Ponds D and E Peak Discharges are from this PDR Report of Filing No. 1

# Galloway

## PRELIMINARY DRAINAGE REPORT

## **GRANDVIEW RESERVE FILING NO. 1**

El Paso County, Colorado

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DATE:

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### **ENGINEER'S STATEMENT**

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Brady A. Shyrock, PE # For and on behalf of Ga	38164 lloway & Company, Inc.	 Date	_
DEVELOPER'S CERTI  I, The developer, have is and plan.		the requirements specified in this	drainage report
By: Address: D.R. Ho	orton . Kingston Court	 Date	_
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	n the requirements of the Drain teria Manual and Land Develop	nage Criteria Manual, Volumes 1 a pment Code as amended.	and 2, El Paso
Joshua Palmer, P.E. Interim County Enginee	r/ECM Administrator	 Date	_
Conditions:			

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### I. Purpose

The purpose of this Preliminary 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.

## II. General Description

The project is a single-family residential development located in the Falcon area of El Paso County, Colorado. The 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 6<sup>th</sup> Principal Meridian, County of El Paso, State of Colorado. The subject property includes Eastonville Road to the west, the proposed extension of Rex Road to the north and 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 preliminary 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 (**MDDP**). The site consists of approximately 189.479 acres and includes 565 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 A, B, C, D, E, and Eastonville Pond.

## IV. Existing Drainage 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.

There are two (2) major drainageways that currently convey existing on & off-site flows through the site to the southeast. These are the Main Stem (MS) and Main Stem Tributary Number 2 (MST) as referenced in the **MDDP**. Both drainageways generally flow to the southeast towards Highway 24, before crossing via existing drainage structures. Currently, these channels receive flows from two off-site basins, one from the west (west of Basin B1 per the **MDDP**; 0.17 mi²,  $Q_5 = \pm 67$  cfs,  $Q_{100} = \pm 413$  cfs) and the second from the northwest (northwest of Basin C1 per the **MDDP**; 0.44 mi²,  $Q_5 = \pm 59$  cfs,  $Q_{100} = \pm 280$  cfs) and are routed under Eastonville Road via existing pipe culverts. There is an existing 24" CMP that conveys runoff under Eastonville Road at the MS, a location approximately 650 feet north of the proposed Rex Road extension that directs runoff via overtopping Eastonville Road at MST, and a 20" x 27" ECMP that directs runoff beneath Eastonville Road at the Falcon Regional Park.

While the **MDDP** shows a total of 22 basins that were analyzed as part of the overall Grandview Reserve development, for the purposes of this report, 7 of the Basins within the MDDP will be used for analysis. These Basins include A1, B1, B2, C1, B3, and the two off-site Basins situated to the northwest of Eastonville Road.

For a more in-depth analysis of existing tributary conditions as it pertains to this phase of development, an existing basin map has been prepared. The existing map can be found in **Appendix F** and basins are described below.

**Basin OS-1** (1.57 AC,  $Q_5 = 0.5$  cfs,  $Q_{100} = 3.6$  cfs): Located to the southwest of the project site, this basin consists of undeveloped land west of Eastonville Road. Runoff is captured at **DP11** in an existing 18" CMP culvert that conveys the flow east across Eastonville Road.

**Basin OS-2** (2.86 AC,  $Q_5 = 0.8$  cfs,  $Q_{100} = 5.3$  cfs): Located to the southwest of the project site, this basin consists of undeveloped land west of Eastonville Road. Runoff is captured at **DP10** in an existing 18" CMP culvert that conveys the flow east across Eastonville Road.

**Basin OS-3** (21.61 AC,  $Q_5 = 4.5$  cfs,  $Q_{100} = 30.5$  cfs): Located to the west-southwest of the project site, this basin consists of undeveloped land west of Eastonville Road. Runoff is captured at **DP9** in an existing 18" CMP culvert that conveys the flow east across Eastonville Road.

**Basin OS-4** (112.71 AC,  $Q_5$  = 19.5 cfs,  $Q_{100}$  = 134.6 cfs): Located to the west of the project site, this basin consists of undeveloped land west of Eastonville Road and a small portion of Falcon Regional Park. Runoff is captured at **DP8** in an existing 24" CMP culvert that conveys the flow east across Eastonville Road.

**Basin OS-5** (51.01 AC,  $Q_5$  = 18.6 cfs,  $Q_{100}$  = 138.0 cfs): Located to the northwest of the project site, this basin consists of undeveloped land and the Falcon Regional Park, west of Eastonville Road. Runoff is captured at **DP7** in an existing 24" CMP culvert that conveys the flow east across Eastonville Road.

**Basin EX-1** (16.18 AC,  $Q_5 = 3.4$  cfs,  $Q_{100} = 24.4$  cfs): Located on the southwest portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem channel (**DP 1**).

**Design Point 1** ( $Q_5$  = 4.7 cfs,  $Q_{100}$  = 33.3 cfs): Located on the southern portion of the site, this design point accounts for the total combined flows from **Basins OS-1**, **OS-2 & EX-1**. Flows from this design point are conveyed off-site to the south, via a naturally formed channel, and discharges into the existing main stem tributary channel.

**Basin EX-2** (46.06 AC,  $Q_5 = 7.6$  cfs,  $Q_{100} = 53.7$  cfs): Located in the southwest portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the Main Stem channel (**DP 2**).

**Design Point 2** ( $Q_5 = 79.1$  cfs,  $Q_{100} = 497.2$  cfs): Located on the southern portion of the site, this design point accounts for the total combined flows from **Basins OS-3**, **OS-4 & EX-2** and represents the total existing main stem tributary channel flows at that point. Flows from this design point are conveyed off-site to the south, via the main stem tributary channel.

**Basin EX-3** (64.34 AC,  $Q_5$  = 10.0 cfs,  $Q_{100}$  = 71.6 cfs): Located in the central portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem Tributary #2 channel **(DP 3)**.

**Basin EX-4** (2.68 AC,  $Q_5 = 0.6$  cfs,  $Q_{100} = 4.4$  cfs): Located on the eastern portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the east into Main Stem Tributary #2 channel (**DP 4**).

**Basin EX-5** (26.15 AC,  $Q_5 = 5.0$  cfs,  $Q_{100} = 35.5$  cfs): Located in the north central portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem Tributary #2 channel **(DP 5)**.

**Basin EX-6** (31.53 AC,  $Q_5$  = 6.6 cfs,  $Q_{100}$  = 46.9 cfs): Located on the northern portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem Tributary #2 channel (**DP 6**).

**Design Point 6** ( $Q_5$  = 14.6 cfs,  $Q_{100}$  = 584.9 cfs): Located on the northeast portion of the site, this design point accounts for the total combined flows from **Basins OS-5 & EX-6** and represents the total existing main stem tributary #2 channel flows at that point. Flows from this design point are conveyed off-site to the southeast, via the main stem tributary #2 channel.

**Design Point 12** ( $Q_5 = 89.2$  cfs,  $Q_{100} = 976.3$  cfs): Located on the southeast portion of the site, this design point accounts for the total combined flows from **Design Points 3, 4, 5 & 6** and represents the total existing main stem tributary #2 channel flows at that point. Flows from this design point are conveyed off-site to the south, via the main stem tributary #2 channel.

## 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. Onsite 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 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 development lies completely within the Gieck Ranch Drainage Basin and consists of six (6) larger basins (EA, A, B, C, D, &E) which have been broken down into fifty-three (53) smaller sub-basins. Adjacent Off-site Basins (OS) were also analyzed in the proposed condition and have been broken down into five (5) smaller sub-basins. Site runoff will be collected via inlets & pipes and diverted to one of the six proposed full spectrum detention ponds or two sediment basins. All necessary calculations can be found within the appendices of this report.

According to the **MDDP**, there are two major drainageways that run through the site. As was discussed within the Existing Conditions portion of the report, both the Main Stem (MS) and Main Stem Tributary Number 2 (MST) run through the site conveying runoff from the northwest to the southeast. Presently, these channels receive flows from two off-site basins, one from the west (west of Sub-basin OS-3 per this report and Basin B1 per the **MDDP**; 0.17 mi<sup>2</sup>,  $Q_5 = \pm 67$  cfs,  $Q_{100} = \pm 413$  cfs) and the second from the north (northwest of Sub-basin OS-1 per this report and Basin C1 per the **MDDP**; 0.44 mi<sup>2</sup>,  $Q_5 = \pm 59$  cfs,  $Q_{100} = \pm 280$  cfs).

**Basin OS-1** (6.73 AC,  $Q_5 = 1.3$  cfs,  $Q_{100} = 8.7$  cfs): Located to the southwest of the project site, this basin consists of undeveloped land west of Eastonville Road. Runoff is captured at **DP32** in a proposed 30" public RCP culvert that conveys the flow east across Eastonville Road and to Channel Main Stem, via a storm sewer system, per the Grandview Reserve MDDP.

**Basin OS-2** (17.28 AC,  $Q_5$  = 2.6 cfs,  $Q_{100}$  = 17.3 cfs): Located to the southwest of the project site, this basin consists of undeveloped land west of Eastonville Road. Runoff is captured at **DP32** in a proposed 30" public RCP culvert that conveys the flow east across Eastonville Road and to Channel Main Stem, via a storm sewer system, per the Grandview Reserve MDDP.

**Design Point 32** ( $Q_5 = 3.6$  cfs,  $Q_{100} = 24.0$  cfs): Located on the southwest side of Eastonville road, this design point accounts for the total combined flows from **Basins OS-1 & OS-2** and represents the total existing upstream flows at that point. Flows from this design point are conveyed in a proposed 30" public RCP culvert that conveys the flow east across Eastonville Road and to Channel Main Stem, via a storm sewer system, per the Grandview Reserve MDDP.

**Basin OS-3** (91.28 AC, Flows superseded by MDDP Flows): Located to the west-southwest of the project site, this basin consists of undeveloped land west of Eastonville Road. Runoff is captured at **DP34** in proposed public (3) – 60" RCP culverts that convey the flow east across Eastonville Road and to Channel Main Stem per the Grandview Reserve MDDP.

**Basin OS-4** (20.30 AC, Flows superseded by MDDP Flows): Located to the west of the project site, this basin consists of undeveloped land west of Eastonville Road and a small portion of Falcon Regional Park. Runoff is captured at **DP34** in proposed public (3) – 60" RCP culverts that convey the flow east across Eastonville Road and to Channel Main Stem per the Grandview Reserve MDDP.

**Design Point 34** ( $Q_5 = 67.0$  cfs,  $Q_{100} = 413.00$  cfs): Located on the northwest side of Eastonville road, the flows for this Design Point were taken from the approved 4 Way Ranch LOMR, 2004, Case No. 04-08-0012P. Flows from this design point are conveyed in proposed public (3) – 60" RCP culverts that convey the flow east across Eastonville Road and to Channel Main Stem per the Grandview Reserve MDDP.

**Basin OS-5** (47.27 AC,  $Q_5 = 8.0$  cfs,  $Q_{100} = 125.0$  cfs): Located to the northwest of the project site, this basin consists of undeveloped land and the Falcon Regional Park, west of Eastonville Road. The flows provided were taken from the approved Falcon Regional Park Drainage Report, 2015. Runoff is captured at **DP35** in a proposed public 48" RCP culvert that bypasses the flow through Grandview Reserve to Channel Main Stem Tributary 2 per the Grandview Reserve MDDP.

Preliminary sizing calculations for the FSD facility have been completed with the Eastonville Pond requiring approximately 1.301 ac-ft of storage capacity. Preliminary sizing for the MS and Eastonville Road crossing has been included within Appendix D, by HR Green. This crossing will require 3-60" RCP pipes with type M riprap for 50' L x 30' W at the downstream end.

There are no proposed major channel improvements for MS associated with this development -however, MST is proposed to be re-routed. The analysis for both channels and design of MST were done by others and a separate report will be submitted for review for all channel improvements.

The site will provide six (6) Full Spectrum Extended Detention Basins (EDBs). Ponds A, B, C, D, E, & Eastonville Pond will discharge treated runoff at historic rates directly into either the MS or MST Channel. The project site will also provide two (2) Sediment Basins (SBs). SB-1 at Rex Road and SB-2 at the southern corner of the church property. Both of these SBs have been sized to function as PBMPs (and will remain in place until such time development east of the proposed site takes place) and will discharge treated runoff at historic rates directly into MST at the northern portion of the project site.

As has been mentioned previously, the site is proposed to have a land use of single family residential. The 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 and/or institutional uses.

The proposed institutional use (Sub-basin A-1) area flows have been included in this analysis at a preliminary level only. The Sub-basin is located on the northwest corner of the site, East of Eastonville Rd. & south of the proposed extension of Rex Rd. It is assumed that the area will have a conservative ultimate imperviousness value of 90%. Sub-basin A-1 encompasses an area of 11.67 acres and proposed developed runoff for the site has been calculated to be  $Q_5 = 46.4$  cfs,  $Q_{100} = 90.7$  cfs. However, in the interim conditions (imperviousness of 2.0%), runoff from this basin ( $Q_5 = 4.4$  cfs,  $Q_{100} = 31.1$  cfs) will sheet flow from the northwest to the southeast, to a separate, onsite detention and water quality facility (SB-2) positioned at the southeastern corner of the property, where treated flows will be released to a proposed modified CDOT Type 'C' inlet on the west side of Ivybridge Boulevard (DP 1). Runoff that originates from the east side of Eastonville Road, outside of the dedicated ROW, will be conveyed to SB-2 via a proposed 4' bottom x 2' deep trapezoidal swale (Swale A-1). Flows will then be routed under Ivybridge Boulevard, via 24" RCP, to the updated Main Stem Tributary 2 channel. It is anticipated that the property will be developed at a later date as a fill in subsequent to the proposed development of the majority of this project site. This property will need to submit a separate drainage report, complete with an updated water quality and detention design, as part of its development. Installation of an internal storm sewer system separate from the outfall for the property will be required. The development is responsible for ensuring the site drainage, once constructed, will not adversely impact any adjacent properties and downstream facilities. Preliminary pond sizing calculations have been provided in Appendix E for reference. As stated above, water quality and detention will be addressed with the future development of the institutional site.

**Basin-1** (1.22 AC,  $Q_5 = 4.2$  cfs,  $Q_{100} = 8.4$  cfs): Located at the northern border of the site, Basin-1 contains the proposed Phase 1 improvements to Rex Rd. This drainage basin consists entirely of onsite

roadway improvements within the project site. Runoff from this basin will sheet flow to the proposed curb & gutter along Rex Rd. The flows will then be routed to the east where they will be conveyed to a proposed Sediment Basin (SB-1) where runoff will be treated prior to discharging into Main Stem Tributary #2 channel.

**Basin A-2a** (4.42 AC,  $Q_5 = 8.5$  cfs,  $Q_{100} = 19.9$  cfs): Located on the north portion of the site, this basin consists of residential lots, Tintagel Trail, and a portion of the north half of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent road. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the northeast side of the intersection of Tintagel Trail and Dawlish Drive (**DP 2a**).

**Basin A-2b** (2.75 AC,  $Q_5 = 8.4$  cfs,  $Q_{100} = 16.7$  cfs): Located on the north portion of the site, this basin consists of residential lots, Ivybridge Boulevard, and a portion of the north half of Dawlish Drive. Runoff from this basin will sheet flow from the residential lots to the adjacent Dawlish Drive and directly from within the ROW of Ivybridge Boulevard. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' inlet in sump conditions, located on the northeast side of the intersection of Ivybridge Boulevard and Dawlish Drive **(DP 2b)**.

**Basin A-3** (0.36 AC,  $Q_5 = 1.6$  cfs,  $Q_{100} = 3.2$  cfs): Located on the north portion of the site, this basin consists of a portion of the south half of Dawlish Drive. Flows will be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' inlet in sump conditions, located on the southeast side of the intersection of Ivybridge Boulevard and Dawlish Drive (**DP 3**).

**Basin A-4a** (6.31 AC,  $Q_5 = 9.8$  cfs,  $Q_{100} = 22.8$  cfs): Located on the northwestern portion of the site, this basin consists of residential lots, Primley Woods Path, and a portion of the west half of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the west side of Dawlish Drive (**DP 4a**), between Primley Woods Path and St Ives Way. Bypass flows will then be routed downstream to a proposed (public) 15' CDOT Type 'R' sump inlet, located on the west side of Dawlish Drive directly across from Sparkwell Street (**DP4**). Emergency overflows will be routed downstream via proposed curb and gutter to Design Point 7 within Sparkwell Street.

**Basin A-4b** (3.99 AC,  $Q_5 = 6.5$  cfs,  $Q_{100} = 15.2$  cfs): Located on the northwestern portion of the site, this basin consists of residential lots, St Ives Way, and a portion of the west half of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the west side of Dawlish Drive (**DP 4b**), between Primley Woods Path and St Ives Way. Bypass flows will then be routed downstream to a proposed (public) 15' CDOT Type 'R' sump inlet, located on the west side of Dawlish Drive directly across from Sparkwell Street (**DP4**). Emergency overflows will be routed downstream via proposed curb and gutter to Design Point 7 within Sparkwell Street.

**Basin A-5** (0.35 AC,  $Q_5 = 1.6$  cfs,  $Q_{100} = 3.1$  cfs): Located on the north portion of the site, this basin consists of a portion of the east half of Dawlish Drive. Flows will be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' inlet in sump conditions, located on the east side of Dawlish Drive (**DP 5**), Just north of the intersection of Sparkwell Street and Dawlish Drive. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point 7 within Sparkwell Street.

**Basin A-6** (2.76 AC,  $Q_5 = 4.6$  cfs,  $Q_{100} = 10.7$  cfs): Located centrally on the site, this basin consists of residential lots, Penryn Circle, and a portion of the south half of Sparkwell Street. Runoff from this basin

will sheet flow from the lots to the adjacent road. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' inlet in sump conditions, located on the south side of Sparkwell Street (**DP 6**), Just southeast of the intersection of Penryn Circle & Sparkwell Street. Emergency overflows will overtop Sparkwell Street crown to Design Point 7 (**DP 7**), then overtop curb and gutter and be routed downstream via an overflow swale to proposed Pond A.

**Basin A-7** (0.23 AC,  $Q_5$  = 1.1 cfs,  $Q_{100}$  = 2.0 cfs): Located centrally on the site, this basin consists of a portion of the north half of Sparkwell Street. Runoff from this basin will sheet flow from edge of ROW to the adjacent road. Flows will then be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' inlet in sump conditions, located on the north side of Sparkwell Street (**DP 7**), Just east of the intersection of Penryn Circle & Sparkwell Street. Emergency overflows will overtop curb and gutter and be routed downstream via an overflow swale to proposed Pond A.

**Basin A-8** (5.44 AC,  $Q_5 = 14.7$  cfs,  $Q_{100} = 30.8$  cfs): Located centrally on the site, this basin consists entirely of proposed amenity / park facilities. Runoff from this basin will sheet flow to paved parking lot and drive aisle with curb and gutter. Flows will then be routed, via curb & gutter, to a series of proposed (public) CDOT Type 'R' inlets and area inlets with storm sewer piping conveying generated runoff downstream to Design Point 8 (**DP 8**), located at the southeast corner of the park site. Emergency overflows will overtop curb and gutter and will sheet flow, across green space, to proposed Pond A.

**Basin A-9** (4.91 AC,  $Q_5 = 7.4$  cfs,  $Q_{100} = 17.3$  cfs): Located in the central portion of the site, directly west from Pond A. This basin consists of residential lots, one-half of Pixie Place, a section of Salcombe Trail, and a section of the west half of Sparkwell Street. Runoff from this basin will sheet flow to the proposed roadways, where runoff will be directed downstream, via curb & gutter, a proposed (public) 20' CDOT Type 'R' sump inlet **(DP 7a)**. Runoff is then conveyed downstream to **DP 7b** where additional runoff is added from Sub-basin A-10.

**Basin A-10** (1.02 AC,  $Q_5 = 2.1$  cfs,  $Q_{100} = 4.9$  cfs): Located in the central portion of the site, directly west from Pond A. This basin consists of residential lots and the easter half of a section of Sparkwell Street. Runoff from this basin will sheet flow to the proposed roadway, where runoff will be directed downstream, via curb & gutter, a proposed (public) 5' CDOT Type 'R' sump inlet **(DP 7b)**. Runoff is then directed downstream to the northwest corner of Pond A. Flows will then be routed to the outlet structure **(DP 8)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem Tributary #2 channel. Emergency overflows will overtop via an emergency spillway and be routed downstream directly to MST.

**Basin A-11** (3.56 AC,  $Q_5 = 2.0$  cfs,  $Q_{100} = 8.6$  cfs): Located on the eastern limits of the site, adjacent to the proposed Main Stem Tributary #2 drainageway. This basin consists of the rear portion of lots along Sparkwell Street and the proposed (private) Full Spectrum Detention Pond A. Runoff from this basin will sheet flow directly to Pond A. Flows will then be routed to the outlet structure (**DP 8**), via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem Tributary #2 channel. Emergency overflows will overtop via an emergency spillway and be routed downstream directly to MST.

**Basin B-1** (3.81 AC,  $Q_5 = 5.3$  cfs,  $Q_{100} = 12.5$  cfs): Located on the western limits of the site, adjacent to Eastonville Road. This basin consists of residential lots and the southwest portion of Pixie Place. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' inlet in sump conditions, located at the end of the Cul-De-Sac of Pixie Place (**DP 9**). Emergency overflows will overtop curb and gutter and be routed

downstream via an overflow swale to Dawlish Drive and then downstream via curb & gutter to Design Point **DP 10b**.

**Basin B-2** (4.62 AC,  $Q_5 = 7.1$  cfs,  $Q_{100} = 16.7$  cfs): Located on the western limits of the site, partially adjacent to Eastonville Road. This basin consists of residential lots, the northwest portion of Pixie Place and the northwestern portion of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet **(DP 10a)**, located on the northwest side of Dawlish Drive, northeast of Marazion Way. Bypass flows are conveyed downstream via curb & gutter to **DP 10b** where a proposed (public) 15' CDOT Type 'R' sump inlet captures flows.

**Basin B-3** (4.15 AC,  $Q_5 = 8.0$  cfs,  $Q_{100} = 18.6$  cfs): Located on the western portion of the site, this basin consists of residential lots, the northwest portion of Dawlish Drive, and Marazion Way. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet (**DP 10b**), located northeast from the intersection of Dawlish Drive and Zelda Street. on the northwest side of Dawlish Drive, northeast of Marazion Way. Emergency overflows will overtop the crown of the roadway and be conveyed downstream via curb and gutter to Design Point **DP 11, DP12b, and DP13**.

**Basin B-4** (1.37 AC,  $Q_5 = 4.6$  cfs,  $Q_{100} = 9.4$  cfs): Located in the west-central portion of the site. This basin consists of the southeast portion of Dawlish Drive. Runoff from this basin will sheet flow directly to the curb & gutter and be directed downstream to a proposed (public) 15' CDOT Type 'R' inlet in sump conditions, located east of the intersection of Dawlish Drive & Zelda Street (**DP 11**). Emergency overflows will overtop the curb return flowline and be conveyed downstream via curb and gutter to Design Point **DP 12b**.

**Basin B-5** (5.12 AC,  $Q_5 = 7.9$  cfs,  $Q_{100} = 18.5$  cfs): Located centrally on the site, this basin consists of residential lots, Marazion Way, the northwest portion of Salcombe Trail, and the southwest portion of Pixie Place. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet **(DP 12a)**, located on the northwest side of Salcombe Trail, northeast of the intersection between Zelda Street and Salcombe Trail. Bypass flows are conveyed downstream via curb & gutter to **DP 12b**.

**Basin B-6** (2.28 AC,  $Q_5$  = 3.7 cfs,  $Q_{100}$  = 8.7 cfs): Located centrally on the site. This basin consists of residential lots and the northwest portion of Plinky Plonk Path. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet, located on the northwest side of Plinky Plonk Path **(DP 14)**. Bypass flows are conveyed downstream via curb & gutter to **DP 12b**.

**Basin B-7** (0.89 AC,  $Q_5$  = 1.6 cfs,  $Q_{100}$  = 3.8 cfs): Located centrally on the site. This basin consists of residential lots and the southeast portion of Plinky Plonk Path. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet, located on the southeast side of Plinky Plonk Path **(DP 15)**. Bypass flows are conveyed downstream via curb & gutter to **DP 12b**.

**Basin B-8** (3.23 AC,  $Q_5 = 5.3$  cfs,  $Q_{100} = 12.4$  cfs): Located centrally on the site. This basin consists of residential lots, the southeast portion of Plinky Plonk Path, and the northeast portion of Zelda Street. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet, located on the southeast side of the

intersection between Plinky Plonk Path and Zelda Street (**DP 12b**). Emergency overflows will overtop the crown of the roadway and be conveyed downstream via curb and gutter to Design Point **DP 13**.

**Basin B-9** (2.42 AC,  $Q_5 = 3.8$  cfs,  $Q_{100} = 9.0$  cfs): Located centrally on the site, adjacent to the Main Stem channel. This basin consists residential lots and the southwest portion of Zelda Street. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' sump inlet, located on the southwest side of the intersection between Plinky Plonk Path and Zelda Street (**DP 13**). Emergency overflows will overtop the curb & gutter of the roadway and be conveyed downstream via a graded swale into Pond B (**DP 16**).

**Basin B-10** (1.10 AC,  $Q_5 = 0.5$  cfs,  $Q_{100} = 3.3$  cfs): Located centrally on the site, adjacent to the Main Stem channel. This basin consists of the proposed (private) Full Spectrum Detention Pond B. Runoff from this basin will sheet flow directly to Pond B. Flows will then be routed to the outlet structure **(DP 16)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

**Basin C-1** (4.12 AC,  $Q_5 = 6.8$  cfs,  $Q_{100} = 16.0$  cfs): Located on the east portion of the site, this basin consists of residential lots and the eastern half of a portion of Salcombe Trail. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the southeast side of the intersection of Stoke Gabriel Way and Totness Terrace (**DP 17b**). Bypass flows are conveyed downstream via curb & gutter to **DP 17e**.

**Basin C-2** (2.71 AC,  $Q_5$  = 4.9 cfs,  $Q_{100}$  = 11.4 cfs): Located on the eastern portion of the site, this basin consists of residential lots and the southern portion of Roads Stoke Gabriel Way and Glampton Drive, and the full section of Totness Terrace. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet **(DP 17a)**, located on the southwest side of the intersection of Stoke Gabriel Way and Totness Terrace. Bypass flows are conveyed downstream via curb & gutter to **DP 17c**.

**Basin C-3** (1.56 AC,  $Q_5 = 0.8$  cfs,  $Q_{100} = 4.5$  cfs): Located on the southeast portion of the site, this basin consists of the rear portion of residential lots along Stoke Gabriel Way. Runoff from this basin will sheet flow in an eastward direction towards the proposed channel. All roof drains (for lots 409-426 & 443) within this sub-basin will be directed toward Stoke Gabriel Way, no impervious surfaces will be allowed within the rear lot setbacks and runoff reduction will be implemented within this sub-basin.

**Basin C-4** (2.47 AC,  $Q_5 = 4.1$  cfs,  $Q_{100} = 9.6$  cfs): Located on the southeast portion of the site, this basin consists of residential lots and the eastern half of Frogmore 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' at-grade inlet **(DP 17c)**, located on the southwest side of the intersection of Stoke Gabriel Way and Frogmore Lane. Bypass flows are conveyed downstream via curb & gutter to **DP 17d**.

**Basin C-5** (3.09 AC,  $Q_5 = 5.5$  cfs,  $Q_{100} = 12.8$  cfs): Located on the southeast portion of the site, this basin consists of residential lots and the western half of Stoke Gabriel Way. 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 **(DP 17d)**, located on the northwest side of the intersection of Stoke Gabriel Way and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 17h**.

**Basin C-6** (2.10 AC,  $Q_5 = 3.2$  cfs,  $Q_{100} = 7.4$  cfs): Located on the southeast portion of the site, this basin consists of residential lots and the eastern half of Stoke Gabriel Way. 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 **(DP 17e)**, located on the northeast side of the intersection of Stoke Gabriel Way and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 17h**.

**Basin C-7a** (0.81 AC,  $Q_5 = 1.1$  cfs,  $Q_{100} = 3.2$  cfs): Located in the central portion of the site, this basin consists of the rear portion of residential lots, existing gas main, and proposed drainage swale (Swale C-7). Runoff from this basin will sheet flow to the proposed swale which will direct runoff to the adjacent roadway (**DP 18a**).

**Basin C-7b** (5.91 AC,  $Q_5 = 9.9$  cfs,  $Q_{100} = 23.2$  cfs): Located in the central portion of the site, this basin consists of residential lots, the western half of Glampton Drive, and a portion of Zelda Drive & Sparkwell Street. 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 **(DP 18b)**, located on the southwest side of the intersection of Totness Terrace and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 18c**.

**Basin C-8** (5.11 AC,  $Q_5 = 8.6$  cfs,  $Q_{100} = 20.0$  cfs): Located in the central portion of the site, this basin consists of residential lots, a portion of Totness Terrace, and a portion of Glampton Drive to the west and south of the sub-basin. 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 **(DP 17f)**, located on the southeast side of the intersection of Totness Terrace and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 17g and DP 17h**.

**Basin C-9a** (3.5 AC,  $Q_5 = 5.6$  cfs,  $Q_{100} = 13.1$  cfs): Located on the southeast corner of the site, this basin consists of residential lots, a portion of Frogmore Lane, and the northern half of Glampton Drive. 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' sump inlet (**DP 17g)**, located on the northeast corner of Glampton Drive and Frogmore Lane. Bypass flows are conveyed downstream via curb & gutter to **DP 17h**. Emergency overflows will overtop the crown of Glampton Drive and be routed downstream via proposed curb and gutter to Design Point **18b** within Glampton Drive.

**Basin C-9b** (3.69 AC,  $Q_5 = 5.9$  cfs,  $Q_{100} = 13.7$  cfs): Located on the southeast corner of the site, this basin consists of residential lots and the northern half of Glampton Drive. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet **(DP 17h)**, located on the north side of Glampton Drive just north of Hope Cove Loop. Emergency overflows will overtop the crown of Glampton Drive and be routed downstream via proposed curb and gutter to Design Point **18b** within Glampton Drive.

**Basin C-10** (3.47 AC,  $Q_5 = 5.2$  cfs,  $Q_{100} = 12.1$  cfs): Located on the southeast corner of the site, this basin consists of residential lots and the southern half of Glampton Drive. 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 **(DP 18c)**, located on the south side of Glampton Drive just north of Hope Cove Loop. Emergency overflows will overtop the curb & gutter of Glampton Drive and be routed downstream via a graded grassed swale and curb & gutter within Hope Cove Loop to Design Point **19** within Hope Cove Loop.

**Basin C-11** (0.46 AC,  $Q_5$  = 1.0 cfs,  $Q_{100}$  = 2.3 cfs): Located on the southeast corner of the site, this basin consists of a grassed amenity area and the north half of Hope Cove Loop. 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 **(DP 19)**, located on the north side of Hope Cove Loop. Emergency overflows will overtop the crown of Hope Cove Loop and be routed downstream via curb & gutter to Design Point **20** within Hope Cove Loop.

**Basin C-12** (1.66 AC,  $Q_5$  = 2.9 cfs,  $Q_{100}$  = 6.7 cfs): Located on the southeast corner of the site, this basin consists of residential lots and the south portion of Hope Cove Loop. 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 **(DP 20)**, located on the south side of Hope Cove Loop. Emergency overflows will overtop the curb & gutter of Hope Cove Loop and be routed downstream via a graded swale to Design Point **21** within Pond C.

**Basin C-13** (2.37 AC,  $Q_5 = 0.8$  cfs,  $Q_{100} = 5.5$  cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the proposed (private) Full Spectrum Detention Pond C. Runoff from this basin will sheet flow directly to Pond C. Flows will then be routed to the outlet structure **(DP 21)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

**Basin C-14** (1.53 AC,  $Q_5 = 0.5$  cfs,  $Q_{100} = 3.8$  cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the undeveloped area outside and downstream of the proposed (private) Full Spectrum Detention Pond C. Runoff from this basin will sheet flow directly to the Main Stem Tributary Number 2 (MST).

**Basin C-15** (0.16 AC,  $Q_5 = 0.1$  cfs,  $Q_{100} = 0.5$  cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the rear portion of Lot 444. Runoff from this basin will sheet flow directly to the Main Stem Tributary Number 2 (MST). Runoff from this basin will sheet flow in an eastward direction towards the proposed channel. All roof drains (for lot 444) within this sub-basin will be directed toward Glampton Drive, no impervious surfaces will be allowed within the rear lot setbacks and runoff reduction will be implemented within this sub-basin.

**Basin D-1** (3.48 AC,  $Q_5 = 5.4$  cfs,  $Q_{100} = 12.7$  cfs): Located on the southwest portion of the 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) 10' CDOT Type 'R' at-grade inlet, located on the west side of Kate Meadow Lane (**DP 22**), just south of the intersection of Kate Meadow Lane & Farm Close Court. Flows will continue downstream to Design Point **24** within Farm Close Court.

**Basin D-2** (0.87 AC,  $Q_5 = 1.7$  cfs,  $Q_{100} = 4.0$  cfs): Located on the southwest portion of the 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) 10' CDOT Type 'R' flow by inlet, located on the east side of Kate Meadow Lane (**DP 23**), just southeast of the intersection of Kate Meadow Lane & Farm Close Court. Emergency overflows will pool up and be routed around the curb return at the intersection of Kate Meadow Lane and Farm Close Court downstream via curb & gutter to Design Point **24** within Farm Close Court.

**Basin D-3** (3.62 AC,  $Q_5 = 5.9$  cfs,  $Q_{100} = 13.8$  cfs): Located on the southwest portion of the site, this basin consists of residential lots and the western 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 conditions, located on the west side of Farm Close Court (**DP 24**), southeast of the intersection of Kate Meadow Lane & Farm Close Court. Emergency overflows will overtop the crown and be routed downstream via curb & gutter in Farm Close Court to Design Point **25**.

**Basin D-4** (1.77 AC,  $Q_5 = 3.3$  cfs,  $Q_{100} = 7.7$  cfs): Located on the southwest portion of the 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) 10' CDOT Type 'R' inlet in sump conditions, located on the east side of Farm Close Court **(DP 25)**, just southeast of the intersection of Kate Meadow Lane & Farm Close Court. Emergency overflows will overtop curb & gutter and be routed downstream via a graded swale within the maintenance access path to Pond D at Design Point **26**.

**Basin D-5** (1.53 AC,  $Q_5$  = 2.0 cfs,  $Q_{100}$  = 6.0 cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. 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 26)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

**Basin D-6** (0.83 AC,  $Q_5 = 0.3$  cfs,  $Q_{100} = 2.1$  cfs): Located on the southwest corner of the site, adjacent to the Main Stem channel. 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 Main Stem channel (MS).

**Basin D-7a** (0.25 AC,  $Q_5 = 0.2$  cfs,  $Q_{100} = 0.8$  cfs): Located on the southwest corner of the site, adjacent to the Main Stem channel. This basin consists of the back portions of residential lots. Runoff from this basin will sheet flow directly to the Main Stem Channel. All roof drains (for lots 18-20) within this subbasin 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 D-7b** (0.88 AC,  $Q_5 = 1.7$  cfs,  $Q_{100} = 4.0$  cfs): Located on the southwest corner of the site, adjacent to the Main Stem channel. This basin consists of the back portions of residential lots and a drainage swale (Swale D-7). Runoff from this basin will sheet flow from the residential lots, into the adjacent swale and will be routed directly to Pond D.

**Basin E-1** (5.33 AC,  $Q_5 = 9.8$  cfs,  $Q_{100} = 22.9$  cfs): Located on the southern portion of the 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 on the southwest corner of the intersection between Kate Meadow Lane and Mill Yard Circle (**DP 27**), just north of the cul-de-sac. Bypass flows are conveyed downstream via curb & gutter to **DP 29**.

**Basin E-2** (5.42 AC,  $Q_5 = 10.1$  cfs,  $Q_{100} = 23.6$  cfs): Located on the southern portion of the 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 on the northwest corner of the intersection between Kate Meadow Lane and Mill Yard Circle (**DP 28**), just north of the cul-de-sac. Bypass flows are conveyed downstream via curb & gutter to **DP 29**.

**Basin E-3** (3.20 AC,  $Q_5 = 6.0$  cfs,  $Q_{100} = 14.0$  cfs): Located on the southern portion of the site, this basin consists of residential lots and the western 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) 20' CDOT Type 'R' sump inlet, located just northeast from the cul-de-sac of Mill Yard Circle (**DP 29**). Emergency overflows will overtop the crown of Mill Yard Circle and be routed downstream via curb & gutter to Design Point **30**.

**Basin E-4** (6.28 AC,  $Q_5 = 9.0$  cfs,  $Q_{100} = 21.0$  cfs): Located on the southern portion of the site, this basin consists of residential lots and the 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) 20' CDOT Type 'R' sump inlet, located just northeast from the cul-de-sac of Mill Yard Circle (**DP 30**). Emergency overflows will overtop the curb & gutter and be routed downstream via a graded swale within the maintenance access to Pond E at Design Point **31**.

**Basin E-5** (1.13 AC,  $Q_5 = 0.4$  cfs,  $Q_{100} = 3.0$  cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. 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 31)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

**Basin E-6** (0.74 AC,  $Q_5 = 0.3$  cfs,  $Q_{100} = 1.8$  cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. 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 Main Stem channel (MS) and offsite to the south.

**Basin EA-1** (7.79 AC,  $Q_5$  = 9.2 cfs,  $Q_{100}$  = 19.5 cfs): Located on the western side of the site. This basin consists of the public right of way (Eastonville Road). Runoff from this basin will sheet flow to proposed curb & gutter and be conveyed downstream to a public 10' CDOT Type R inlet in sump conditions **(EA1)** located just west from Lots 17 & 18 at the end of the cul-de-sac for Farm Close Court. Emergency overflows will overtop the crown of Eastonville Road to Design Point **EA2**.

**Basin EA-2** (5.59 AC,  $Q_5 = 7.0$  cfs,  $Q_{100} = 14.9$  cfs): Located on the western side of the site. This basin consists of the public right of way (Eastonville Road). Runoff from this basin will sheet flow to proposed curb & gutter and be conveyed downstream to a public 10' CDOT Type R inlet in sump conditions **(EA2)** located just west from Lots 16 & 17 at the end of the cul-de-sac for Farm Close Court. Emergency overflows will overtop the curb & gutter on the east side of Eastonville Road and be directed into the proposed Eastonville Pond via swale.

**Basin EA-3** (0.94 AC,  $Q_5 = 0.4$  cfs,  $Q_{100} = 3.1$  cfs): Located immediately adjacent to the Main Stem Tributary on the south side, just east of Eastonville Road. This basin consists of the proposed (private) Eastonville Full Spectrum Detention Pond. Runoff from this basin will sheet flow directly to the Pond.

## 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 a minimum of 5 proposed storm systems within the site. Each of the five storm sewer systems will discharge storm water into its correlated WQCV pond. Additionally, there will be two bypass storm sewer systems that collect off-site basin flows at **DP 32 & DP 35.** 

The bypass system at **DP 32** will cross through on-site sub-basins **EA-1**, **EA-2**, **EA-3**, **D-1**, **D-3** & **D-4**, and tie-into the outfall pipe from the Eastonville Road Pond, discharging directly into the main stem tributary channel. This bypass system will only convey flows from **DP 32** and will not be connected to any storm systems within any of the on-site sub-basins it crosses.

The bypass system at **DP 35** will cross through on-site sub-basins **EA-1**, **EA-2**, **A-4a**, **A-5** & **A-8** and discharge directly main stem tributary #2. This bypass system will only convey flows from **DP 35** and will not be connected to any storm systems within any of the on-site sub-basins it crosses.

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

Furthermore, there are three (3) proposed drainage swales that runs along the back of the residential lots in Basins A-1, C-7a, and D-7. The swales were analyzed using the Bentley software FlowMaster to properly size a trapezoidal channel (4' W x 2.0' D), (1' W x 1.50' D), & (1' W x 1.54' D), respectively, to convey the 100-year flows from the basin to corresponding outfall locations (SB-2, Glampton Drive, & Pond D), while providing 1.0-ft of freeboard. The sizing calculations can be found in **Appendix D**.

The Final drainage report will include details concerning at-grade inlet locations, street capacity, storm sewer sizing, outlet protection and location. Preliminary sump inlets have been sized and the calculations can be found in **Appendix D**. As mentioned, these sump inlets sizes are preliminary and are currently oversized. It is anticipated that the inlets will reduce in size with the addition of at-grade inlets at the time of the Final Drainage Report.

## VIII. Proposed Water Quality Detention Ponds

Eight (8) Water Quality Capture Volume Detention Ponds will be provided for the proposed site, six (6) of which are full spectrum ponds and two (2) of which are sediment basins. Of These, all six (6) of the ponds and the (2) Sediment Basins on-site 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. The 100-year volume 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. will be designed with the final drainage report during final plat. The required FSD pond volumes are as described below:

**Eastonville Road Pond:** Located along the southwest side of the site. This pond will discharge into the Main Stem Tributary. The required volume WQCV and EURV are 0.233 Ac-Ft & 0.614 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.234 Ac-Ft & 0.850 Ac-Ft, respectively. The total required detention basin volume is 1.301 Ac-Ft. The total provided detention basin storage is 1.320 Ac-Ft.

**Pond A:** Located to the north of the site, just west of the newly routed Main Stem Tributary #2 channel. This pond will discharge into the Main Stem Tributary #2, ultimately merging with Main Stem to the south, off-site. The required volume WQCV and EURV are 0.756 Ac-Ft & 2.115 Ac-Ft, respectively. The

provided storage for the WQCV and EURV are 0.761 Ac-Ft & 2.882 Ac-Ft, respectively. The total required detention basin volume is 4.290 Ac-Ft. The total provided detention basin storage is 4.626 Ac-Ft.

