cfs / 50.0 ft = 0.576 cfs/ft

Pond E Unit Discharge = 64.2 cfs / 70.0 ft = 0.917 cfs/ft

# APPENDIX F

# Drainage Maps

| RUNOFF SUMMARY TABLE | | | |
|---|---|---|---|
| Basin ID | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| *EX1 | 321.53 | 28.3 | 365.2 |
| *EX2 | 18.88 | 1.7 | 18.8 |
| *EX3 | 131.26 | 6.1 | 112.1 |
| *EX4 | 832.70 | 22.4 | 491.0 |
| *EX5 | 22.35 | 7.0 | 43.3 |
| *EX6 | 3.05 | 1.2 | 6.9 |
| *EX7 | 1.47 | 0.9 | 4.2 |
| ES-1 | 16.37 | 3.5 | 24.7 |
| ES-2 | 46.05 | 7.5 | 53.7 |
| ES-3 | 64.30 | 10.0 | 71.5 |
| ES-4 | 2.68 | 0.6 | 4.4 |
| ES-5 | 26.15 | 5.0 | 35.5 |
| ES-6 | 31.26 | 6.5 | 46.5 |

*Values taken from Eastonville Road PDR prepared by HR Green, Dated September 2023

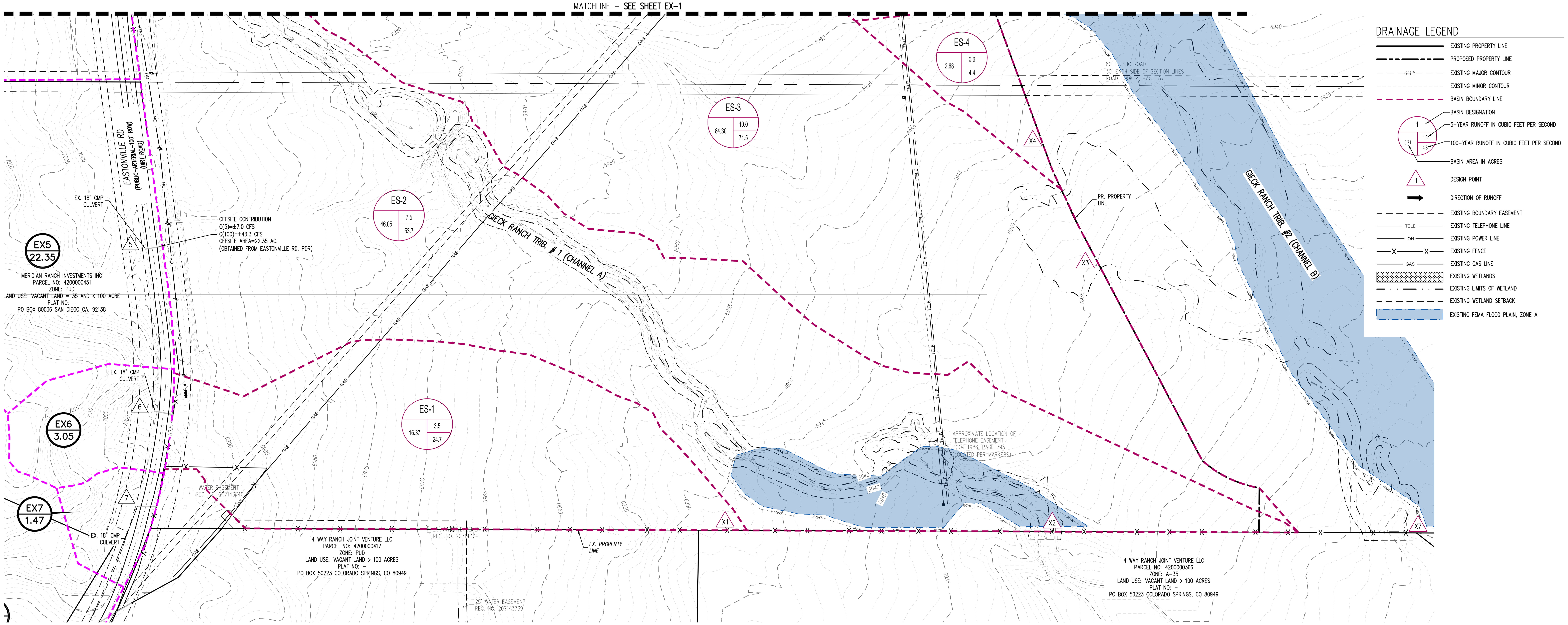
| DESIGN POINT SUMMARY TABLE | | | |
|---|---|---|---|
| | Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| | X1 | 4.7 | 31.6 |
| | X2 | 36.9 | 588.0 |
| | X3 | 10.0 | 71.5 |
| | X4 | 0.6 | 4.4 |
| | X5 | 5.0 | 35.5 |
| | X6 | 40.9 | 523.8 |
| | X7 | 56.5 | 635.2 |
| * | 1 | 28.3 | 365.2 |
| * | 2 | 1.7 | 18.8 |
| * | 3 | 6.1 | 112.1 |
| * | 4 | 22.4 | 491.0 |
| * | 5 | 7.0 | 43.3 |
| * | 6 | 1.2 | 6.9 |
| * | 7 | 0.9 | 4.2 |

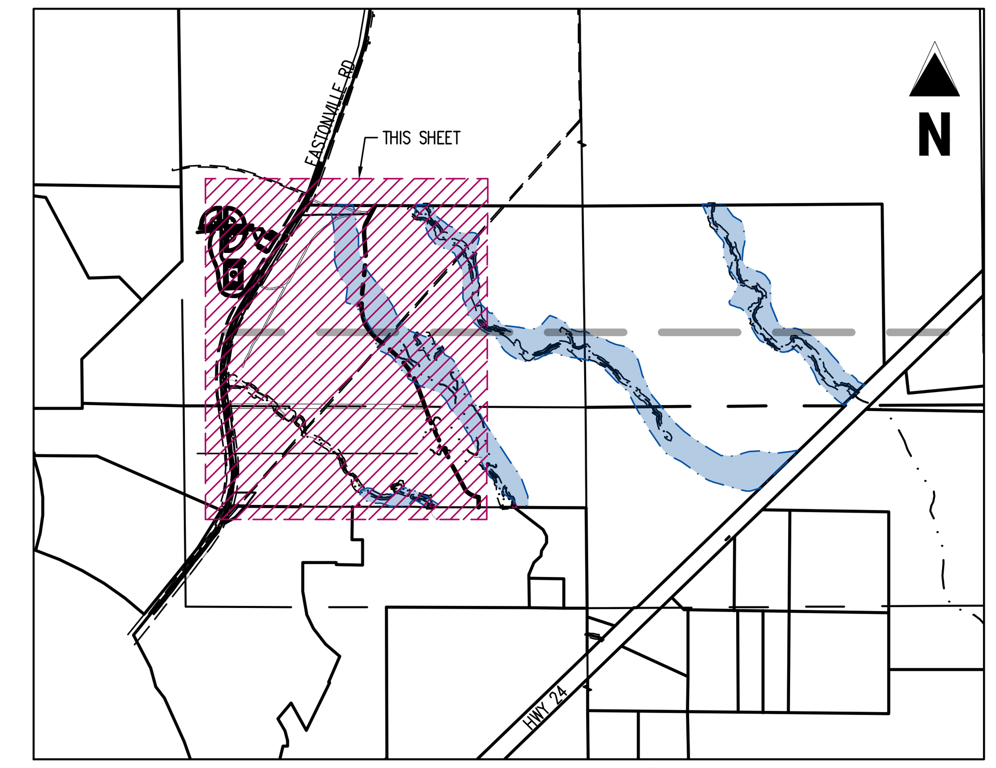
*Values taken from Eastonville Road PDR prepared by HR Green, Dated September 2023

NOTE:

1. FOR EXISTING WESTERN OFFSITE SUB-BASIN ANALYSIS AS WELL AS PROPOSED EASTONVILLE ROAD SUB-BASIN ANALYSIS, SEE "EASTONVILLE ROAD FINAL DRAINAGE REPORT", BY HR GREEN, SEPTEMBER 2022.