**Pond B:** Located centrally on the site, just east of the Main Stem drainage way. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.586 Ac-Ft & 1.610 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.587 Ac-Ft & 2.197 Ac-Ft, respectively. The total required detention basin volume is 3.310 Ac-Ft. The total provided detention basin storage is 3.449 Ac-Ft.

**Pond C:** Located on the southeast portion of the site, between the Main Stem & Main Stem Tributary #2 channels. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.828 Ac-Ft & 2.256 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.831 Ac-Ft & 3.088 Ac-Ft, respectively. The total required detention basin volume is 4.633 Ac-Ft. The total provided detention basin storage is 5.040 Ac-Ft.

**Pond D:** Located centrally on the site, just west of the Main Stem channel. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.244 Ac-Ft & 0.666 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.246 Ac-Ft & 0.913 Ac-Ft, respectively. The total required detention basin volume is 1.373 Ac-Ft. The total provided detention basin storage is 1.373 Ac-Ft.

**Pond E:** Located on the south side of the site, just west of the Main Stem channel. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.431 Ac-Ft & 1.163 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.437 Ac-Ft & 1.601 Ac-Ft, respectively. The total required detention basin volume is 2.421 Ac-Ft. The total provided detention basin storage is 2.583 Ac-Ft.

**SB-1:** Located on the far north side of the site, just east of the extension of Rex Road. This TSB will discharge into the Main Stem Tributary Number 2 (MST). The TSB has been sized to treat the developed runoff for water quality prior to releasing into MST. This TSB captures an upstream tributary area of approximately 1.22 acres and per the MHFD standard, this TSB has been upsized to 2-acre tributary area.

**SB-2:** Located on the north side of the site, at the southeast corner of the church property. This TSB will discharge into the Main Stem Tributary Number 2 (MST This TSB captures an upstream tributary area of approximately 11.23 acres and per the MHFD standard, this TSB has been upsized to 12-acre tributary area.

## IX. Proposed Channel Improvements

According to the **MDDP**, there are two major drainage ways that run through the site. As was discussed within the Existing Conditions portion of the report, both the Main Stem channel (MS) and Main Stem Tributary #2 channel (MST) run through the site. There are no proposed major channel improvements for MS as part of this project (to be determined with CDR-22-008). An analysis has been done for the Main Stem channel (MS) with both existing and future condition flows as described within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022 (**CLOMR**). All HEC-RAS modelling, velocities, shear, depths, etc. are included within the CLOMR, which can be found in Appendix D. Both scenarios, throughout the channel fall within the channel stability criteria.

The MST is proposed to be rerouted. As part of this rerouting of MST, offsite upstream tributary flows will be captured upstream from the proposed Rex Road extension and be conveyed via culvert to the rerouted MST. An analysis has been done for the Main Stem Tributary Number 2 (MST) with both existing and future condition flows as described within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022 (**CLOMR**). 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. Some basins will release directly into the respective adjacent channels. These basins are contained within the backs of lots and will provide water quality through runoff reduction; impervious areas and 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 both drainage ways (MS and MST), offsite upstream tributary capture, and design of MST were done by HR Green within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022 (**CLOMR**) which will be submitted separately for review. A copy of this report is included in Appendix D.

Additional channel stabilization may be required for erosion control prevention measures at a later date, pending the channel design review with the County.

#### 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.

All 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 Main Stem channel (MS) and Main Stem Tributary Number 2 (MST) will be maintained by the DISTRICT. Maintenance access for all full spectrum detention facilities will be provided from public Right-of-Way. Maintenance access for MS and MST will be provided along the respective eastern top of channel bank within the proposed tracts.

## XI. Wetlands Mitigation

There are two existing wetlands on site associated with the two major channels, MS and MST. The wetlands are both contained within the existing channels with the wetland in MS being classified as jurisdictional and the wetland in MST classified as non-jurisdictional. The wetlands USACE determination will be provided with the *Grandview Reserve CLOMR Report*, HR Green; April 2022, 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 and 08041C0556G 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. If it is found drainage basin fees are required, these will be included in the Final Drainage Report.

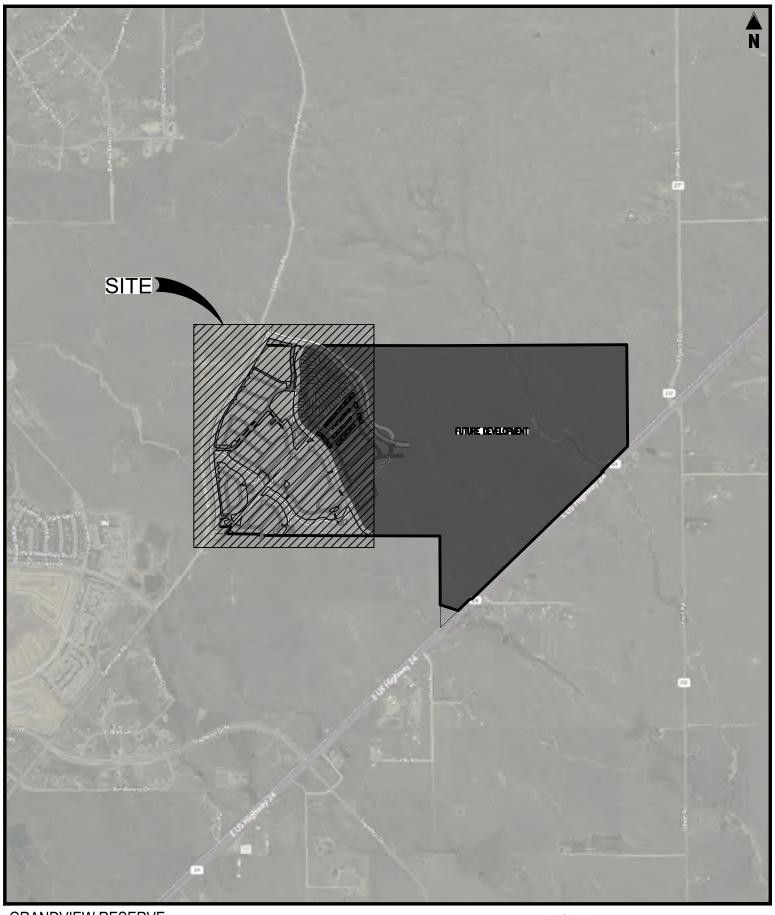
#### XIV. Conclusion

The Grandview Reserve residential subdivision lies within the Gieck Ranch Drainage Basin. Water quality for the site is provided in six on-site Full Spectrum Detention Ponds; Ponds A, B, C, D, E, & Eastonville Pond as well as two Sediment Basins; SB-1 and SB-2. Both of these SBs have been sized to function as PBMPs (and will remain in place until such time development east of the proposed site takes place) and will discharge treated runoff at historic rates directly into MST at the northern portion of the project site. 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 are two major channels passing through the site Main Stem channel and Main Stem Tributary Number 2, which will be addressed by HR Green within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022. The six (6) WQCV ponds will be maintained by a newly established Grandview Reserve Metropolitan District No. 2 (DISTRICT). A Final Drainage Report will be submitted along with the final plat and construction drawings.

#### 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).
- 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; April 2022.

# APPENDIX A Exhibits and Figures



**GRANDVIEW RESERVE** 

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EASTONVILLE RD SCALE: 1"=2,000' VICINITY MAP

Project No:	HRG1.20
Drawn By:	JDP
Checked By:	RGD
Date:	07/26/2021



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

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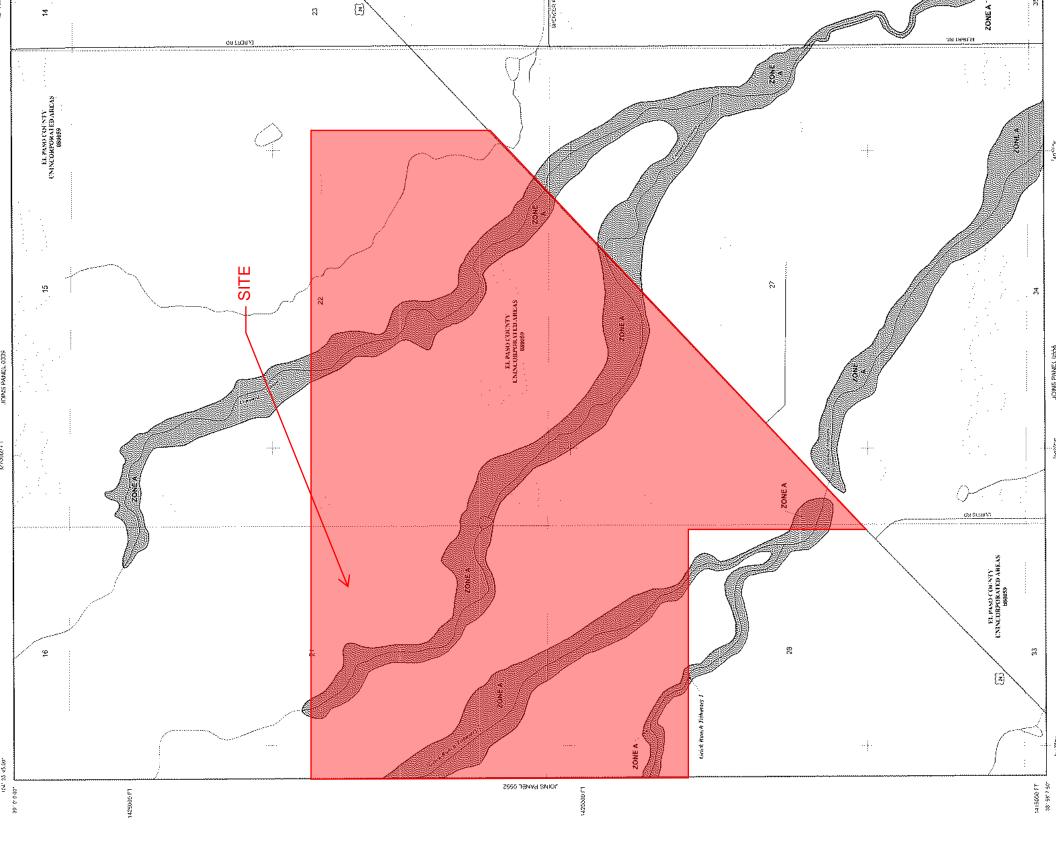
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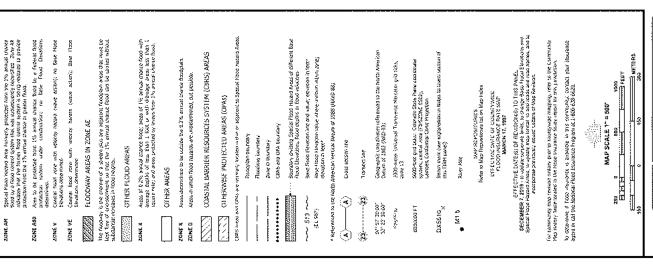




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NOTES TO USERS

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

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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 a http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following

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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 floodolains 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 floodolain.

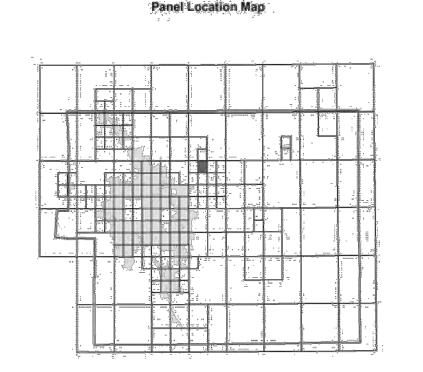
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate

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

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 a http://www.msc.fema.gov/.

If you have questions about this map or questions concerning the National Floor 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.

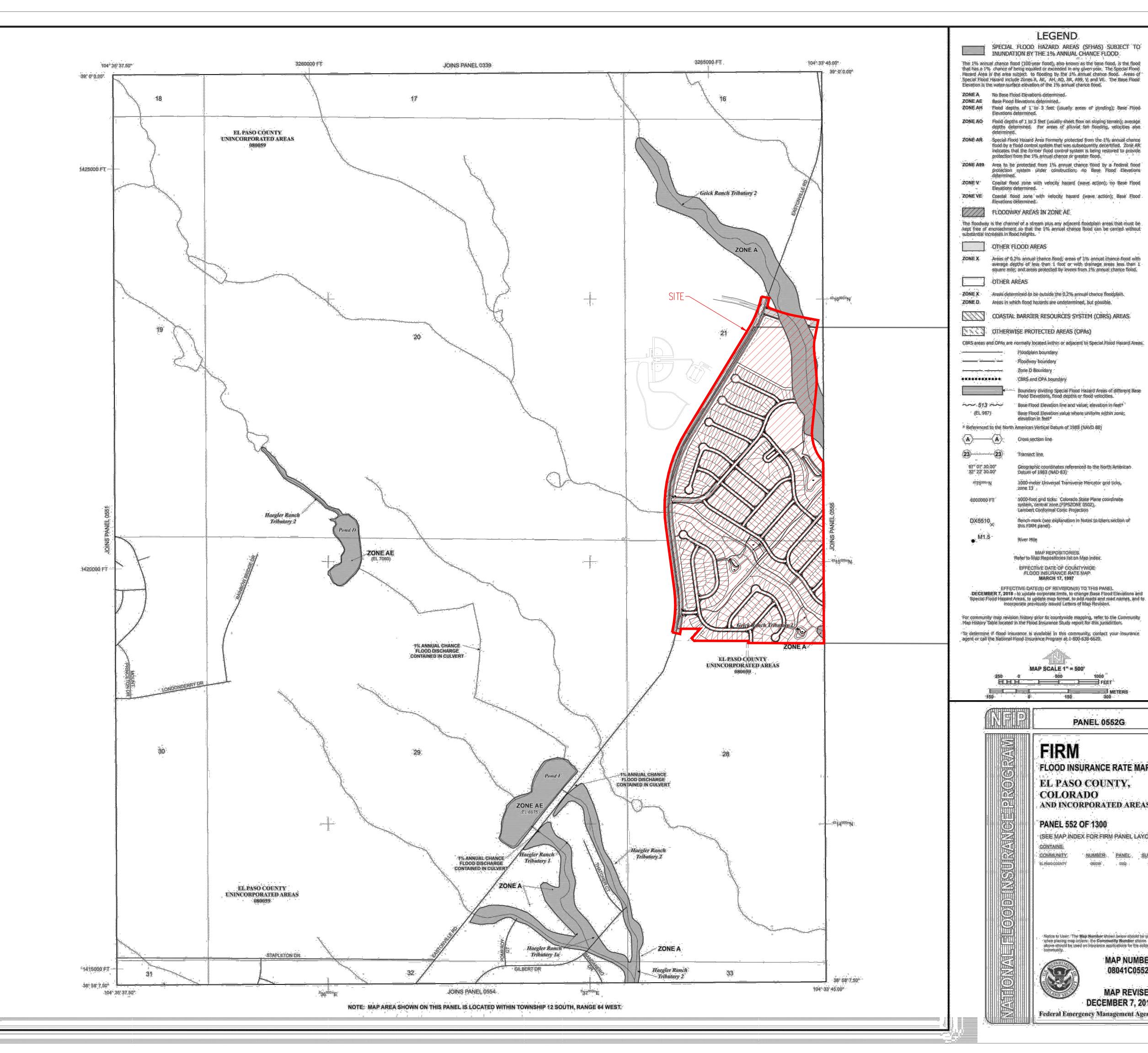
> El Paso County Vertical Datum Offset Table Flooding Source REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION



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



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



LEGEND.

Floodplain boundary:

Floodway boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base

Flood Elevations, flood depths or flood velocities

Base Flood Elevation line and value; elevation in feet\*

Base Flood Elevation value where uniform within zone;

Geographic coordinates referenced to the North American Datum of 1983 (NAD-83)

1000-meter Universal Transverse Mercator grid ticks,

5000 foot grid ticks: Colorado State Plane coordinate

Bench-mark (see explanation in Notes to Users section of

system, central zone (FIPSZONE 0502);.

MAP REPOSITORIES Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

MARCH 17, 1997

MAP SCALE 1" = 500"

PANEL 0552G

FLOOD INSURANCE RATE MAP

AND INCORPORATED AREAS

(SEE MAP INDEX FOR FIRM PANEL LAYOUT).

Notice to Licer: The Map Number shows below should be used: when planing map orders: the Community Humber shoun above should be used on insurance applications for the subject

Federal Emergency Management Agency

NUMBER PANEL SUFFIX

0552

MAP NUMBER

08041C0552G

MAP REVISED

**DECEMBER 7, 2018** 

EL PASO COUNTY,

COLORADO

PANEL 552 OF 1300

COMMUNITY

Lambert Conformal Conic Projection

Zone D Boundary

Cross section line

this FIRM panel)

## 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

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, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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.

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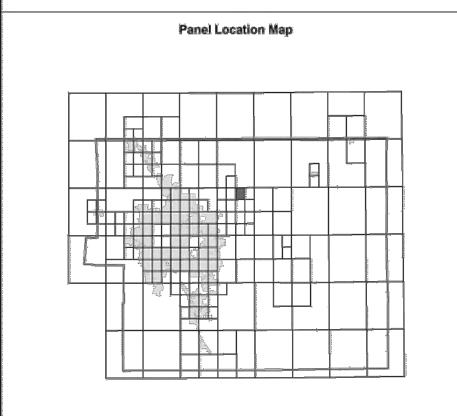
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## El Paso County Vertical Datum Offset Table

Flooding Source

Vertical Datum
Offset (ft)

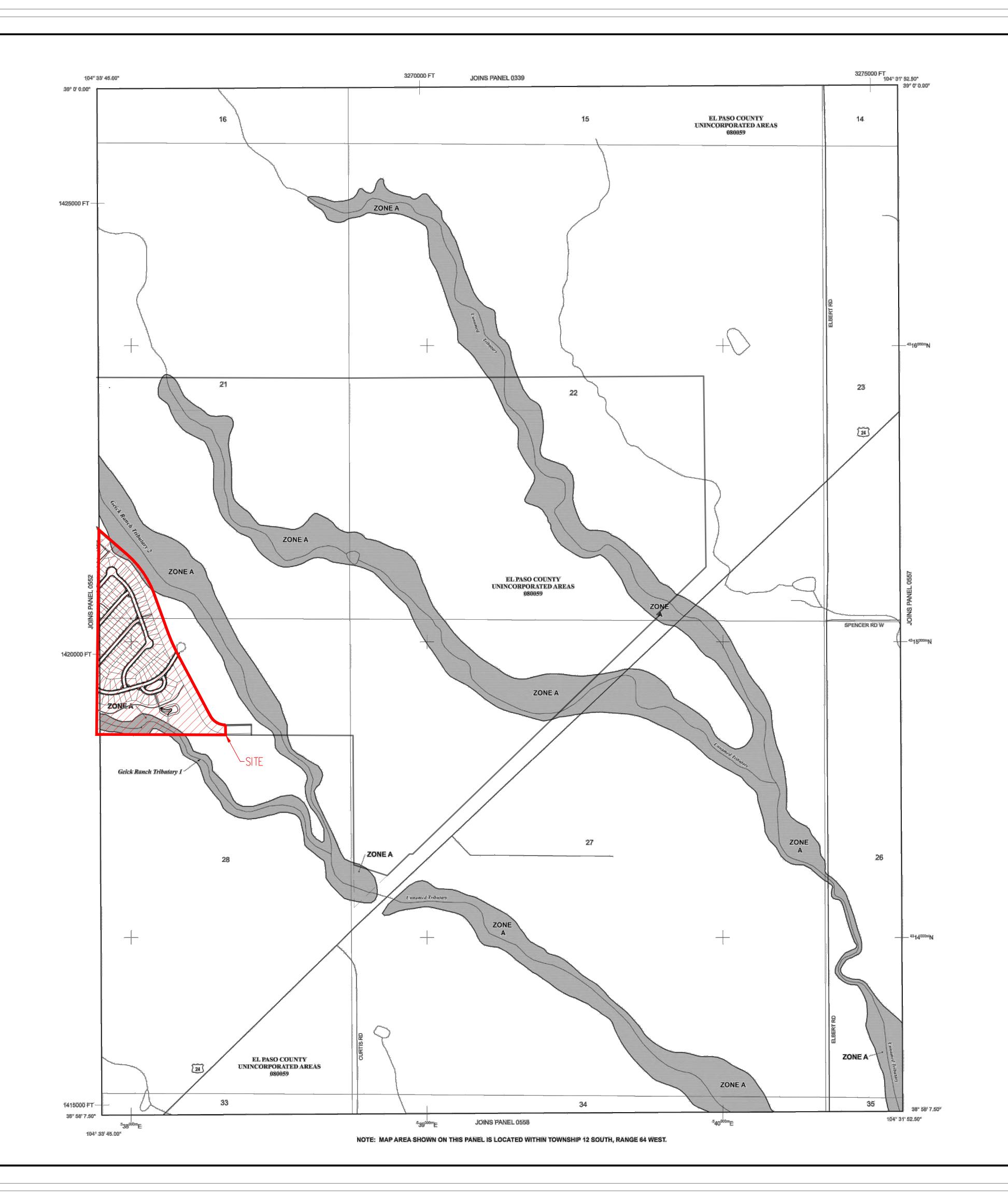
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY
FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION



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).



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## 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 AH 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

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

IE 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.

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

A Cross section line

)------(23) Transe

M1,5

97°07°30.00° Geographic coordinates referenced to the North American 32°22°30.00° Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid ticks, zone 13

600000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZGNE 0502); Lambert Conformat Conic Projection

DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)

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.

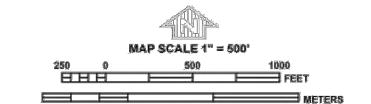
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

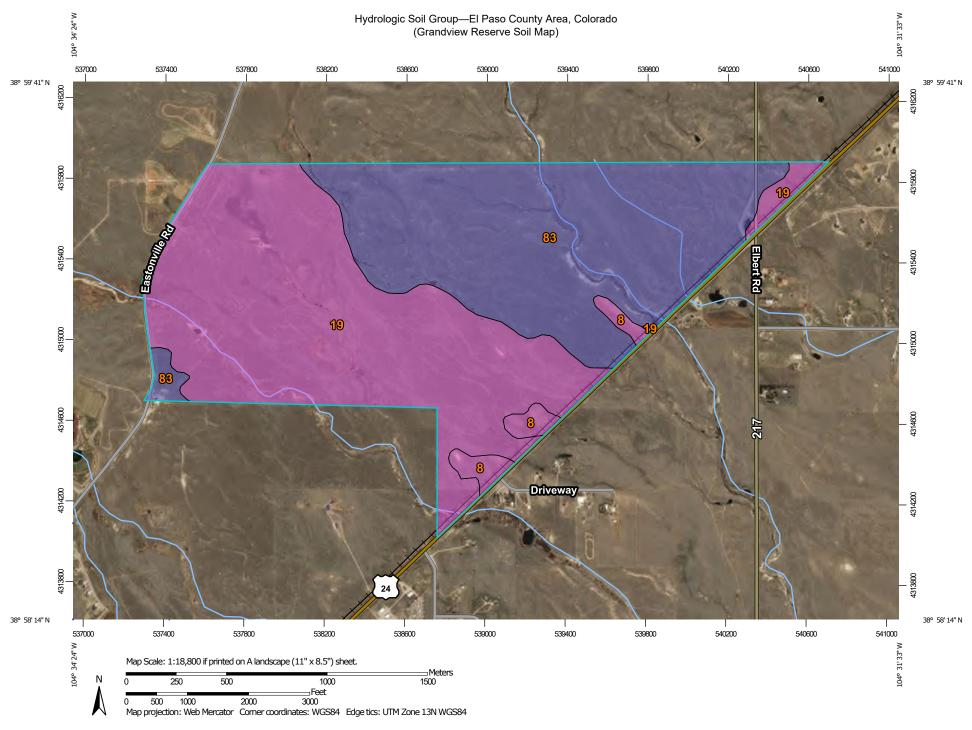
agent or call the National Flood Insurance Program at 1-800-638-6625.



## PANEL 0556G **FIRM** FLOOD INSURANCE RATE MAP EL PASO COUNTY, COLORADO AND INCORPORATED AREAS PANEL 556 OF 1300 (SEE MAP INDEX FOR FIRM PANEL LAYOUT) CONTAINS: COMMUNITY: NUMBER PANEL SUFFIX EL PASO COUNTY 686059 0556 Notice to User. The Map Number shown below should be used when placing map orders; fire Community Number shown above should be used on insurance applications for the MAP NUMBER 08041C0556G MAP REVISED

**DECEMBER 7, 2018** 

Federal Emergency Management Agency



#### MAP LEGEND MAP INFORMATION The soil surveys that comprise your AOI were mapped at Area of Interest (AOI) С 1:24.000. Area of Interest (AOI) C/D Please rely on the bar scale on each map sheet for map Soils D measurements. Soil Rating Polygons Not rated or not available Α Source of Map: Natural Resources Conservation Service Web Soil Survey URL: **Water Features** A/D Coordinate System: Web Mercator (EPSG:3857) Streams and Canals В Maps from the Web Soil Survey are based on the Web Mercator Transportation projection, which preserves direction and shape but distorts B/D Rails <del>. . .</del> distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more Interstate Highways accurate calculations of distance or area are required. C/D **US Routes** This product is generated from the USDA-NRCS certified data as D Major Roads of the version date(s) listed below. Not rated or not available Local Roads Soil Survey Area: El Paso County Area, Colorado Soil Rating Lines Survey Area Data: Version 17, Sep 13, 2019 Background Aerial Photography Soil map units are labeled (as space allows) for map scales 1:50.000 or larger. A/D Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019 B/D 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 C/D shifting of map unit boundaries may be evident. D Not rated or not available **Soil Rating Points** A/D B/D

## **Hydrologic Soil Group**

Map unit symbol	Map unit symbol Map unit name		Acres in AOI	Percent of AOI	
8	Blakeland loamy sand, 1 to 9 percent slopes	А	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	В	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.

## **Rating Options**

Aggregation Method: Dominant Condition
Component Percent Cutoff: None Specified

Tie-break Rule: Higher



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) <sup>1</sup>										
Duration	Average recurrence interval (years)									
Duration	1	2	5	10	25	50	100	200	500	1000
5-min	<b>0.239</b> (0.189-0.303)	<b>0.291</b> (0.231-0.370)	<b>0.381</b> (0.301-0.486)	<b>0.461</b> (0.361-0.589)	<b>0.576</b> (0.440-0.768)	<b>0.671</b> (0.499-0.904)	<b>0.770</b> (0.554-1.06)	<b>0.875</b> (0.604-1.24)	<b>1.02</b> (0.678-1.48)	<b>1.14</b> (0.733-1.67)
10-min	<b>0.350</b> (0.277-0.444)	<b>0.426</b> (0.338-0.542)	<b>0.558</b> (0.441-0.711)	<b>0.674</b> (0.529-0.863)	<b>0.844</b> (0.644-1.13)	<b>0.982</b> (0.731-1.32)	<b>1.13</b> (0.811-1.56)	<b>1.28</b> (0.884-1.81)	<b>1.49</b> (0.992-2.17)	<b>1.66</b> (1.07-2.44)
15-min	<b>0.426</b> (0.338-0.541)	<b>0.520</b> (0.412-0.660)	<b>0.681</b> (0.537-0.867)	<b>0.823</b> (0.645-1.05)	<b>1.03</b> (0.785-1.37)	<b>1.20</b> (0.891-1.62)	<b>1.37</b> (0.988-1.90)	<b>1.56</b> (1.08-2.21)	<b>1.82</b> (1.21-2.65)	<b>2.03</b> (1.31-2.98)
30-min	<b>0.608</b> (0.482-0.771)	<b>0.740</b> (0.586-0.940)	<b>0.968</b> (0.764-1.23)	<b>1.17</b> (0.916-1.49)	<b>1.46</b> (1.11-1.94)	<b>1.70</b> (1.26-2.29)	<b>1.94</b> (1.40-2.68)	<b>2.21</b> (1.52-3.12)	<b>2.57</b> (1.71-3.73)	<b>2.86</b> (1.85-4.19)
60-min	<b>0.775</b> (0.615-0.984)	<b>0.933</b> (0.739-1.19)	<b>1.21</b> (0.956-1.54)	<b>1.46</b> (1.15-1.87)	<b>1.84</b> (1.41-2.47)	<b>2.16</b> (1.61-2.92)	<b>2.49</b> (1.80-3.45)	<b>2.85</b> (1.97-4.05)	3.37 (2.24-4.90)	<b>3.78</b> (2.44-5.55)
2-hr	<b>0.943</b> (0.754-1.19)	<b>1.13</b> (0.898-1.42)	<b>1.46</b> (1.16-1.84)	<b>1.76</b> (1.39-2.23)	<b>2.22</b> (1.72-2.97)	<b>2.62</b> (1.97-3.52)	<b>3.04</b> (2.21-4.19)	<b>3.50</b> (2.45-4.95)	<b>4.16</b> (2.80-6.03)	<b>4.70</b> (3.06-6.85)
3-hr	<b>1.03</b> (0.829-1.29)	<b>1.22</b> (0.978-1.53)	<b>1.57</b> (1.25-1.97)	<b>1.90</b> (1.51-2.40)	<b>2.41</b> (1.88-3.22)	<b>2.86</b> (2.17-3.84)	<b>3.35</b> (2.45-4.60)	3.88 (2.73-5.48)	<b>4.66</b> (3.15-6.74)	<b>5.29</b> (3.46-7.69)
6-hr	<b>1.20</b> (0.968-1.49)	<b>1.40</b> (1.13-1.74)	<b>1.78</b> (1.44-2.22)	<b>2.16</b> (1.73-2.70)	<b>2.76</b> (2.18-3.66)	<b>3.28</b> (2.52-4.39)	<b>3.86</b> (2.86-5.29)	<b>4.51</b> (3.21-6.34)	<b>5.46</b> (3.73-7.86)	<b>6.24</b> (4.12-9.01)
12-hr	<b>1.38</b> (1.13-1.70)	<b>1.61</b> (1.31-1.98)	<b>2.05</b> (1.67-2.53)	<b>2.48</b> (2.00-3.07)	<b>3.15</b> (2.51-4.15)	<b>3.74</b> (2.89-4.96)	<b>4.39</b> (3.28-5.96)	<b>5.12</b> (3.67-7.13)	<b>6.17</b> (4 25-8 82)	<b>7.04</b> (4.69-10.1)
24-hr	<b>1.60</b> (1.31-1.95)	<b>1.87</b> (1.54-2.28)	<b>2.38</b> (1.94-2.91)	<b>2.85</b> (2.32-3.51)	<b>3.60</b> (2.88-4.67)	<b>4.24</b> (3.29-5.56)	<b>4.94</b> (3.71-6.63)	<b>5.71</b> (4.12-7.87)	<b>6.82</b> (4.73-9.66)	<b>7.73</b> (5.20-11.0)
2-day	<b>1.85</b> (1.54-2.24)	<b>2.18</b> (1.80-2.63)	<b>2.76</b> (2.28-3.35)	<b>3.29</b> (2.70-4.01)	<b>4.11</b> (3.30-5.27)	<b>4.80</b> (3.76-6.22)	<b>5.54</b> (4.19-7.36)	<b>6.35</b> (4.62-8.68)	<b>7.50</b> (5.25-10.5)	<b>8.44</b> (5.73-11.9)
3-day	<b>2.03</b> (1.69-2.44)	<b>2.39</b> (1.98-2.87)	<b>3.02</b> (2.50-3.64)	<b>3.60</b> (2.97-4.36)	<b>4.47</b> (3.60-5.69)	<b>5.20</b> (4.09-6.70)	<b>5.98</b> (4.55-7.90)	<b>6.83</b> (4.99-9.28)	<b>8.03</b> (5.65-11.2)	<b>9.00</b> (6.15-12.7)
4-day	<b>2.18</b> (1.82-2.61)	<b>2.56</b> (2.13-3.06)	<b>3.22</b> (2.68-3.87)	<b>3.82</b> (3.16-4.62)	<b>4.73</b> (3.83-6.00)	<b>5.49</b> (4.33-7.04)	<b>6.30</b> (4.81-8.30)	<b>7.18</b> (5.26-9.72)	<b>8.43</b> (5.95-11.7)	<b>9.43</b> (6.46-13.3)
7-day	<b>2.58</b> (2.17-3.07)	<b>2.98</b> (2.50-3.54)	<b>3.68</b> (3.08-4.39)	<b>4.32</b> (3.60-5.18)	<b>5.29</b> (4.31-6.65)	<b>6.09</b> (4.84-7.76)	<b>6.96</b> (5.34-9.09)	<b>7.89</b> (5.82-10.6)	<b>9.21</b> (6.55-12.8)	<b>10.3</b> (7.10-14.4)
10-day	<b>2.93</b> (2.48-3.47)	<b>3.37</b> (2.84-3.98)	<b>4.13</b> (3.47-4.90)	<b>4.81</b> (4.02-5.74)	<b>5.83</b> (4.76-7.29)	<b>6.68</b> (5.32-8.45)	<b>7.58</b> (5.85-9.86)	<b>8.55</b> (6.34-11.4)	<b>9.92</b> (7.09-13.7)	<b>11.0</b> (7.65-15.4)
20-day	<b>3.91</b> (3.33-4.58)	<b>4.51</b> (3.84-5.29)	<b>5.52</b> (4.68-6.50)	<b>6.39</b> (5.39-7.55)	<b>7.63</b> (6.25-9.37)	<b>8.62</b> (6.90-10.8)	<b>9.64</b> (7.47-12.4)	<b>10.7</b> (7.98-14.1)	<b>12.2</b> (8.74-16.6)	<b>13.3</b> (9.31-18.4)
30-day	<b>4.70</b> (4.02-5.47)	<b>5.44</b> (4.65-6.34)	<b>6.65</b> (5.66-7.78)	<b>7.66</b> (6.49-9.00)	<b>9.06</b> (7.44-11.0)	<b>10.1</b> (8.15-12.5)	<b>11.2</b> (8.74-14.3)	<b>12.3</b> (9.24-16.2)	<b>13.8</b> (9.98-18.7)	<b>15.0</b> (10.5-20.6)
45-day	<b>5.67</b> (4.88-6.57)	<b>6.55</b> (5.63-7.60)	<b>7.97</b> (6.82-9.27)	<b>9.12</b> (7.77-10.7)	<b>10.7</b> (8.79-12.9)	<b>11.9</b> (9.56-14.5)	<b>13.0</b> (10.2-16.4)	<b>14.2</b> (10.6-18.4)	<b>15.6</b> (11.3-21.0)	<b>16.7</b> (11.9-23.0)
60-day	<b>6.49</b> (5.60-7.48)	<b>7.46</b> (6.43-8.62)	<b>9.01</b> (7.74-10.4)	<b>10.3</b> (8.77-11.9)	<b>11.9</b> (9.82-14.3)	<b>13.1</b> (10.6-16.0)	<b>14.3</b> (11.2-18.0)	<b>15.5</b> (11.7-20.0)	<b>16.9</b> (12.3-22.6)	<b>18.0</b> (12.8-24.6)

<sup>&</sup>lt;sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

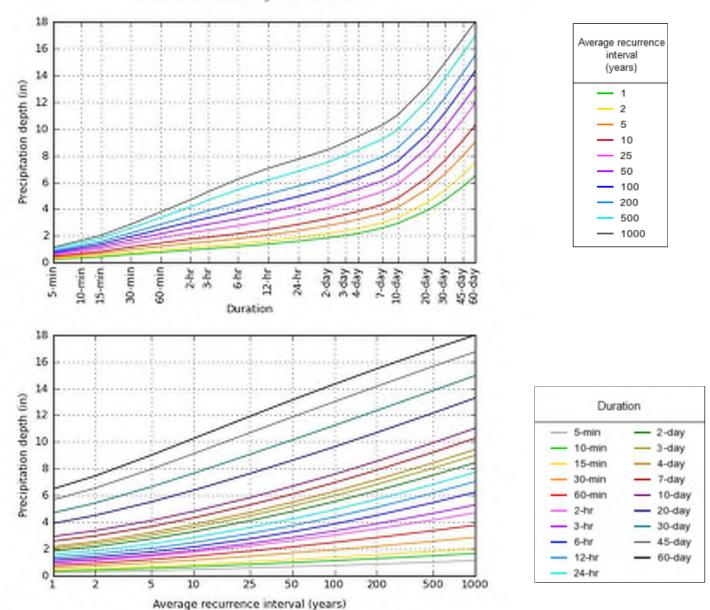
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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

#### PDS-based depth-duration-frequency (DDF) curves Latitude: 38.9850°, Longitude: -104.5650°



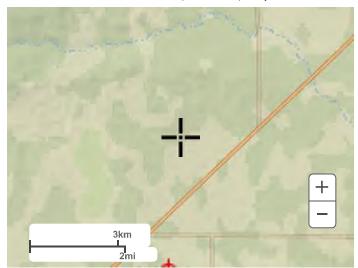
NOAA Atlas 14, Volume 8, Version 2

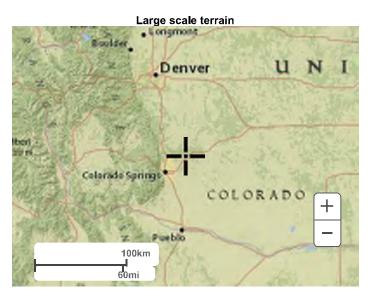
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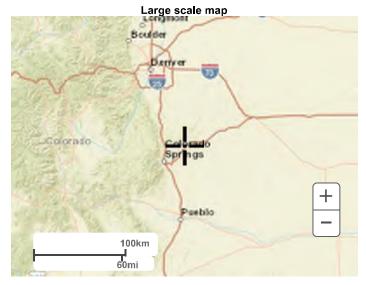
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### Maps & aerials