GRANDVIEW RESERVE HISTORIC DRAINAGE MAP
(THIS DRAINAGE MAP IS FROM THE APPROVED PDR,
"GRANDVIEW RESERVE FILING NO.1 ", APPROVED ON 03/06/2024)




KEY MAP SCALE: (1"=2,000')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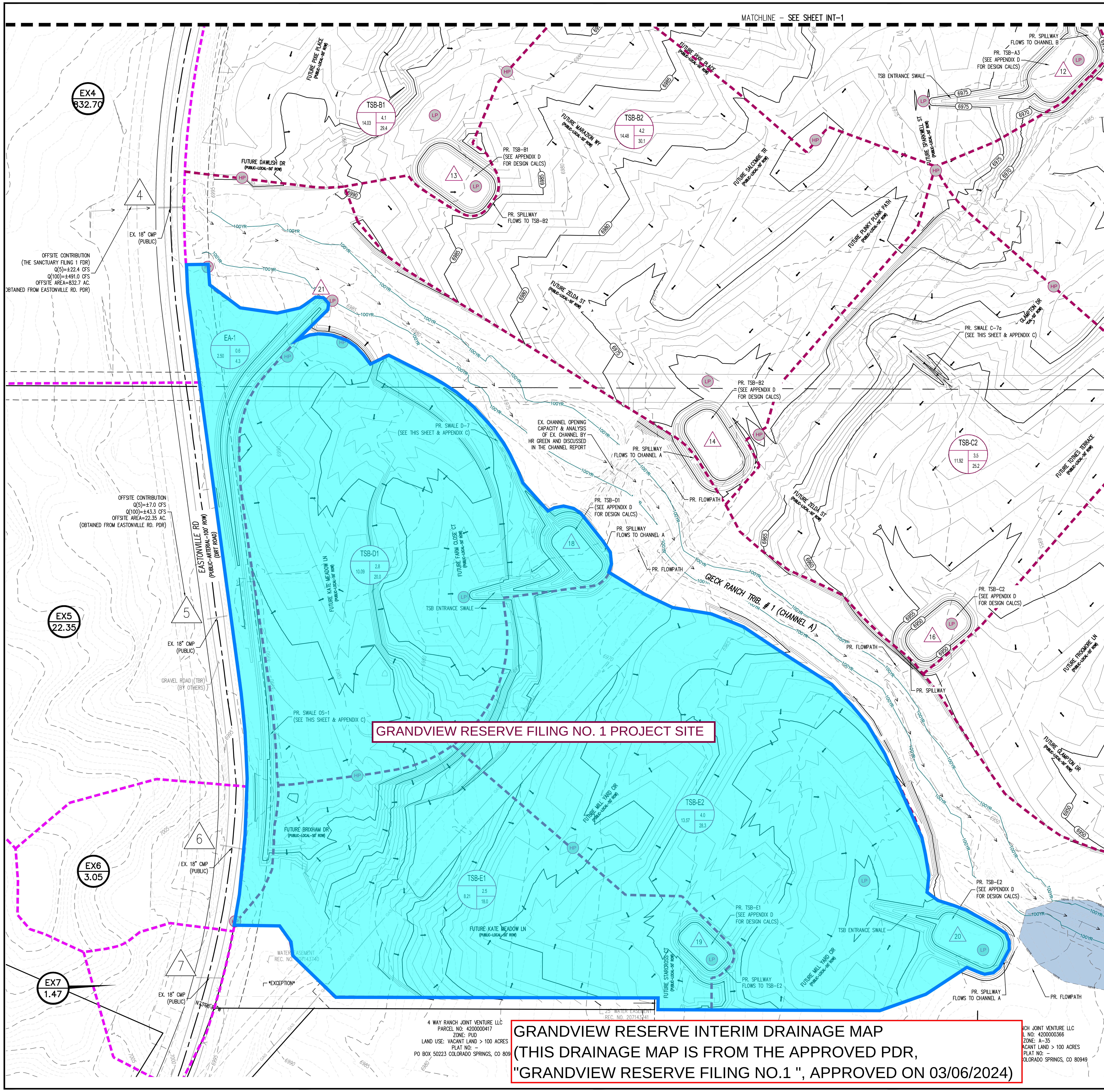
PRELIMINARY DRAINAGE PLAN
GRANDVIEW RESERVE
FOR
HR GREEN, INC
EASTONVILLE RD
EL PASO COUNTY, PEYTON, CO 80831