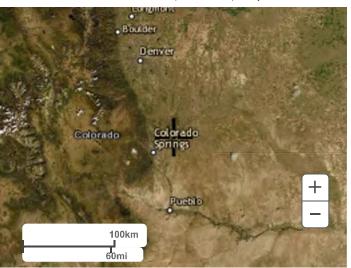
Small scale terrain







Large scale aerial

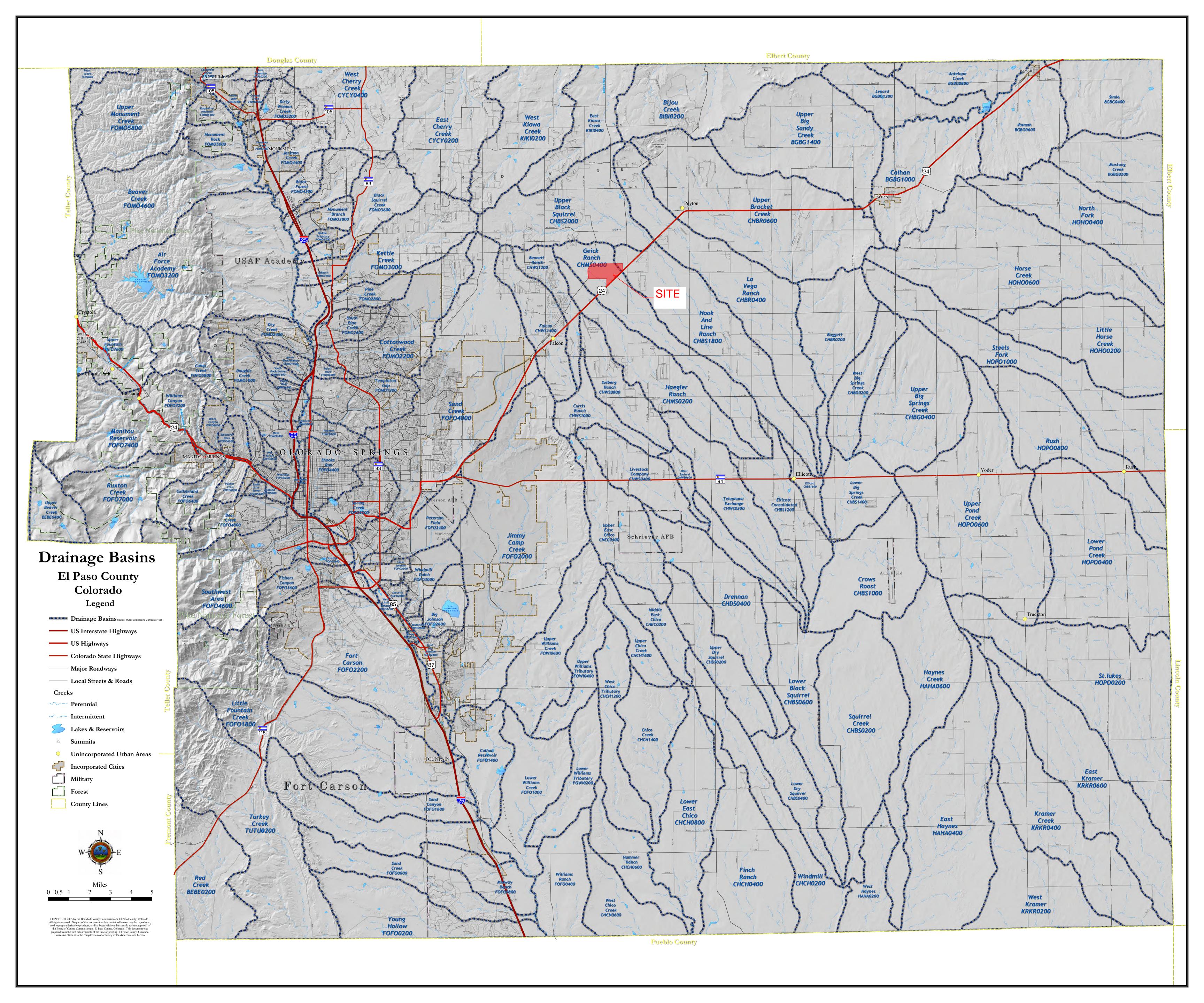


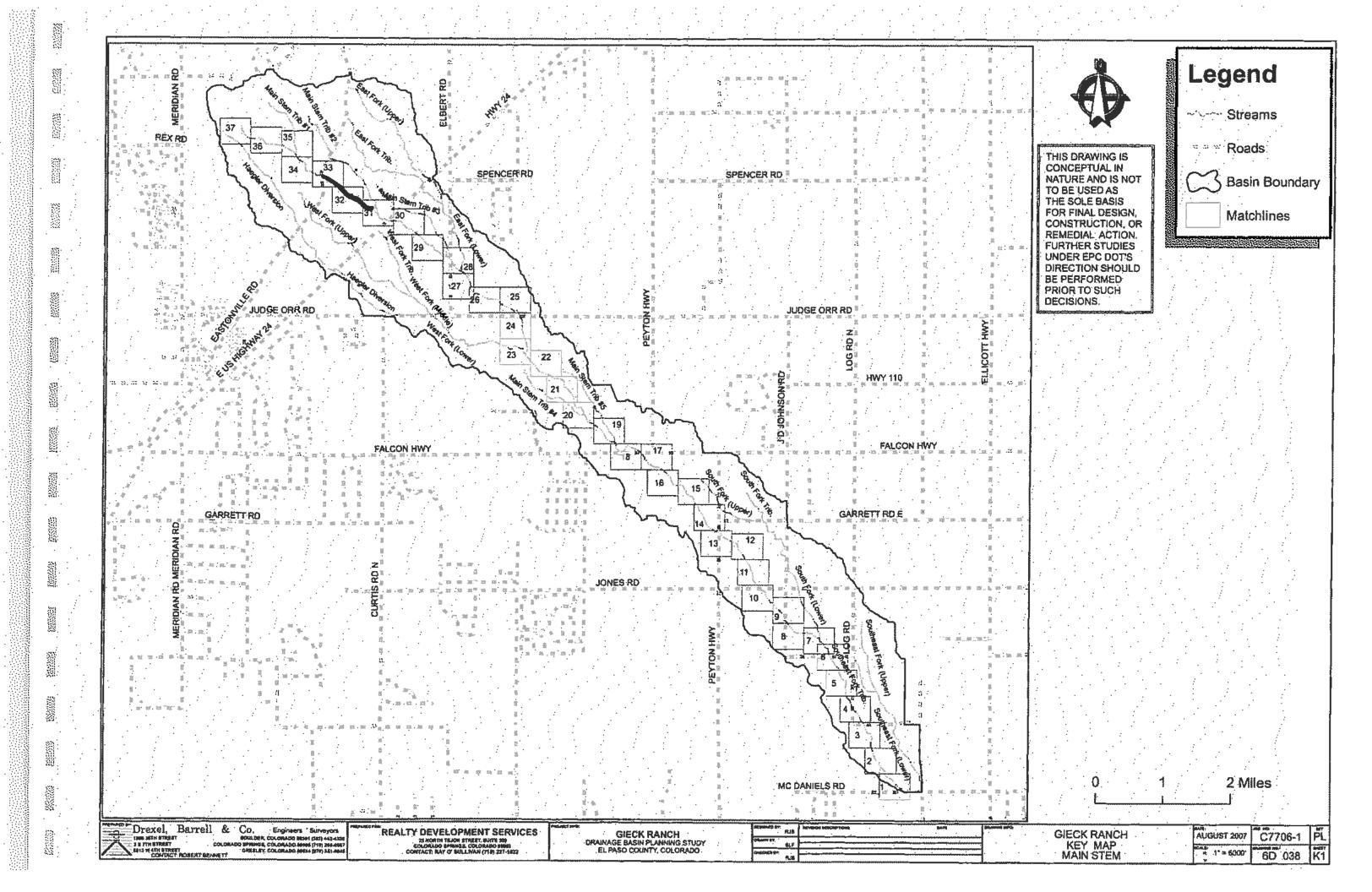
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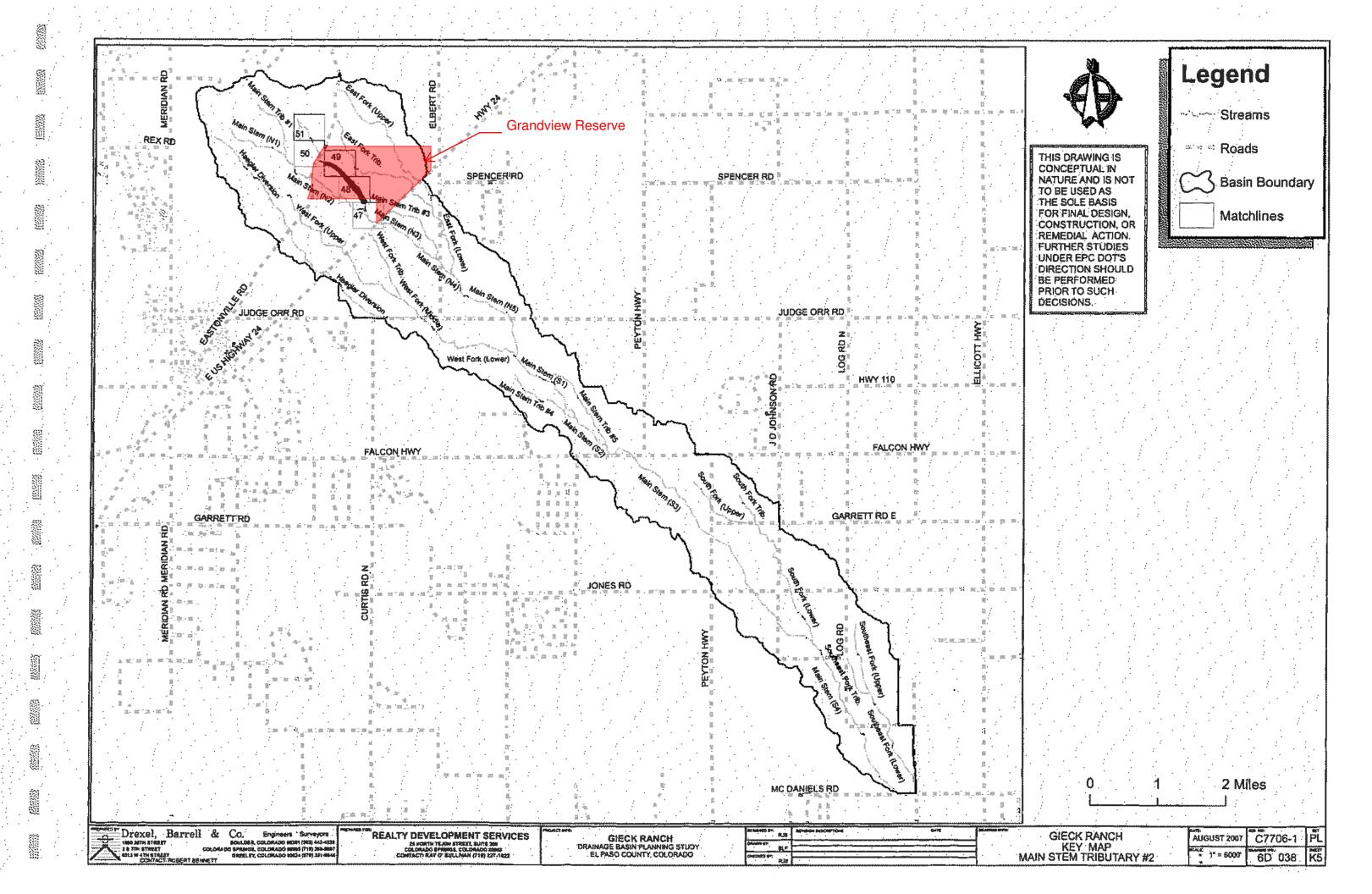
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

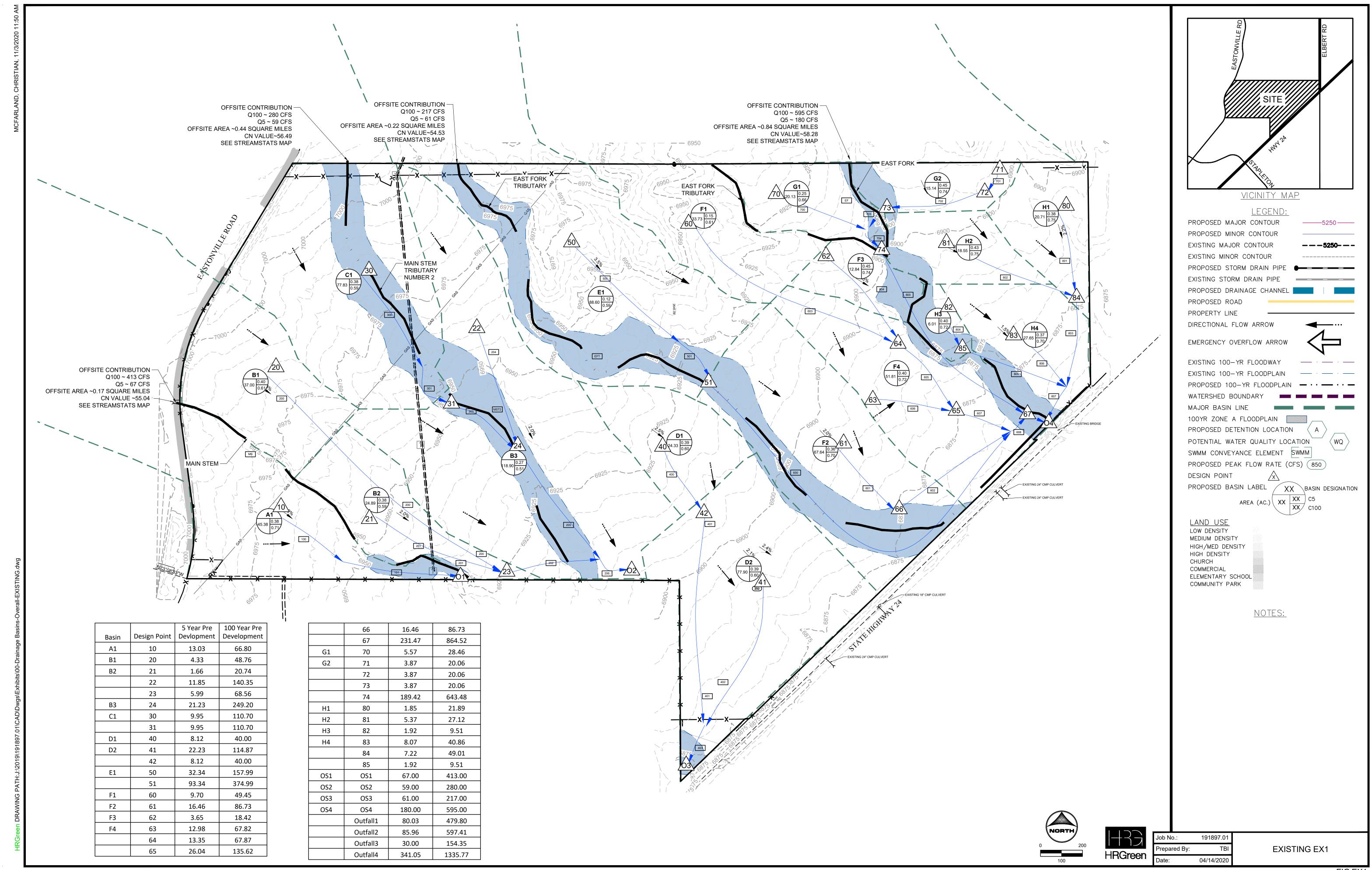
<u>Disclaimer</u>

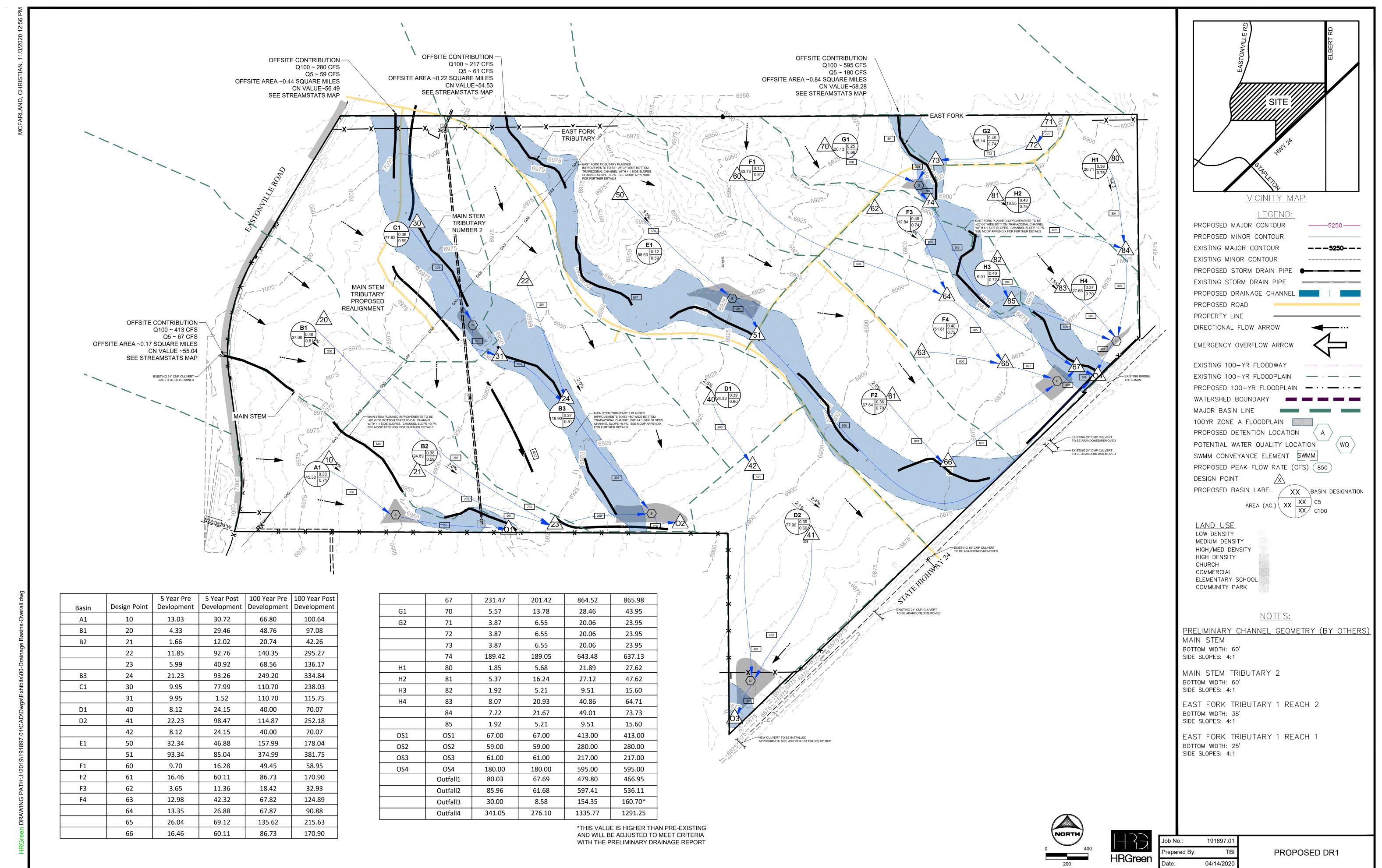
## APPENDIX B MDDP & DBPS Sheet References











# APPENDIX C Hydrologic Computations



EASTONVILLE ROAD	Calc'd by:	CLB
EXISTING CONDITIONS	Checked by:	ИQJ
LOCATION: EL PASO COUNTY, COLORADO	Date:	5/27/2022

	SUMMARY RUNOFF TABLE														
BASIN	AREA (ac)	% IMPERVIOUS	Q <sub>5</sub> (cfs)	Q <sub>100</sub> (cfs)											
OS1	1.57	2	0.5	3.6											
OS2	2.86	2	8.0	5.3											
OS3	21.61	2	4.5	30.5											
OS4*	112.71	2	67.0	413.0											
OS5**	51.01	2	8.0	125.0											

DES	DESIGN POINT SUMMARY TABLE													
DESIGN POINT	CONTRIBUTING BASINS	$\Sigma Q_5$ (cfs)	ΣQ <sub>100</sub> (cfs)											
11	OS1	0.5	3.6											
10	OS2	0.8	5.3											
9	OS3	4.5	30.5											
8*	OS4	67.0	413.0											
7**	OS5	8.0	125.0											

\* TAKEN FROM APPROVED FALCON REGIONAL PARK DRAINAGE REPORT, 2015

TAKEN FROM APPROVED 4 WAY RANCH LOMR, 2004, CASE No. 04-08-0012P



	EASTONVILLE ROAD			Calc'd by:	CLB		
	EXISTING CONDITIONS			Checked by:	NQJ		
n	LOCATION: EL PASO COUNTY, COLORADO			Date:	5/9/2022		

#### COMPOSITE 'C' FACTORS

					•	JIMIF OOI	-	•	A0.0												
	MEADOW/FIELD	BLDGS/CONC	GRAVEL	NEIGHBORHOOD	TOTAL	SOIL	MEA	DOW	/FIELD	BLDG	S/CONC	RETE		GRAVI		NEIG	HBORH	DOD		MPOSIT	
BASIN		RETE	PARKING	AREA		TVDE									NG		AREA		IMPERVIOUSNESS & C		
			ACRES			TYPE	<b>%</b> I	C <sub>5</sub>	C <sub>100</sub>	<b>%l</b>	C <sub>5</sub>	C <sub>100</sub>	<b>%I</b>	C <sub>5</sub>	C <sub>100</sub>	<b>%I</b>	C <sub>5</sub>	C <sub>100</sub>	<b>%I</b>	C <sub>5</sub>	C <sub>100</sub>
OS1	1.57	0.00	0.00	0.00	1.57	A/B	2	0.09	0.36	100	0.90	0.96	80	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS2	2.86	0.00	0.00	0.00	2.86	A/B	2	0.09	0.36	100	0.90	0.96	80	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS3	21.61	0.00	0.00	0.00	21.61	A/B	2	0.09	0.36	100	0.90	0.96	80	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS4	112.71	0.00	0.00	0.00	112.71	A/B	2	0.09	0.36	100	0.90	0.96	80	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS5	51.01	0.00	0.00	0.00	51.01	A/B	2	0.09	0.36	100	0.90	0.96	80	0.45	0.59	70	0.49	0.62	2	0.09	0.36
Total					189.76														2.0		



EASTONVILLE ROAD	Calc'd by:	CLB
EXISTING CONDITIONS	Checked by:	ИQJ
LOCATION: EL PASO COUNTY, COLORADO	Date:	5/9/2022

				TIME O	F CONCE	NTRATI	ON								
BAS	IN DATA		OVER		TRAVEL TIME (T <sub>f</sub> )										
DESIGNATION	C <sub>5</sub>	AREA (ac)	LENGTH (ft)	SLOPE %	t <sub>i</sub> (min)	$C_V$	LENGTH (ft)	SLOPE %	V (ft/s)	t <sub>t</sub> (min)	$t_c$ (min)				
OS1	0.09	1.57	77	3.2	11.0	7	143	5.2	1.6	1.5	12.5				
OS2	0.09	2.86	119	1.5	17.6	7	332	8.0	2.0	2.8	20.4				
OS3	0.09	21.61	194	2.0	20.5	7	980	3.4	1.3	12.7	33.1				
OS4	0.09	112.71	300	1.0	32.1	7	830	3.0	1.2	11.4	43.5				
OS5	0.09	51.01	200	1.0	26.2	7	250	2.6	1.1	3.7	29.9				

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$
  $V = C_v S_w^{-0.5}$ 

Table 6-7. Conveyance Coefficient,  $C_v$ 

Type of Land Surface	$C_{\nu}$
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

For buried riprap, select C<sub>v</sub> value based on type of vegetative cover.



EASTONVILLE ROAD	Calc'd by:	СРМ
EXISTING CONDITIONS	Checked by:	
DESIGN STORM: 5-YEAR	Date:	5/27/2022

				DII	RECT	RUNOF	F		T	OTAL I	RUNG	OFF	S	TREE	т		PIF	PΕ		TR	AVEL	TIME	REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	င်	t <sub>c</sub> (min)	C <sub>5</sub> *A (ac)	/ (in./ hr.)	Q (cfs)	t <sub>c</sub> (min)	C <sub>5</sub> *A (ac)	/ (in./ hr.)	Q (cfs)	Q <sub>street</sub> (cfs)	C <sub>5</sub> *A (ac)	% <b>3401</b> 8	Q <sub>PIPE</sub> (cfs)	C <sub>5</sub> *A (ac)	% alone	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
	11	OS1	1.57	0.09	12.5	0.14	3.79	0.5															BASIN OS2 FLOW @ DP11, CAPTURED IN EX 18" CULVERT
	10	OS2	2.86	0.09	20.4	0.26	3.06	0.8															BASIN OS2 FLOW @ DP10, CAPTURED IN EX 18" CULVERT
	9	OS3	21.61	0.09	33.1	1.94	2.33	4.5															BASIN OS3 FLOW @ DP9, CAPTURED IN EX 18" CULVERT
																							TAKEN FROM APPROVED 4 WAY RANCH LOMR, 2004, CASE No. 04-08-0012P
																							INCLUDES OFFSITE FLOWS FROM MERIDIAN RANCH
	8	OS4	112.71					67.0															BASIN OS4 FLOW @ D8, CAPTURED IN EX 24" CULVERT
																							TAKEN FROM APPROVED FALCON REGIONAL PARK DRAINAGE REPORT, 2015
	7	OS5	51.01					8.0															BASIN OS5 FLOW @ DP7, CAPTURED IN EX 24" CULVERT



EASTONVILLE ROAD	Calc'd by:	СРМ
EXISTING CONDITIONS	Checked by:	
DESIGN STORM: 100-YEAR	Date:	5/27/2022

			DIRECT RUNOFF							TOTAL RUNOFF STREET							PIF	\=		TD	AVEL	TIME	REMARKS
				DII	KECI	KUNUF	-		10	IALI	KUNUI		5	IKEE			PII	'E	1	IK	AVEL		REWARNS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C <sub>100</sub>	t <sub>c</sub> (min)	C <sub>100</sub> *A (ac)	/ (in./ hr.)	Q (cfs)	t <sub>c</sub> (min)	C <sub>100</sub> *A (ac)	/ (in./ hr.)	Q (cfs)	Q <sub>street</sub> (cfs)	C <sub>100</sub> *A (ac)	SLOPE %	Q <sub>PIPE</sub> (cfs)	C <sub>100</sub> *A (ac)	% SLOPE	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
	11	OS1	1.57	0.36	12.5	0.57	6.37	3.6															BASIN OS2 FLOW @ DP11, CAPTURED IN EX 18" CULVERT
	- ' '	031	1.57	0.30	12.3	0.57	0.37	3.0															BAGIN CO21 EOW @ BI 11, CAI TONED IN EX 10 COEVERT
	10	OS2	2.86	0.36	20.4	1.03	5.13	5.3															BASIN OS2 FLOW @ DP10, CAPTURED IN EX 18" CULVERT
	9	OS3	21.61	0.36	33.1	7.78	3.91	30.5															BASIN OS3 FLOW @ DP9, CAPTURED IN EX 18" CULVERT
																							TAKEN FROM APPROVED 4 WAY RANCH LOMR, 2004, CASE No. 04-08-0012P
																							INCLUDES OFFSITE FLOWS FROM MERIDIAN RANCH
	8	OS4	112.71					413.0															BASIN OS4 FLOW @ D8, CAPTURED IN EX 24" CULVERT
																							TAKEN FROM APPROVED FALCON REGIONAL PARK DRAINAGE REPORT, 2015
	7	OS5	51.01					125.0															BASIN OS5 FLOW @ DP7, CAPTURED IN EX 24" CULVERT

	一つ こ	EASTONVILLE ROAD	Calc'd by:	СРМ
	גרד	PROPOSED CONDITIONS	Checked by:	
H	RGreen	LOCATION: EL PASO COUNTY, COLORADO	Date:	5/27/2022

5	SUMMARY RUNOFF TABLE														
BASIN	AREA (ac)	% IMPERVIOUS	Q <sub>5</sub> (cfs)	Q <sub>100</sub> (cfs)											
EA1	7.79	59	9.2	19.5											
EA2	5.59	59	7.0	14.9											
OS1	6.73	2	1.3	8.7											
OS2	17.28	2	2.6	17.3											
OS3	91.28	59	-	-											
OS4	20.30	59	-	-											
OS3&OS4*	111.58	59	67.0	413.0											
OS5**	47.27	2	8.0	125.0											

DESI	GN POINT SUM	IMARY T	ABLE
DESIGN POINT	CONTRIBUTING BASINS	ΣQ <sub>5</sub> (cfs)	ΣQ <sub>100</sub> (cfs)
EA1	EA1	7.6	16.1
EA2	EA2	7.0	14.9
EA2.1	DPEA1 & DPEA2	14.1	30
32	OS1 & OS2	3.6	24
33	DP32	3.9	25.8
34*	OS3 & OS4	67	413
35**	OS5	8.0	125.0

<sup>\*</sup> TAKEN FROM APPROVED 4 WAY RANCH LOMR, 2004, CASE No.

\* 04-08-0012P

TAKEN FROM APPROVED FALCON REGIONAL PARK DRAINAGE

\*\* REPORT, 2015



#### **EASTONVILLE ROAD** NQJ Calc'd by: PROPOSED CONDITIONS Checked by: HRGreen LOCATION: EL PASO COUNTY, COLORADO Date: 5/9/2022

#### **COMPOSITE 'C' FACTORS**

					•	J 00.		•	AU. U.												
BASIN	UNDEVELOPED	ROADWAY	SINGLE FAMILY	NEIGHBORHOOD AREA	TOTAL SOIL U					ROADWAY				SINGL FAMIL			HBORH AREA	OOD	IMPERV	MPOSI IOUSNE	
			ACRES	•	•	TYPE	<b>%</b> I	C <sub>5</sub>	C <sub>100</sub>	<b>%I</b>	C <sub>5</sub>	C <sub>100</sub>	<b>%I</b>	C <sub>5</sub>	C <sub>100</sub>	<b>%I</b>	C <sub>5</sub>	C <sub>100</sub>	%I	C <sub>5</sub>	C <sub>100</sub>
EA1	2.70	3.72	0.00	0.00	6.42	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	59	0.56	0.71
EA2	2.35	3.24	0.00	0.00	5.59	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	59	0.56	0.71
OS1	6.73	0.00	0.00	0.00	6.73	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS2	17.28	0.00	0.00	0.00	17.28	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS3	91.28	0.00	0.00	0.00	91.28	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS4	20.30	0.00	0.00	0.00	20.30	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	2	0.09	0.36
OS5	48.60	0.00	0.00	0.00	48.60	A/B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	70	0.49	0.62	2	0.09	0.36
Eastonville Pond	ı				12.01														59		
Total					196.20														5		
	·	·	·																		



EASTONVILLE ROAD	Calc'd by:	ИQJ
PROPOSED CONDITIONS	Checked by:	
LOCATION: EL PASO COUNTY, COLORADO	Date:	5/9/2022

10

10

				TIME OF CONCENTRATION													
BAS	IN DATA		OVER	LAND TIM	E (T <sub>i</sub> )		TOTAL										
DESIGNATION	C <sub>5</sub>	AREA (ac)	LENGTH (ft)	SLOPE %	t <sub>i</sub> (min)	$C_{V}$	LENGTH (ft)	SLOPE %	V (ft/s)	t <sub>t</sub> (min)	$t_c$ (min)						
EA1	EA1 0.56 6.42		50	2.0	5.6	20	3750	0.9	1.9	32.9	38.5						
EA2	0.56	5.59	50	2.0	5.6	20	3350	0.9	1.9	29.4	35.0						
OS1	0.09	6.73	178	1.0	24.7	10	770	1.0	1.0	12.8	37.5						
OS2			300	1.0	32.1	10	1200	1.0	1.0	20.0	52.1						
OS3	0.09	91.28	300	1.0	32.1	10	3300	1.0	1.0	55.0	87.1						

32.1

32.1

1.0

1.0

OS5 **FORMULAS**:

OS4

0.09

0.09

20.30

48.60

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S^{0.33}}$$
  $V = C_v S_w^{-0.5}$ 

300

300

Table 6-7. Conveyance Coefficient, C<sub>r</sub>

1.0

1.0

1.0

1.0

23.3

26.7

55.4

58.7

1400

1600

$C_{\nu}$
2.5
5
6.5
7
10
15
20

For buried riprap, select C<sub>v</sub> value based on type of vegetative cover.



EASTONVILLE ROAD	Calc'd by:	СРМ
PROPOSED CONDITIONS	Checked by:	
DESIGN STORM: 5-YEAR	Date:	5/27/2022

DIDECT DIMOSE																				_			
	DIRECT RUNOFF								т	TAL	RUNG	)FF	s	TREE	т		PIF	PE		T	RAVE	L TIME	REMARKS
STREET	DESIGN POINT BASIN ID AREA (ac) C <sub>5</sub> C <sub>5</sub> (min) f <sub>c</sub> (min) / (in./ hr.)					Q (cfs)	t <sub>c</sub> (min)	C₅*A (ac)	/ (in./ hr.)	Q (cfs)	Q <sub>street</sub> (cfs)	C <sub>5</sub> *A (ac)	SLOPE %	Q <sub>PIPE</sub> (cfs)	C <sub>5</sub> *A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min			
	EA1	EA1	7.79	0.50	20.5	4.00	0.44	9.2								0	4.00	2.0	4.5		0.4	0.40	BASIN EA1 FLOW CAPTURED IN 10' TYPE R SUMP @ DPEA1, PIPE TO DPEA2.1
	EAT	EAT	7.79	0.56	38.5	4.36	2.11	9.2								9.2	4.30	2.0	1.5	5 52	8.4	0.10	BASIN EAT FLOW CAPTURED IN 10 TYPE R SOMP @ DPEAT, PIPE TO DPEAZ.T
	EA2	EA2	5.59	0.56	35.0	3.13	2.25	7.0															BASIN EA2 FLOW CAPTURED IN 10' TYPE R SUMP @ DPEA2 PIPE TO DPEA2.1
	EA2.1								38.6	7.49	2.10	15.8				15.8	7.49	2.0	2.0	56	10.2	0.09	COMBINED DPEA1 & DPEA2 FLOW @ DPEA2.1, PIPE TO EASTONVILLE POND
		OS1	6.73	0.09	37.5	0.61	2.14	1.3															BASIN OS1 FLOW, CONVEYED IN ROADSIDE SWALE TO DP32
		OS2	17.28	0.09	52.1	1.56	1.65	2.6															BASIN OS2 FLOW, CONVEYED IN ROADSIDE SWALE TO DP32
	32								52.1	2.16	1.65	3.6				3.6	2.16	1.0	2.5	830	8.4	1.66	BASIN OS1 & BASIN OS2 FLOW CAPTURED @ DP32 IN 30" RCP CULVERT, PIPE TO DP33
	33											3.9											EASTONVILLE POND DISCHARGE & DP32 COMBINED @ DP33, PIPE TO CHANNEL
																							INCLUDES OFFSITE FLOWS FROM MERIDIAN RANCH
		OS3	91.28																				BASIN OS3 FLOW @ DP34
		OS4	20.30																<u> </u>	1	-	_	BASIN OS4 FLOW, CONVEYED IN ROADSIDE SWALE TO DP34
	34	24			67.0															TAKEN FROM APPROVED 4 WAY RANCH LOMR, 2004, CASE No. 04-08-0012P  BASIN OS3 & BASIN OS4 @ DP34, CAPTURED IN TRIPLE 60" RCP CULVERTS			
	34	34 07.0											1	1	+	+	TAKEN FROM APPROVED FALCON REGIONAL PARK DRAINAGE REPORT, 2015						
	35	OS5	OS5 47.27 8.0														BASIN OS5 FLOW @ DP35, CAPTURED IN 48" RCP CULVERT						
	00 000 41.21													1	1								
																				1			



EASTONVILLE ROAD	Calc'd by:	СРМ
PROPOSED CONDITIONS	Checked by:	
DESIGN STORM: 100-YEAR	Date:	5/27/2022

				DII	RECT	RUNOF	F		TC	TAL I	RUNOI	FF	S	TREE	т		PII	PE		TR	AVEL	TIME	REMARKS
STREET DESIGN POINT BASIN ID			AREA (ac)	C <sub>100</sub>	t <sub>c</sub> (min)	C <sub>100</sub> *A (ac)	/ (in./ hr.)	Q (cfs)	t <sub>c</sub> (min)	C <sub>100</sub> *A (ac)	/ (in./ hr.)	Q (cfs)	Q <sub>street</sub> (cfs)	C <sub>100</sub> *A (ac)	SLOPE %	Q <sub>PIPE</sub> (cfs)	C <sub>100</sub> *A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
	EA1	EA1	7.79	0.71	38.5	5.52	3.54	19.5								19.5	5.52	2.0	1.5	52	8.4	0.10	BASIN EA1 FLOW CAPTURED IN 10' TYPE R SUMP @ DPEA1, PIPE TO DPEA2.1
	EA2	EA2	5.59					14.9															BASIN EA2 FLOW CAPTURED IN 10' TYPE R SUMP @ DPEA2 PIPE TO DPEA2.1
	EA2.1								38.6	9.47	3.53	33.4				33.4	9.47	2.0	2.0	56	10.2	0.09	COMBINED DPEA1 & DPEA2 FLOW @ DPEA2.1, PIPE TO EASTONVILLE POND
		OS1	6.73	0.36	37.5	2.42	3.60	8.7															BASIN OS1 FLOW, CONVEYED IN ROADSIDE SWALE TO DP32
		OS2	17.28	0.36	52.1	6.22	2.77	17.3															BASIN OS2 FLOW, CONVEYED IN ROADSIDE SWALE TO DP32
	32								52.1	8.64	2.77	24.0				24.0	8.64	1.0	2.5	830	8.4	1.66	BASIN OS1 & BASIN OS2 FLOW CAPTURED @ DP32 IN 30" RCP CULVERT, PIPE TO DP33
	33											25.8											EASTONVILLE POND DISCHARGE & DP32 COMBINED @ DP33, PIPE TO CHANNEL
		OS3	91.28																				INCLUDES OFFSITE FLOWS FROM MERIDIAN RANCH BASIN OS3 FLOW @ DP34
		OS4	20.30																				BASIN OS4 FLOW, CONVEYED IN ROADSIDE SWALE TO DP34
			413.0											TAKEN FROM APPROVED 4 WAY RANCH LOMR, 2004, CASE No. 04-08-0012P  BASIN OS3 & BASIN OS4 @ DP34, CAPTURED IN TRIPLE 60" RCP CULVERTS									
		OS5	47.27					125.0				413.0											TAKEN FROM APPROVED FALCON REGIONAL PARK DRAINAGE REPORT, 2015  BASIN OS5 FLOW @ DP35, CAPTURED IN 48" RCP CULVERT
	35	035	41.21					125.0															BAGIN COOT ECTY & DI CO, CAPTURED IN 40 NOF CUEVENT

#### COMPOSITE % IMPERVIOUS CALCULATIONS: EXISTING & PROPOSED

Subdivision: Grandview Reserve
Location: CO, El Paso County

Project Name: Grandview Subdivision PDR
Project No.: HRG01

Calculated By: TJE
Checked By: BAS
Date: 5/26/22

1	2	3 Pav	4 ed/Gravel Ro	5 nads	6 La	7 wns/Undevelo	8 oned	8 12 13 Residential - 1/8 Acre		14 Acre	14 15 16 17 Residential - 1/4 Acre			18 19 20 Residential - 1/3 Acre			21 22 23 Residential - 1/2 Acre			24 25 26 Residential - 1 Acre			27 Basins Total
Basin ID	Total Area (ac)	% Imp.	Area (ac)	Weighted	% Imp.	Area (ac)	Weighted	% Imp.	I	Weighted % Imp.	% Imp.	Area (ac)	Weighted	% Imp.	Area (ac)	Weighted	% Imp.	Area (ac)	Weighted	% Imp.	Area (ac)	Weighted	Weighted %
EXISTING		/ v ====p/	11111 (111)	% Imp.	, vp.	111111 (111)	% Imp.	, vp.	()	% Imp.	, v s <b>p</b> .	111111(111)	% Imp.	, v =p.	11111 (110)	% Imp.	/ · · · · · · · · · · · · · · · · · · ·	111111 (111)	% Imp.			% Imp.	Imp.
	tional Calcs Include	d, titled "Eas	tonville Road	d - Existing Co	onditions," fo	or Western Of	f-site Sub-Ba	sins															
EX-1	16.18	100	0	0	2	16.18	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
EX-2	46.06	100	0	0	2	46.06	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
EX-3	64.34	100	0	0	2	64.34	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
EX-4 EX-5	2.68	100	0	0	2	2.68 26.15	2	65 65	0	0	40	0	0	30	0	0	25 25	0	0	20	0	0	2 2
EX-6	31.53	100	0	0	2	31.53	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
PROPOSED	0.00						_																
Basin-1	1.22	100	0.98	80.3	2	0.24	0.4	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	80.7
	tional Calcs Include						1				r						1		ı				
EA-3 A-1	0.94 11.67	100 100	0.00	0.0	2	0.94 11.67	2.0	65.0 65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	2.0
A-2a	4.42	100	0.00	0.0	2	0.00	0.0	65.0	4.42	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-2b A-3	2.75 0.36	100 100	1.80 0.36	65.5 100.0	2 2	0.00	0.0	65.0 65.0	0.95 0.00	22.5 0.0	40 40	0.00	0.0	30 30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	88.0 100.0
A-3 A-4a	6.31	100	0.00	0.0	2	0.00	0.0	65.0	6.31	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-4b	3.99	100	0.00	0.0	2	0.00	0.0	65.0	3.99	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-5 A-6	0.35 2.76	100 100	0.35	100.0 0.0	2 2	0.00	0.0	65.0 65.0	0.00 2.76	0.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	100.0 65.0
A-7	0.23	100	0.23	100.0	2	0.00	0.0	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	100.0
A-8 A-9	5.44 4.91	100 100	4.06 0.00	74.5 0.0	2 2	1.39 0.00	0.5	65.0 65.0	0.00 4.91	0.0 65.0	40 40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	75.0 65.0
A-10	1.02	100	0.00	0.0	2	0.00	0.0	65.0	1.02	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-11	3.56	100	0.00	0.0	2	2.77	1.6	65.0	0.79	14.4	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	16.0
B-1 B-2	3.81 4.62	100 100	0.00	0.0	2	0.00	0.0	65.0 65.0	3.33 4.51	56.8 63.5	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20	0.00	0.0	56.8 63.5
B-3	4.15	100	0.00	0.0	2	0.00	0.0	65.0	4.15	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-4 B-5	1.37 5.12	100 100	1.07 0.00	78.1 0.0	2 2	0.30	0.4	65.0 65.0	0.00 5.12	0.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	78.5 65.0
B-6	2.28	100	0.00	0.0	2	0.00	0.0	65.0	2.28	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-7	0.89	100	0.00	0.0	2	0.00	0.0	65.0	0.89	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-8 B-9	3.23 2.42	100 100	0.00	0.0	2 2	0.00	0.0	65.0 65.0	3.23 2.42	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
B-10	1.10	100	0.00	0.0	2	1.10	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
C-1 C-2	4.12 2.71	100 100	0.00	0.0	2	0.00	0.0	65.0 65.0	4.12 2.71	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
C-3	1.56	100	0.08	5.1	2	1.48	1.9	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	7.0
C-4 C-5	2.47 3.09	100 100	0.00	0.0	2	0.00	0.0	65.0 65.0	2.47 3.09	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0 65.0
C-6	2.1	100	0.00	0.0	2	0.00	0.0	65.0	2.10	65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20	0.00	0.0	65.0
C-7a	0.81	100	0.00	0.0	2	0.26	0.6	65.0	0.55	44.1	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	44.7
C-7b C-8	5.91 5.11	100 100	0.00	0.0	2 2	0.00	0.0	65.0 65.0	5.91 5.11	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
C-9a	3.5	100	0.00	0.0	2	0.00	0.0	65.0	3.50	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-9b C-10	3.69 3.47	100 100	0.00	0.0	2 2	0.00	0.0	65.0 65.0	3.69 3.47	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
C-11	0.46	100	0.00	0.0	2	0.00	0.0	65.0	0.46	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-12 C-13	1.66 2.37	100 100	0.00	0.0	2 2	0.00	0.0 2.0	65.0 65.0	1.66 0.00	65.0 0.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 2.0
C-13 C-14	1.53	100	0.00	0.0	2	2.37 1.53	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
C-15	0.16	100	0.01	6.3	2	0.15	1.9	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	8.2
D-1 D-2	3.48 0.87	100 100	0.00	0.0	2	0.00	0.0	65.0 65.0	3.48 0.87	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
D-3	3.62	100	0.00	0.0	2	0.00	0.0	65.0	3.62	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
D-4 D-5	1.77	100 100	0.00	0.0	2 2	0.00 0.71	0.0	65.0 65.0	1.77 0.82	65.0 34.8	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 35.7
D-6	0.83	100	0.00	0.0	2	0.71	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
D-7a	0.25	100	0.02	8.0	2	0.23	1.8	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	9.8
D-7b E-1	0.88 5.33	100 100	0.00	0.0	2 2	0.00	0.0	65.0 65.0	0.88 5.33	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
E-2	5.42	100	0.00	0.0	2	0.00	0.0	65.0	5.42	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
E-3 E-4	3.20 6.28	100 100	0.00	0.0	2 2	0.00	0.0	65.0 65.0	3.20 6.28	65.0 65.0	40	0.00	0.0	30	0.00	0.0	25 25	0.00	0.0	20 20	0.00	0.0	65.0 65.0
E-4 E-5	1.13	100	0.00	0.0	2	1.13	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
E-6	0.74	100	0.00	0.0	2	0.74	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 Id	lentification:
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

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

Page 1 of 1 5/26/2022 HRG01\_Pr. Drainage Calcs.xlsm

## COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: EXISTING & PROPOSED

Subdivision: Grandview Reserve
Location: CO, El Paso County

Project Name: Grandview Subdivision PDR
Project No.: HRG01

Calculated By: TJE
Checked By: BAS
Date: 5/26/22

				_		_													•								••
1	2	3	4		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		P	aved/Gravel R	oads	Lav	wns/Undevel	oped		Roofs	_	Res	idential - 1/8	Acre	Res	idential - 1/4	Acre	Resi	idential - 1/3	Acre	Res	idential - 1/2	Acre	Re	sidential - 1	Acre		Composite
Basin ID	Total Area (ac)	C <sub>5</sub>	C100	Area (ac)	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	C <sub>5</sub>	$C_{100}$	Area (ac)	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	$C_5$	C <sub>100</sub>	Area (ac)	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	$C_5$	C <sub>100</sub>	Area (ac)	Composite C <sub>5</sub>	C <sub>100</sub>
		- 3	- 100	()	- 3	- 100	()	- 3	- 100	()	- 3	- 100	()	- 3	- 100	()	- 3	- 100	(,	- 3	- 100	()	- 3	- 100	(,		- 100
EXISTING																											
See HR Green Ra	tional Calcs Includ	led, titled "	Eastonville Ro	ad - Existing	Conditions,"	for Western	Off-site Sub-I	Basins																			
EX-1	16.18	0.90	0.96	0.00	0.09	0.36	16.18	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
EX-2	46.06	0.90	0.96	0.00	0.09	0.36	46.06	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
EX-3	64.34	0.90	0.96	0.00	0.09	0.36	64.34	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
EX-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
EX-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
EX-6	31.53	0.90	0.96	0.00	0.09	0.36	31.53	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
PROPOSED																											
Basin-1	1.22	0.90	0.96	0.98	0.09	0.36	0.24	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	0.74	0.84
See HR Green Ra	tional Cales Includ	led, titled "	Eastonville Ro	ad - Proposed	d Conditions,"	for Eastony	ville Road Sub	-Basins EA-1.	EA-2 & W	estern Off-site	Sub-Basins	•	•	•										•	•		
EA-3	0.94	0.90	0.96	0.00	0.09	0.36	0.94	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-1	11.67	0.90	0.96	0.00	0.09	0.36	11.67	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
A-1 A-2a	4.42	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.42	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-2a A-2b	2.75	0.90	0.96	1.80	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.95	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.43	0.83
A-26 A-3	0.36	0.90	0.96	0.36	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.93	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.74	0.83
A-3 A-4a	6.31	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	6.31	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-4a A-4b	3.99	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.99	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-40 A-5	0.35	0.90	0.96	0.00	0.09	0.36	0.00	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	0.43	0.96
A-6	2.76	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.76	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-7	0.23	0.90	0.96	0.00	0.09	0.36	0.00	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	0.43	0.96
A-8	5.44	0.90	0.96	4.06	0.09	0.36	1.39	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	0.69	0.81
A-9	4.91	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.91	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-10	1.02	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.02	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-11	3.56	0.90	0.96	0.00	0.09	0.36	2.77	0.73	0.81	0.00	0.45	0.59	0.79	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.17	0.41
B-1	3.81	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.33	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.39	0.52
B-2	4.62	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.51	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.44	0.58
B-3	4.15	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.15	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
B-4	1.37	0.90	0.96	1.07	0.09	0.36	0.30	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	0.72	0.83
B-5	5.12	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.12	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
B-6	2.28	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.28	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
B-7	0.89	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.89	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
B-8	3.23	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.23	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
B-9	2.42	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.42	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
B-10	1.10	0.90	0.96	0.00	0.09	0.36	1.10	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
C-1	4.12	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.12	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-2	2.71	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.71	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-3	1.56	0.90	0.96	0.08	0.09	0.36	1.48	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	0.13	0.39
C-4	2.47	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.47	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-5	3.09	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.09	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-6	2.10	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.10	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-7a	0.81	0.90	0.96	0.00	0.09	0.36	0.26	0.73	0.81	0.00	0.45	0.59	0.55	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.33	0.52
C-7b	5.91	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.91	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-8	5.11	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.11	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-9a	3.50	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.50	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-9b	3.69	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.69	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-10	3.47	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.47	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-11	0.46	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.46	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-12	1.66	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.66	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-13	2.37	0.90	0.96	0.00	0.09	0.36	2.37	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
C-14	1.53	0.90	0.96	0.00	0.09	0.36	1.53	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
C-15	0.16	0.90	0.96	0.01	0.09	0.36	0.15	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	0.14	0.40
D-1	3.48	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.48	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-2	0.87	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.87	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-3	3.62	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.62	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-4	1.77	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.77	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-5	1.53	0.90	0.96	0.00	0.09	0.36	0.71	0.73	0.81	0.00	0.45	0.59	0.82	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.28	0.48
D-6	0.83	0.90	0.96	0.00	0.09	0.36	0.83	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
D-7a	0.25	0.90	0.96	0.02	0.09	0.36	0.23	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	0.15	0.41
D-7b	0.88	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.88	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
E-1	5.33	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.33	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
E-2	5.42	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.42	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
E-3	3.20	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.20	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
E-4	6.28	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	6.28	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
E-5	1.13	0.90	0.96	0.00	0.09	0.36	1.13	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
E-6	0.74	0.90	0.96	0.00	0.09	0.36	0.74	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 Ide	entification:
Lot Size (SF)	Lot Size (Acre)
0 - 8,167	= 1/8 Acre</th
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 & PROPOSED TIME OF CONCENTRATION

Subdivision: Grandview Reserve
Location: CO, El Paso County

Project Name: Grandview Subdivision PDR
Project No.: HRG01 

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		SUB-BA				INITIA	L/OVER	LAND		TR	AVEL TI	ME			Te CHECH	(	
L		DAT					(T <sub>i</sub> )				$(T_t)$				(T <sub>c</sub> )		FINAL
BASIN	D.A.	Hydrologic		C <sub>5</sub>	C <sub>100</sub>	L	S	T <sub>i</sub>	L	S	Cv	VEL.	T <sub>t</sub>	COMP. T.	TOTAL	Calculated T <sub>c</sub>	T <sub>c</sub>
ID EXISTING	(AC)	Soils Group	(%)			(FT)	(%)	(MIN)	(FT)	(%)		(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	(MIN)
	en Rationa	l Cales Inclu	ded, titled "	Eastonville	Road - E	xisting Co	nditions."	for Weste	rn Off-site	Sub-Basi	ins						
EX-1	16.18	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
EX-2	46.06	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
EX-3	64.34	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
EX-4 EX-5	2.68 26.15	A A	2.0	0.09	0.36	300 300	2.5 3.1	23.8	462 2121	2.4	15 15	2.3	3.3 15.6	27.1 37.7	762.3 2420.8	14.2 23.4	27.1 37.7
EX-6	31.53	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
PROPOSED																	
Basin-1	1.22	A	80.7	0.74	0.84	46	2.0	3.5	556	1.8	20	2.7	3.5	7.0		13.3	7.0
EA-3	0.94	nal Calcs In A	2.0	0.09	0.36	ad - Prop	25.0	ditions," 3.0	285	3.0	ad Sub-E	3.5	<b>1, EA-2 د.</b> 1.4	4.3	Off-site Sub-B 307.0	asins 11.7	5.0
A-1	11.67	A	2.0	0.09	0.36	50	10.0	6.1	957	5.0	20	4.5	3.6	9.6	1007.0	15.6	9.6
A-2a	4.42	A	65.0	0.45	0.59	50	5.0	4.9	742	2.5	20	3.2	3.9	8.8	792.0	14.4	8.8
A-2b	2.75	A	88.0	0.74	0.83	250	2.0	8.3	300	2.5	20	3.2	1.6	9.9	550.0	13.1	9.9
A-3 A-4a	0.36 6.31	A A	100.0 65.0	0.90 0.45	0.96	18 230	2.0	1.2 14.3	560 700	1.9 2.5	20 20	2.8 3.2	3.4	4.6 18.0	578.0 930.0	13.2 15.2	5.0 15.2
A-4a A-4b	3.99	A	65.0	0.45	0.59	100	2.0	9.4	770	2.5	20	3.2	4.1	13.5	930.0 870.0	14.8	13.5
A-5	0.35	A	100.0	0.90	0.96	18	2.0	1.2	332	1.4	20	2.4	2.3	3.6	350.0	11.9	5.0
A-6	2.76	A	65.0	0.45	0.59	217	4.5	10.6	310	1.0	20	2.0	2.6	13.2	527.0	12.9	12.9
A-7 A-8	0.23 5.44	A A	100.0 75.0	0.90 0.69	0.96	36 250	3.0 2.0	1.5 9.4	340 300	2.3	20 20	3.0 2.8	1.9	3.4 11.2	376.0 550.0	12.1 13.1	5.0 11.2
A-8 A-9	4.91	A	65.0	0.69	0.81	160	2.0	11.9	950	1.5	20	2.8	6.5	11.2	1110.0	16.2	16.2
A-10	1.02	A	65.0	0.45	0.59	18	3.0	3.5	450	1.0	20	2.0	3.8	7.3	468.0	12.6	7.3
A-11	3.56	A	16.0	0.17	0.41	450	5.0	21.1	718	1.0	20	2.0	6.0	27.1	1168.0	16.5	16.5
B-1 B-2	3.81	A	56.8 63.5	0.39	0.52	210 230	3.5	12.4	560 611	1.7	20	2.6	3.6	16.0 15.9	770.0 841.0	14.3	14.3
B-2 B-3	4.62 4.15	A A	65.0	0.44	0.58	34	3.0 2.0	12.7 5.5	680	2.5 2.7	20 20	3.2 3.3	3.2	9.0	714.0	14.7 14.0	14.7 9.0
B-4	1.37	A	78.5	0.72	0.83	10	6.0	1.2	700	1.0	20	2.0	5.8	7.0	710.0	13.9	7.0
B-5	5.12	A	65.0	0.45	0.59	60	1.0	9.2	946	1.7	20	2.6	6.0	15.3	1006.0	15.6	15.3
B-6	2.28	A	65.0	0.45	0.59	186	3.0	11.3	480	1.0	20	2.0	4.0	15.3	666.0	13.7	13.7
B-7 B-8	0.89 3.23	A A	65.0 65.0	0.45	0.59	62 177	3.0 5.0	6.5 9.3	509 700	1.0 2.0	20 20	2.0	4.2	10.7 13.4	571.0 877.0	13.2 14.9	10.7 13.4
B-9	2.42	A	65.0	0.45	0.59	152	3.0	10.2	800	2.4	20	3.1	4.3	14.5	952.0	15.3	14.5
B-10	1.10	A	2.0	0.09	0.36	66	25.0	5.1	187	1.0	20	2.0	1.6	6.7	253.0	11.4	6.7
C-1	4.12	A	65.0	0.45	0.59	65	3.0	6.7	1077	2.0	20	2.8	6.3	13.0	1142.0	16.3	13.0
C-2 C-3	2.71 1.56	A	65.0 7.0	0.45	0.59	55 77	2.0 4.0	7.0 9.8	620 0	1.9 0.0	20 20	2.8	3.7 0.0	10.8 9.8	675.0 77.0	13.8	10.8
C-3	2.47	A A	65.0	0.13 0.45	0.59	194	2.0	13.2	345	1.3	20	2.3	2.5	15.7	539.0	10.4 13.0	13.0
C-5	3.09	A	65.0	0.45	0.59	38	4.0	4.6	761	1.0	20	2.0	6.3	11.0	799.0	14.4	11.0
C-6	2.10	A	65.0	0.45	0.59	61	3.0	6.4	1176	1.0	20	2.0	9.8	16.2	1236.5	16.9	16.2
C-7a	0.81	A	44.7	0.33	0.52	142	8.3	8.3	136	2.5	15	2.4	1.0	9.3	278.0	11.5	9.3
C-7b C-8	5.91 5.11	A A	65.0 65.0	0.45 0.45	0.59	35 58	4.0 2.0	4.4 7.2	1278 834	1.7 1.6	20 20	2.6	8.2 5.5	12.6 12.7	1313.0 892.0	17.3 15.0	12.6 12.7
C-9a	3.50	A	65.0	0.45	0.59	193	2.0	13.1	570	0.7	20	1.7	5.7	18.8	763.0	14.2	14.2
C-9b	3.69	A	65.0	0.45	0.59	160	3.0	10.4	665	2.0	20	2.8	3.9	14.4	825.0	14.6	14.4
C-10	3.47	A	65.0	0.45	0.59	122	3.0	9.1	1084	1.5	20	2.4	7.4	16.5	1206.0	16.7	16.5
C-11 C-12	0.46 1.66	A A	65.0 65.0	0.45 0.45	0.59	26 160	2.0 4.0	4.8 9.5	152 200	0.5	20 20	1.4	1.8	6.6 11.8	178.0 360.0	11.0 12.0	6.6
C-12	2.37	A	2.0	0.43	0.39	225	15.0	11.3	352	1.0	20	2.0	2.9	14.2	577.0	13.2	13.2
C-14	1.53	A	2.0	0.09	0.36	300	5.0	18.7	0	0.0	10	0.0	0.0	18.7	300.0	11.7	11.7
C-15	0.16	A	8.2	0.14	0.40	72	5.0	8.7	0	0.0	20	0.0	0.0	8.7	72.0	10.4	8.7
D-1 D-2	3.48 0.87	A A	65.0 65.0	0.45 0.45	0.59	170 10	3.0 2.0	10.8	715 700	1.0	20 20	2.0	6.0 5.1	16.7 8.1	885.0 710.0	14.9 13.9	14.9 8.1
D-2 D-3	3.62	A	65.0	0.45	0.59	140	3.0	9.8	660	2.2	20	3.0	3.7	13.5	800.0	13.9	13.5
D-4	1.77	A	65.0	0.45	0.59	50	3.0	5.8	663	2.0	20	2.8	3.9	9.7	713.0	14.0	9.7
D-5	1.53	A	35.7	0.28	0.48	110	25.0	5.4	201	1.0	20	2.0	1.7	7.1	311.0	11.7	7.1
D-6 D-7a	0.83	A	2.0 9.8	0.09	0.36	300 75	5.0 5.0	18.7 8.8	0	0.0	10 20	0.0	0.0	18.7 8.8	300.0 75.0	11.7 10.4	11.7 8.8
D-7a D-7b	0.25	A A	65.0	0.15	0.41	75	8.0	5.2	478	2.0	15	2.1	3.8	8.8 8.9	553.0	10.4	8.8
E-1	5.33	A	65.0	0.45	0.59	25	4.0	3.7	1360	3.3	20	3.6	6.2	10.0	1385.0	17.7	10.0
E-2	5.42	A	65.0	0.45	0.59	20	2.0	4.2	1250	3.5	20	3.7	5.6	9.8	1270.0	17.1	9.8
E-3	3.20	A	65.0	0.45	0.59	10	2.0	3.0	965	1.5	20	2.4	6.6	9.6	975.0	15.4	9.6
E-4 E-5	6.28 1.13	A A	65.0 2.0	0.45	0.59	305 127	7.0 25.0	10.9 7.1	1125 315	1.6 1.0	20 20	2.5 2.0	7.4	18.3 9.8	1430.0 442.0	17.9 12.5	17.9 9.8
E-5	0.74	A	2.0	0.09	0.36	350	25.0	27.5	113	2.0	10	1.4	1.3	28.8	463.0	12.5	12.6
L-0	0.74	Λ	2.0	0.07	0.50	550	2.0	41.3	113	2.0	10	1.4	1.3	20.0	+03.0	12.0	12.0

#### NOTES:

NOTES:  $T_{i} = (0.395^{*}(1.1 - C_{i})^{*}(L)^{*}0.5)/((S)^{*}0.33), S in ft/ft$   $T_{i} = L/60V (Velocity From Fig. 501)$   $Velocity V = Cv^{*}S^{*}0.5, S in ft/ft$   $T_{c} Check = 10H/L/180$ For Urbanized basins a minimum  $T_{c}$  of 5.0 minutes is required.

For non-urbanized basins a minimum T<sub>c</sub> of 10.0 minutes is required

#### STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

 Subdivision: Grandview Reserve
 Project Name: Project No.: HRG01

 Location: CO, El Paso County
 Calculated By: TJE

 Design Storm: 5-Year
 Checked By: BAS

 Date: 5/26/22

		1		DIDI	ECT RU	NOEE			,	TOTAL	RUNOF	enc.	err	REET	1	PIPE	,	TDAY	VEL T	IME	I
			1	DIKI	CI KU.	NOFF	1		-	IOIAL	KUNOF	r	511	_	- G	PIPE	Ι ດ	IKA	VEL I	IIVIE	
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
EXISTING																					·
	1	EX-1	16.18	0.09	31.6	1.46	2.35	3.4				4.7									Sheet flow to Main Stem Channel Total Flow from DP 10, DP 11 & Basin EX-1
	2	EX-2	46.06	0.09	48.3	4.15	1.82	7.6				79.1									Sheet flow to Main Stem Channel Total Flow from DP 8, DP 9 & Basin EX-2
	3	EX-3	64.34	0.09	52.1	5.79	1.73	10.0				10.0									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	4	EX-4	2.68	0.09	27.1	0.24	2.57	0.6				0.6		<u> </u>							Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	5	EX-5	26.15	0.09	37.7	2.35	2.12	5.0				5.0		_							Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	6	EX-6	31.53	0.09	32.3	2.84	2.32	6.6				14.6									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel Total Flow from DP 7 & EX-6
					Se	ee HR Gre	en Rationa	l Calcs Inc	luded, title	ed "Easto	nville Roa	d - Existin	g Cond	litions,'	' for W	estern C	Off-site	Sub-Bas	ins		
	12											30.2									Total Existing Flow offsite - outfalls to Main Stem Tributary #2 Channel
PROPOSED		•			•		•	•			•	•		•							
		Basin-1	1.22	0.74	7.0	0.90	4.64	4.2				4.2									East Leg of Rex Road Intersection
		•	See I	IR Green	Rational (	Cales Inclu	ıded, titled	"Eastonvi	lle Road -	Proposed	Condition	ns," for Ea	stonvill	le Road	Sub-B	asins E	A-1, EA	-2 & W	estern C	off-site S	ub-Basins
		EA-3	0.94	0.09	5.0	0.08	5.10	0.4													Eastonville Road Pond
	1	A-1	11.67	0.09	9.6	1.05	4.16	4.4				4.4									Institutional Tract Basin will have own water quality & detention pond
	2a	A-2a	4.42	0.45	8.8	1.99	4.29	8.5				8.5									On-Grade 15' CDOT Type R Inlet (0.6 cfs bypass to DP 2b)
	2b	A-2b	2.75	0.74	9.9	2.04	4.13	8.4				9.0									Sump 20' CDOT Type R Inlet (Receives 0.6 cfs upstream bypass)
	3	A-3	0.36	0.90	5.0	0.32	5.10	1.6				1.6									Sump 5' CDOT Type R Inlet
	4a	A-4a	6.31	0.45	15.2	2.84	3.44	9.8				9.8									On-Grade 15' CDOT Type R Inlet (1.2 cfs bypass to DP 4)
	4b 4	A-4b	3.99	0.45	13.5	1.80	3.63	6.5				6.5 2.5									On-Grade 15' CDOT Type R Inlet (1.3 cfs bypass to DP 4) Sump 15' CDOT Type R Inlet (Receives 2.5 cfs upstream bypass)
	5	A-5	0.35	0.90	5.0	0.32	5.10	1.6				1.6									Sump 5' CDOT Type R Inlet
	6	A-6	2.76	0.45	12.9	1.24	3.70	4.6				4.6									On-Grade 10' CDOT Type R Inlet (0.4 cfs bypass to DP 7a)
	7	A-7	0.23	0.90	5.0	0.21	5.10	1.1				1.1									On-Grade 5' CDOT Type R Inlet (0.1 cfs bypass to DP 7b)
	8	A-8	5.44	0.69	11.2	3.75	3.93	14.7				14.7									Proposed Amenitity Center - Assumed 75% Imperviousness
	7a	A-9	4.91	0.45	16.2	2.21	3.34	7.4				7.8									Sump 20' CDOT Type R Inlet (Receives 0.4 cfs upstream bypass)
	7b	A-10	1.02	0.45	7.3	0.46	4.59	2.1				2.2									Sump 5' CDOT Type R Inlet (Receives 0.1 cfs upstream bypass)
	8a	A-11	3.56	0.17	16.5	0.61	3.31	2.0	16.5	17.79	3.31	58.9									Total of Flows to Pond A
	9	B-1	3.81	0.39	14.3	1.49	3.54	5.3				5.3									Sump 15' CDOT Type R Inlet
	10a	B-2	4.62	0.44	14.7	2.03	3.50	7.1				7.1									On-Grade 10' CDOT Type R Inlet (1.6 cfs bypass to DP 10b)
	10b	B-3	4.15	0.45	9.0	1.87	4.27	8.0				9.6									Sump 20' CDOT Type R Inlet (Receives 1.6 cfs of upstream bypass)
	11	B-4	1.37	0.72	7.0	0.99	4.63	4.6				4.6									Sump 15' CDOT Type R Inlet
	12a	B-5	5.12	0.45	15.3	2.30	3.43	7.9				7.9									On-Grade 10' CDOT Type R Inlet (2.0 cfs bypass to DP 12b)

#### STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

	Project Name: Grandview Subdivision PDR
Subdivision: Grandview Reserve	Project No.: HRG01
Location: CO, El Paso County	Calculated By: TJE
Design Storm: 5-Year	Checked By: BAS

ulated By: TIE
lecked By: BAS
Date: 5/26/22

				DIRE	ECT RU	NOFF			· ·	TOTAL	RUNOF	F	STR	REET		PIPE	,	TRA	VEL T	IME	
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
	14	B-6	2.28	0.45	13.7	1.03	3.61	3.7				3.7									On-Grade 10' CDOT Type R Inlet (0.1 cfs bypass to DP 12b)
	15	B-7	0.89	0.45	10.7	0.40	3.99	1.6				1.6									On-Grade 10' CDOT Type R Inlet (0.0 cfs bypass to DP 12b)
	12b	B-8	3.23	0.45	13.4	1.45	3.64	5.3				7.4									Sump 20' CDOT Type R Inlet (Receives 2.1 cfs of upstream bypass)
	13	B-9	2.42	0.45	14.5	1.09	3.52	3.8				3.8									Sump 10' CDOT Type R Inlet
	16	B-10	1.10	0.09	6.7	0.10	4.70	0.5	15.3	12.75	3.43	43.7									Total of flows to Pond B
	17b	C-1	4.12	0.45	13.0	1.85	3.69	6.8	13.3	12./3	3.43	6.8									On-Grade 15' CDOT Type R (0.1 cfs bypass to DP 17e)
	17a	C-2	2.71	0.45	10.8	1.22	3.99	4.9				4.9									On-Grade 15' CDOT Type R (1.7 cfs bypass to DP 17c)
	17c	C-4	2.47	0.45	13.0	1.11	3.69	4.1				5.8									Receives 1.7 cfs of Bypass from DP 17a On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17d)
	17d	C-5	3.09	0.45	11.0	1.39	3.96	5.5				5.5									Receives 0.0 cfs of Bypass from DP 17c On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17h)
	17e	C-6	2.10	0.45	16.2	0.95	3.34	3.2				3.3									Receives 0.1 cfs of Bypass from DP 17b On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17h)
	17f	C-8	5.11	0.45	12.7	2.30	3.73	8.6				8.6									On-Grade 15' CDOT Type R (0.6 cfs bypass to DP 17g)
	17g	C-9a	3.50	0.45	14.2	1.58	3.54	5.6				6.2									Receives 0.6 cfs of Bypass from DP 17f On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17h)
	17h	C-9b	3.69	0.45	14.4	1.66	3.53	5.9				5.9									Sump 20' CDOT Type R (Receives 0.0 cfs of upstream bypass)
	18a	C-7a	0.81	0.33	9.3	0.27	4.22	1.1				1.1									Drainage Swale/SW Chase - Flows to DP 18b
	18b	C-7b	5.91	0.45	12.6	2.66	3.74	9.9	12.6	2.93	3.74	11.0									On-Grade 15' CDOT Type R (1.6 cfs bypass to DP 18c)
	18c	C-10	3.47	0.45	16.5	1.56	3.31	5.2				6.9									Sump 15' CDOT Type R (Receives 1.6 cfs of upstream bypass)
	19	C-11	0.46	0.45	6.6	0.21	4.72	1.0				1.0									Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)
	20	C-12	1.66	0.45	11.8	0.75	3.84	2.9				2.9									Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)
	21	C-13	2.37	0.09	13.2	0.21	3.66	0.8	16.5	17.72	3.31	58.7									Total combined flows to Pond C
		C-3	1.56	0.13	9.8	0.20	4.13	0.8	10.5	17.72	3.51	30.7									Back of Lots 409-426 - Sheet Flows to MS 2
		C-14	1.53	0.09	11.7	0.14	3.86	0.5													Un-developed area - Sheet flows to MS 2
		C-15	0.16	0.14	8.7	0.02	4.31	0.1													Portion of Lot 444 - Sheet flows to MS 2
	22	D-1	3.48	0.45	14.9	1.57	3.47	5.4				5.4									On-Grade 10' CDOT Type R Inlet (0.7 cfs bypass to DP 24)
	23	D-2	0.87	0.45	8.1	0.39	4.42	1.7				1.7									On-Grade 10' CDOT Type R Inlet (0.0 cfs bypass to DP 24)
	24	D-3	3.62	0.45	13.5	1.63	3.63	5.9				6.6									Receives 0.4 cfs of upstream bypass Sump 15' CDOT Type R Inlet
	25	D-4	1.77	0.45	9.7	0.80	4.14	3.3				3.3									Sump 10' CDOT Type R Inlet
	25a	D-7b	0.88	0.45	8.9	0.40	4.28	1.7				1.7									Sheet flows to Channel and Conveyed to Pond D
	26	D-5	1.53	0.28	7.1	0.43	4.63	2.0	14.9	5.22	3.47	18.1									Total of flows to Pond D
		D-6	0.83	0.09	11.7	0.07	3.86	0.3													Un-developed area - Sheet flows to MS
		D-7a	0.25	0.15	8.8	0.04	4.30	0.2													Back of Lots 18-20 - Sheet Flows to MST

#### STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:Grandview ReserveGrandview Subdivision PDRLocation:Project No.:HRG01Location:CO, El Paso CountyTJEDesign Storn:5-YearChecked By:BASDate:5/26/22

				DIRE	ECT RU	NOFF			1	ΓΟΤΑL	RUNOF	F	STR	REET		PIPE		TRAY	VEL T	IME	
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
	27	E-1	5.33	0.45	10.0	2.40	4.10	9.8				9.8									On-Grade 15' CDOT Type R Inlet (0.9 cfs bypass to DP 29)
	28	E-2	5.42	0.45	9.8	2.44	4.13	10.1				10.1									On-Grade 15' CDOT Type R Inlet (1.2 cfs bypass to DP 29)
	29	E-3	3.20	0.45	9.6	1.44	4.17	6.0				8.1									Receives 2.1 cfs of upstream bypass Sump 15' CDOT Type R Inlet
	30	E-4	6.28	0.45	17.9	2.83	3.18	9.0				9.0									Sump 20' CDOT Type R Inlet
	31	E-5	1.13	0.09	9.8	0.10	4.14	0.4	17.9	9.21	3.18	29.3									Total of flows to Pond E
		E-6	0.74	0.09	12.6	0.07	3.74	0.3													Un-developed area - Sheet flows to MS

Page 3 of 3 5/27/2022

#### STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

 Subdivision:
 Grandview Reserve

 Location:
 CO, El Paso County

 Design Storm:
 100-Year

 Project Name:
 Grandview Subdivision PDR

 Project No.:
 HRG01

 Calculated By:
 TJE

 Checked By:
 BAS

 Date:
 5/26/22

				DIR	ECT RU	JNOFF				TOTAL	RUNOF	F	ST	REET		PIPE		TRA	VEL T	IME	
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
EXISTING		EX-1	16.18	0.36	31.6	5.82	4.19	24.4	1				1	ı	1				1	ı	Sheet flow to Main Stem Channel
	1											33.3									Total Flow from DP 10, DP 11 & Basin EX-1
	2	EX-2	46.06	0.36	48.3	16.58	3.24	53.7				497.2									Sheet flow to Main Stem Channel Total Flow from DP 8, DP 9 & Basin EX-2
	3	EX-3	64.34	0.36	52.1	23.16	3.09	71.6				71.6									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	4	EX-4	2.68	0.36	27.1	0.96	4.57	4.4													Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
		EX-5	26.15	0.36	37.7	9.41	3.77	35.5				4.4									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	5	EX-6	31.53	0.36	32.3	11.35	4.13	46.9				35.5			$\vdash$						Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	6											584.9						<u> </u>			Total Flow from DP 7 & EX-6
						See HR G	reen Ratio	nal Calcs I	ncluded, 1	itled "Eas	tonville R	oad - Exis	ting Co	nditions,"	for Wes	stern Of	f-site Su	ıb-Basi	ns		
	12											696.3									Total Existing Flow offsite - outfalls to Main Stem Tributary #2 Channel
PROPOSED																					
		Basin-1	1.22	0.84	7.0	1.02	8.26	8.4				8.4			Π						East Leg of Rex Road Intersection
			Soc	HD Cros	n Dations	al Calce In	cluded titl	ed "Easton	wille Pose	d - Propos	ed Condit	ione " for	Factors	ille Dood	Sub Roc	eine FA	1 FA-2	& Wo	etorn O	ff.cita S	uh Racine
		EA-3	0.94	0.36	5.0	0.34	9.09	3.1	T Roan	1 - 110pos	T Conun	10113, 101	Laston	lic Road	T	J	1, 12.1-2	I	I	II-site 5	Eastonville Road Pond
															<u> </u>						
	1	A-1	11.67	0.36	9.6	4.20	7.40	31.1				31.1									Institutional Tract Basin will have own water quality & detention pond
	2a	A-2a	4.42	0.59	8.8	2.61	7.64	19.9				19.9									On-Grade 15' CDOT Type R Inlet (7.0 cfs bypass to DP 2b)
	21	A-2b	2.75	0.83	9.9	2.28	7.34	16.7				22.7									a successful pulling in the successful pulli
	2b 3	A-3	0.36	0.96	5.0	0.35	9.09	3.2				23.7 3.2			1						Sump 20' CDOT Type R Inlet (Receives 7.0 cfs upstream bypass) Sump 5' CDOT Type R Inlet
	4a	A-4a	6.31	0.59	15.2	3.72	6.13	22.8				22.8			$\vdash$						On-Grade 15' CDOT Type R Inlet (9.0 cfs bypass to DP 4)
	4b	A-4b	3.99	0.59	13.5	2.35	6.46	15.2				15.2			-						On-Grade 15' CDOT Type R Inlet (7.1 cfs bypass to DP 4)
	4											16.1									Sump 15' CDOT Type R Inlet (Receives 16.1 cfs upstream bypass)
	5	A-5	0.35	0.96	5.0	0.34	9.09	3.1				3.1									Sump 5' CDOT Type R Inlet
	6	A-6	2.76	0.59	12.9	1.63	6.58	10.7				10.7									On-Grade 10' CDOT Type R Inlet (3.8 cfs bypass to DP 7a)
	7	A-7	0.23	0.96	5.0	0.22	9.09	2.0				2.0									On-Grade 5' CDOT Type R Inlet (0.4 cfs bypass to DP 7b)
	8	A-8	5.44	0.81	11.2	4.41	6.99	30.8				30.8									Proposed Amenitity Center - Assumed 75% Imperviousness
		A-9	4.91	0.59	16.2	2.90	5.95	17.3							1						
	7a	A-10	1.02	0.59	7.3	0.60	8.17	4.9				21.1			1						Sump 20' CDOT Type R Inlet (Receives 3.8 cfs upstream bypass)
	7b	A-11	3.56	0.41	16.5	1.46	5.90	8.6				5.3			-			-			Sump 5' CDOT Type R Inlet (Receives 0.4 cfs upstream bypass)
	8a								16.5	22.87	5.90	134.9			_						Total of Flows to Pond A
	9	B-1	3.81	0.52	14.3	1.98	6.30	12.5				12.5									Sump 15' CDOT Type R Inlet
	10a	B-2	4.62	0.58	14.7	2.68	6.22	16.7				16.7									On-Grade 10' CDOT Type R Inlet (8.3 cfs bypass to DP 10b)
	101	B-3	4.15	0.59	9.0	2.45	7.61	18.6				26.0									Comma 201 CDOT Time B Inlet (Bensions 9.2 C. C
	10b	B-4	1.37	0.83	7.0	1.14	8.25	9.4				26.9 9.4			1						Sump 20' CDOT Type R Inlet (Receives 8.3 cfs of upstream bypass) Sump 15' CDOT Type R Inlet
	12a	B-5	5.12	0.59	15.3	3.02	6.11	18.5				18.5	-		1	-		$\vdash$	-		On-Grade 10' CDOT Type R Inlet (9.5 cfs bypass to DP 12b)
																					( o,pano to 51 120)

#### STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Grandview Reserve
Location: CO, El Paso County Design Storm: 100-Year

Project Name: Grandview Subdivision PDR
Project No.: HRG01
Calculated By: TJE
Checked By: BAS
Date: 5/26/22

				DIR	ECT RU	NOFF				TOTAL	RUNOF	F	ST	REET		PIPE	C.	TRA	VEL T	IME	
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
	14	B-6	2.28	0.59	13.7	1.35	6.42	8.7				8.7									On-Grade 10' CDOT Type R Inlet (2.5 cfs bypass to DP 12b)
	15	B-7	0.89	0.59	10.7	0.53	7.10	3.8				3.8									On-Grade 10' CDOT Type R Inlet (0.1 cfs bypass to DP 12b)
	12b	B-8	3.23	0.59	13.4	1.91	6.48	12.4				24.5									Sump 20' CDOT Type R Inlet (Receives 12.1 cfs of upstream bypass)
	13	B-9	2.42	0.59	14.5	1.43	6.26	9.0				9.0									Sump 10' CDOT Type R Inlet
		B-10	1.10	0.36	6.7	0.40	8.37	3.3							$\vdash$						
	16 17b	C-1	4.12	0.59	13.0	2.43	6.57	16.0	15.3	16.89	6.11	103.2 16.0			$\vdash$						Total of flows to Pond B On-Grade 15' CDOT Type R (4.3 cfs bypass to DP 17e)
	17a	C-2	2.71	0.59	10.8	1.60	7.10	11.4				11.4			-						On-Grade 15' CDOT Type R (11.2 cfs bypass to DP 17c)
		C-4	2.47	0.59	13.0	1.46	6.57	9.6							-						Receives 11.2 cfs of Bypass from DP 17a
	17c											20.8			ļ						On-Grade 15' CDOT Type R (7.4 cfs bypass to DP 17d)
	17d	C-5	3.09	0.59	11.0	1.82	7.04	12.8				20.2									Receives 7.4 cfs of Bypass from DP 17c On-Grade 15' CDOT Type R (7.0 cfs bypass to DP 17h)
	17e	C-6	2.10	0.59	16.2	1.24	5.94	7.4				11.7									Receives 4.3 cfs of Bypass from DP 17b On-Grade 15' CDOT Type R (2.0 cfs bypass to DP 17h)
	17f	C-8	5.11	0.59	12.7	3.01	6.63	20.0				20.0									On-Grade 15' CDOT Type R (6.9 cfs bypass to DP 17g)
	17g	C-9a	3.50	0.59	14.2	2.07	6.31	13.1				20.0									Receives 6.9 cfs of Bypass from DP 17f On-Grade 15' CDOT Type R (6.8 cfs bypass to DP 17h)
		C-9b	3.69	0.59	14.4	2.18	6.29	13.7													
	17h 18a	C-7a	0.81	0.52	9.3	0.42	7.51	3.2				29.5 3.2			$\vdash$						Sump 20' CDOT Type R (Receives 15.8 cfs of upstream bypass) Drainage Swale/SW Chase - Flows to DP 18b
		C-7b	5.91	0.59	12.6	3.49	6.65	23.2							-						
	18b	C-10	3.47	0.59	16.5	2.05	5.90	12.1	12.6	3.91	6.65	26.0			-						On-Grade 15' CDOT Type R (11.3 cfs bypass to DP 18c)
	18c											23.3			_						Sump 15' CDOT Type R (Receives 11.3 cfs of upstream bypass)
	19	C-11	0.46	0.59	6.6	0.27	8.41	2.3				2.3									Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)
	20	C-12	1.66	0.59	11.8	0.98	6.83	6.7				6.7									Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)
	21	C-13	2.37	0.36	13.2	0.85	6.52	5.5	16.5	23.87	5.90	140.8									Total combined flows to Pond C
		C-3	1.56	0.39	9.8	0.61	7.35	4.5													Back of Lots 409-426 - Sheet Flows to MS 2
		C-14	1.53	0.36	11.7	0.55	6.87	3.8							T						Un-developed area - Sheet flows to MS 2
		C-15	0.16	0.40	8.7	0.06	7.68	0.5													Portion of Lot 444 - Sheet flows to MS 2
	22	D-1	3.48	0.59	14.9	2.05	6.18	12.7				12.7			$\vdash$						On-Grade 10' CDOT Type R Inlet (5.2 cfs bypass to DP 24)
	23	D-2	0.87	0.59	8.1	0.51	7.88	4.0		-		4.0	$\vdash$		$\vdash$		-				On-Grade 10' CDOT Type R Inlet (0.2 cfs bypass to DP 24)
		D-3	3.62	0.59	13.5	2.14	6.46	13.8							-						Receives 5.4 cfs of upstream bypass
	24											19.2 7.7			<u> </u>		1				Sump 15' CDOT Type R Inlet Sump 10' CDOT Type R Inlet
	25	D-4	1.77	0.59	9.7	1.04	7.37	7.7													
	25a	D-7b	0.88	0.59	8.9	0.52	7.62	4.0				4.0			L						Sheet flows to Channel and Conveyed to Pond D
	26	D-5	1.53	0.48	7.1	0.73	8.24	6.0	14.9	6.99	6.18	43.2									Total of flows to Pond D
		D-6	0.83	0.36	11.7	0.30	6.87	2.1													Un-developed area - Sheet flows to MS
		D-7a	0.25	0.41	8.8	0.10	7.65	0.8													Back of Lots 18-20 - Sheet Flows to MST
						1	l								1						

#### STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Grandview Reserve

Location: CO, El Paso County

Design Storm: 100-Year

 Project Name:
 Grandview Subdivision PDR

 Project No.:
 HRG01

 Calculated By:
 TJE

 Checked By:
 BAS

 Date:
 5/26/22

				DIR	ECT RU	NOFF			1	TOTAL :	RUNOF	F	ST	REET		PIPE		TRAV	EL T	IME	
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
	27	E-1	5.33	0.59	10.0	3.14	7.30	22.9				22.9									On-Grade 15' CDOT Type R Inlet (8.8 cfs bypass to DP 29)
	28	E-2	5.42	0.59	9.8	3.20	7.36	23.6				23.6									On-Grade 15' CDOT Type R Inlet (9.3 cfs bypass to DP 29)
	29	E-3	3.20	0.59	9.6	1.89	7.43	14.0				32.1									Receives 18.1 cfs of upstream bypass Sump 15' CDOT Type R Inlet
	30	E-4	6.28	0.59	17.9	3.71	5.66	21.0				21.0									Sump 20' CDOT Type R Inlet
	31	E-5	1.13	0.36	9.8	0.41	7.37	3.0	17.9	12.35	5.66	69.9									Total of flows to Pond E
		E-6	0.74	0.36	12.6	0.27	6.66	1.8													Un-developed area - Sheet flows to MS

Page 3 of 3 5/27/2022

# APPENDIX D Hydraulic Computations

Inlets Chapter 8

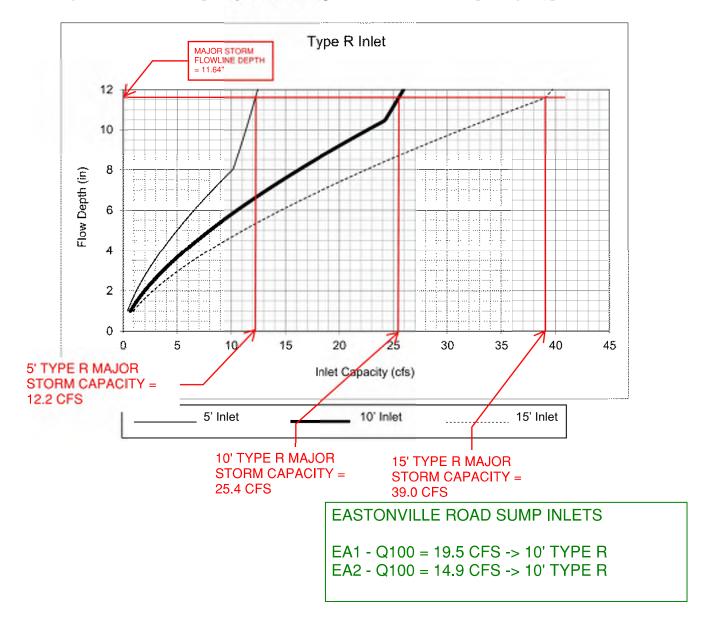


Figure 8-11. Inlet Capacity Chart Sump Conditions, Curb Opening (Type R) Inlet

Notes:

1. The standard inlet parameters must apply to use this chart.

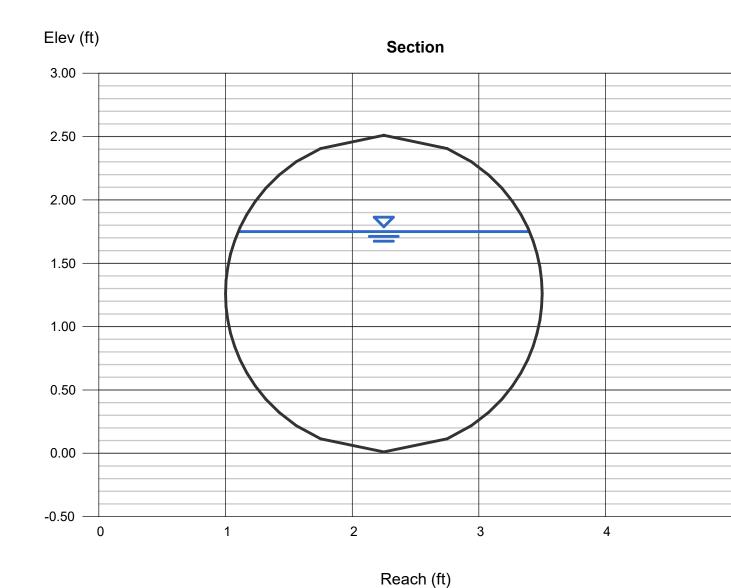
## **Channel Report**

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

Thursday, May 26 2022

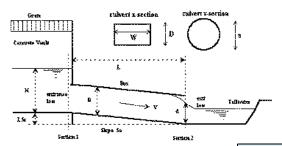
## DP 32 30-Inch Bypass Culvert

Circular		Highlighted	
Diameter (ft)	= 2.50	Depth (ft)	= 1.74
		Q (cfs)	= 24.00
		Area (sqft)	= 3.65
Invert Elev (ft)	= 0.01	Velocity (ft/s)	= 6.57
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.94
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.67
		Top Width (ft)	= 2.30
Calculations		EGL (ft)	= 2.41
Compute by:	Known Q		
Known Q (cfs)	= 24.00		



## CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

ID:



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches Inlet Edge Type (Choose from pull-down list) D = 30 inches Square Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet Barrel Width (Span) in Feet

Inlet Edge Type (Choose from pull-down list)

H (Rise) = W (Span) =

Number of Barrels

Inlet Elevation at Culvert Invert Outlet Elevation **OR** Slope

Culvert Length Manning's Roughness Bend Loss Coefficient Exit Loss Coefficient

# Barrels =	1	
Elev IN =	5000	ft
So =	0.005	ft/ft
L =	800	ft
n =	0.013	
$n = K_b = K_x = K_x = K_x$	0.7	
K <sub>x</sub> =	1	

#### Design Information (calculated):

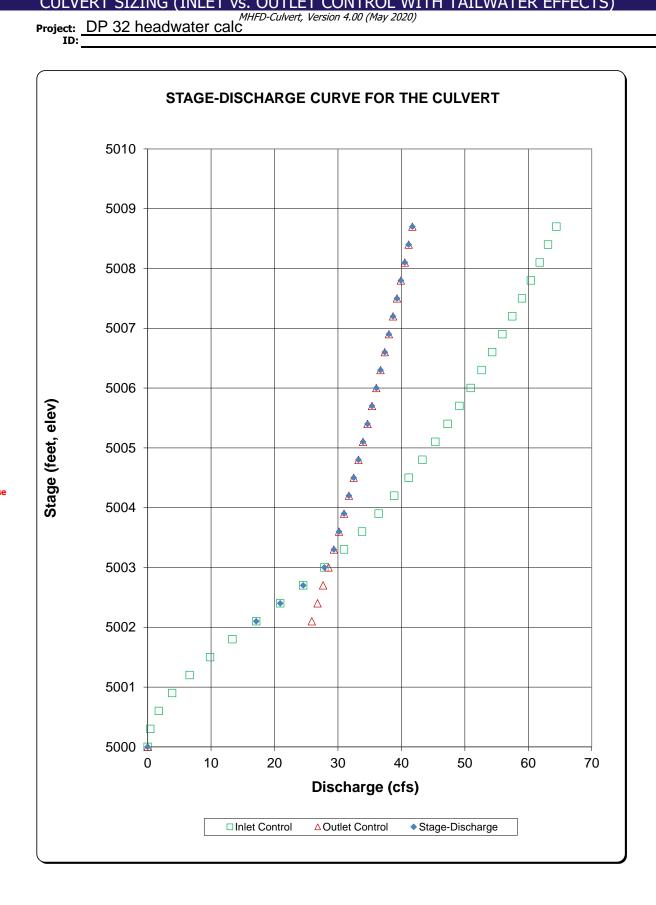
Entrance Loss Coefficient Friction Loss Coefficient Sum of All Loss Coefficients Minimum Energy Condition Coefficient Orifice Inlet Condition Coefficient

$K_e =$	0.20
$K_f =$	7.34
$K_s =$	9.24
(E <sub>low</sub> =	0.1127
$C_d =$	0.60

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 \* Culvert Ris Calculations of Culvert Capacity (output):

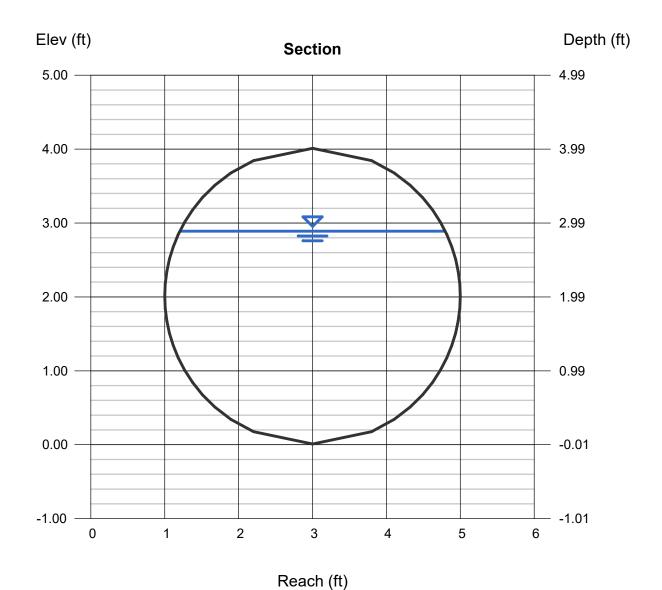
Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
Surface	Surface	Control	Control	Control	Culvert	Control
Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	
5000.00	5000.00	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
5000.30		Min. Energy. Eqn.	0.41	#N/A	#N/A	#N/A
5000.60		Min. Energy. Eqn.	1.77	#N/A	#N/A	#N/A
5000.90		Min. Energy. Eqn.	3.86	#N/A	#N/A	#N/A
5001.20		Min. Energy. Eqn.	6.63	#N/A	#N/A	#N/A
5001.50		Regression Eqn.	9.83	#N/A	#N/A	#N/A
5001.80		Regression Eqn.	13.36	#N/A	#N/A	#N/A
5002.10		Regression Eqn.	17.12	25.87	17.12	INLET
5002.40		Regression Eqn.	20.89	26.78	20.89	INLET
5002.70		Regression Eqn.	24.51	27.65	24.51	INLET
5003.00		Regression Eqn.	27.86	28.51	27.86	INLET
5003.30		Regression Eqn.	30.95	29.35	29.35	OUTLET
5003.60		Regression Eqn.	33.80	30.16	30.16	OUTLET
5003.90		Regression Eqn.	36.42	30.95	30.95	OUTLET
5004.20		Regression Eqn.	38.87	31.72	31.72	OUTLET
5004.50		Regression Eqn.	41.15	32.48	32.48	OUTLET
5004.80		Regression Eqn.	43.31	33.22	33.22	OUTLET
5005.10		Regression Eqn.	45.35	33.94	33.94	OUTLET
5005.40		Regression Eqn.	47.29	34.66	34.66	OUTLET
5005.70		Regression Eqn.	49.15	35.35	35.35	OUTLET
5006.00		Regression Eqn.	50.93	36.04	36.04	OUTLET
5006.30		Regression Eqn.	52.65	36.71	36.71	OUTLET
5006.60		Regression Eqn.	54.31	37.38	37.38	OUTLET
5006.90		Regression Eqn.	55.91	38.03	38.03	OUTLET
5007.20		Regression Eqn.	57.47	38.67	38.67	OUTLET
5007.50		Regression Eqn.	59.01	39.30	39.30	OUTLET
5007.80		Orifice Eqn.	60.41	39.92	39.92	OUTLET
5008.10		Orifice Eqn.	61.81	40.53	40.53	OUTLET
5008.40		Orifice Eqn.	63.12	41.14	41.14	OUTLET
5008.70		Orifice Eqn.	64.43	41.73	41.73	OUTLET
	•					

Processing Time: **02.56 Seconds** 



## DP 35 48-Inch Bypass Culvert

	Highlighted	
= 4.00	Depth (ft)	= 2.88
	Q (cfs)	= 125.00
	Area (sqft)	= 9.71
= 0.01	Velocity (ft/s)	= 12.87
= 1.00	Wetted Perim (ft)	= 8.12
= 0.013	Crit Depth, Yc (ft)	= 3.36
	Top Width (ft)	= 3.59
	EGL (ft)	= 5.46
Known Q		
= 125.00		
	= 0.01 = 1.00 = 0.013	= 4.00  Depth (ft) Q (cfs) Area (sqft) Velocity (ft/s) = 1.00 Vetted Perim (ft) Crit Depth, Yc (ft) Top Width (ft) EGL (ft)  Known Q

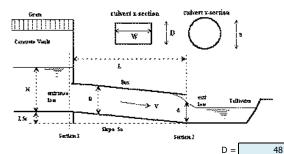


#### CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: DP ID:

DP 35 headwater calc



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches

Inlet Edge Type (Choose from pull-down list)

OR:

Box Culvert:

Barrel Height (Rise) in Feet Barrel Width (Span) in Feet

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

Inlet Elevation at Culvert Invert Outlet Elevation **OR** Slope

Culvert Length Manning's Roughness Bend Loss Coefficient Exit Loss Coefficient

# Barrels =	1	
Elev IN =	5000	ft
So =	0.01	ft/ft
L =	800	ft
n =	0.013	
$K_b =$	0.7	

H (Rise) =

W (Span) =

Square Edge Projecting

inches

#### Design Information (calculated):

Entrance Loss Coefficient
Friction Loss Coefficient
Sum of All Loss Coefficients
Minimum Energy Condition Coefficient
Orifice Inlet Condition Coefficient

$K_e =$	0.20
$K_f =$	3.92
$K_s =$	5.82
$KE_{low} =$	0.0961
$C_d =$	0.60

Calculations of Culvert Capacity (output): Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 \* Culvert Ris

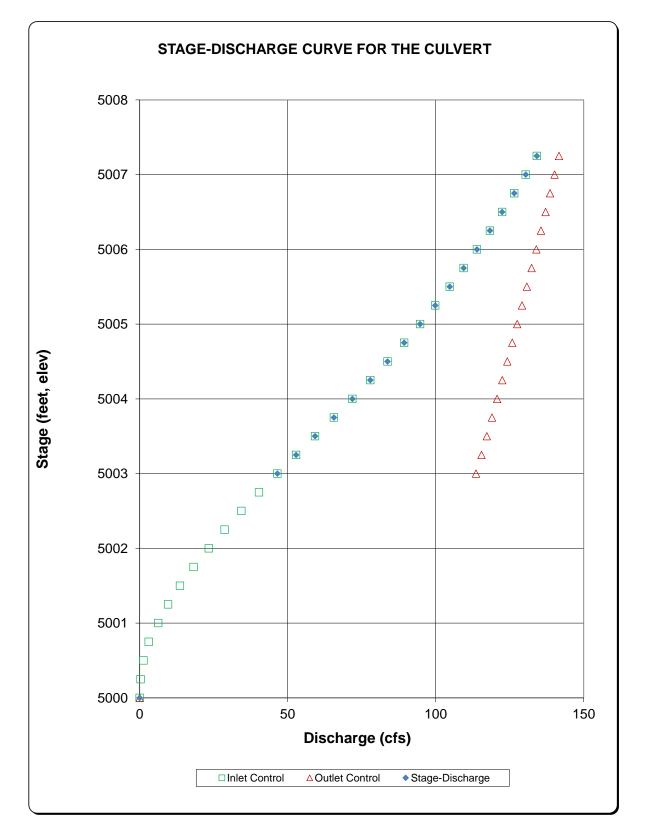
Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
Surface	Surface	Control	Control	Control	Culvert	Control
Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	
5000.00	5000.00	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
5000.25		Min. Energy. Eqn.	0.32	#N/A	#N/A	#N/A
5000.50		Min. Energy. Eqn.	1.31	#N/A	#N/A	#N/A
5000.75		Min. Energy. Eqn.	3.07	#N/A	#N/A	#N/A
5001.00		Min. Energy. Eqn.	6.25	#N/A	#N/A	#N/A
5001.25		Min. Energy. Eqn.	9.61	#N/A	#N/A	#N/A
5001.50		Min. Energy. Eqn.	13.61	#N/A	#N/A	#N/A
5001.75		Min. Energy. Eqn.	18.21	#N/A	#N/A	#N/A
5002.00		Min. Energy. Eqn.	23.35	#N/A	#N/A	#N/A
5002.25		Regression Eqn.	28.71	#N/A	#N/A	#N/A
5002.50		Regression Eqn.	34.34	#N/A	#N/A	#N/A
5002.75		Regression Eqn.	40.31	#N/A	#N/A	#N/A
5003.00		Regression Eqn.	46.51	113.63	46.51	INLET
5003.25		Regression Eqn.	52.85	115.45	52.85	INLET
5003.50		Regression Eqn.	59.26	117.25	59.26	INLET
5003.75		Regression Eqn.	65.62	119.01	65.62	INLET
5004.00		Regression Eqn.	71.86	120.75	71.86	INLET
5004.25		Regression Eqn.	77.91	122.48	77.91	INLET
5004.50		Regression Eqn.	83.74	124.18	83.74	INLET
5004.75		Regression Eqn.	89.33	125.86	89.33	INLET
5005.00		Regression Eqn.	94.71	127.51	94.71	INLET
5005.25		Regression Eqn.	99.82	129.16	99.82	INLET
5005.50		Regression Eqn.	104.72	130.79	104.72	INLET
5005.75		Regression Eqn.	109.42	132.39	109.42	INLET
5006.00		Regression Eqn.	113.94	133.97	113.94	INLET
5006.25		Regression Eqn.	118.31	135.55	118.31	INLET
5006.50		Regression Eqn.	122.45	137.10	122.45	INLET
5006.75		Regression Eqn.	126.51	138.63	126.51	INLET
5007.00		Regression Egn.	130.41	140.16	130.41	INLET
5007.25		Regression Eqn.	134.15	141.66	134.15	INLET
		- 3 4			22.22.2	

Processing Time: **02.28 Seconds** 

### CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

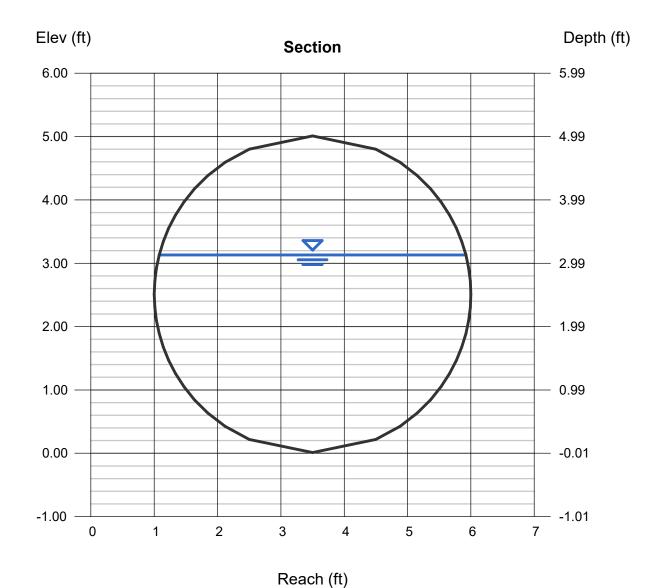
Project: DP 35 headwater calc



Thursday, May 26 2022

### DP 34 3 - 60-Inch RCP Culverts

Circular		Highlighted	
Diameter (ft)	= 5.00	Depth (ft)	= 3.12
. ,		Q (cfs)	= 138.00
		Area (sqft)	= 12.93
Invert Elev (ft)	= 0.01	Velocity (ft/s)	= 10.67
Slope (%)	= 0.55	Wetted Perim (ft)	= 9.12
N-Value	= 0.013	Crit Depth, Yc (ft)	= 3.36
		Top Width (ft)	= 4.84
Calculations		EGL (ft)	= 4.89
Compute by:	Known Q		
Known Q (cfs)	= 138.00		



MHFD-Culvert, Version 4.00 (May 2020) Project: DP 34 headwater calc

#### Design Information (Input):

ID:

Circular Culvert: Barrel Diameter in Inches

Inlet Edge Type (Choose from pull-down list)

D = 60 inches Square Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

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

Number of Barrels

Inlet Elevation at Culvert Invert Outlet Elevation **OR** Slope Culvert Length

Manning's Roughness Bend Loss Coefficient Exit Loss Coefficient

# Barrels =	3	
Elev IN =	5000	ft
So =	0.0055	ft/ft
L =	170	ft
n =	0.013	
$K_b = K_x =$	0	
K <sub>x</sub> =	1	

H (Rise) =

#### Design Information (calculated):

Entrance Loss Coefficient Friction Loss Coefficient Sum of All Loss Coefficients Minimum Energy Condition Coefficient Orifice Inlet Condition Coefficient

$K_e =$	0.20
$K_f =$	0.62
$K_s =$	1.82
$E_{low} =$	0.1131
$C_d =$	0.60

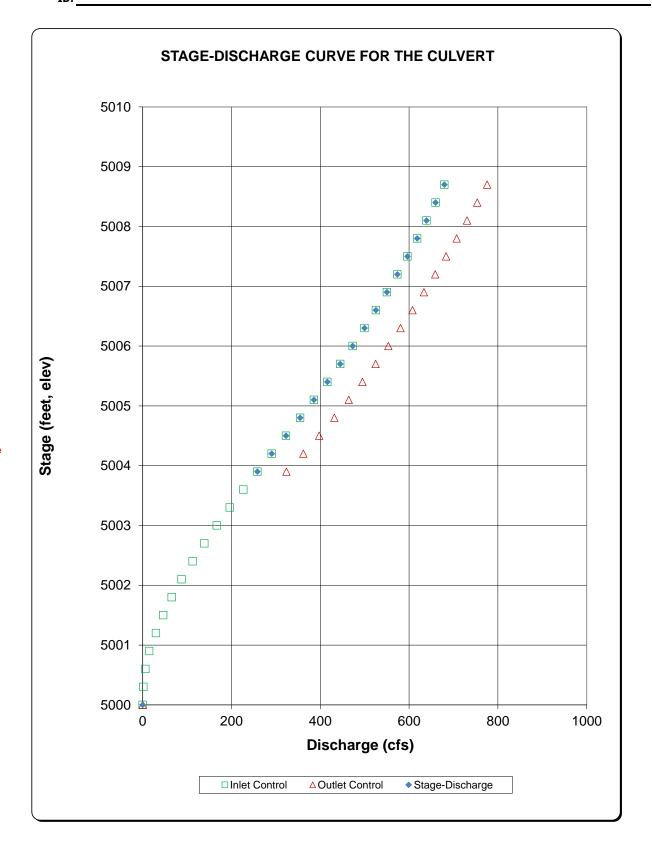
Calculations of Culvert Capacity (output): Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 \* Culvert Ris

			•			
Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
Surface	Surface	Control	Control	Control	Culvert	Control
Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	
5000.00	5000.00	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
5000.30		Min. Energy. Eqn.	1.53	#N/A	#N/A	#N/A
5000.60		Min. Energy. Eqn.	6.21	#N/A	#N/A	#N/A
5000.90		Min. Energy. Eqn.	14.82	#N/A	#N/A	#N/A
5001.20		Min. Energy. Eqn.	30.03	#N/A	#N/A	#N/A
5001.50		Min. Energy. Eqn.	46.23	#N/A	#N/A	#N/A
5001.80		Min. Energy. Eqn.	65.40	#N/A	#N/A	#N/A
5002.10		Min. Energy. Eqn.	87.63	#N/A	#N/A	#N/A
5002.40		Min. Energy. Eqn.	112.53	#N/A	#N/A	#N/A
5002.70		Regression Eqn.	138.96	#N/A	#N/A	#N/A
5003.00		Regression Eqn.	166.83	#N/A	#N/A	#N/A
5003.30		Regression Eqn.	196.23	#N/A	#N/A	#N/A
5003.60		Regression Eqn.	226.83	#N/A	#N/A	#N/A
5003.90		Regression Eqn.	258.42	323.65	258.42	INLET
5004.20		Regression Eqn.	290.55	361.75	290.55	INLET
5004.50		Regression Eqn.	322.83	397.56	322.83	INLET
5004.80		Regression Eqn.	354.63	431.46	354.63	INLET
5005.10		Regression Eqn.	385.68	463.94	385.68	INLET
5005.40		Regression Eqn.	415.86	494.79	415.86	INLET
5005.70		Regression Eqn.	444.93	524.60	444.93	INLET
5006.00		Regression Eqn.	472.86	553.11	472.86	INLET
5006.30		Regression Eqn.	499.62	580.75	499.62	INLET
5006.60		Regression Eqn.	525.33	607.64	525.33	INLET
5006.90		Regression Eqn.	549.93	633.42	549.93	INLET
5007.20		Regression Eqn.	573.63	658.75	573.63	INLET
5007.50		Regression Eqn.	596.28	683.29	596.28	INLET
5007.80		Regression Eqn.	618.15	707.16	618.15	INLET
5008.10		Regression Eqn.	639.24	730.45	639.24	INLET
5008.40		Regression Eqn.	659.73	753.43	659.73	INLET
5008.70		Regression Eqn.	679.32	775.71	679.32	INLET

Processing Time: **01.87 Seconds** 

Project: DP 34 headwater calc MHFD-Culvert, Version 4.00 (May 2020)

ID:



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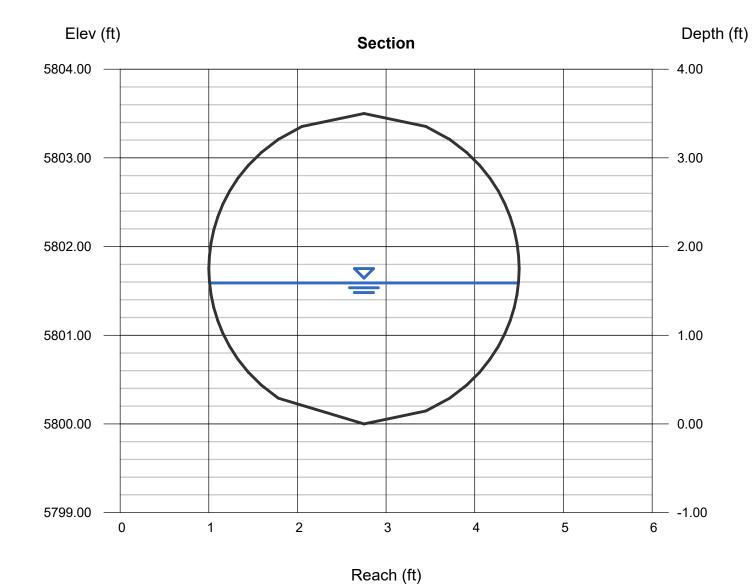
= 30.00

Tuesday, May 10 2022

### DP33 - Q100 = 25.8 cfs

Known Q (cfs)

Circular		Highlighted	
Diameter (ft)	= 3.50	Depth (ft)	= 1.59
		Q (cfs)	= 30.00
		Area (sqft)	= 4.26
Invert Elev (ft)	= 5800.00	Velocity (ft/s)	= 7.05
Slope (%)	= 0.50	Wetted Perim (ft)	= 5.18
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.69
		Top Width (ft)	= 3.49
Calculations		EGL (ft)	= 2.36
Compute by:	Known Q		

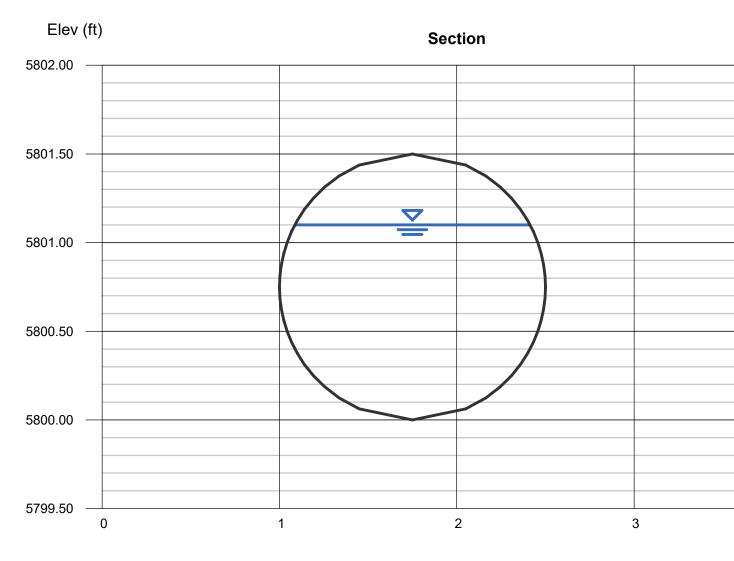


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Tuesday, May 10 2022

### **DPEA1 - Q100 = 16.1 cfs**

Circular		Highlighted	
Diameter (ft)	= 1.50	Depth (ft)	= 1.10
		Q (cfs)	= 16.10
		Area (sqft)	= 1.39
Invert Elev (ft)	= 5800.00	Velocity (ft/s)	= 11.57
Slope (%)	= 3.00	Wetted Perim (ft)	= 3.09
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.43
		Top Width (ft)	= 1.32
Calculations		EGL (ft)	= 3.18
Compute by:	Known Q		
Known Q (cfs)	= 16.10		



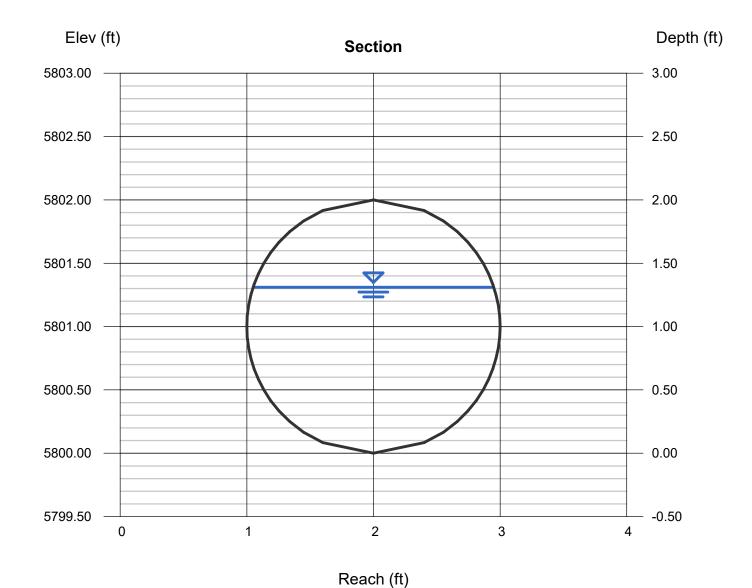
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, May 10 2022

### DPEA2.1 - Q100 = 30.0 cfs

Known Q (cfs) = 30.00

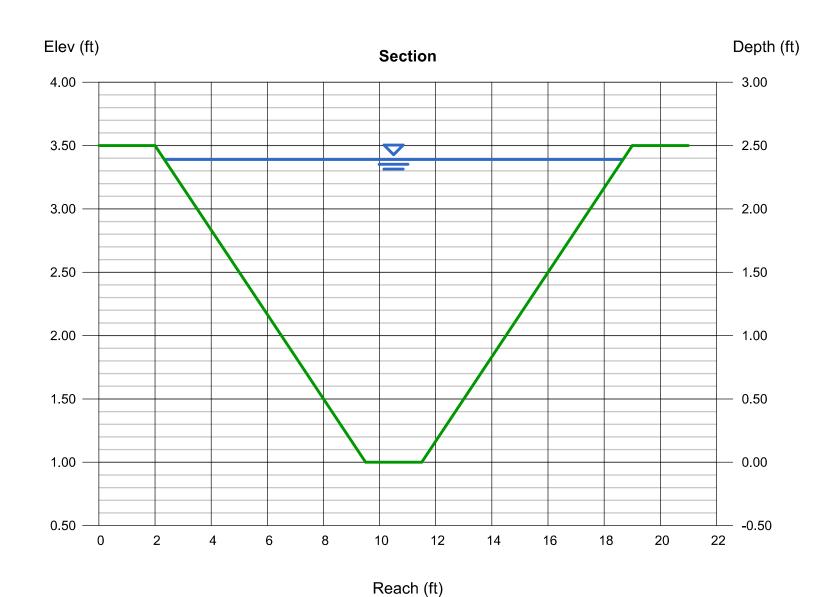
Circular		Highlighted	
Diameter (ft)	= 2.00	Depth (ft)	= 1.31
		Q (cfs)	= 30.00
		Area (sqft)	= 2.19
Invert Elev (ft)	= 5800.00	Velocity (ft/s)	= 13.71
Slope (%)	= 3.00	Wetted Perim (ft)	= 3.78
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.87
		Top Width (ft)	= 1.90
Calculations		EGL (ft)	= 4.23
Compute by:	Known Q		



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### **INTERIM SWALE FOR GEC**

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 2.39
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 135.00
Total Depth (ft)	= 2.50	Area (sqft)	= 21.92
Invert Elev (ft)	= 1.00	Velocity (ft/s)	<b>7</b> = 6.16
Slope (%)	= 2.00	Wetted Perim (ft)	' = 17.12
N-Value	= 0.040	Crit Depth, Yc (ft)	= 2.33
		Top Width (ft)	= 16.34
Calculations		EGL (ft)	= 2.98
Compute by:	Known Q		
Known Q (cfs)	= 135.00		
,			
	ADD 500 ( 1 '' 5 ( )		
	ADD ECB (velocity > 5 fps) -		



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

Friday, May 6 2022

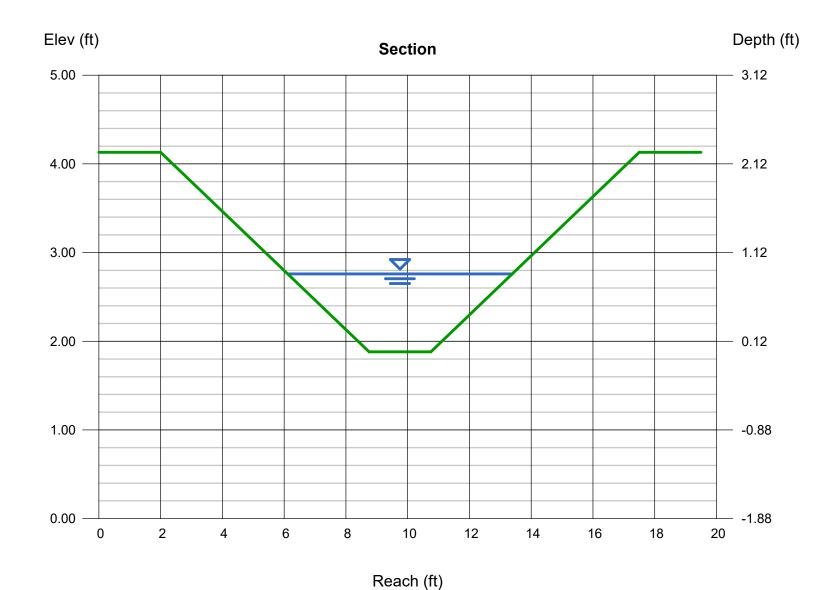
### PROPOSED OFFSITE BASIN 0S-1 SWALE

Trapezoidal	
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.25
Invert Elev (ft)	= 1.88
Slope (%)	= 0.78
N-Value	= 0.040

**Calculations** 

Compute by: Known Q Known Q (cfs) = 8.70

Highlighted	
Depth (ft)	= 0.88
Q (cfs)	= 8.700
Area (sqft)	= 4.08
Velocity (ft/s)	= 2.13
Wetted Perim (ft)	= 7.57
Crit Depth, Yc (ft)	= 0.62
Top Width (ft)	= 7.28
EGL (ft)	= 0.95



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Friday, May 6 2022

### PROPOSED OFFSITE BASIN 0S-2 SWALE

Trapezoida	ı
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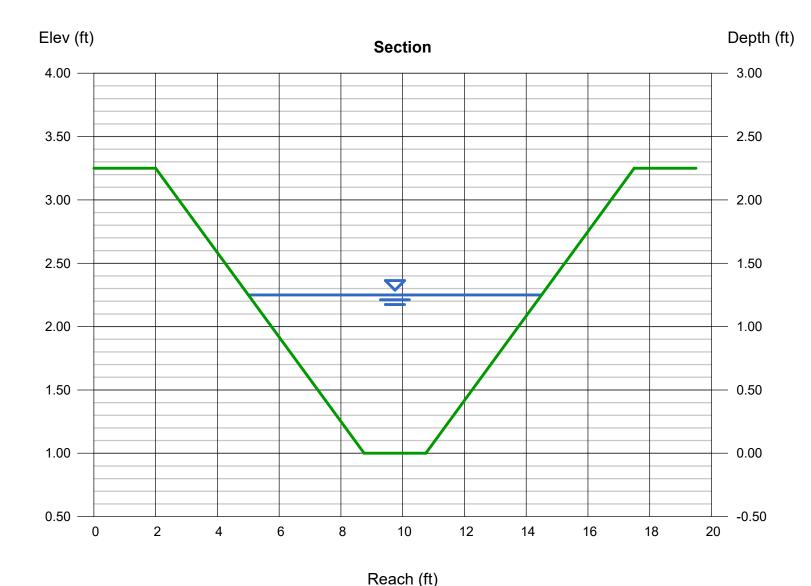
Bottom Width (ft) = 2.00 Side Slopes (z:1) = 3.00, 3.00 Total Depth (ft) = 2.25 Invert Elev (ft) = 1.00 Slope (%) = 0.66 N-Value = 0.040

### **Calculations**

Compute by: Known Q Known Q (cfs) = 17.30

### Highlighted

= 1.25Depth (ft) Q (cfs) = 17.30Area (sqft) = 7.19Velocity (ft/s) = 2.41 Wetted Perim (ft) = 9.91 Crit Depth, Yc (ft) = 0.88Top Width (ft) = 9.50EGL (ft) = 1.34



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

Friday, May 6 2022

### PROPOSED OFFSITE BASIN 0S-4 SWALE

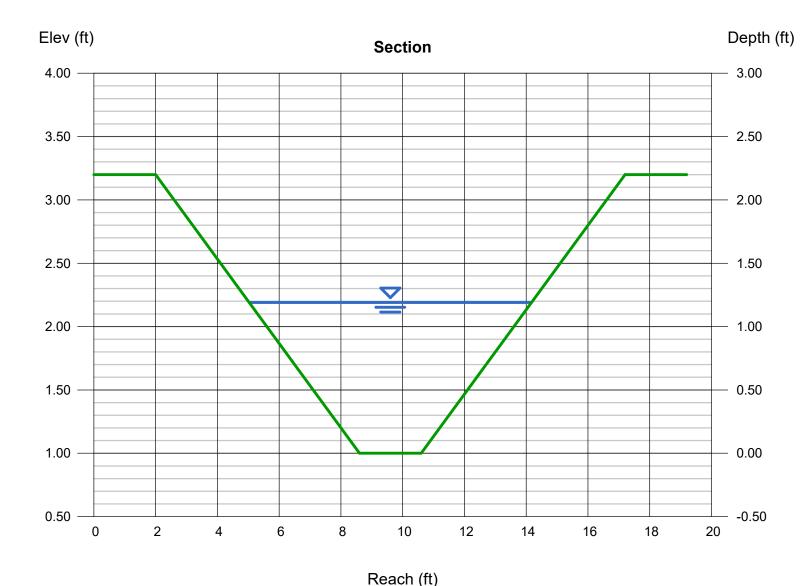
Bottom Width (ft) = 2.00 Side Slopes (z:1) = 3.00, 3.00 Total Depth (ft) = 2.20 Invert Elev (ft) = 1.00 Slope (%) = 1.00 N-Value = 0.040

### **Calculations**

Compute by: Known Q Known Q (cfs) = 19.10

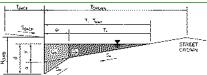
### Highlighted

Depth (ft) = 1.19 Q (cfs) = 19.10 Area (sqft) = 6.63Velocity (ft/s) = 2.88Wetted Perim (ft) = 9.53Crit Depth, Yc (ft) = 0.93Top Width (ft) = 9.14EGL (ft) = 1.32



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

Project: Grandview Reserve
Inlet ID: Basin A-2a (DP2a)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.02 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) nches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X =$ 15.2 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_X$ $\,Q_X\,$ cfs 11.5 11.5 Discharge within the Gutter Section W $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread 2.0 2.0 $Q_W =$ cfs QRACK = cfs $Q_T =$ cfs 13.5 13.5 Flow Velocity within the Gutter Section fps 1.2 V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.5 Minor Storm Major Storm T<sub>TH</sub> = 15.6 29.4 T<sub>X TH</sub> = 14.7 28.6 E<sub>o</sub> = 0.153 0.079 Q<sub>X TH</sub> = 10.6 cfs 62.1

 $Q_X =$ 

Q<sub>W</sub> =

Q =

R =

 $Q_d =$ 

 $d_{CROWN} =$ 

d =

V\*d =

QRACK

10.6

1.9

12.5 1.2

0.4

1.00

12.5

4.36

0.00

cfs

cfs

cfs

cfs

fps

cfs

inches

53.9

5.3 1.2

60.4

1.8

0.70

42.1

6.69

Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

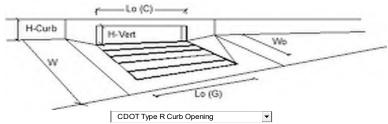
MAJOR STORM Allowable Capacity is based on Depth Criterion

Qallow = 12.5 | 42.1 cfs

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

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

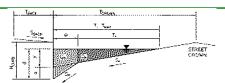
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	i
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	· · ·	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	a <sub>LOCAL</sub> = No =	3.0	3.0	Hillies
Length of a Single Unit Inlet (Grate or Curb Opening)		15.00	5.00	- ft
	L <sub>o</sub> =		N/A	∃rt ∥
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	II.
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A		
Clogqing Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'	0 -1	MINOR	MAJOR	7.4.
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o =$	8.5	19.9	cfs
Water Spread Width	T = d =	13.2	16.0	_ft
Water Depth at Flowline (outside of local depression)	- 1	3.8	5.0	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	d <sub>CROWN</sub> =	0.0	0.5	inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.183	0.130	<b>⊣</b> . ∥
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	6.6	16.4	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.5	2.5	cfs
Discharge Behind the Curb Face	Q <sub>BACK</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.23	0.32	sq ft
Velocity within the Gutter Section W	$V_W =$	6.3	7.8	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.8	8.0	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	
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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	GrateCoef =	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 <sub>e</sub> =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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	<b>Q</b> <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	$Q_b =$	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> = [	0.087	0.068	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> =	18.41	31.80	ft
Under No-Clogging Condition		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L =	15.00	15.00	ft
Interception Capacity	$Q_i =$	7.7	12.9	cfs
Under Clogging Condition	٠ ١	MINOR	MAJOR	-
Clogging Coefficient	CurbCoef =	1.31	1.31	7
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.04	0.04	1
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	ft
Actual Interception Capacity	Qa =	7.7	12.8	cfs
Carry-Over Flow = $Q_{h(GRATE)}$ - $Q_a$	Q <sub>b</sub> =	0.8	7.1	cfs
Summary	<u> ₹.B = I</u>	MINOR	MAJOR	1
Total Inlet Interception Capacity	Q =	7.7	12.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.8	7.1	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	90	64	- %
COMPANIE I GIGGITANGE — QAI QUI —	C 70 - 1		, 07	1.0

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

Project: Grandview Reserve
Inlet ID: Basin A-2b (DP2b)



#### Gutter Geometry

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

$n_{BACK} =$	0.020	
$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
_		1 - 1

0.020

TRACK =

S<sub>BACK</sub> =

	Min ou Chouse	Maior Charm
STREET =	0.016	
$S_0 =$	0.000	ft/ft
J₩ -	0.063	וועונ

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
	57	F"	_

ft/ft

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_x$ 

Discharge within the Gutter Section W  $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor)

Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

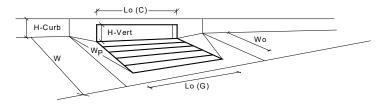
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