| # | Date | Issue / Description | Init. |
|---|---|---|---|

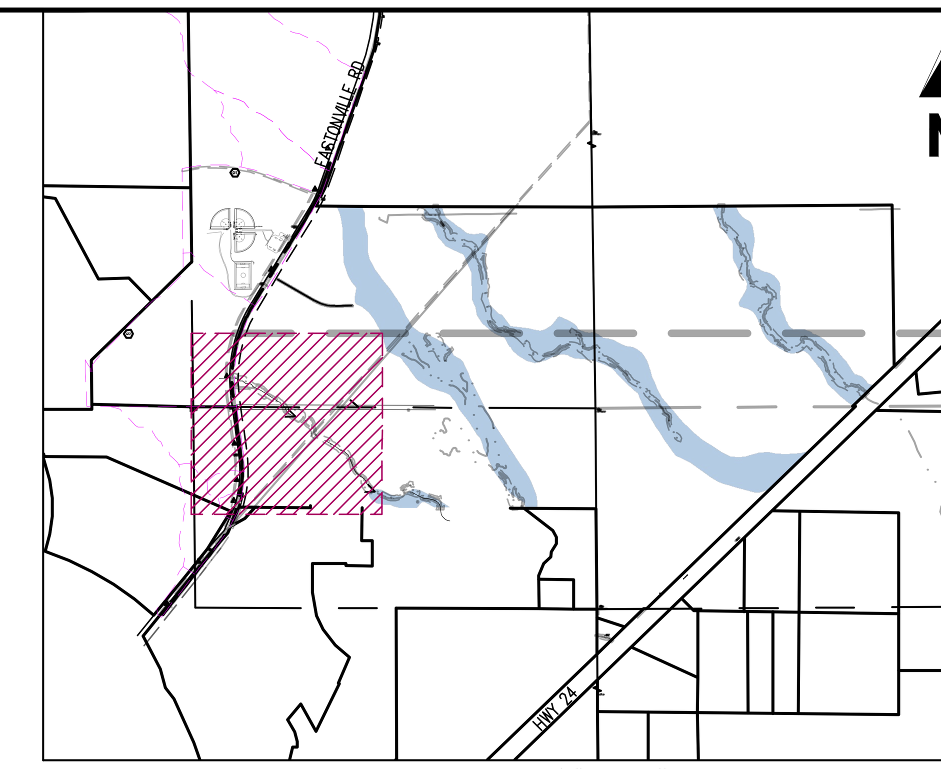
| | |
|---|---|
| Project No: | HRG 1.20 |
| Drawn By: | TJE |
| Checked By: | GRD |
| Date: | 1/23/2024 |

EXISTING DRAINAGE MAP

EX-2




GRANDVIEW RESERVE INTERIM DRAINAGE MAP
(THIS DRAINAGE MAP IS FROM THE APPROVED PDR,
"GRANDVIEW RESERVE FILING NO.1 ", APPROVED ON 03/06/2024)




KEY MAP SCALE: (1"=2,000')

SCALE: 1"=100'

## DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- EXISTING MAJOR CONTOUR (6480)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR (6480)
- PROPOSED MINOR CONTOUR
- TSB BASIN BOUNDARY LINE
- EXISTING WETLANDS
- EXISTING LIMITS OF WETLAND
- EXISTING WETLAND SETBACK
- EXISTING FEMA FLOOD PLAIN, ZONE A
- 100-YEAR WATER SURFACE ELEVATION AND FLOODPLAIN (100YR)
- EX3 / 131.26 — OFF-SITE BASIN DESIGNATION; OFF-SITE BASIN TRIBUTARY AREA
- 1 / 0.71 / 1.8 / 4.8 — BASIN DESIGNATION; 5-YEAR RUNOFF IN CUBIC FEET PER SECOND; 100-YEAR RUNOFF IN CUBIC FEET PER SECOND; BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

NOTE:

1. FOR EXISTING WESTERN OFFSITE SUB-BASIN ANALYSIS AS WELL AS PROPOSED EASTONVILLE ROAD SUB-BASIN ANALYSIS, SEE "EASTONVILLE ROAD- LONDONDERRY DR. TO REX RD. PRELIMINARY DRAINAGE REPORT", BY HR GREEN, DATED SEPTEMBER 2023.
2. ALL OFF SITE FLOWS NORTHWEST OF REX ROAD NOTED IN THIS REPORT WILL VARY FROM THOSE IN THE CLOMR REPORT PRPARED BY HR GREEN. THIS IS DUE TO SLIGHT DIFFERENCES IN HYDROLOGIC MODELING. THE FLOW AT THE INLET OF THE PROPOSED REX ROAD CULVERT IS 262 CFS IN THE SUBMITTED CLOMR MODEL, AS OPPOSED TO 280 CFS FROM THE ACCEPTED MERIDIAN RANCH DEVELOPMENT DRAINAGE PLAN MODEL OUTPUT. THE FLOW AT THE OUTLET OF THE PROPOSED REX ROAD CULVERT IS 536 CFS. THIS VALUE COMES FROM THE NEXT DOWNSTREAM DESIGN POINT AT THE INLET OF THE PROPOSED DAWLISH ROAD AND IS CARRIED UPSTREAM TO THE PREVIOUS DESIGN POINT.
3. PROPOSED CHANNEL DESIGN AND ANALYSIS FOR BOTH ON-SITE TRIBUTARIES (MAIN STEM AND MAIN STEM TRIBUTARY NUMBER 2) IS PROVIDED IN A SEPARATE REPORT "GRANDVIEW RESERVE CLOMR REPORT", BY HR GREEN, DATED MARCH 22, 2023. ALL CHANNEL CULVERTS ARE SHOWN FOR REFERENCE ONLY AND ACTUAL SIZING AND ANALYSIS IS PROVIDED WITHIN THE CLOMR REPORT.

### DESIGN POINT SUMMARY TABLE

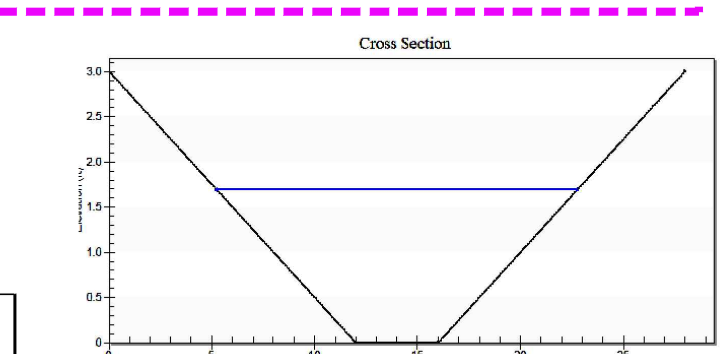
| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| * 2 | 1.7 | 18.8 |
| * 3 | 6.1 | 112.1 |
| * 4 | 22.4 | 491.0 |
| * 5 | 7.0 | 43.3 |
| * 6 | 1.2 | 6.9 |
| * 7 | 0.9 | 4.2 |
| 8 | 0.7 | 5.0 |
| 9 | 3.3 | 23.3 |
| 10 | 10.6 | 144.2 |
| 11 | 1.4 | 10.1 |
| 12 | 5.4 | 38.3 |
| 13 | 4.1 | 29.4 |
| 14 | 8.3 | 59.5 |
| 15 | 3.2 | 23.0 |
| 16 | 3.5 | 25.2 |
| 17 | 7.3 | 52.0 |
| 18 | 2.8 | 20.0 |
| 19 | 2.5 | 18.0 |
| 20 | 6.5 | 46.3 |
| 21 | 8.9 | 55.3 |

*Values taken from Eastonville Road PDR prepared by HR Green, Dated September 2023