	1111101 3(01111	Major Storm	_
y =	3.84	3.84	inches
d <sub>C</sub> = a =	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X = E_0 =$	15.2	15.2	ft
	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
donoun =			linches

o -	Minor Storm SUMP	Major Storm SUMP	cfs
$Q_{allow} =$	SUMP	SUMP	CIS

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

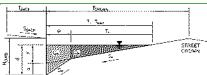


G-	CDOT Type R Curb Opening				
	Design Information (Input)	_ =	MINOR	MAJOR	
	Type of Inlet	Type =		Curb Opening	4
	Local Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	1	4	Override Depths
	Nater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	, (C) F	MINOR	MAJOR	76
	Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
	Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (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	٦, .
	Length of a Unit Curb Opening	L <sub>o</sub> (C) =	20.00	5.00	feet
	Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o(C) =$	0.67	0.67	
	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 Modified HEC22 Method)		MINOR	MAJOR	
	Interception without Clogging	$Q_{wi} =$	N/A	N/A	cfs
I	Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
<u> </u>	Grate Capacity as a Orifice (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
I	Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
I	Interception with Clogging	$Q_{oa} =$	N/A	N/A	cfs
	Grate Capacity as Mixed Flow		MINOR	MAJOR	_
	Interception without Clogging	$Q_{mi} = \Gamma$	N/A	N/A	cfs
	Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
1	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
	Clogging Factor for Multiple Units	Clog =	0.03	0.03	
	Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
	Interception without Clogging	$Q_{wi} = $	10.0	35.4	cfs
	Interception with Clogging	Q <sub>wa</sub> =	9.7	34.3	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	~cwa —	MINOR	MAJOR	<b>_</b>
	Interception without Clogging	$Q_{oi} = \Gamma$	33.6	1 43.9	cfs
	Interception with Clogging	Q <sub>oa</sub> =	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow	≺oa − [	MINOR	MAJOR	J
	Interception without Clogging	$Q_{mi} = \Gamma$	17.0	36.7	cfs
	Interception with Clogging  Interception with Clogging	Q <sub>mi</sub> = Q <sub>ma</sub> =	16.5	35.5	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	9.7	34.3	cfs
	Resultant Street Conditions	-curb -	MINOR	MAJOR	10.0
	Total Inlet Length	L=[	20.00	20.00	Tfeet
	rotal Inlet Length Resultant Street Flow Spread (based on street geometry from above)	_ = L T = L	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	· -	0.0	3.2	inches
١	vezarrani i iow pebri at oriest crown	$d_{CROWN} = $	0.0	J.2	Tilles
∥.	ow Hoad Porformance Poduction (Calculated)		MINOR	MAJOR	
	Low Head Performance Reduction (Calculated)	, -	MINOR	MAJOR	٦۵
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	_ft
	Depth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	4
	Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.67	0.88	4
	Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	9.7	34.3	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	9.2	23.8	ີ່ cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin A-3 (DP3)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 2.00 Gutter Width Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter O for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) So 0.000 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) nches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = inches d = 5.35 5.35 Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X =$ 14.0 14.0 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.372 E<sub>0</sub> = 0.372 Discharge within the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $T_X$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 0.0 0.0 $Q_W =$ 0.0 0.0 cfs Q<sub>BACK</sub> 0.0 0.0 cfs $\mathbf{Q}_{\mathsf{T}} = \mathbf{Q}_{\mathsf{T}}$ SUMP cfs SUMP

i laximam rion basca on riiionabic oprada
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section TXTH
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

-C1	56111	30111	
V =	0.0	0.0	fps
V*d =	0.0	0.0	
	Minor Storm	Major Storm	
$T_{TH} =$	11.9	25.7	ft
$T_{XTH} =$	9.9	23.7	ft
$E_0 =$	0.497	0.228	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches

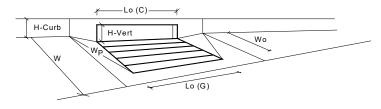
 Minor Storm
 Major Storm

 Qallow =
 SUMP
 SUMP
 cfs

inches

d<sub>CROWN</sub> =

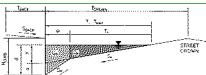
# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening				
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R	Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	Override Depths
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
Grate Information		MINOR	MAJOR	_
Length of a Unit Grate	$L_o(G) =$	N/A	N/A	feet
Width of a Unit Grate	$W_o =$	N/A	N/A	feet
Area Opening 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	
<u>Curb Opening Information</u>	_	MINOR	MAJOR	-
Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	$H_{throat} =$	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) = C <sub>o</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C₀ (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)	6 6 5	MINOR	MAJOR	7
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 Modified HEC22 Method)	ο Γ	MINOR	MAJOR	7.4.
Interception without Clogging	$Q_{wi} =$	N/A	N/A	cfs cfs
Interception with Clogging Grate Capacity as a Orifice (based on Modified HEC22 Method)	$Q_{wa} = $	N/A MINOR	N/A MAJOR	Jus
Interception without Clogging	ο - Γ			cfs
Interception without clogging Interception with Clogging	Q <sub>oi</sub> =	N/A N/A	N/A N/A	cfs
Grate Capacity as Mixed Flow	$Q_{oa} = $	MINOR	MAJOR	_us
Interception without Clogging	$Q_{mi} = \Gamma$	N/A	N/A	ີ່ Icfs
Interception without clogging	Q <sub>mi</sub> – Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes cloqged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	Corace	MINOR	MAJOR	10.0
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	7
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Opening as a Weir (based on Modified HEC22 Method)	c.09 L	MINOR	MAJOR	_
Interception without Clogging	$Q_{wi} = \Gamma$	2.7	10.1	cfs
Interception with Clogging	Q <sub>wa</sub> =	2.4	9.1	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)	Cira L	MINOR	MAJOR	_
Interception without Clogging	Q <sub>oi</sub> =	8.4	11.0	cfs
Interception with Clogging	Q <sub>oa</sub> =	7.6	9.9	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	$Q_{mi} = \Gamma$	4.4	9.8	cfs
Interception with Clogging	Q <sub>ma</sub> =	4.0	8.8	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	2.4	8.8	cfs
Resultant Street Conditions		MINOR	MAJOR	<u> </u>
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	11.9	25.7	ft.>T-Crown
Resultant Flow Depth at Street Crown	$d_{CROWN} =$	0.0	2.3	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 <sub>Curb</sub> =	0.20	0.47	_ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.56	0.98	
Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	
	_			
	_	MINOR	MAJOR	_
Total Inlet Interception Capacity (assumes clogged condition)	<b>Q</b> <sub>a</sub> =	2.4	8.8	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	1.6	3.0	cfs

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

Project: Grandview Reserve
Inlet ID: Basin A-4a (DP4a)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> = Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 n<sub>BACK</sub> = Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> = linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 0.83 Gutter Width Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.02 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm $T_{MAX}$ 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 inches 3.84 inches inches 0.63 inches 4.47 15.2 0.149 cfs 11.5 2.0 cfs

Water Depart Without Gutter Depression (Eq. 51-2)	y - [	3.04	
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_C = [$	0.8	
Gutter Depression ( $d_C$ - (W * $S_x$ * 12))	a =	0.63	
Nater Depth at Gutter Flowline	d =	4.47	
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_X = $	15.2	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E <sub>0</sub> =	0.149	
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	$Q_X = $	11.5	Ξ
Discharge within the Gutter Section W (Q <sub>T</sub> - Q <sub>X</sub> )	$Q_W = $	2.0	
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	
Maximum Flow Based On Allowable Spread	$Q_T = [$	13.5	
Flow Velocity within the Gutter Section	V =	1.2	
/*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.5	
Maximum Capacity for 1/2 Street based on Allowable Depth	_	Minor Storm	
Theoretical Water Spread	$T_{TH} = [$	15.6	_
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = $	14.7	

Maximum Capacity for 1/2 Street based on Allowable Depth	
Theoretical Water Spread	$T_{TH} = [$
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = $
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E <sub>0</sub> =
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>	$Q_{XTH} =$
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )	$Q_X = $
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )	$Q_W =$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =
Average Flow Velocity Within the Gutter Section	V =
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =
Max Flow Based on Allowable Depth (Safety Factor Applied)	$Q_d =$
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =

	Major storm max. allowable capacity GOOD - greater than the design flow given	on sheet '	Inlet Managem	ient'	
-	Minor storm max. allowable capacity GOOD - greater than the design flow given	on sheet '	Inlet Managem	ent'	_
-	MAJOR STORM Allowable Capacity is based on Depth Criterion	Q <sub>allow</sub> =	12.5	42.1	cfs
-	MINOR STORM Allowable Capacity is based on Depth Criterion	_	Minor Storm	Major Storm	
-		_			_
- 1	Resultant Flow Depth at Street Crown (Safety Factor Applied)	$a_{CROWN} =$	0.00	2.22	Jinche

cfs cfs

fps

cfs

cfs

cfs

cfs

cfs

fps

cfs

inches

13.5

1.2 0.5 Major Storm 29.4 28.6

0.079

62.1

60.4

1.8

0.70

42.1

6.69

0.153

10.6

10.6

1.9

12.5

1.2

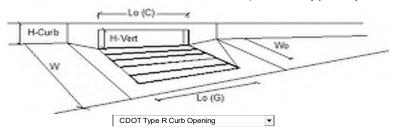
0.4

1.00

12.5

4.36

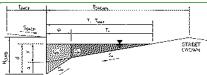
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	1
Type of Inlet	Type =		Curb Opening	<b>-</b>
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	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 <sub>o</sub> =	15.00	15.00	⊣ <sub>ft</sub>
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣՛ր
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> '' Ⅱ
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	-
Street Hydraulics: OK - Q < Allowable Street Capacity'	<u> </u>	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	9.8	22.8	cfs
Water Spread Width	√0 −   T =	14.2	16.0	- ft
Water Spread width Water Depth at Flowline (outside of local depression)	1 = 1 d =	4.0	5.3	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	0.9	inches
	d <sub>CROWN</sub> =			- Inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.169	0.122	- - <sub></sub>
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	8.1	20.0	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.7	2.8	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.25	0.34	sq ft
Velocity within the Gutter Section W	V <sub>w</sub> =	6.6	8.2	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	7.0	8.3	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	
<u>Under No-Clogging Condition</u>	r	MINOR	MAJOR	٦. ا
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	$R_f =$	N/A	N/A	<b>」</b>
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Interception Capacity	$Q_i = [$	N/A	N/A	cfs
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	<b>_</b>
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	_
Effective (unclogged) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	_ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	$R_f =$	N/A	N/A	_
Interception Rate of Side Flow	$R_x = 1$	N/A	N/A	_
Actual Interception Capacity	<b>Q</b> <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	<b>Q</b> <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	_
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	$S_e =$	0.082	0.064	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	$L_T = [$	20.84	35.80	ft
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$ )	L =	15.00	15.00	ft
Interception Capacity	$Q_i = [$	8.8	14.2	cfs
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	_  ∥
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	_  ∥
Effective (Unclogged) Length	L <sub>e</sub> =	13.03	13.03	ft
Actual Interception Capacity	$Q_a = [$	8.6	13.8	cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - $Q_a$	<b>Q</b> <sub>b</sub> =	1.2	9.0	cfs
<u>Summary</u>		MINOR	MAJOR	_
Total Inlet Interception Capacity	Q =[	8.6	13.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = [$	1.2	9.0	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	88	61	%
70.70			·	

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

Project: Grandview Reserve
Inlet ID: Basin A-4b (DP4b)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> : 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.02 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) nches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X =$ 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_X$ $\,Q_X\,$ cfs 11.5 11.5 Discharge within the Gutter Section W $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread 2.0 2.0 $Q_W =$ cfs QRACK = cfs $Q_T =$ cfs 13.5 13.5 Flow Velocity within the Gutter Section fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d 0.5 Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

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

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

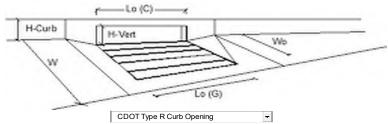
	Minor Storm	Major Storm	
$T_{TH} = $	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	10.6	62.1	cfs
$Q_X = $	10.6	53.9	cfs
$Q_W = [$	1.9	5.3	cfs
$Q_{BACK} = $	0.0	1.2	cfs
Q =	12.5	60.4	cfs
V =	1.2	1.8	fps
V*d =	0.4	1.2	
R =	1.00	0.70	
$Q_d = $	12.5	42.1	cfs
d =	4.36	6.69	inches
$d_{CROWN} =$	0.00	2.22	inches

Major Storm

42.1

cfs

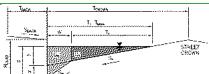
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =		Curb Opening	¬
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	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 <sub>o</sub> =	15.00	10.00	- ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	- '`
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'	G-C - 1	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	6.5	15.2	Tcfs T
Water Spread Width	Ψ <sub>0</sub> −   T =	12.1	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.5	4.7	inches
Water Depth at Flowinie (outside of local depression)  Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	0.2	inches
Ratio of Gutter Flow to Design Flow	d <sub>CROWN</sub> = E <sub>o</sub> =	0.200	0.142	liicies
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>		5.2	13.1	cfs
	Q <sub>x</sub> =	1.3	2.2	cfs
Discharge within the Gutter Section W Discharge Behind the Curb Face	Q <sub>w</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	$Q_{BACK} =$	0.22	0.0	sq ft
Velocity within the Gutter Section W	$A_W = V_W $	6.0	7.4	fps
Water Depth for Design Condition		6.5	7.7	inches
Grate Analysis (Calculated)	d <sub>LOCAL</sub> =	MINOR	MAJOR	Jinches
Total Length of Inlet Grate Opening	L = [	N/A	N/A	∃ft
Ratio of Grate Flow to Design Flow	- 1	N/A	N/A	⊣"
Under No-Clogging Condition	$E_{o-GRATE} = [$	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	v _[	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>o</sub> =		N/A	⊣ <sup>1ps</sup>
Interception Rate of Frontal Flow Interception Rate of Side Flow	R <sub>f</sub> =	N/A N/A	N/A N/A	-
Interception Rate of Side Flow Interception Capacity	R <sub>x</sub> =	N/A	N/A N/A	cfs
Under Clogging Condition	$Q_i = [$	MINOR	MAJOR	_lus
Clogging Condition Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦ ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A N/A	-
Effective (unclogged) Length of Multiple-unit Grate Inlet	- I	N/A	N/A	- ft
Minimum Velocity Where Grate Splash-Over Begins	L <sub>e</sub> =	N/A	N/A N/A	fps
Interception Rate of Frontal Flow	V <sub>o</sub> =   R <sub>f</sub> =	N/A	N/A N/A	I I I I I I I I I I I I I I I I I I I
Interception Rate of Frontal Flow Interception Rate of Side Flow				-
Actual Interception Capacity	R <sub>x</sub> =	N/A N/A	N/A N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>a</sub> =   Q <sub>b</sub> =	N/A N/A	N/A N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>Q</b> <sub>b</sub> −	MINOR	MAJOR	CIS
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.093	0.072	∏ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	J <sub>e</sub> − L L <sub>T</sub> =	15.94	27.68	Ift I
Under No-Clogging Condition	LT -[	MINOR	MAJOR	<b>_</b> 1''
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	10.00	10.00	∃ft
Interception Capacity	Q <sub>i</sub> =	5.4	8.4	cfs
Under Clogging Condition	Q <sub>i</sub> −[	MINOR	MAJOR	J <sup>u</sup> 3
Clogging Coefficient	CurbCoef =	1.25	1.25	٦ ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	<b>⊣</b> ∥
Effective (Uncloqued) Length	L <sub>e</sub> =	8.75	8.75	- ft
Actual Interception Capacity	Q <sub>a</sub> =	5.2	8.1	cfs
Carry-Over Flow = Q <sub>h(GRATE)</sub> -Q <sub>a</sub>	Q <sub>a</sub> =	1.3	7.1	cfs
Summary	<b>Q</b> <sub>b</sub> −	MINOR	MAJOR	leta .
Total Inlet Interception Capacity	<b>Q</b> =	5.2	8.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	1.3	7.1	cfs
Capture Percentage = $Q_a/Q_0$ =	С% =	80	53	- %
Captain Ferentiage - Val Vn -	C /0 -1		, 33	170

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

Project: Grandview Reserve
Inlet ID: DP 4



Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020) ft/ft  $S_{BACK} =$ 0.020  $n_{BACK} =$ 0.020 Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 2.00 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition  $S_{0}$ 0.000 ft/ft Manning's Roughness for Street Section (typically between 0.012 and 0.020) n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") d<sub>C</sub> = inches 2.0 2.0 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) 1.51 inches Water Depth at Gutter Flowline d = 5.35 inches Allowable Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $T_X =$ 14.0 14.0 ft  $E_0 =$ 0.372 0.372 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub>  $Q_X =$ 0.0 0.0 cfs cfs Q<sub>W</sub> = 0.0 0.0 Q<sub>BACK</sub> = 0.0 cfs 0.0

Disc	harge within the Gutter Section W (Q <sub>T</sub> - Q <sub>X</sub> )
Disc	harge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Max	imum Flow Based On Allowable Spread
Flow	Velocity within the Gutter Section
V*d	Product: Flow Velocity times Gutter Flowline Depth
	rimum Capacity for 1/2 Street based on Allowable Depth
	pretical Water Spread
The	pretical Spread for Discharge outside the Gutter Section W (T - W)
Gutt	er Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W ( $Q_d$ - $Q_X$ )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

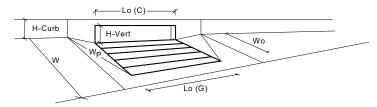
Resultant Flow Depth at Street Crown (Safety Factor Applied)
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

<b>Q</b> ⊤ −	SUMP	SUMP	CIS
V =	0.0	0.0	fps
V*d =	0.0	0.0	
	Minor Storm	Major Storm	
$T_{TH} =$	11.9	25.7	ft
$T_{XTH} =$	9.9	23.7	ft
E <sub>o</sub> =	0.497	0.228	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches

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

linches

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

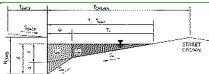


Design Information (Input)  CDOT Type R Curb Opening		MINOR	MAJOR	-
Type of Inlet	Type =	CDOT Type R		<b>4</b>
Local Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	<u>.</u> .
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	linches
Grate Information	. (c) F	MINOR	MAJOR	Override Depths
Length of a Unit Grate Width of a Unit Grate	L <sub>0</sub> (G) =	N/A N/A	N/A N/A	feet feet
	$W_0 =$	,	N/A	Treet
Area Opening Ratio for a Grate (typical values 0.15-0.90) Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$A_{ratio} = C_f(G) = C_f(G)$	N/A N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>r</sub> (G) = C <sub>w</sub> (G) =	N/A N/A	N/A	-
Grate Orifice Coefficient (typical value 2.13 - 3.60)	C <sub>o</sub> (G) =	N/A N/A	N/A	+
Curb Opening Information	C₀ (G) − [	MINOR	MAJOR	_
Length of a Unit Curb Opening	L <sub>0</sub> (C) =	15.00	15.00	∏feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>n</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C <sub>f</sub> (C) =	0.10	0.10	- rect
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	-
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_0(C) = $	0.67	0.67	+
Grate Flow Analysis (Calculated)	-0 (-7	MINOR	MAJOR	1
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	7
Clogging Factor for Multiple Units	Clog =	N/A	N/A	+
Grate Capacity as a Weir (based on Modified HEC22 Method)	Glog – L	MINOR	MAJOR	_
Interception without Clogging	$Q_{wi} = \Gamma$	N/A	N/A	<b>∃cfs</b>
Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)	-Cwa L	MINOR	MAJOR	J
Interception without Clogging	$Q_{oi} = \Gamma$	N/A	N/A	ີ່ໄcfs
Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow	-Cua L	MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	ີ່ cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	•	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	7
Clogging Factor for Multiple Units	Clog =	0.04	0.04	7
Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	-
Interception without Clogging	$Q_{wi} = \Gamma$	3.9	19.2	cfs
Interception with Clogging	$Q_{wa} = $	3.8	18.4	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)	-	MINOR	MAJOR	_
Interception without Clogging	Q <sub>oi</sub> =	25.2	32.9	cfs
Interception with Clogging	Q <sub>oa</sub> =	24.1	31.5	cfs
Curb Opening Capacity as Mixed Flow	_	MINOR	MAJOR	_
Interception without Clogging	$Q_{mi} =$	9.2	23.4	cfs
Interception with Clogging	Q <sub>ma</sub> =	8.8	22.4	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	3.8	18.4	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 =	11.9	25.7	ft.>T-Crown
Resultant Flow Depth at Street Crown	$d_{CROWN} =$	0.0	2.3	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	$d_{Curb} =$	0.20	0.47	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	_
Curb Opening Performance Reduction Factor for Long Inlets	$RF_{Curb} =$	0.67	0.88	_
Grated Inlet Performance Reduction Factor for Long Inlets	$RF_{Grate} = $	N/A	N/A	_
	_	MINOR	MAJOR	_
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	3.8	18.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	2.5	16.1	cfs

MHFD-A Basin Inlets\_v5.01.xlsm, DP 4 5/25/2022, 6:09 PM

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

Project: Grandview Reserve
Inlet ID: Basin A-5 (DP5)



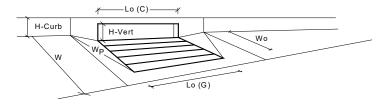
#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> = linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 2.00 Gutter Width Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.000 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") Gutter Depression (d<sub>c</sub> - (W \* $S_x$ \* 12)) Water Depth at Gutter Flowline inches inches d = 5.35 inches Allowable Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $W(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

- 1	i laximam nov basea on miowable spread
-	Flow Velocity within the Gutter Section
-	V*d Product: Flow Velocity times Gutter Flowline Depth
-	
-	Maximum Capacity for 1/2 Street based on Allowable Depth
-	Theoretical Water Spread
-	Theoretical Spread for Discharge outside the Gutter Section W (T - W)
-	Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
-	Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>
-	Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
-	Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
-	Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
-	Total Discharge for Major & Minor Storm (Pre-Safety Factor)
-	Average Flow Velocity Within the Gutter Section
-	V*d Product: Flow Velocity Times Gutter Flowline Depth
-	Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
-	Max Flow Based on Allowable Depth (Safety Factor Applied)
-	Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

$T_X =$	14.0	14.0	ft
$E_0 =$	0.372	0.372	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
	Minou Chaum	Maior Charm	
т –	Minor Storm 11.9	Major Storm 25.7	∃ft
$T_{TH} = T_{XTH} =$	9.9	23.7	ft
	0.497	0.228	- ''
E <sub>0</sub> =			cfs
Q <sub>X TH</sub> =	0.0	0.0	cfs
$Q_X =$	0.0	0.0	
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
$d_{CROWN} =$			inches
	Minor Storm	Major Storm	_
$Q_{allow} =$	SUMP	SUMP	cfs
			-

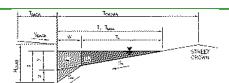
# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

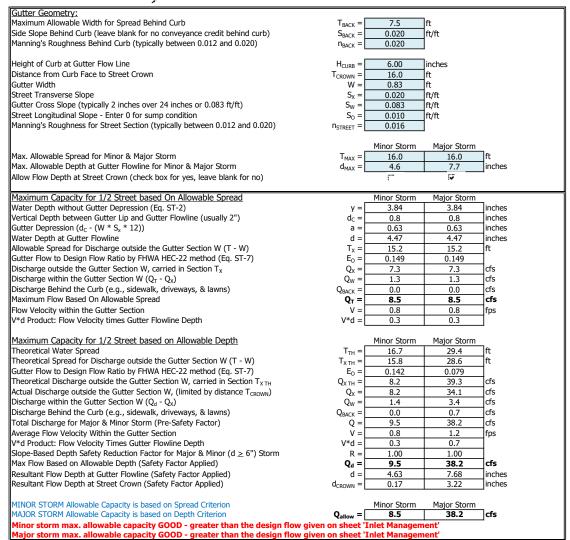


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R	Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	Override Depths
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.3	5.6	inches
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	$L_{o}(G) = $	N/A	N/A	∏feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	-
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>0</sub> (G) =	N/A	N/A	+
Curb Opening Information	G (G) -	MINOR	MAJOR	_
Length of a Unit Curb Opening	$L_{0}(C) = $	5.00	5.00	∏feet
Height of Vertical Curb Opening in Inches	* * * /	6.00	6.00	inches
	H <sub>vert</sub> =	6.00		
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =		6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) = C_o(C) = C_o(C)$	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (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 Modified HEC22 Method)	_	MINOR	MAJOR	<del></del>
Interception without Clogging	Q <sub>wi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	_
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow	- COS	MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	• • • • • • • • • • • • • • • • • • •	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	7
Clogging Factor for Multiple Units	Clog =	0.10	0.10	-
Curb Opening as a Weir (based on Modified HEC22 Method)	clog – L	MINOR	MAJOR	_
Interception without Clogging	Q <sub>wi</sub> =	2.6	5.1	cfs
Interception with Clogging		2.3	4.6	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)	Q <sub>wa</sub> =	MINOR	MAJOR	_us
Interception without Clogging	0 -	8.3	9.4	ີ່ lcfs
	$Q_{oi} =$	7.5	8.5	cfs
Interception with Clogging	$Q_{oa} = $			Jas
Curb Opening Capacity as Mixed Flow	, r	MINOR	MAJOR	٦,
Interception without Clogging	$Q_{mi} = $	4.3	6.4	cfs
Interception with Clogging	_ Q <sub>ma</sub> =	3.9	5.8 <b>4.6</b>	cfs
' 33 3				cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	2.3		
Resulting Curb Opening Capacity (assumes cloqued condition) Resultant Street Conditions	-	MINOR	MAJOR	-
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length	L = [	MINOR 5.00	MAJOR 5.00	feet
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above)	L = _ T = _	MINOR 5.00 11.5	MAJOR 5.00 17.0	ft.>T-Crown
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length	L = [	MINOR 5.00	MAJOR 5.00	
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown	L = _ T = _	MINOR 5.00 11.5 0.0	MAJOR 5.00 17.0 0.2	ft.>T-Crown
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated)	L = _ T = _	MINOR 5.00 11.5 0.0	MAJOR 5.00 17.0 0.2 MAJOR	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth	L = _ T = _	MINOR 5.00 11.5 0.0 MINOR N/A	MAJOR 5.00 17.0 0.2 MAJOR N/A	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated)	L = T = d <sub>CROWN</sub> =	MINOR 5.00 11.5 0.0	MAJOR 5.00 17.0 0.2 MAJOR N/A 0.30	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth	L =	MINOR 5.00 11.5 0.0 MINOR N/A	MAJOR 5.00 17.0 0.2 MAJOR N/A	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation		MINOR 5.00 11.5 0.0 MINOR N/A 0.19	MAJOR 5.00 17.0 0.2 MAJOR N/A 0.30	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets		MINOR 5.00 11.5 0.0 MINOR N/A 0.19 0.55 1.00	MAJOR 5.00 17.0 0.2 MAJOR N/A 0.30 0.72	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets		MINOR 5.00 11.5 0.0 MINOR N/A 0.19 0.55	MAJOR 5.00 17.0 0.2 MAJOR N/A 0.30 0.72 1.00	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets		MINOR 5.00 11.5 0.0 MINOR N/A 0.19 0.55 1.00	MAJOR 5.00 17.0 0.2 MAJOR N/A 0.30 0.72 1.00	ft.>T-Crown inches
Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets		MINOR 5.00 11.5 0.0 MINOR N/A 0.19 0.55 1.00 N/A	MAJOR 5.00 17.0 0.2 MAJOR N/A 0.30 0.72 1.00 N/A	ft.>T-Crown inches

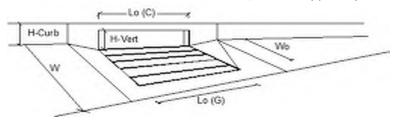
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Grandview Reserve
Inlet ID: Basin A-6 (DP6)





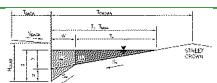
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet CDOT Type R Curb Opening	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	∃ <sup></sup>
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00	5.00	⊣ft I
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	⊣ft I
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>r</sub> -G =	N/A	N/A	<b>∃</b> ``
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	Q <sub>o</sub> =	4.6	10.7	□cfs
Water Spread Width	T =	12.6	16.0	∃ft I
Water Depth at Flowline (outside of local depression)	d =	3.7	4.8	inches
Water Depth at Street Crown (or at T <sub>MAY</sub> )	d <sub>CROWN</sub> =	0.0	0.4	inches
Ratio of Gutter Flow to Design Flow	E <sub>o</sub> =	0.191	0.136	- I
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	O <sub>v</sub> =	3.7	9.2	cfs
Discharge within the Gutter Section W	$Q_w = 1$	0.9	1.5	cfs
Discharge Behind the Curb Face	Q <sub>BACK</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W = \begin{bmatrix} A_W & A_W & A_W \end{bmatrix}$	0.22	0.30	sq ft
Velocity within the Gutter Section W	$V_{W} = 1$	3.9	4.8	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.7	7.8	inches
Grate Analysis (Calculated)	MIDICAL — I	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L = [	N/A	l N/A	∃ft
Ratio of Grate Flow to Design Flow	E <sub>o-GRATE</sub> =	N/A	N/A	⊣'` ∥
Under No-Clogging Condition	Lo-GRATE -[	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> = [	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>0</sub> – R <sub>f</sub> =	N/A	N/A	∃ <sup>ips</sup>
Interception Rate of Frontal Flow	R <sub>x</sub> =	N/A	N/A	-
Interception Rate of Side Flow  Interception Capacity	$Q_i = $	N/A	N/A	cfs
Under Clogging Condition	Qi -[	MINOR	MAJOR	_lus
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦ ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	-
Effective (uncloqued) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	⊣ <sub>ft</sub> ∥
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>0</sub> – R <sub>f</sub> =	N/A	N/A	∃ <sup>ips</sup>
Interception Rate of Flow	R <sub>x</sub> =	N/A	N/A	-
Actual Interception Capacity	$\mathbf{Q_a} = \begin{bmatrix} \mathbf{Q_a} \\ \mathbf{Q_a} \end{bmatrix}$	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>a</sub> = Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<u> </u>	MINOR	MAJOR	CIS
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.090	0.070	∏ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	$L_T = 1$	12.88	22.25	ft I
Under No-Clogging Condition	L <sub>T</sub> - [	MINOR	MAJOR	ا"،
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	10.00	10.00	Tft I
Interception Capacity	L =   Q <sub>i</sub> =	4.3	7.0	cfs
Under Clogging Condition	Q <sub>i</sub> – [	MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	٦ ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	<del> </del>
Effective (Unclogged) Length	L <sub>e</sub> =	9.37	9.37	⊣ <sub>ft</sub> ∥
Actual Interception Capacity	· •	4.2	6.9	cfs
Carry-Over Flow = $Q_{\text{h/GRATE}}$ - $Q_{\text{a}}$	Q <sub>a</sub> =	0.4	3.8	cfs
Summary	<b>Q</b> <sub>b</sub> =	MINOR	MAJOR	1013
Total Inlet Interception Capacity	<b>Q</b> = [	4.2	6.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q =   Qь =	0.4	3.8	cfs
Capture Percentage = $Q_a/Q_0$ =	Qь =   С% =	92	64	- CTS %
Capture i creentage – Qa/Qn –	C-70 -	72	. 07	170

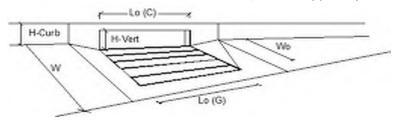
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Grandview Reserve
Inlet ID: Basin A-7 (DP7)



Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 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 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 2.00 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) ft/ft 0.083 Street Longitudinal Slope - Enter 0 for sump condition So ft/ft 1.000 Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 Allow Flow Depth at Street Crown (check box for yes, leave blank for no) V Maximum Capacity for 1/2 Street based On Allowable Spread Minor Storm Major Storm Water Depth without Gutter Depression (Eq. ST-2) 3.84 3.84 inches Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") inches d<sub>C</sub> = 2.0 2.0 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) 1.51 inches Water Depth at Gutter Flowline d = 5.35 inches Allowable Spread for Discharge outside the Gutter Section W (T - W)  $T_X =$ 14.0 14.0 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $E_0 =$ 0.372 0.372 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub> Q<sub>X</sub> = 58.7 58.7 cfs Discharge within the Gutter Section W  $(Q_T - Q_X)$ Q<sub>W</sub> = 34.8 cfs 34.8 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Orack = cfs 0.0 0.0 Maximum Flow Based On Allowable Spread Q<sub>T</sub> = 93.5 93.5 cfs Flow Velocity within the Gutter Section 48.0 48.0 fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 21.4 Maximum Capacity for 1/2 Street based on Allowable Depth Minor Storm Major Storm Theoretical Water Spread T<sub>TH</sub> = 11.9 25.7 Theoretical Spread for Discharge outside the Gutter Section W (T - W) T<sub>X TH</sub> = 9.9 23.7 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>o</sub> = 0.497 0.228 Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ cfs Q<sub>X TH</sub> = 23.1 239.0 Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>) cfs  $Q_x =$ 23.1 217.0 22.8 Discharge within the Gutter Section W (Q<sub>d</sub> - Q<sub>X</sub>) cfs Q<sub>W</sub> = 70.7 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) cfs Q<sub>BACK</sub> = 0.0 7.4 Total Discharge for Major & Minor Storm (Pre-Safety Factor) Q = 45.9 295.0 cfs Average Flow Velocity Within the Gutter Section 40.6 fps 63.4 V\*d Product: Flow Velocity Times Gutter Flowline Depth V\*d = 14.8 40.6 Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm R = 0.13 0.04 Max Flow Based on Allowable Depth (Safety Factor Applied)  $Q_d =$ 6.2 10.8 cfs Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) d = inches Resultant Flow Depth at Street Crown (Safety Factor Applied)  $d_{CROWN} =$ 0.00 0.00 linches MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion  $Q_{allow} =$ 6.2 10.8 cfs Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management lajor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

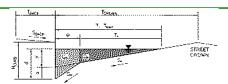
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Danisa Information (Inna.)		MINOD	MAJOR	1
Design Information (Input)  CDOT Type R Curb Opening		MINOR	MAJOR	- I
Type of Inlet	Type =	CDOT Type R		<b>-</b>
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	-l I
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00	5.00	_ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -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'	- 1	MINOR	MAJOR	ا ا
Design Discharge for Half of Street (from Inlet Management)	$Q_o =$	1.1	2.0	cfs
Water Spread Width	T =	1.3	1.6	_ft
Water Depth at Flowline (outside of local depression)	d =	1.3	1.6	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	$d_{CROWN} =$	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	1.012	1.000	
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	$Q_x = $	0.0	0.0	cfs
Discharge within the Gutter Section W	$Q_w =$	1.1	2.0	cfs
Discharge Behind the Curb Face	Q <sub>BACK</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.05	0.10	sa ft
Velocity within the Gutter Section W	V <sub>w</sub> =	22.0	19.2	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	4.3	4.6	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L = [	N/A	N/A	∃ft I
Ratio of Grate Flow to Design Flow	E <sub>o-GRATE</sub> =	N/A	N/A	1
Under No-Clogging Condition	-0 divite [	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	∏fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	ا ا
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	<del> </del>
Interception Rate of Side Flow  Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	ζı – [	MINOR	MAJOR	ا ا
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	¬
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	<del> </del>
Effective (unclogged) Length of Multiple-unit Grate Inlet	- 1	N/A	N/A	⊣ <sub>ft</sub>
Minimum Velocity Where Grate Splash-Over Begins	L <sub>e</sub> =   V <sub>o</sub> =	N/A	N/A	fps
				-lips
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	- <del> </del>
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	-
Actual Interception Capacity	<b>Q</b> <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = Q <sub>o</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	٦
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.208	0.208	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> = [	5.50	7.47	_ft
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	٦. ا
Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$ )	L =	5.00	5.00	_ft
Interception Capacity	$Q_i =  $	1.1	1.7	cfs
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.00	1.00	_
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.10	0.10	
Effective (Unclogged) Length	L <sub>e</sub> =	4.50	4.50	ft
Actual Interception Capacity	$Q_a =$	1.0	1.6	cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - $Q_a$	Q <sub>b</sub> =	0.1	0.4	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	1.0	1.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.1	0.4	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	95	81	%
E				

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

Project: Grandview Reserve
Inlet ID: Basin A-9(DP7a)



## Gutter Geometry

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

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

ı	M · O · C · C · C · C · C · C · C · C · C
	Check boxes are not applicable in SUMP conditions

Maximum Capacity for 1/2 Street based On Allowable Spread Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12))
Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_X$  Discharge within the Gutter Section  $W\left(Q_T - Q_X\right)$  Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor)

Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

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

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
пстрест =	0.016	

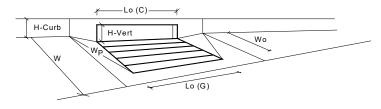
	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
		<-	_

	Minor Storm	Major Storm	_
y =	3.84	3.84	inches
d <sub>C</sub> = a =	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
$E_0 =$	0.149	0.149	1
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
T <sub>X TH</sub> =	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
$d_{CROWN} =$			inches

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

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

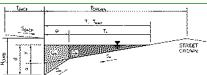


	CDOT Type R Curb Opening   ▼				
Design Information (	(nput)		MINOR	MAJOR	
Type of Inlet	<u></u>	Type =		Curb Opening	
	ional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3,00	inches
	Grate or Curb Opening)	No =	4	4	Override Depths
	e (outside of local depression)	Ponding Depth =	4.4	7.7	inches
Grate Information	c (dublac of local acpression)	ronaling Depart —	MINOR	MAJOR	Interies
Length of a Unit Grate		L₀ (G) = [	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
	a Grate (typical values 0.15-0.90)		N/A	N/A	-1000
	ngle Grate (typical value 0.50 - 0.70)	$A_{ratio} =$	N/A	N/A	-
		$C_f(G) =$	N/A N/A		
	typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A N/A	N/A N/A	4
	t (typical value 0.60 - 0.80)	$C_o(G) =$		,	
Curb Opening Inform			MINOR	MAJOR	٦
Length of a Unit Curb C		$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb		$H_{vert} = $	6.00	6.00	inches
Height of Curb Orifice 1		$H_{throat} =$	6.00	6.00	inches
Angle of Throat (see U		Theta =	63.40	63.40	degrees
	on Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
Clogging Factor for a S	ngle Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coe	fficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	7
	pefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (C) =	0.67	0.67	1
Grate Flow Analysis (			MINOR	MAJOR	•
Clogging Coefficient for		Coef =	N/A	N/A	7
Clogging Factor for Mul		Clog =	N/A	N/A	┥
	Veir (based on Modified HEC22 Method)	ciog – L	MINOR	MAJOR	_
		ο -Γ			<b>∃cfs</b>
Interception without Cl		Q <sub>wi</sub> =	N/A	N/A	
Interception with Clogg		$Q_{wa} =$	N/A	N/A	cfs
	Orifice (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
Interception without Cl		$Q_{oi} = $	N/A	N/A	cfs
Interception with Clogg		$Q_{oa} = $	N/A	N/A	cfs
Grate Capacity as Mix	red Flow	_	MINOR	MAJOR	<del>_</del>
Interception without Cle	ogging	$Q_{mi} = \Gamma$	N/A	N/A	cfs
Interception with Clogg	ing	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacit	y (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow A	nalysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for	Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Mul		Clog =	0.03	0.03	
	eir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Cle		$Q_{wi} = $	10.0	35.4	cfs
Interception with Clogg		Q <sub>wa</sub> =	9.7	34.3	cfs
		Qwa — L	MINOR	MAJOR	703
Interception without Co	Orifice (based on Modified HEC22 Method)	$Q_{oi} = \Gamma$	33.6	MAJOR 1 43.9	ີ່ cfs
Interception with Clogg		$Q_{oa} = $	32.5	42.4	cfs
Curb Opening Capaci			MINOR	MAJOR	٦.
Interception without Cl		$Q_{mi} = $	17.0	36.7	cfs
Interception with Clogg		$Q_{ma} = $	16.5	35.5	cfs
	Capacity (assumes cloqged condition)	Q <sub>Curb</sub> =	9.7	34.3	cfs
Resultant Street Cond	litions		MINOR	MAJOR	_
Total Inlet Length		L =	20.00	20.00	feet
Resultant Street Flow S	pread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
Resultant Flow Depth a		d <sub>CROWN</sub> =	0.0	3.2	inches
					_
Low Head Performan	ce Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwid		d <sub>Grate</sub> =	N/A	N/A	Πft
Depth for Curb Opening		d <sub>Curb</sub> =	0.29	0.57	⊣ft
	rmance Reduction Factor for Long Inlets		0.41	0.72	<b>⊣</b> ∵
	nce Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	4
		RF <sub>Curb</sub> =			4
Grated Inlet Performan	ce Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	_
			MINOD	MA100	
	0 11 1 11 11 11	• -	MINOR	MAJOR	7-6-
	Capacity (assumes clogged condition)	Q <sub>a</sub> =	9.7	34.3	cfs
	OD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	7.8	21.1	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin A-10(DP7b)



### Gutter Geometry Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

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

iriax. Allowable Deptit at Gutter Flowline for Pillion & Plajor Storm
Check boxes are not applicable in SUMP conditions

IIBACK —	0.020	
$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
S	U U83	ft/ft

0.000

0.016

0.020

TRACK :

S<sub>BACK</sub> =

 $S_0 =$ 

n<sub>STREET</sub> =

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
	===	5-	

ft/ft

ft/ft

### Maximum Capacity for 1/2 Street based On Allowable Spread Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") Gutter Depression (d<sub>C</sub> - (W \*  $S_x$  \* 12)) Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_x$ 

Discharge within the Gutter Section W  $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor)

Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

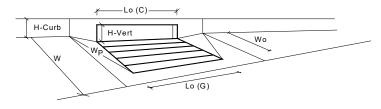
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	_
y =	3.84	3.84	inches
d <sub>C</sub> =	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
$E_0 =$	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
d <sub>CROWN</sub> =			inches

o -	Minor Storm SUMP	Major Storm SUMP	cfs
$Q_{allow} =$	SUMP	SUMP	CIS

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



Type Local Number Wate Grate Lengt Width Area Clogg Grate Curb Lengt Heigh Heigh Heigh Heigh Heigh Inter Clogg Grate Inter Inter Inter Grate Inter Inter Inter Grate Inter Inter Inter Grate Inter Inter Inter Inter Grate Inter Int	nber of Unit Inlets (Grate or of the Publish of a Unit Grate the Information of Information o	of local depression)  sypical values 0.15-0.90) e (typical value 0.50 - 0.70) lue 2.15 - 3.60) value 0.60 - 0.80)  In Inches nches rre ST-5) ypically the gutter width of 2 feet) Opening (typical value 0.10) ypical value 2.3-3.7) (typical value 0.60 - 0.70) d) Juits is ed on Modified HEC22 Method)	Type  alocal No Ponding Depth  Lo (G) Wo Aratio Cr (G) Cw (G) Cv (G) Cv (G) Cv (C)	= 3.00 = 1 4.3 MINOR = N/A = N/A = N/A = N/A = N/A = N/A MINOR = S.00 = 6.00 = 6.00 = 6.00 = 6.3.40 = 2.00 = 0.10 = 3.60 = 0.67 MINOR = N/A = N/A MINOR = N/A = N/A MINOR	MAJOR Curb Opening 3.00 1 8.0 MAJOR N/A	inches inches inches inches inches feet feet feet inches inches degrees feet
Local Numl Wate Grate Lengi Width Area Clogg Grate Curb Lengi Heigi Heigi Heigi Heigi Heigi Inter Clogg Curb Grate Clogg Grate Inter Inter Inter Inter Inter Inter Inter Grate Inter Inter Grate Inter Inter Grate Inter Inter Inter Inter Grate Inter Inter Inter Inter Inter Inter Inter Grate Inter	al Depression (additional to comber of Unit Inlets (Grate or of Unit Inlets (Grate or of Unit Inlets) (Grate or of Unit Grate of Unit	curb Opening) of local depression)  Expical values 0.15-0.90) e (typical value 0.50 - 0.70) lue 2.15 - 3.60) value 0.60 - 0.80)  In Inches nches nches nches value 0.60 - 0.80  Opening (typical value 0.10) vpical value 2.3-3.7) (typical value 0.60 - 0.70) d) Units ed on Modified HEC22 Method)	alocal No Ponding Depth  Lo (G) Wo Aratio Cr (G) Co (G)  Lo (C) Hvert Hthrosta Threta Wp Cr (C) Cw (	= 3.00 = 1 4.3 MINOR = N/A = N/A = N/A = N/A = N/A = N/A MINOR = S.00 = 6.00 = 6.00 = 6.00 = 6.3.40 = 2.00 = 0.10 = 3.60 = 0.67 MINOR = N/A = N/A MINOR = N/A = N/A MINOR	3.00  1  8.0  MAJOR  N/A  N/A  N/A  N/A  N/A  N/A  MAJOR  5.00  6.00  6.00  63.40  2.00  0.10  3.60  0.67  N/A  N/A  N/A  N/A  N/A  MAJOR  N/A  N/A  N/A  N/A  MAJOR  N/A  N/A  N/A  MAJOR	feet feet inches feet inches feet cfs cfs cfs
Numl Wate Grate Lengi Widti Area Clogg Grate Grate Lengi Heigh Heigh Heigh Grate Clogg Curb Grate Clogg Curb Grate Inter	nber of Unit Inlets (Grate or of the Depth at Flowline (outside the Information of Inf	curb Opening) of local depression)  Expical values 0.15-0.90) e (typical value 0.50 - 0.70) lue 2.15 - 3.60) value 0.60 - 0.80)  In Inches nches nches nches value 0.60 - 0.80  Opening (typical value 0.10) vpical value 2.3-3.7) (typical value 0.60 - 0.70) d) Units ed on Modified HEC22 Method)	No Ponding Depth  L <sub>0</sub> (G) W <sub>0</sub> Aratio Cr (G) C <sub>w</sub> (G) C <sub>0</sub> (G)  L <sub>0</sub> (C) H <sub>throat</sub> Theta W <sub>p</sub> Cr (C) C <sub>w</sub> (C) C <sub>o</sub> (C)	= 1	1 8.0 MAJOR N/A	feet feet inches feet inches feet cfs cfs cfs
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Angle Angle Side Side Side Side Side Side Side Sid	le of Throat (see USDCM Figure Width for Depression Pan (to Depression Pan (to Depression Pan (to Depression Pan (to Depening Weir Coefficient (to Depening Orifice Coefficient (to Depening Orifice Coefficient to Depening Orifice Coefficient for Multiple giging Factor for Multiple Units to Capacity as a Weir (baserception without Clogging erception with Clogging to Capacity as a Orifice (bierception without Clogging erception with Clogging to Capacity as a Mixed Flow erception with Clogging to Capacity as a Mixed Flow erception with Clogging	ure ST-5) ypically the gutter width of 2 feet) Opening (typical value 0.10) ypical value 2.3-3.7) (typical value 0.60 - 0.70) d) Jnits jed on Modified HEC22 Method)	Theta W <sub>p</sub> C <sub>f</sub> (C) C <sub>w</sub> (C) C <sub>o</sub> (C)  Coef Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>oa</sub>	= 63.40 = 2.00 = 0.10 = 3.60 = 0.67 MINOR = N/A MINOR = N/A MINOR = N/A MINOR = N/A N/A MINOR = N/A N/A	63.40 2.00 0.10 3.60 0.67 MAJOR N/A MAJOR N/A MAJOR N/A N/A MAJOR N/A N/A	degrees feet cfs cfs
g 1 Side 'Clogg Curb' Curb Curb Grate Interval I	width for Depression Pan (t gging Factor for a Single Curt b Opening Weir Coefficient (t b Opening Orifice Coefficient te Flow Analysis (Calculate gging Coefficient for Multiple gging Factor for Multiple te Capacity as a Weir (bas erception with Clogging erception with Clogging erception without Clogging erception without Clogging erception with Clogging te Capacity as Mixed Flow erception without Clogging erception without Clogging	ypically the gutter width of 2 feet) Opening (typical value 0.10) ypical value 2.3-3.7) (typical value 0.60 - 0.70) d) Units ed on Modified HEC22 Method)	W <sub>p</sub> C <sub>f</sub> (C) C <sub>w</sub> (C) C <sub>o</sub> (C) Coef Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>oa</sub>	= 2.00 = 0.10 = 3.60 = 0.67 = N/A = N/A = N/A = N/A = N/A = N/A = N/A = N/A = N/A = N/A	2.00 0.10 3.60 0.67 MAJOR N/A N/A MAJOR N/A MAJOR N/A N/A N/A N/A N/A N/A	cfs
Clogg Curb Curb Gratt Clogg Gratt Inter In	gging Factor for a Single Curt to Opening Weir Coefficient (t b Opening Orifice Coefficient to Opening Orifice Coefficient te Flow Analysis (Calculate aging Coefficient for Multiple Unit te Capacity as a Weir (bas crception with Ologging reception with Clogging reception without Clogging reception with Clogging reception with Clogging te Capacity as Mixed Flow proception without Clogging reception with Clogging reception with Clogging reception with Clogging	Opening (typical value 0.10) ypical value 2.3-3.7) (typical value 0.60 - 0.70) d) Units ed on Modified HEC22 Method) ased on Modified HEC22 Method)	C <sub>f</sub> (C) C <sub>w</sub> (C) C <sub>o</sub> (C) Coef Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>oi</sub>	= 0.10 = 3.60 = 0.67 MINOR = N/A = N/A MINOR = N/A = N/A MINOR = N/A = N/A = N/A	0.10 3.60 0.67 MAJOR N/A MAJOR N/A N/A MAJOR N/A N/A MAJOR	cfs cfs cfs
Curb Curb Grate Grate Intere	o Opening Weir Coefficient (to Opening Orifice Coefficient to Opening Orifice Coefficient to Flow Analysis (Calculate ging Coefficient for Multiple ging Factor for Multiple Units the Capacity as a Weir (baserception with Clogging erception with Clogging the Capacity as a Orifice (biserception with Clogging erception with Clogging the Capacity as Mixed Flow erception with Clogging the Capacity as Mixed Flow erception without Clogging the Capacity as Mixed Flow erception with Clogging erception with Clogging erception with Clogging	ypical value 2.3-3.7) (typical value 0.60 - 0.70) d) Units ed on Modified HEC22 Method)	C <sub>w</sub> (C) C <sub>o</sub> (C) Coef Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>oa</sub>	= 3.60 = 0.67 MINOR = N/A = N/A MINOR = N/A MINOR = N/A MINOR = N/A MINOR = N/A	3.60 0.67 MAJOR N/A N/A MAJOR N/A N/A MAJOR N/A N/A	cfs cfs
Curb Gratt Clogg Clogg Grate Inter Inter Gratt Inter Inter Inter Gratt Inter Grate Inter Grate Inter Inter Grate Inter I	b Opening Orifice Coefficient te Flow Analysis (Calculate gging Coefficient for Multiple gging Factor for Multiple gging Factor for Multiple Units te Capacity as a Weir (bas erception without Clogging erception with Clogging te Capacity as a Orifice (bi erception without Clogging erception with Clogging te Capacity as Mixed Flow erception without Clogging te Capacity as Mixed Flow erception without Clogging erception with Clogging	(typical value 0.60 - 0.70) d) Units sied on Modified HEC22 Method)	C <sub>o</sub> (C)  Coef Clog  Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>ol</sub> Q <sub>oa</sub>	= 0.67  MINOR = N/A N/A MINOR = N/A MINOR = N/A N/A N/A N/A MINOR = N/A N/A MINOR N/A MINOR N/A N/A	0.67  MAJOR N/A N/A MAJOR N/A MAJOR N/A N/A MAJOR N/A MAJOR N/A N/A	cfs cfs
Curb Grate Clogg Clogg Grate Intere Intere Intere Intere Intere Grate Intere Corb Clogg Curb Intere Clogg Curb Intere	b Opening Orifice Coefficient te Flow Analysis (Calculate gging Coefficient for Multiple gging Factor for Multiple gging Factor for Multiple Units te Capacity as a Weir (bas erception without Clogging erception with Clogging te Capacity as a Orifice (bi erception without Clogging erception with Clogging te Capacity as Mixed Flow erception without Clogging te Capacity as Mixed Flow erception without Clogging erception with Clogging	(typical value 0.60 - 0.70) d) Units sied on Modified HEC22 Method)	C <sub>o</sub> (C)  Coef Clog  Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>ol</sub> Q <sub>oa</sub>	= 0.67  MINOR = N/A N/A MINOR = N/A MINOR = N/A N/A N/A N/A MINOR = N/A N/A MINOR N/A MINOR N/A N/A	0.67  MAJOR N/A N/A MAJOR N/A MAJOR N/A N/A MAJOR N/A MAJOR N/A N/A	cfs cfs
Grate Clogg Grate Intere	te Flow Analysis (Calculate gging Coefficient for Multiple gging Factor for Multiple Units te Capacity as a Weir (bas erception with Clogging erception with Clogging erception without Clogging erception with Clogging te Capacity as Mixed Flow erception with Clogging te Capacity as Mixed Flow erception with Clogging erception with Clogging erception with Clogging	d) Units ed on Modified HEC22 Method) ased on Modified HEC22 Method)	Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>ol</sub> Q <sub>oa</sub>	= N/A = N/A MINOR = N/A = N/A MINOR = N/A MINOR = N/A	N/A N/A N/A MAJOR N/A N/A N/A MAJOR N/A N/A N/A	cfs cfs
Clogg Craft Intern Intern Intern Intern Intern Intern Intern Curb Clogg Clogg Curb	gging Coefficient for Multiple Ingging Factor for Multiple Unit to Capacity as a Weir (bas reception with Clogging reception with Clogging te Capacity as a Orifice (bis reception with Clogging reception with Clogging reception with Clogging te Capacity as Mixed Flow reception without Clogging reception with Clogging reception with Clogging	Units sed on Modified HEC22 Method) assed on Modified HEC22 Method)	Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>ol</sub> Q <sub>oa</sub>	= N/A = N/A MINOR = N/A = N/A MINOR = N/A MINOR = N/A	N/A N/A N/A MAJOR N/A N/A N/A MAJOR N/A N/A N/A	cfs cfs
Clogg Grate Interd Interd Interd Interd Interd Interd Interd Curb Clogg Clogg Curb Interd	Iging Factor for Multiple Units to Capacity as a Weir (bas creeption without Clogging to Capacity as a Orifice (bis creeption with Clogging to Capacity as a Orifice (bis creeption with Clogging to Capacity as Mixed Flow creeption without Clogging to Capacity as Mixed Flow creeption without Clogging creeption with Clogging creeption with Clogging creeption with Clogging	ed on Modified HEC22 Method) ased on Modified HEC22 Method)	Clog Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>ol</sub> Q <sub>oa</sub>	= N/A MINOR = N/A = N/A MINOR = N/A = N/A	N/A MAJOR N/A N/A MAJOR N/A N/A	cfs cfs
Grate Interest Interes	te Capacity as a Weir (bas preption without Clogging preption with Clogging te Capacity as a Orifice (bas preption with Clogging te Capacity as Mixed Flow preption with Clogging preption with Clogging	ed on Modified HEC22 Method) ased on Modified HEC22 Method)	Q <sub>wi</sub> Q <sub>wa</sub> Q <sub>oi</sub> Q <sub>oa</sub>	MINOR = N/A = N/A MINOR = N/A = N/A = N/A = N/A	MAJOR N/A N/A MAJOR N/A N/A	cfs cfs
Intervalue	reception without Clogging reception with Clogging te Capacity as a Orifice (bi- reception without Clogging reception with Clogging te Capacity as Mixed Flow reception with Clogging reception with Clogging	ased on Modified HEC22 Method)	Q <sub>wa</sub> Q <sub>oi</sub> Q <sub>oa</sub>	= N/A = N/A MINOR = N/A = N/A	N/A N/A MAJOR N/A N/A	cfs cfs
Interest Int	erception with Clogging te Capacity as a Orifice (bi erception without Clogging erception with Clogging te Capacity as Mixed Flow erception without Clogging erception with Clogging	,	Q <sub>wa</sub> Q <sub>oi</sub> Q <sub>oa</sub>	= N/A MINOR = N/A = N/A	N/A MAJOR N/A N/A	cfs cfs
Grate Interes	te Capacity as a Orifice (bi creption without Clogging creeption with Clogging te Capacity as Mixed Flow creeption without Clogging creeption with Clogging	,	$\begin{array}{c}Q_{oi}\\Q_{oa}\end{array}$	MINOR = N/A = N/A	MAJOR N/A N/A	cfs
Interview Interv	erception without Clogging erception with Clogging te Capacity as Mixed Flow erception without Clogging erception with Clogging	,	$Q_{oa}$	= N/A = N/A	N/A N/A	
Interded Int	erception with Clogging te Capacity as Mixed Flow erception without Clogging erception with Clogging		$Q_{oa}$	= N/A	N/A	
Grate Interes Interes Resul Curb Clogg Clogg Curb Interes	te Capacity as Mixed Flow erception without Clogging erception with Clogging					cfs
Interd Interd Resul Curb Clogg Clogg Curb Interd	erception without Clogging erception with Clogging					
Interd Interd Resul Curb Clogg Clogg Curb Interd	erception without Clogging erception with Clogging		^	MINOR	MAJOR	_
Interest Result Curb Clogg Curb Interest	erception with Clogging		Umi		N/A	Tcfs T
Resul Curb Clogg Clogg Curb Interd			Q <sub>ma</sub>	= N/A	N/A	cfs
Curb Clogg Clogg Curb Intere		es clogged condition)	Q <sub>Grate</sub>		N/A	cfs
Clogg Clogg <u>Curb</u> Intere	b Opening Flow Analysis (	Salculated)	Corace	MINOR	MAJOR	
Clogg Curb Inter	ging Coefficient for Multiple		Coef		1.00	$\neg$
Curb Inter					0.10	_
Inter	gging Factor for Multiple Units		Clog			_
		d on Modified HEC22 Method)		MINOR	MAJOR	¬ .
	rception without Clogging		$Q_{wi}$		10.8	cfs
	rception with Clogging		$Q_{wa}$		9.7	cfs
		ased on Modified HEC22 Method)		MINOR	MAJOR	
Inter	rception without Clogging	-	$Q_{oi}$	= 8.3	11.2	cfs
Inter	erception with Clogging		$Q_{oa}$		10.1	cfs
	b Opening Capacity as Mix	ed Flow	Cou	MINOR	MAJOR	_
	rception without Clogging	<del></del>	$Q_{mi}$		10.2	cfs
	rception with Clogging		Q <sub>ma</sub>		9.2	cfs
		(assumes clogged condition)	Q <sub>Curb</sub>		9.2	cfs
Doc	sultant Street Conditions	(assumes cioqqea coffallion)	*Curb	MINOR	MAJOR	
						76
	al Inlet Length		L		5.00	feet
		sed on street geometry from above)	. Т		30.7	ft.>T-Crown
Resul	ultant Flow Depth at Street C	rown	$d_{CROWN}$	= 0.0	3.5	inches
	v Head Performance Reduce	tion (Calculated)		MINOR	MAJOR	_
Dept	th for Grate Midwidth		$d_{Grate}$		N/A	ft
Dept	th for Curb Opening Weir Equ	uation	d <sub>Curb</sub>		0.60	ft
					1.00	ヿ
	nbination Inlet Performance F	eduction Factor for Long Inlets	RFcombination	=1 0.55		
		eduction Factor for Long Inlets	RF <sub>Combination</sub>		1.00	⊣
Giale	b Opening Performance Redu	ction Factor for Long Inlets	RF <sub>Curb</sub>	= 1.00	1.00 N/A	7
		ction Factor for Long Inlets		= 1.00	1.00 N/A	
	b Opening Performance Redu	ction Factor for Long Inlets	RF <sub>Curb</sub>	= 1.00 = N/A	N/A	
Total	b Opening Performance Redu	ction Factor for Long Inlets ion Factor for Long Inlets	RF <sub>Curb</sub>	= 1.00 = N/A MINOR		cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

TRACK =

SBACK

n<sub>BACK</sub> =

H<sub>CURB</sub> =

T<sub>CROWN</sub> =

S<sub>X</sub> =

 $S_0 =$ 

n<sub>STREET</sub> =

0.020

0.020

6.00

16.0

0.83

0.020

0.083

0.000

0.016

ft/ft

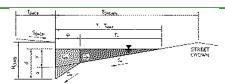
linches

ft/ft

ft/ft

ft/ft

Project: Grandview Reserve
Inlet ID: Basin B-1 (DP 9)



### Gutter Geometry

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

	MILLOL STOLLI	Major Storm	_
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_x$ 

Discharge within the Gutter Section W  $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

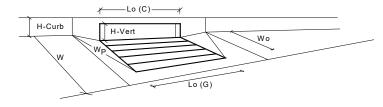
MINOR STO	RM Allowable Ca RM Allowable Ca	pacity is base	d on Depth	Criterion
MAJOR STO	RM Allowable Ca	pacity is base	d on Depth	Criterion

	Minor Storm	Major Storm	
y =	3.84	3.84	inches
$d_C =$	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
E <sub>0</sub> =	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} = [$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W = $	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
d <sub>CROWN</sub> =			inches

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

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

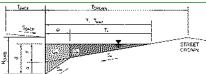


-	CDOT Type R Curb Opening				
	esign Information (Input)	_	MINOR	MAJOR	_
	pe of Inlet	Type =	CDOT Type R		
	cal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
	ımber of Unit Inlets (Grate or Curb Opening)	No =	1	1	Override Depth:
	ater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	ate Information	_	MINOR	MAJOR	_
	ngth of a Unit Grate	$L_o(G) =$	N/A	N/A	feet
	dth of a Unit Grate	$W_o =$	N/A	N/A	feet
Are	ea Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
	ogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_f(G) =$	N/A	N/A	
Gra	ate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Gra	ate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	
Cu	urb Opening Information	_	MINOR	MAJOR	_
Ler	ngth of a Unit Curb Opening	$L_0(C) = \Gamma$	15.00	15.00	feet
	eight of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	eight of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	gle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	de Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
	ogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	-1000
	rb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	
	rb Opening Orifice Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	0.67	0.67	-
	ate Flow Analysis (Calculated)	G <sub>0</sub> (G)	MINOR	MAJOR	
		Coef =			7
	ogging Coefficient for Multiple Units		N/A	N/A	_
	ogging Factor for Multiple Units	Clog =	N/A	N/A	
	rate Capacity as a Weir (based on Modified HEC22 Method)	۰ ٦	MINOR	MAJOR	¬ ,
	terception without Clogging	$Q_{wi} =$	N/A	N/A	cfs
	terception with Clogging	$Q_{wa} = $	N/A	N/A	cfs
	rate Capacity as a Orifice (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
	terception without Clogging	$Q_{oi} = $	N/A	N/A	cfs
	terception with Clogging	$Q_{oa} = $	N/A	N/A	cfs
	ate Capacity as Mixed Flow	_	MINOR	MAJOR	_
	terception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
	terception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Re	sulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Cu	rb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clo	ogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clo	ogging Factor for Multiple Units	Clog =	0.04	0.04	
Cu	urb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	_
Int	terception without Clogging	$Q_{wi} = \Gamma$	6.3	22.5	cfs
Int	terception with Clogging	Q <sub>wa</sub> =	6.1	21.5	cfs
	urb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
	terception without Clogging	$Q_{oi} = \Gamma$	25.2	32.9	cfs
	terception with Clogging	Q <sub>oa</sub> =	24.1	31.5	cfs
	urb Opening Capacity as Mixed Flow	-coa - [	MINOR	MAJOR	J
	terception without Clogging	Q <sub>mi</sub> =	11.8	25.3	cfs
	terception with Clogging	Q <sub>mi</sub> – Q <sub>ma</sub> =	11.2	24.2	cfs
	sulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.1	21.5	- cfs
ID A	esultant Street Conditions	*Curb =	MINOR	MAJOR	10.3
		. г			Teach
	tal Inlet Length	L =	15.00	15.00	feet
	sultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
Re	sultant Flow Depth at Street Crown	$d_{CROWN} = $	0.0	3.2	inches
Lo	w Head Performance Reduction (Calculated)		MINOR	MAJOR	
	epth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	∏ft
	epth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	⊣ft
	mbination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	⊣``
	rb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.41	0.72	⊣
	ated Inlet Performance Reduction Factor for Long Inlets	DE _	N/A	N/A	┥
Gra	ated trief renormance Reduction Factor for Long Tillets	$RF_{Grate} = $	IN/A	N/A	_
			MINOR	MAJOR	
Tot	tal Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	6.1	21.5	cfs
	let Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	5.3	12.5	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin B-2 (DP 10a)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.020 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm $\mathsf{T}_{\mathsf{MAX}}$ Max. Allowable Spread for Minor & Major Storm 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depth between Gutter Lip and Gutter Depression ( $d_C - (W * S_x * 12))$ ) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>0</sub> = Discharge within the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $T_X$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread $\,Q_X\,$ cfs 10.3 10.3 1.8 1.8 $Q_W =$ cfs Q<sub>BACK</sub> = cfs Q<sub>T</sub> = cfs 12.1 12.1

Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. S1-/)	E <sub>0</sub> =	0.153	0.079	
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>XTH</sub>	Q <sub>X TH</sub> =	9.5	55.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )	Q <sub>X</sub> =	9.5	48.2	cfs
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )	$Q_W =$	1.7	4.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	1.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.2	54.0	cfs
Average Flow Velocity Within the Gutter Section	V =	1.1	1.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.4	1.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.83	
Max Flow Based on Allowable Depth (Safety Factor Applied)	$Q_d =$	11.2	45.0	cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.36	7.17	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} =$	0.00	2.70	inches
MINOR STORM Allowable Capacity is based on Depth Criterion		Minor Storm	Major Storm	-

interest of orally allowable capacity is based on bepair officialist	_	1 111101 0001111	r lajor ocoriii	_
MAJOR STORM Allowable Capacity is based on Depth Criterion Q	2 <sub>allow</sub> =	11.2	45.0	cfs
Minor storm max. allowable capacity GOOD - greater than the design flow given on	sheet '	Inlet Managem	ent'	_
Major storm max, allowable capacity GOOD - greater than the design flow given on	sheet '	Inlet Managem	ent'	

fps

1.1

Major Storm

29.4

28.6

1.1

0.4

15.6

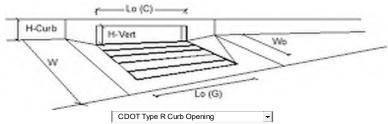
14.7

V\*d =

T<sub>TH</sub> =

 $T_{X}$ <sub>TH</sub> =

# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	· · ·	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	a <sub>LOCAL</sub> = No =	3.0	3.0	Inches
				-ft
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	10.00	10.00	
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_f$ - $G =$	N/A	N/A	
Clogqing Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	٦. ا
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o =$	7.1	16.7	cfs
Water Spread Width	T =	13.1	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.8	5.0	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	$d_{CROWN} = 1$	0.0	0.5	inches
Ratio of Gutter Flow to Design Flow	$E_o =$	0.184	0.131	
Discharge outside the Gutter Section W, carried in Section $T_x$	$Q_x =$	5.8	14.5	cfs
Discharge within the Gutter Section W	$Q_w =$	1.3	2.2	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W =$	0.23	0.32	sq ft
Velocity within the Gutter Section W	$V_W =$	5.7	6.9	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.8	8.0	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	
<u>Under No-Clogging Condition</u>	_	MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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	$\hat{Q_i} =$	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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, =	N/A	N/A	∃ft I
Minimum Velocity Where Grate Splash-Over Begins	V <sub>0</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	- 1
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	
Actual Interception Capacity	<b>Q</b> a =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>3.</b> 0	MINOR	MAJOR	10.0
Equivalent Slope $S_{\rho}$ (based on grate carry-over)	S <sub>e</sub> =	0.087	0.068	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> =	16.94	29.43	ft I
Under No-Clogging Condition	-1 - [	MINOR	MAJOR	J.,
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	10.00	10.00	∃ft
Interception Capacity	Q <sub>i</sub> =	5.7	8.8	cfs
Under Clogging Condition	Qi - [	MINOR	MAJOR	Ju <sub>2</sub>
Clogging Coefficient	CurbCoef =	1.25	1.25	٦ ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.06	0.06	-
Effective (Unclogged) Length	Curbciog = L	8.75	8.75	-ft
			8.75 <b>8.4</b>	_⊓π cfs
Actual Interception Capacity	Q <sub>a</sub> =	5.5 1.6		
Carry-Over Flow = Q <sub>b(GRATE)</sub> -Q <sub>a</sub>	Q <sub>b</sub> =		8.3 MAJOR	cfs
Summary Total Talet Interception Conneits	<b>.</b> [	MINOR		ا ا
Total Inlet Interception Capacity	Q =	5.5	8.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	1.6	8.3	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	77	50	%

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

TRACK =

S<sub>BACK</sub> =

 $d_C =$ 

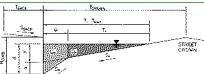
a =

d =

 $T_X =$ 

 $d_{CROWN} =$ 

Project: Grandview Reserve
Inlet ID: Basin B-3 (DP 10b)



## Gutter Geometry: Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown Gutter Width Street Transverse Slope Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm Max. Allowable Depth at Gutter Flowline for Minor & Major Storm Check boxes are not applicable in SUMP conditions

$n_{BACK} =$	0.020		
$H_{CURB} =$	6.00	inches	
$T_{CROWN} =$	16.0	ft	
W =	0.83	ft	
$S_X =$	0.020	ft/ft	
$S_W =$	0.083	ft/ft	
$S_0 =$	0.000	ft/ft	
n <sub>street</sub> =	0.016		
	Minor Storm	Major Storm	
Tuny =	16.0	16.0	ft

inches

nches

inches inches

inches

cfs

cfs

cfs

Major Storm

0.63

4.47

15.2

0.149

0.0

0.0

0.0

ft/ft

0.020

Minor Storm

0.8

0.63

4.47

15.2

Maximum Capacity for 1/2 Street based On Allowable Spread
Water Depth without Gutter Depression (Eq. ST-2)
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")
Gutter Depression (d <sub>C</sub> - (W * S <sub>x</sub> * 12))
Water Depth at Gutter Flowline
Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Disc

Gutter Flow to Design Flow Ratio by FRWA REC-22 metriou (Eq. 31-7)	E0 − [	0.149
Discharge outside the Gutter Section W, carried in Section T <sub>X</sub>	$Q_X =$	0.0
Discharge within the Gutter Section W (Q <sub>T</sub> - Q <sub>X</sub> )	$Q_W = $	0.0
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0
Maximum Flow Based On Allowable Spread	$Q_T = $	SUMP
Flow Velocity within the Gutter Section	V =	0.0
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	_	Minor Storn

ı	Theoretical Water Spread
I	Theoretical Spread for Discharge outside the Gutter Section W (T - W)
I	Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
I	Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
I	Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
I	Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
I	Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
I	Total Discharge for Major & Minor Storm (Pre-Safety Factor)
I	Average Flow Velocity Within the Gutter Section
I	V*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

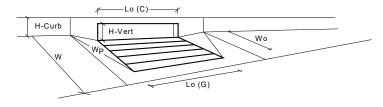
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_T =$	SUMP SUMP		cts
V =	0.0 0.0		fps
V*d =	0.0	0.0	
			_
	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =		· ·	inches

	Minor Storm	Major Storm	
O F	SIIMD	SIIMD	Tofo

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

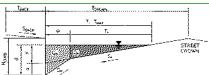


	CDOT Type R Curb Opening	▼			
Design Inform	nation (Input)	_	MINOR	MAJOR	_
Type of Inlet		Type =		Curb Opening	
	on (additional to continuous gutter depression 'a' from ab	oove) $a_{local} = $	3.00	3.00	inches
	Inlets (Grate or Curb Opening)	No =	4	4	Override Depth
Water Depth at	Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
Grate Informa	<u>tion</u>	_	MINOR	MAJOR	<del></del>
Length of a Uni	t Grate	L <sub>0</sub> (G) =	N/A	N/A	feet
Width of a Unit	Grate	W <sub>0</sub> =	N/A	N/A	feet
Area Opening F	latio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
	for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
	fficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
	pefficient (typical value 0.60 - 0.80)	C <sub>0</sub> (G) =	N/A	N/A	-
Curb Opening		38 (3)	MINOR	MAJOR	_
	t Curb Opening	$L_{0}(C) = \Gamma$	5.00	5.00	lfeet
	cal Curb Opening in Inches	* * * *	6.00	6.00	inches
		H <sub>vert</sub> =			inches
	Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	
	(see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
	for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
	Veir 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 <sub>o</sub> (C) =	0.67	0.67	
Grate Flow Ar	alysis (Calculated)		MINOR	MAJOR	•
	cient for Multiple Units	Coef = □	N/A	N/A	7
	for Multiple Units	Clog =	N/A	N/A	-
	y as a Weir (based on Modified HEC22 Method)	clog – L	MINOR	MAJOR	_
Interception wi		$Q_{wi} = \Gamma$	N/A	N/A	ີ່ cfs
Interception wi		$Q_{wa} = L$	N/A	N/A	cfs
	y as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	<b>-</b> -
Interception wi		$Q_{oi} = $	N/A	N/A	cfs
Interception wi		Q <sub>oa</sub> =	N/A	N/A	cfs
Grate Capacit	as Mixed Flow	_	MINOR	MAJOR	<del></del>
Interception wi	thout Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception wi		Q <sub>ma</sub> =	N/A	N/A	cfs
	Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening	Flow Analysis (Calculated)	Contact	MINOR	MAJOR	
	cient for Multiple Units	Coef =	1.33	1.33	7
	for Multiple Units	Cloq =	0.03	0.03	-
		ciog = [	MINOR		
	as a Weir (based on Modified HEC22 Method)	۰ ۲		MAJOR	٦,
Interception wi		$Q_{wi} =$	10.0	35.4	cfs
Interception wi		$Q_{wa} = L$	9.7	34.3	cfs
	as an Orifice (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
Interception wi	thout Clogging	$Q_{oi} = $	33.6	43.9	cfs
Interception wi	th Clogging	$Q_{oa} =$	32.5	42.4	cfs
	Capacity as Mixed Flow	200 [	MINOR	MAJOR	-
Interception wi		Q <sub>mi</sub> =	17.0	36.7	cfs
Interception wi		Q <sub>ma</sub> =	16.5	35.5	cfs
		Q <sub>Curb</sub> =	9.7	34.3	cfs
Docultant Chic	Opening Capacity (assumes cloqged condition)	₹Curb =	MINOR	MAJOR	10.3
Resultant Stre					76
Total Inlet Leng		<u>L</u> = L	20.00	20.00	feet
	t Flow Spread (based on street geometry from above)	_ T = L	15.6	29.4	ft.>T-Crown
Resultant Flow	Depth at Street Crown	$d_{CROWN} =$	0.0	3.2	inches
Low Head Per	formance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate	e Midwidth	d <sub>Grate</sub> =	N/A	N/A	∏ft
	Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	- ft
	let Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	<b>⊣</b>
	Performance Reduction Factor for Long Inlets		0.67	0.72	┪
	rformance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =			-
lerated Thief be	normance Reduction Factor for Long InletS	$RF_{Grate} = $	N/A	N/A	
			MINIOD	MAJOR	
Total Inlat I	rception Capacity (assumes cloqged condition)	<b>Q</b> <sub>a</sub> = [	MINOR 9.7	MAJOR 34.3	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin B-4 (DP 11)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = 8.0 Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.013 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> = linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 17.0 2.00 Gutter Width Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.000 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm $\mathsf{T}_{\mathsf{MAX}}$ Max. Allowable Spread for Minor & Major Storm Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 6.0 inches Check boxes are not applicable in SUMP conditions Maximum Capacity for 1/2 Street based On Allowable Spread Water Depth without Gutter Depression (Eq. ST-2) Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") Gutter Depression (d<sub>c</sub> - (W \* $S_x$ \* 12)) Water Depth at Gutter Flowline Allowable Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $W(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

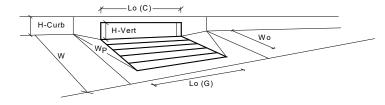
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)	
MINOR STORM Allowable Capacity is based on Depth Criterion MATOR STORM Allowable Capacity is based on Depth Criterion	

	Minor Storm	Major Storm	_
y =	2.76	4.08	inches
$d_C =$	2.0	2.0	inches
a =	1.51	1.51	inches
d =	4.27	5.59	inches
T <sub>X</sub> =	9.5	15.0	ft
E <sub>0</sub> =	0.511	0.350	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
	Minor Storm	Major Storm	_
$T_{TH} =$	18.7	27.0	ft
$T_{XTH} =$	16.7	25.0	ft
E <sub>o</sub> =	0.318	0.216	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
$d_{CROWN} =$			inches

	Minor Storm	Major Storm	
Q <sub>allow</sub> =	SUMP	SUMP	cfs

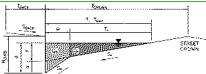
## INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



Design Information Linguist   Type of Information (additional to continuous gutter depression 'a' from above)   No	CDOT Type R Curb Opening   ▼				
Local Depression (additional to continuous quiter depression 'a' from above)   Nacer at   3.00   3.00   3.00   1.0   1	Design Information (Input)				_
Number of Unit Inlets (Grate or Curb Opening)   No     3   3		Type =			
Water Depth at Flowline (outside of local depression)   Ponding Depth     4.3   5.6   Inches (rate Lingtonia)   Cargatin (and the Care)   (a)   (b)   (b)   (c)					
Grate Information					
Length of a Unit Grate   Victor of a Single Grate (typical value 0.50 - 0.70)   Auto		Ponding Depth =			inches
Width of a Unit Grate					٦
Apea Opening Ratio for a Grate (typical values 0.15-0.90)					
Cogging Factor for a Single Grate (typical value 0.50 - 0.70)   C <sub>1</sub> (G) =   N/A					feet
Grate Weir Coefficient (typical value 2.15 - 3.60)  Carb Opinion Certificent (typical value 0.60 - 0.80)  Curb Opening Information  Length of a luft Curb Opening in Inches  Height of Vertical Curb Opening in Inches  Height of Curb Opening (typical value 0.10)  Clogging Factor for a Single Curb Opening (typical value 0.10)  Curb Opening Office Coefficient (typical value 0.10)  Curb Opening Office Coefficient (typical value 0.60 - 0.70)  Grate Flow Analysis (Calculated)  Clogging Factor for Multiple Units  Clogging Card Capacity as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Grate Capacity as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Grate Capacity as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Grate Capacity as a Weir (based on Modified HEC22 Method)  Interception with Clogging  Grate Capacity as Always (Calculated)  Curb Opening Always (Calculated)  Quis = N/A N/A N/A  Interception with Clogging  Interception with Clogging  Grate Capacity as Mixed Flow  Interception with Clogging  Interception with Clogging  Quis = N/A N/A N/A  Interception with Clogging  Interception with Clogging  Interception with Clogging  Interception with Clogging  Quis = N/A N/A N/A  Interception with Clogging  Interception with Clogging  Quis = N/A N/A N/A  Interception with Clogging  Interception with Clogging  Quis = N/A N/A N/A					
Grate Orline (typical value 0.60 - 0.80)					
Curb Opening Information				,	
Length of a Unit Curb Opening in Inches		C₀ (G) −[			
Height of Vertical Curb Opening in Inches   Height of Curb Opfice Throat in Inches   Height of Curb Orifice Throat in Inches   Height of Curb Orifice Throat in Inches   Height of Curb Office Curb Office (Spiral Value 2.75)   The tata   63.40   63.40   degrees   Good office Curb Office (Opening Verto Opening (typical value 0.10)   C. (C) = 0.10   0.10		L (C) -[			Teet
Hejota of Curb Orifice Throat in Inches   Angle of Throat (See USDOM Figure ST-5)   The tate					
Angle of Throat (see USDCM Figure ST-5)					
Sude Width for Depression Pan (typically the gutter width of 2 feet)					
Cogging Factor for a Single Curb Opening (typical value 0.10)					
Curb Opening Weir Coefficient (typical value 2.3-3.7)         C <sub>0</sub> (C) = 0.657         0.67           Curb Opening Orfice Coefficient (typical value 0.60 - 0.70)         C <sub>0</sub> (C) = 0.657         0.67           Grate Flow Analysis (Calculated)         MINOR         MAJOR           Clogging Factor for Multiple Units         Coe = N/A N/A N/A         N/A N/A           Grate Capacity as a Weir (based on Modified HEC22 Method)         MINOR         MAJOR           Interception without Clogging         Q <sub>m</sub> = N/A N/A N/A N/A Cfs         MINOR           Interception without Clogging         Q <sub>m</sub> = N/A N/A N/A N/A Cfs         MINOR           Interception without Glogging         Q <sub>m</sub> = N/A					Hicci
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)   C_0^2 (C)   =   0.67					
Grate Flow Analysis (Calculated)		C, (C) =			-
Clogging Coefficient for Multiple Units   Clogs   N/A   N/		-0 (-7			
Clogging Factor for Multiple Units   Clog =   N/A   N/A   N/A   Grate Capacity as a Weir (based on Modified HEC22 Method)   N/A		Coef =			7
Sirate Capacity as a Weir (based on Modified HEC22 Method)   Interception without Clogging   Qw					
Interception without Clogging		c.09 [			_
Interception with Clogging		O <sub>wi</sub> = [			☐cfs
Strate Capacity as a Orifice (based on Modified HEC22 Method)   Qoi = N/A N/A N/A Cfs   Interception with Ologging   Qoi = N/A			N/A	N/A	cfs
Interception without Clogging		CWG L			
Interception with Clogging Grate Capacity as Mixed Flow Interception without Clogging Interception with Clogging Interception with Clogging Qmi = N/A N/A N/A Cfs Interception with Clogging Qma = N/A N/A N/A Cfs Interception with Clogging Qma = N/A N/A N/A Cfs Resulting Grate Capacity (assumes cloaged condition) Qmanalysis (Calculated) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Clogging as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Qmi = 5.1 11.6 Cfs Interception with Clogging Qma = 4.9 111.1 Cfs Qmb Opening as a Nortifice (based on Modified HEC22 Method) Interception without Clogging Qma = 23.8 27.1 Cfs Qmb Opening Capacity as Mixed Flow Interception with Clogging Qma = 10.0 16.1 Cfs Interception with Clogging Qma = 10.0 16.1 Cfs Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Street Flow Spread (based on street geometry from above) Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Grate		$Q_{0i} = $	N/A	N/A	cfs
Grate Capacity as Mixed Flow   Interception without Glogging   Qmi = N/A N/A N/A N/A of s   N/A	Interception with Clogging		N/A	N/A	cfs
Interception with Clogging Resulting Grate Capacity (assumes cloqued condition)  Qinate   N/A   N/A   N/A   Resulting Grate Capacity (assumes cloqued condition)  Qind Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Clogging Factor for Multiple Units  Clog = 0.04   0.04    Qind Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Qind   5.1   11.6    Qind Opening as an Orifice (based on Modified HEC22 Method)  Interception with Clogging  Qind   24.9   28.3    Qind   24.9	Grate Capacity as Mixed Flow		MINOR	MAJOR	_
Resulting Grate Capacity (assumes cloqged condition)  Quantum Grate Capacity (assumes cloqqed condition)  Quantum Grate Conditions  Quantum Grate Capacity (assumes cloqqed condition)  Quantum Grate Capacity (assumes cloqqed co	Interception without Clogging	$Q_{mi} = [$	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	Interception with Clogging	Q <sub>ma</sub> =			
Clogging Coefficient for Multiple Units   Coef		Q <sub>Grate</sub> =			cfs
Clogging Factor for Multiple Units   Clog =   0.04   0.04					
Curb Opening as a Weir (based on Modified HEC22 Method)   MINOR   MAJOR					
Interception with Clogging $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Clog =			
Interception with Clogging					_
Interception with Clogging $Q_{oi} = 24.9 28.3                                   $		$Q_{wa} = [$			cfs
Interception with Clogging $Q_{oa} = 23.8 27.1 \text{ cfs}$		_ r			٦.
$ \begin{array}{ c c c c } \hline Interception without Clogging & Q_{ml} & 10.5 & 16.9 & cfs \\ Interception with Clogging & Q_{ma} & 10.0 & 16.1 & cfs \\ \hline Resulting Curb Opening Capacity (assumes cloqqed condition) & Q_{Curb} & 4.9 & 11.1 & cfs \\ \hline Resultant Street Conditions & MINOR & MAJOR \\ \hline Total Inlet Length & L & 15.00 & 15.00 & feet \\ Resultant Street Flow Spread (based on street geometry from above) & T & 11.5 & 17.0 & ft \\ Resultant Flow Depth at Street Crown & d_{CROWN} & 0.0 & 0.0 & inches \\ \hline 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} & 0.19 & 0.30 & ft \\ Combination Inlet Performance Reduction Factor for Long Inlets & RF_{Combination} & 0.40 & 0.53 & Curb Opening Performance Reduction Factor for Long Inlets & RF_{Curb} & 0.66 & 0.76$		$Q_{oa} = [$			crs
Interception with Clogging $\frac{Q_{ma}}{Resulting Curb Opening Capacity (assumes cloqqed condition)}$ Resultant Street Conditions  Total Inlet Length  Resultant Street Flow Spread (based on street geometry from above)  Resultant Street Flow Spread (based on street geometry from above)  Resultant Flow Depth at Street Crown $\frac{L_{CROWN}}{d_{CROWN}} = \frac{11.5}{17.0} $		o r			٦,
$ \begin{array}{ l l l l l l l l l l l l l l l l l l l$					
		$Q_{ma} =$			
Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) $ \begin{array}{c cccc} L & = & 15.00 & 15.00 & \text{feet} \\ T & = & 11.5 & 17.0 & \text{ft} \\ Resultant Flow Depth at Street Crown & d_{CROWN} & 0.0 & 0.0 & \text{inches} \\ \hline \\ Low Head Performance Reduction (Calculated) & MINOR & MAJOR \\ Depth for Grate Midwidth & d_{Grate} & N/A &$		QCurb =			us
Resultant Street Flow Spread (based on street geometry from above)		, г			Teach
Resultant Flow Depth at Street Crown					
Low Head Performance Reduction (Calculated)  Depth for Grate Midwidth  Depth for Curb Opening Weir Equation  Combination Inlet Performance Reduction Factor for Long Inlets  RFCombination Inlet Performance Reduction Factor for Long Inlets					
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	resultant Flow Depth at Street Crown	u <sub>CROWN</sub> = [	0.0	1 0.0	
Depth for Curb Opening Weir Equation $ \frac{d_{Curb}}{d_{Curb}} = \frac{0.19}{0.40} = \frac{0.30}{0.53} $ ft Combination Inlet Performance Reduction Factor for Long Inlets $ \frac{RF_{Combination}}{RF_{Curb}} = \frac{0.40}{0.66} = \frac{0.76}{0.76} $ Curb Opening Performance Reduction Factor for Long Inlets $ \frac{RF_{Curb}}{RF_{Curb}} = \frac{0.66}{0.76} = \frac{0.76}{0.76} $					٦.
Combination Inlet Performance Reduction Factor for Long Inlets $RF_{Combination} = 0.40 0.53$ Curb Opening Performance Reduction Factor for Long Inlets $RF_{Curb} = 0.66 0.76$					
Curb Opening Performance Reduction Factor for Long Inlets $RF_{Curb} = 0.66  0.76$					⊣ <sup>tt</sup>
					4
Grated Inlet Performance Reduction Factor for Long Inlets RF <sub>Grate</sub> = N/A N/A					4
	Grated Inlet Performance Reduction Factor for Long Inlets	$RF_{Grate} = $	N/A	I N/A	
MINOR MAJOR			MINOR	MΔ1OP	
Total Inlet Interception Capacity (assumes clogged condition)  Q <sub>a</sub> = 4.9 11.1 cfs	Total Inlet Intercention Capacity (assumes cloqued condition)	<b>o</b> <sub>2</sub> = [			cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>O PEAK)  Q PEAK REQUIRED = 4.6 9.4 Cfs					