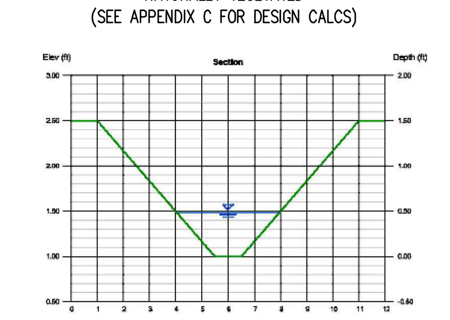
### RUNOFF SUMMARY TABLE

| Basin ID | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| *EX2 | 18.88 | 1.7 | 18.8 |
| *EX3 | 131.26 | 6.1 | 112.1 |
| *EX4 | 832.70 | 22.4 | 491.0 |
| *EX5 | 22.35 | 7.0 | 43.3 |
| *EX6 | 3.05 | 1.2 | 6.9 |
| *EX7 | 1.47 | 0.9 | 4.2 |
| A-1 | 2.29 | 0.7 | 5.0 |
| A-2 | 3.96 | 1.2 | 8.8 |
| EA-1 | 2.50 | 0.7 | 5.1 |
| TSB-A1 | 10.67 | 3.3 | 23.3 |
| TSB-A2 | 4.56 | 1.4 | 10.1 |
| TSB-A3 | 13.72 | 3.9 | 28.2 |
| TSB-B1 | 14.03 | 4.1 | 29.4 |
| TSB-B2 | 14.48 | 4.2 | 30.1 |
| TSB-C1 | 11.26 | 3.2 | 23.0 |
| TSB-C2 | 11.92 | 3.5 | 25.2 |
| TSB-C3 | 15.29 | 4.1 | 29.0 |
| TSB-D1 | 10.09 | 2.8 | 20.0 |
| TSB-E1 | 8.21 | 2.5 | 18.0 |
| TSB-E2 | 13.57 | 4.0 | 28.3 |

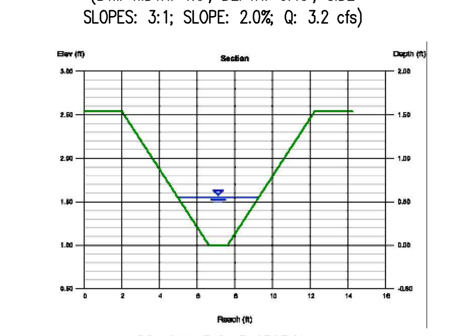
*Values taken from Eastonville Road PDR prepared by HR Green, Dated September 2023




PR. SWALE OS-1 SECTION
BTM WIDTH: 4.0'; DEPTH: 2.03'; SIDE SLOPES: 4:1; SLOPE: 0.50%; Q: 55.3 cfs
NATURALLY VEGETATED
(SEE APPENDIX C FOR DESIGN CALCS)




PR. SWALE C-7a SECTION
(BTM WIDTH: 1.0'; DEPTH: 0.49'; SIDE SLOPES: 3:1; SLOPE: 2.0%; Q: 3.2 cfs)




PR. SWALE D-7 SECTION
(BTM WIDTH: 1.0'; DEPTH: 0.55'; SIDE SLOPES: 3:1; SLOPE: 2.0%; Q: 4.0 cfs)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PRELIMINARY DRAINAGE PLAN
GRANDVIEW RESERVE FILING NO. 1
FOR
HR GREEN, INC

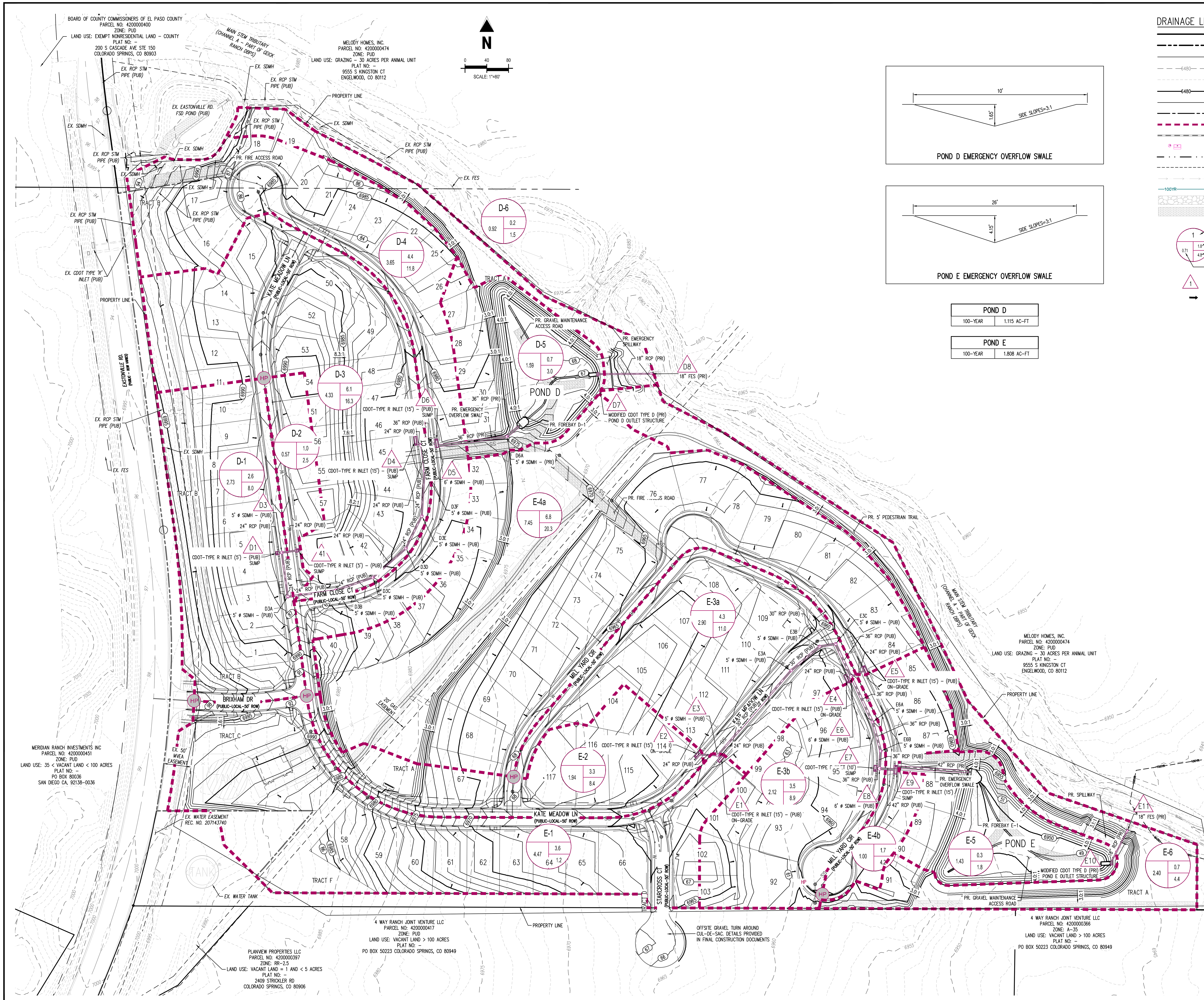
EASTONVILLE RD
EL PASO COUNTY, PEYTON, CO 80831

| # | Date | Issue / Description | Init. |
|---|---|---|---|

| | |
|---|---|
| Project No: | HRG 1.20 |
| Drawn By: | TJE |
| Checked By: | GRD |
| Date: | 1/23/2024 |

INTERIM DRAINAGE MAP

INT-2
Sheet 2 of 3




| POND D | |
|---|---|
| 100-YEAR | 1.115 AC-FT |

| POND E | |
|---|---|
| 100-YEAR | 1.808 AC-FT |

## DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE / ROW
- LOT BOUNDARY LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ROAD CENTERLINE
- BASIN BOUNDARY LINE
- PROPOSED STORM SEWER
- PROPOSED STORM STRUCTURES
- EXISTING LIMITS OF WETLAND
- EXISTING WETLAND SETBACK
- CENTERLINE OF STREAM
- 100-YEAR WATER SURFACE ELEVATION AND FLOODPLAIN
- PROPOSED RIPRAP
- PROPOSED GRAVEL ACCESS
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

**BASIN SUMMARY TABLE**

| Tributary Sub-basin | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| D-1 | 2.73 | 2.6 | 8.0 |
| D-2 | 0.57 | 1.0 | 2.5 |
| D-3 | 4.33 | 6.1 | 16.3 |
| D-4 | 3.65 | 4.4 | 11.8 |
| D-5 | 1.59 | 0.7 | 3.0 |
| D-6 | 0.92 | 0.2 | 1.5 |
| E-1 | 4.47 | 3.6 | 11.2 |
| E-2 | 1.94 | 3.3 | 8.4 |
| E-3a | 2.90 | 4.3 | 11.0 |
| E-3b | 2.12 | 3.5 | 8.9 |
| E-4a | 7.45 | 6.8 | 20.3 |
| E-4b | 1.00 | 1.7 | 4.2 |
| E-5 | 1.43 | 0.3 | 1.8 |
| E-6 | 2.40 | 0.7 | 4.4 |

**DESIGN POINT SUMMARY TABLE**

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| D1 | 2.6 | 5.3 |
| D2 | 1.0 | 5.3 |
| D3 | 3.6 | 10.5 |
| D4 | 6.1 | 14.1 |
| D5 | 9.8 | 24.6 |
| D6 | 14.2 | 25.8 |
| D7 | 14.8 | 28.8 |
| D8 | 0.2 | 8.0 |
| E1 | 3.6 | 9.3 |
| E2 | 3.3 | 7.8 |
| E3 | 6.9 | 17.1 |
| E4 | 4.3 | 11.7 |
| E5 | 6.6 | 11.6 |
| E6 | 17.8 | 40.4 |
| E7 | 3.5 | 11.0 |
| E8 | 21.3 | 51.4 |
| E9 | 1.7 | 62.4 |
| E10 | 2.0 | 64.2 |
| E11 | 0.4 | 14.9 |

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DRAINAGE MAPS
GRANDVIEW RESERVE FILING NO. 1
MELODY HOMES, INC.

EASTONVILLE RD & REX RD
EL PASO COUNTY, FALCON, CO 80831

| # | Date | Issue / Description | Init. |
|---|---|---|---|

| | |
|---|---|
| Project No: | HRG02 |
| Drawn By: | TJE |
| Checked By: | BAS |
| Date: | 06/21/2024 |

PROPOSED DRAINAGE MAP

DR-2


## WATER QUALITY EXCLUSIONS

| BASIN ID | TOTAL AREA | TOTAL PROPOSED DISTURBED AREA (AC) | DISTURBED AREA TREATED VIA RUNOFF REDUCTION (AC) | DISTURBED AREA EXCLUDED FROM WQ PER ECM APP I.7.1.B.# (AC) | APPLICABLE WQ EXCLUSIONS (APP I.7.1.B.#) | DISTURBED AREA EXCLUDED FROM WQ PER ECM APP I.7.1.C.1 (AC) |
|---|---|---|---|---|---|---|
| D-1 | 2.73 | 2.73 | - | - | - | - |
| D-2 | 0.57 | 0.57 | - | - | - | - |
| D-3 | 4.33 | 4.33 | - | - | - | - |
| D-4 | 3.65 | 3.65 | - | - | - | - |
| D-5 | 1.59 | 1.59 | - | - | - | - |
| D-6 | 0.92 | 0.41 | - | 0.13 | APP I.7.1.B.8 | 0.28 |
| E-1 | 4.47 | 3.29 | - | - | - | - |
| E-2 | 1.92 | 1.92 | - | - | - | - |
| E-3a | 2.90 | 2.90 | - | - | - | - |
| E-3b | 2.12 | 2.12 | - | - | - | - |
| E-4a | 7.45 | 5.49 | - | - | - | - |
| E-4b | 1.00 | 1.00 | - | - | - | - |
| E-5 | 1.43 | 1.43 | - | - | - | - |
| E-6 | 2.40 | 0.98 | 0.88 | - | APP I.7.1.B.7 | 0.1 |
| | | | | | | |
| **TOTAL** | **37.48** | **32.41** | **0.88** | **0.13** | **-** | **0.38** |

| | |
|---|---|
| **TOTAL PROPOSED DISTURBED AREA** | **32.41** |
| **DISTURBED AREA EXCLUDED FROM WQ PER ECM APP I.7.1.B.#** | **0.13** |
| **DISTURBED AREA EXCLUDED FROM WQ PER ECM APP I.7.1.C.1** *UDE UP TO 20%, NOT TO EXCEED 1 ACRE, WHEN NOT PRACTICABLE TO CAPTURE* | **0.38** |

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DRAINAGE MAPS
GRANDVIEW RESERVE FILING NO. 1
MELODY HOMES, INC.

EASTONVILLE RD & REX RD
EL PASO COUNTY, FALCON, CO 80831

| # | Date | Issue / Description | Init. |
|---|---|---|---|

| | |
|---|---|
| Project No: | HRG02 |
| Drawn By: | JDM |
| Checked By: | BAS |
| Date: | 06/21/2024 |

PROPOSED WATER QUALITY MAP

DR-3