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

Project: Grandview Reserve
Inlet ID: Basin B-5 (DP 12a)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.020 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) nches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>O</sub> = Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $W\left(Q_T - Q_X\right)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread $\,Q_X\,$ cfs 10.3 10.3 1.8 1.8 $Q_W =$ cfs cfs QRACK = $Q_T =$ cfs 12.1 12.1 Flow Velocity within the Gutter Section fps 1.1 1.1 V\*d = 0.4

Minor Storm

15.6

14.7

0.153

9.5

9.5

 $T_{TH} =$ 

T<sub>X TH</sub> =

Q<sub>X TH</sub> =

E<sub>o</sub> =

 $Q_X =$ 

Major Storm

29.4

28.6

0.079

55.6

48.2

45.0 cfs

cfs

cfs

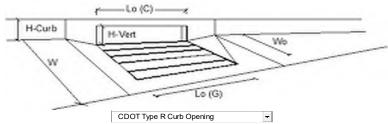
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Discharge within the Gutter Section W $(Q_d - Q_X)$	$Q_W =$	1.7	4.8	CTS
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	1.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.2	54.0	cfs
Average Flow Velocity Within the Gutter Section	V =	1.1	1.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.4	1.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.83	
Max Flow Based on Allowable Depth (Safety Factor Applied)	$Q_d =$	11.2	45.0	cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.36	7.17	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} =$	0.00	2.70	inches
MINOR STORM Allowable Capacity is based on Depth Criterion		Minor Storm	Major Storm	

MAJOR STORM Allowable Capacity is based on Depth Criterion

Qallow = 11.2

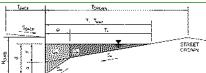
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management' Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Type of Inlet   Cload Depression (additional to continuous gutter depression 'a')   Cload Depression (a')   Cload De	Design Information (Input)		MINOR	MAJOR	
Local Depression (additional to continuous gutter depression 'a')   Carlo Number of Units in the Intel (Grate or Curb Opening)   Laptin of a Single Unit Intel (Grate or Curb Opening)   Laptin of a Single Unit Intel (Grate or Curb Opening)   Laptin of a Single Unit Intel (Grate or Curb Opening)   Laptin of a Single Unit Intel (Grate or Curb Opening)   Laptin of a Single Unit Grate (typical min. value = 0.5)   Cr. 6		Type -			
Total Number of Units in the Inlet (Grate or Curb Opening)		· · · ·			inches
Length of a Single Unit Intel (Grate or Curb Opening)					
Worth of a Unit Grate (cannot be greater than W, Gutter Width)					<b>⊣</b> ₌ ∥
Cogging Factor for a Single Unit Grate (typical min. value = 0.1)					
Coopinio Factor for a Single Unit Curb Opening (typical min. value = 0.1)					<b>⊣</b> '` ∥
Street Hydraulics: Ok - O < Allowable Street Capacity   Design Discharge for Half of Street (from Inlet Management)   Q <sub>0</sub>					
Design Discharge for Half of Street (from Inlet Management)		C <sub>f</sub> -C - 1			
Water Depth at Flowline (outside of local depression)   d		1- 0			T <sub>cfc</sub>
Water Depth at Flowline (outside of local depression)         d = 3.9 5.2 inches           Water Depth at Street Crown (or at T <sub>NLV</sub> )         d <sub>CROWN</sub> = 0.0 0.7 inches           Ratio of Gutter Flow to Design Flow         E <sub>5</sub> = 0.177 0.126           Discharge within the Gutter Section W, carried in Section T <sub>x</sub> Q <sub>x</sub> = 6.5 16.2 cfs           Discharge Behind the Gutter Section W         Q <sub>w</sub> = 1.4 2.3 cfs           Brow Area within the Gutter Section W         A <sub>W</sub> = 0.24 0.33 sq ft           Velocity within the Gutter Section W         V <sub>w</sub> = 5.8 7.1 fps           Water Depth for Design Condition         d <sub>Crown</sub> = 6.9 8.2 inches           Grate Analysis (Calculated)         Implication of the Crown of the Condition of the Crown of the Condition of the Crown of the					
Water Depth at Street Crown (or at T <sub>MAC</sub> )					<b>⊣</b> '' ∥
Ratio of Gutter Flow to Design Flow   Set   Se					
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>   Q <sub>s</sub> =   1.4   2.3   cfs   Discharge within the Gutter Section W   Q <sub>w</sub> =   1.4   2.3   cfs   Discharge Behind the Curb Face   Q <sub>abcX</sub> =   0.0   0.0   cfs   Flow Area within the Gutter Section W   Q <sub>w</sub> =   0.24   0.33   sq ft   Velocity within the Gutter Section W   V <sub>w</sub> =   5.8   7.1   fps   Water Depth for Design Condition   d <sub>I CCA</sub> =   6.9   8.2   inches   Grate Analysis (Calculated)   MINOR   MAJOR   Total Length of Inlet Grate Opening   L =   N/A   N/A   N/A   Ratio of Grate Flow to Design Flow   MINOR   MAJOR   Minimum Velocity Where Grate Splash-Over Begins   Lerception Rate of Frontal Flow   R, =   N/A   N/A   N/A   Interception Rate of Flow   R, =   N/A   N/A   N/A   Interception Rate of Side Flow   R, =   N/A   N/A   N/A   Interception Rate of Frontal Flow   R, =   N/A   N/A   N/A   Interception For Multiple-unit Grate Inlet   GrateCog =   N/A   N/A   N/A   Clogging Condition   MINIMOR   MAJOR   Minimum Velocity Where Grate Splash-Over Begins   MINOR   N/A   N/A   Interception Rate of Side Flow   R, =   N/A   N/A   N/A   Interception Rate of Side Flow   R, =   N/A   N/A   N/A   Interception Rate of Frontal Flow   R, =   N/A   N/A   N/A   Interception Rate of Side Flow   R, =   N/A   N/A   N/A   Interception Rate of Frontal Flow   R, =   N/A   N/A   N/A   Interception Rate of Frontal Flow   R, =   N/A   N/A   N/A   Interception Rate of Frontal Flow   R, =   N/A   N/A   N/A   Interception Rate of Flow   R, =   N/A   N/A   N/A   Interception Rate of Flow   R, =   N/A   N/A   N/A   Interception Rate of Flow   R, =   N/A   N/A   N/A   Interception Capacity   N/A   N/					- Inches
Discharge within the Gutter Section W   Discharge Behind the Curb Face   Qbuck =   0.0   0.0   0.0   cfs					
Discharge Behind the Curto Face   Flow Area within the Gutter Section W					_ · · ·
Flow Area within the Gutter Section W					<b>-</b>   · · ·
Velocity within the Gutter Section W   Vw =   5.8   7.1   fps   Mater Depth for Design Condition   diocal   6.9   8.2   inches   Grate Analysis (Calculated)   MINOR   MAJOR					
Water   Depth for Design Condition   Grate Analysis (Calculated)   MINOR   MAJOR					
Grate Analysis (Calculated)					
Total Length of Inlet Grate Opening   Ratio of Grate Flow to Design Flow   Hongard Flow   Hong		a <sub>l OCAL</sub> = I			inches
Ratio of Grate Flow to Design Flow Under No-Clogging Condition Minimum Velocity Where Grate Splash-Over Begins Interception Rate of Frontal Flow Interception Rate of Side Flow Interception Rate of Side Flow Interception Capacity Q = N/A N/A N/A Interception Capacity Under Clogging Condition Clogging Coefficient Curb Opening or Slotted Inlet (minimum of L, L_T) Interception Capacity Q = N/A N/A N/A  Interception Capacity Q = N/A N/A N/A  Interception Capacity Curb Conging Coefficient Curb Opening or Slotted Inlet (minimum of L, L_T) Interception Capacity Q = N/A N/A N/A  Interception Capacity Q = 0.084 0.066 Interception Capacity Q = 0.084 0.066 Interception Capacity Q = 0.09.2 cfs  Interception Capacity Q = 0.09.2 cfs  Interception Capacity Q = 0.00 10.00 Interception Capacity Q = 0.00 0.00 0.06  Interception Capacity Q = 5.9 9.0 cfs  Interception Capacity Q = 5.9 9.0 cfs  Interception Capacity Q = 5.9 9.0 cfs  Interception Capacity Interception Capacity Q = 5.9 9.0 cfs  Interception Capacity Interception Capacity Interception Capacity Q = 5.9 9.0 cfs  Interception Capacity Interception Capacity Interception Capacity Interception Capacity Interception Capacity Interception Capacity Q = 5.9 9.0 cfs  Interception Capacity Intercep		. 1			٦_
Under No-Clogging Condition   Minimum Velocity Where Grate Splash-Over Begins   V <sub>o</sub> = N/A   N/A   N/A   N/A   Interception Rate of Frontal Flow   R <sub>c</sub> = N/A   N/A   N/A   Interception Rate of Frontal Flow   R <sub>c</sub> = N/A   N/A   N/A   Interception Capacity   Q <sub>c</sub> = N/A   N/A   N/A   N/A   Interception Capacity   Q <sub>c</sub> = N/A		- 1			⊣π
Minimum Velocity Where Grate Splash-Over Begins   V_0 = N/A N/A   N/A     Interception Rate of Frontal Flow   R_x = N/A N/A N/A     Interception Rate of Side Flow   R_x = N/A N/A N/A     Interception Capacity   Q_1 = N/A N/A N/A     Interception Capacity   Q_2 = N/A N/A N/A N/A     Interception Capacity   Q_2 = N/A N/A N/A N/A N/A     Clogging Condition   Minor MAJOR     Clogging Factor for Multiple-unit Grate Inlet   GrateClog = N/A N/A N/A N/A     Clogging Factor for Multiple-unit Grate Inlet   GrateClog = N/A N/A N/A N/A N/A     Clogging Factor for Multiple-unit Grate Inlet   GrateClog = N/A	· · · · · · · · · · · · · · · · · · ·	E <sub>o-GRATE</sub> =			
Interception Rate of Frontal Flow Interception Rate of Side Flow Interception Capacity Qi = N/A N/A N/A Interception Capacity Under Clogging Condition Clogging Coefficient for Multiple-unit Grate Inlet Clogging Factor Factor Clogging Factor Clogg		,, r			¬.
Interception Rate of Side Flow					rps
Interception Capacity Under Clogging Condition Under Clogging Condition Clogging Coefficient for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Curb Opening or next d/s inlet) Clogging Factor for Multiple-unit Curb Opening or next d/s inlet) Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef					
Under Clogging Condition					<b>-</b>
Clogging Coefficient for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet Effective (unclogged) Length of Multiple-unit Grate Inlet Minimum Velocity Where Grate Splash-Over Begins Vo = N/A N/A N/A Interception Rate of Frontal Flow Interception Rate of Frontal Flow Interception Rate of Side Flow R <sub>f</sub> = N/A N/A N/A Interception Capacity Q <sub>a</sub> = N/A N/A N/A Cfs Carry-Over Flow = Q <sub>a</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet) Q <sub>b</sub> = N/A N/A N/A Cfs Curb or Slotted Inlet Opening Analysis (Calculated) Equivalent Slope S <sub>c</sub> (based on grate carry-over) S <sub>c</sub> = 0.084 0.066 Equivalent Slope S <sub>c</sub> (based on grate carry-over) Under No-Clogging Condition Under No-Clogging Condition Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> ) Under Clogging Condition Clogging Coefficient CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbCoef = 1.25 1.25 Clogging Factor for Multiple-unit Curb Opening Op		$Q_i = [$			_cts
Clogging Factor for Multiple-unit Grate Inlet  Effective (unclogged) Length of Multiple-unit Grate Inlet  Minimum Velocity Where Grate Splash-Over Begins  Interception Rate of Frontal Flow  Interception Rate of Frontal Flow  Rr = N/A N/A N/A  Interception Rate of Frontal Flow  RR = N/A N/A N/A  Actual Interception Capacity  Carry-Over Flow = Q <sub>h</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)  Carry-Over Flow = Q <sub>h</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)  Required Length L <sub>T</sub> to Have 100% Interception  Under No-Clogging Condition  Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )  Interception Capacity  CurbCoef = 1.25  Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet  CurbCoef = 9.37  CurbCoef = 1.25  Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet  CurbCoef = 9.37  Actual Interception Capacity  Qa = 5.9  Qb = 2.0  Ofs  Total Inlet Interception Clogo (flow bypassing inlet)  Rink  N/A  N/A  Rt  N/A  N/A  N/A  Rt  N/A  N/A  N/A  Rt  N/A  N/A  N/A  N/A  N/A  ACts  Rr = N/A  N/A  N/A  N/A  N/A  N/A  N/A  N/A					
Effective (unclogged) Length of Multiple-unit Grate Inlet  Minimum Velocity Where Grate Splash-Over Begins  Vo = N/A N/A N/A Interception Rate of Frontal Flow Interception Rate of Frontal Flow R <sub>r</sub> = N/A N/A N/A Interception Rate of Side Flow R <sub>r</sub> = N/A N/A N/A  Actual Interception Capacity Carry-Over Flow = $Q_n$ - $Q_n$ (to be applied to curb opening or next d/s inlet)  Qa = N/A N/A N/A  Avia Cfs  Curb or Slotted Inlet Opening Analysis (Calculated)  Equivalent Slope S <sub>e</sub> (based on grate carry-over)  Equivalent					
Minimum Velocity Where Grate Splash-Over Begins $V_o = N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A$		- 1			<b>⊣</b> . ∥
Interception Rate of Frontal Flow $R_r = N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A$					
Interception Rate of Side Flow Actual Interception Capacity Carry-Over Flow = $Q_{A}$ - $Q_{A}$ (to be applied to curb opening or next d/s inlet)  Q <sub>a</sub> = N/A N/A N/A cfs  N/A N/A N/A Cfs  N/A N/A Cfs  N/A N/A N/A  N/A N/A Cfs  N/A N/A N/A  N/A Cfs  N/A N/A N/A  N/A Cfs  N/A N/A N/A  N/A Cfs  N/A N/A  N/A Cfs  N/A N/A Cfs  N/A N/A Cfs  N/A 0.66  ft/ft t t  N/A N/A Cfs  N/A N/A  N/A Cfs  N/A N/A  N/A Cfs  N/A N/A  N/A Cfs  N/A N/A  N/A Cfs  N/A N/A  N/A Cfs  N/A N/A  N/A Cfs  Carboral Car					tps
Actual Interception Capacity  Carry-Over Flow = Q <sub>n</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)  Curb or Slotted Inlet Opening Analysis (Calculated)  Equivalent Slope S <sub>e</sub> (based on grate carry-over)  Required Length L <sub>T</sub> to Have 100% Interception  Under No-Clogging Condition  Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )  Interception Capacity  Q <sub>i</sub> = 6.0  Q <sub>i</sub>					
$ \begin{array}{ c c c c } \hline \text{Carry-Over Flow} = Q_n \cdot Q_n \text{ (to be applied to curb opening or next d/s inlet)} & Q_h = & N/A & N/A & cfs \\ \hline \hline \text{Curb or Slotted Inlet Opening Analysis (Calculated)} & & MINOR & MAJOR \\ \hline \text{Equivalent Slope S}_e \text{ (based on grate carry-over)} & S_e = & 0.084 & 0.066 & ft/ft \\ \hline \text{Required Length } \Gamma_t \text{ to Have } 100\% \text{ Interception} & \Gamma_t = & 18.17 & 31.40 & ft \\ \hline \text{Under No-Clogging Condition} & & MINOR & MAJOR \\ \hline \text{Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)} & L = & 10.00 & 10.00 & ft \\ \hline \text{Interception Capacity} & Q_i = & 6.0 & 9.2 & cfs \\ \hline \text{Under Cloaging Condition} & & MINOR & MAJOR \\ \hline \text{Clogging Coefficient} & & CurbCoef = & 1.25 & 1.25 & \\ \hline \text{Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet} & & CurbClog = & 0.06 & 0.06 & \\ \hline \text{Effective (Unclogged) Length} & L_e = & 9.37 & 9.37 & ft \\ \hline \text{Actual Interception Capacity} & Q_a = & 5.9 & 9.0 & cfs \\ \hline \text{Carry-Over Flow} = Q_{\text{NGRATE}} Q_a & Q_b = & 2.0 & 9.5 & cfs \\ \hline \hline \text{Summary} & & MINOR & \\ \hline \text{Total Inlet Interception (flow bypassing inlet)} & Q_b = & 2.0 & 9.5 & cfs \\ \hline \end{array}$					
					<b>-</b>
Equivalent Slope $S_e$ (based on grate carry-over) $S_e = 0.084  0.066  ft/ft$ Required Length $L_T$ to Have 100% Interception $L_T = 18.17  31.40  ft$ $L_T = 19.00  ft$ $L_T = 19.$		Q <sub>b</sub> =			cfs
Required Length $L_T$ to Have 100% Interception $L_T = \begin{bmatrix} 18.17 & 31.40 \\ MINOR & MINOR \\ MINOR & MAJOR \end{bmatrix}$ ft Under No-Clogging Condition					٦
Under No-Clogging Condition         MINOR         MAJOR           Effective Length of Curb Opening or Slotted Inlet (minimum of L, L₁)         L = 10.00 10.00 ft           Interception Capacity         Q₁ = 6.0 9.2 cfs           Under Clogging Condition         MINOR MAJOR           Clogging Coefficient         CurbCoef = 1.25 1.25 1.25 (0.66 0.06 0.06 0.06 0.06 0.06 0.06 0.0					
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )		L <sub>T</sub> = [			_tt
Interception Capacity   Q		r			٦. ا
		, i			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		$Q_i = [$			cfs
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet					_
					_
$ \begin{array}{c cccc} Actual Interception Capacity & Q_a = & 5.9 & 9.0 & cfs \\ \hline Carry-Over Flow = Q_{h/GRATE}-Q_a & Q_b = & 2.0 & 9.5 & cfs \\ \hline \underline{Summary} & \underline{MINOR} & \underline{MAIOR} \\ \hline Total Inlet Interception Capacity & Q = & 5.9 & 9.0 & cfs \\ \hline Total Inlet Carry-Over Flow (flow bypassing inlet) & Q_b = & 2.0 & 9.5 & cfs \\ \hline \end{array} $					_
Total Inlet Interception Capacity $Q = \begin{bmatrix} 5.9 & 9.0 \\ Q_b = \end{bmatrix}$ cfs Total Inlet Carry-Over Flow (flow bypassing inlet) $Q_b = \begin{bmatrix} 2.0 & 9.5 \\ 0.5 & \end{bmatrix}$ cfs		<b>Q</b> <sub>b</sub> =			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet) $Q_b = 2.0$ 9.5 cfs					_
Capture Percentage = Q <sub>n</sub> /Q <sub>n</sub> =         C% =         75         49         %	Capture Percentage = Qa/Qo =	C% =	75	49	<u></u>

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

Project: Grandview Reserve
Inlet ID: Basin B-6 (DP 14)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> : Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 0.83 Gutter Width Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.020 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm $\mathsf{T}_{\mathsf{MAX}}$ 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm inches

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	F	(F	-
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2) y =	3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C = \Box$	0.8	0.8	inches
Gutter Depression ( $d_C - (W * S_x * 12)$ ) a =	0.63	0.63	inches
Water Depth at Gutter Flowline d =	4.47	4.47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X = T_X = T_X$	15.2	15.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) $E_0 = $	0.149	0.149	
Discharge outside the Gutter Section W, carried in Section $T_X$ $Q_X = T$	10.3	10.3	cfs
Discharge within the Gutter Section W ( $Q_T - Q_X$ ) $Q_W = \bigcap$	1.8	1.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Q <sub>BACK</sub> =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread $\mathbf{Q}_{T} = \Box$	12.1	12.1	cfs
Flow Velocity within the Gutter Section V =	1.1	1.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth $V*d =$	0.4	0.4	
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm	Major Storm	
Theoretical Water Spread $T_{TH} = \Box$	15.6	29.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W) $T_{XTH} = T_{XTH}$	14.7	28.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) $E_0 = $	0.153	0.079	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$ $Q_{XTH} = $	9.5	55.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance $T_{CROWN}$ ) $Q_X = $	9.5	48.2	cfs
Discharge within the Gutter Section W ( $Q_d$ - $Q_X$ ) $Q_W = \Box$	1.7	4.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Q <sub>BACK</sub> =	0.0	1.0	cfs

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E <sub>0</sub> =	0.153	0.079
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>	Q <sub>X TH</sub> =	9.5	55.6
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )	$Q_X = $	9.5	48.2
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )	$Q_W = $	1.7	4.8
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	1.0
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.2	54.0
Average Flow Velocity Within the Gutter Section	V =	1.1	1.6
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.4	1.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.83
Max Flow Based on Allowable Depth (Safety Factor Applied)	$Q_d = [$	11.2	45.0
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.36	7.17
Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} =$	0.00	2.70

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

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

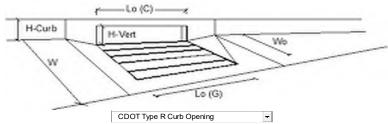
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

cfs

fps

cfs

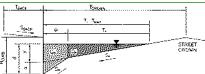
inches



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	- ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	- '`
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'	G-C - 1	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	3.7	8.7	Tcfs T
Water Spread Width	Ψ <sub>0</sub> −   T =	10.2	14.1	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	4.0	inches
Water Depth at Flowinie (outside of local depression)  Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	d <sub>CROWN</sub> = E <sub>o</sub> =	0.240	0.170	liicies
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>		2.8	7.2	cfs
	Q <sub>x</sub> =	0.9	1.5	cfs
Discharge within the Gutter Section W Discharge Behind the Curb Face	Q <sub>w</sub> =	0.9	0.0	cfs
Flow Area within the Gutter Section W	$Q_{BACK} = $	0.18	0.0	sq ft
Velocity within the Gutter Section W	$A_W = V_W $	4.8	5.9	fps
Water Depth for Design Condition		6.1	7.0	inches
Grate Analysis (Calculated)	d <sub>LOCAL</sub> =	MINOR	MAJOR	Jinches
Total Length of Inlet Grate Opening	L = [	N/A	N/A	∃ft
Ratio of Grate Flow to Design Flow	- 1	N/A	N/A	⊣"
Under No-Clogging Condition	$E_{o-GRATE} = [$	MINOR	MAJOR	<b>-</b>
Minimum Velocity Where Grate Splash-Over Begins	v _[	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>o</sub> =	N/A	N/A	⊣ <sup>1ps</sup>
Interception Rate of Frontal Flow Interception Rate of Side Flow	R <sub>f</sub> =	N/A N/A	N/A N/A	-
Interception Rate of Side Flow Interception Capacity	R <sub>x</sub> =	N/A N/A	N/A N/A	cfs
Under Clogging Condition	$Q_i = [$	MINOR	MAJOR	_lus
Clogging Condition Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦ ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A N/A	N/A N/A	-
Effective (unclogged) Length of Multiple-unit Grate Inlet	- I	N/A	N/A	- ft
Minimum Velocity Where Grate Splash-Over Begins	L <sub>e</sub> =	N/A N/A	N/A N/A	fps
Interception Rate of Frontal Flow	V <sub>o</sub> =   R <sub>f</sub> =	N/A N/A	N/A N/A	I I I I I I I I I I I I I I I I I I I
Interception Rate of Frontal Flow Interception Rate of Side Flow				-
Actual Interception Capacity	R <sub>x</sub> =	N/A N/A	N/A N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>a</sub> =   Q <sub>b</sub> =	N/A N/A	N/A N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>Q</b> <sub>b</sub> −	MINOR	MAJOR	CIS
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.107	0.082	∏ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	J <sub>e</sub> − L L <sub>T</sub> =	11.03	19.34	Ift I
Under No-Clogging Condition	LT -[	MINOR	MAJOR	<b>_</b> 1''
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	10.00	10.00	∃ft
Interception Capacity	Q <sub>i</sub> =	3.6	6.4	cfs
Under Clogging Condition	Q <sub>i</sub> −[	MINOR	MAJOR	J <sup>u</sup> 3
Clogging Coefficient	CurbCoef =	1.25	1.25	٦ ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	<b>⊣</b> ∥
Effective (Uncloqued) Length	L <sub>e</sub> =	9.37	9.37	- ft
Actual Interception Capacity	Q <sub>a</sub> =	3.6	6.2	cfs
Carry-Over Flow = Q <sub>h(GRATE)</sub> -Q <sub>a</sub>	Q <sub>a</sub> =	0.1	2.5	cfs
Summary	<b>Q</b> <sub>b</sub> −	MINOR	MAJOR	leta .
Total Inlet Interception Capacity	<b>Q</b> =	3.6	6.2	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.1	2.5	cfs
Capture Percentage = $Q_a/Q_0$ =	С% =	98	71	- %
Captain Ferentiage - Val Vn -	C /0 -1		, /±	170

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

Project: Grandview Reserve
Inlet ID: Basin B-7 (DP 15)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.020 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm $\mathsf{T}_{\mathsf{MAX}}$ Max. Allowable Spread for Minor & Major Storm 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) nches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>0</sub> = Discharge outside the Gutter Section W, carried in Section $T_X$ $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 10.3 10.3 Discharge within the Gutter Section W $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread 1.8 1.8 $Q_W =$ cfs Q<sub>BACK</sub> = cfs Q<sub>T</sub> = cfs 12.1 12.1 Flow Velocity within the Gutter Section fps 1.1 1.1 V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.4 Minor Storm Major Storm T<sub>TH</sub> = 15.6 29.4 T<sub>X TH</sub> = 14.7 28.6 E<sub>o</sub> = 0.153 0.079 Q<sub>X TH</sub> = 9.5 cfs 55.6 $Q_X =$ 9.5 48.2 cfs

1.7

11.2 1.1

0.4

1.00

11.2

4.36

0.00

 $Q_W =$ 

Q = V =

R =

Q<sub>d</sub> =

 $d_{CROWN} =$ 

d =

V\*d =

 $Q_{\text{BACK}}$ 

cfs

cfs

cfs

fps

cfs

inches

4.8

1.0

54.0

1.6

0.83

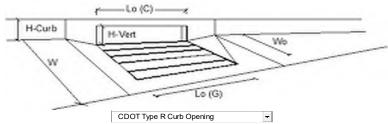
45.0

2.70

Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W ( $Q_d - Q_X$ )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

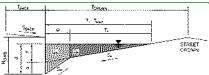
Minor storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					
MAJOR STORM Allowable Capacity is based on Depth Criterion Qallow =	11.2	45.0	cfs		
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm	Major Storm	_		



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> ''
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'	G-C - 1	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	1.6	3.8	cfs
Water Spread Width	Ψ <sub>0</sub> −   T =	7.3	10.3	ft
Water Depth at Flowline (outside of local depression)	d =	2.4	3.1	inches
Water Depth at Flowinie (outside of local depression)  Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	d <sub>CROWN</sub> = E <sub>o</sub> =	0.339	0.238	- Inches
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>		1.1	2.9	cfs
	Q <sub>x</sub> =	0.5	0.9	cfs
Discharge within the Gutter Section W Discharge Behind the Curb Face	Q <sub>w</sub> =	0.0	0.9	cfs
Flow Area within the Gutter Section W	$Q_{BACK} =$	0.14	0.0	sq ft
Velocity within the Gutter Section W	$A_W = V_W $	4.0	4.9	fps
Water Depth for Design Condition		5.4	6.1	inches
Grate Analysis (Calculated)	d <sub>LOCAL</sub> =	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L = [	N/A	N/A	∃ft
Ratio of Grate Flow to Design Flow	- 1	N/A	N/A	⊣''
Under No-Clogging Condition	$E_{o-GRATE} = [$	MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	v _[	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>o</sub> =	N/A	N/A	⊣ <sup>1ps</sup>
Interception Rate of Frontal Flow Interception Rate of Side Flow	R <sub>f</sub> =	N/A	N/A N/A	
Interception Rate of Side Flow Interception Capacity	R <sub>x</sub> =	N/A	N/A N/A	cfs
Under Clogging Condition	$Q_i = [$	MINOR	MAJOR	_las
Clogging Condition Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	- I	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	L <sub>e</sub> =	N/A	N/A N/A	fps
Interception Rate of Frontal Flow	V <sub>o</sub> =   R <sub>f</sub> =	N/A	N/A N/A	¬ <sup>ips</sup>
Interception Rate of Frontal Flow Interception Rate of Side Flow				-
Actual Interception Capacity	R <sub>x</sub> =	N/A N/A	N/A N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>a</sub> =   Q <sub>b</sub> =	N/A N/A	N/A N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>Q</b> <sub>b</sub> −	MINOR	MAJOR	CIS
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.143	0.106	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	J <sub>e</sub> − L L <sub>T</sub> =	6.31	11.23	ft
Under No-Clogging Condition	LT -[	MINOR	MAJOR	<b>-</b> ''`
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	6.31	10.00	∃ft
Interception Capacity	Q <sub>i</sub> =	1.6	3.7	cfs
Under Clogging Condition	Q <sub>i</sub> −[	MINOR	MAJOR	Ju <sub>2</sub>
Clogging Coefficient	CurbCoef =	1.25	1.25	٦ ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	-
Effective (Uncloqued) Length	L <sub>e</sub> =	9.37	9.37	ft
Actual Interception Capacity	Q <sub>a</sub> =	1.6	3.7	cfs
Carry-Over Flow = Q <sub>h(GRATE)</sub> -Q <sub>a</sub>	Q <sub>a</sub> =	0.0	0.1	cfs
Summary	<b>Q</b> <sub>b</sub> −	MINOR	MAJOR	ļus —
Total Inlet Interception Capacity	<b>Q</b> =	1.6	3.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.0	0.1	cfs
Capture Percentage = $Q_a/Q_0$ =	С% =	100	97	%
Captain Ferentiage - Val Vn -	C /0 -1	100	, ,,	170

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

Project: Grandview Reserve
Inlet ID: Basin B-8 (DP 12b)



## Gutter Geometry Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

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

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ı	Check boxes are not applicable in SUMP conditions
ı	

Maximum Capacity for 1/2 Street based On Allowable Spread Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12))
Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_x$ 

Discharge within the Gutter Section W  $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor)

Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

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

$H_{CURB} =$	6.00	inche
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
$n_{STREET} =$	0.016	

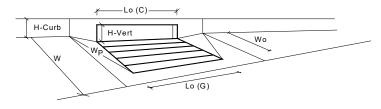
	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
		s-	

	Minor Storm	Major Storm	_
y =	3.84	3.84	inches
d <sub>C</sub> = a =	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
$E_0 =$	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
$d_{CROWN} =$			inches

o -	Minor Storm SUMP	Major Storm SUMP	cfs
$Q_{allow} =$	SUMP	SUMP	CIS

## INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

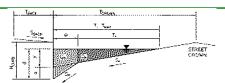


ĺΓ	CDOT Type R Curb Opening  Design Information (Input)		MINOR	MAJOR	
	ype of Inlet	Type =		Curb Opening	
	ocal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3,00	inches
	lumber of Unit Inlets (Grate or Curb Opening)	No =	4	4	Override Depth:
	Vater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	ronding Depart – [	MINOR	MAJOR	Inches
	ength of a Unit Grate	L <sub>0</sub> (G) =	N/A	N/A	Tfeet
	Vidth of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
	rea Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	-
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	
	Curb Opening Information	-0(-)	MINOR	MAJOR	
	ength of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	5.00	feet
	leight of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	leight of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	ngle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63,40	degrees
	ide Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>D</sub> =	2.00	2.00	feet
	Rogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	1
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	-
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>o</sub> (C) =	0.67	0.67	-
	Grate Flow Analysis (Calculated)	-0 ( - /	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	1
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Grate Capacity as a Weir (based on Modified HEC22 Method)	Clog – L	MINOR	MAJOR	
	nterception without Clogging	$Q_{wi} = \Gamma$	N/A	N/A	cfs
	nterception with Clogging	$Q_{wa} = $	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	Qwa — L	MINOR	MAJOR	
	nterception without Clogging	Q <sub>oi</sub> =	N/A	N/A	ີ່ cfs
	nterception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	40a - [	MINOR	MAJOR	٦٥١٥
	nterception without Clogging	$Q_{mi} = \Gamma$	N/A	N/A	cfs
	nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
	Lesulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
ic	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	<u>'</u>
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	7
	Clogging Factor for Multiple Units	Clog =	0.03	0.03	
	Curb Opening as a Weir (based on Modified HEC22 Method)	5	MINOR	MAJOR	_
	nterception without Clogging	Q <sub>wi</sub> =	10.0	35.4	cfs
	nterception with Clogging	Q <sub>wa</sub> =	9.7	34.3	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	-cwa L	MINOR	MAJOR	<b>_</b> '
	nterception without Clogging	$Q_{oi} = \Gamma$	33.6	43.9	cfs
	nterception with Clogging	$Q_{oa} = $	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow	-t0a [	MINOR	MAJOR	<b>_</b>
	nterception without Clogging	$Q_{mi} = \Gamma$	17.0	36.7	cfs
	nterception with Clogging	Q <sub>ma</sub> =	16.5	35.5	cfs
	Lesulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	9.7	34.3	cfs
	Resultant Street Conditions		MINOR	MAJOR	•
	otal Inlet Length	L = [	20.00	20.00	Tfeet
	lesultant Street Flow Spread (based on street geometry from above)		15.6	29.4	ft.>T-Crown
	esultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	3.2	inches
``	***	CHOWN			
- II.	ow Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	Πft
	Depth for Curb Opening Weir Equation	$d_{Curb} =$	0.29	0.57	⊣ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	٦Ť
	Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.67	0.88	1
	Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	1
∥°	stated thee restriction and reduction ratio for Long threes	Grate —	N/A	11//	_1
			MINOR	MAJOR	
					¬ -
<sub> </sub>	otal Inlet Interception Capacity (assumes cloqged condition)	Q <sub>a</sub> =	9.7	34.3	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin B-9 (DP 13)



### Gutter Geometry

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

I <sub>BACK</sub> =	/.5	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.020	
$H_{CURB} =$	6.00	inches

I ICURB -	0.00	IIICHE
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
пстоет =	0.016	

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
	===	:-	_

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_x$ 

Discharge within the Gutter Section W  $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

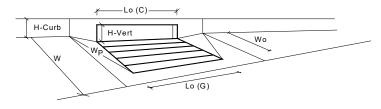
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	_
y =	3.84	3.84	inches
$d_C =$	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
E <sub>o</sub> =	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
d <sub>CROWN</sub> =			inches

	Minor Storm	Major Storm	ء 1
$Q_{allow} =$	SUMP	SUMP	cfs

## INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

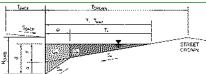


	CDOT Type R Curb Opening				
	Design Information (Input)	_ =	MINOR	MAJOR	_
	ype of Inlet	Type =	CDOT Type R		
	ocal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
	lumber of Unit Inlets (Grate or Curb Opening)	No =	2	2	Override Depth
	Vater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	_	MINOR	MAJOR	_
	ength of a Unit Grate	$L_o(G) =$	N/A	N/A	feet
W	Vidth of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
A	rea Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
C	logging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_f(G) =$	N/A	N/A	
G	Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w(G) =$	N/A	N/A	
G	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	
llc	Curb Opening Information	٠, ١	MINOR	MAJOR	
	ength of a Unit Curb Opening	L <sub>0</sub> (C) =	5.00	5.00	feet
	leight of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	leight of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	nagle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	ide Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
		W <sub>p</sub> =			_leet
	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 <sub>w</sub> (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	_
	logging Coefficient for Multiple Units	Coef =	N/A	N/A	
	logging Factor for Multiple Units	Clog =	N/A	N/A	
<u>G</u>	Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	_
Ir	nterception without Clogging	$Q_{wi} = \Gamma$	N/A	N/A	cfs
Ir	nterception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	CNG L	MINOR	MAJOR	
	nterception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
	nterception with Clogging	$Q_{oa} = $	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	- Coa − L	MINOR	MAJOR	
		ο -Γ	N/A		□cfs
	nterception without Clogging	Q <sub>mi</sub> =		N/A	
	nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
<u>III</u>	esulting Grate Capacity (assumes cloqged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	_
	logging Coefficient for Multiple Units	Coef =	1.25	1.25	
	logging Factor for Multiple Units	Clog =	0.06	0.06	
	Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Ir	nterception without Clogging	$Q_{wi} = \Gamma$	6.1	20.2	cfs
Ir	nterception with Clogging	Q <sub>wa</sub> =	5.7	18.9	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
	nterception without Clogging	$Q_{oi} = \Gamma$	16.8	21.9	cfs
	nterception with Clogging	$Q_{oa} = $	15.7	20.6	cfs
	Curb Opening Capacity as Mixed Flow	∠ <sub>0a</sub> – [	MINOR	MAJOR	٦,,,
	nterception without Clogging	Δ -Γ	9.4	19.6	cfs
		Q <sub>mi</sub> =			
	nterception with Clogging	Q <sub>ma</sub> =	8.8	18.3	cfs cfs
<u> R</u>	esulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	5.7	18.3	CIS
	Resultant Street Conditions	_	MINOR	MAJOR	٦.
	otal Inlet Length	L = [	10.00	10.00	feet
	esultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
R	esultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	3.2	inches
		_			
- ∥L	ow Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	∏ft
	Depth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	⊣ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	⊣``
	curb Opening Performance Reduction Factor for Long Inlets		0.41	1.00	$\dashv$
		RF <sub>Curb</sub> =			-
G	Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	_
			MINOR	M4300	
		• -	MINOR	MAJOR	٦
IIT.	otal Inlet Interception Capacity (assumes clogged condition) nlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_a = Q_{PEAK REQUIRED} = Q_{PEAK REQUIRED}$	<b>5.7</b> 3.8	<b>18.3</b> 9.0	cfs cfs
11		U DEAK DECUTOED =			

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin C-1 (DP 17b)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 n<sub>BACK</sub> = Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> = linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.02 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm $T_{MAX}$ 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>0</sub> = 0.149 $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 11.5 11.5 2.0 2.0 $Q_W =$ cfs $Q_{BACK}$ cfs **Q**<sub>T</sub> = cfs 13.5 13.5

Discharge outside the Gutter Section W, carried in Section T <sub>X</sub>
Discharge within the Gutter Section W (Q <sub>T</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Maximum Flow Based On Allowable Spread
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth

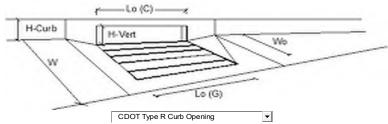
Plaximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section TXTH
Actual Discharge outside the Gutter Section W, (limited by distance $T_{CROWN}$ )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
Resultant Flow Depth at Street Crown (Safety Factor Applied)

resultant How	Depair de Sa ce	c crown (surce)	ractor ripplica)
MINOR STORM	Allowable Cap	acity is based or	Depth Criterion

v =			rps
V*d =	*d = 0.5 0.5		
			_
	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	10.6	62.1	cfs
$Q_X =$	10.6	53.9	cfs
$Q_W =$	1.9	5.3	cfs
$Q_{BACK} =$	0.0	1.2	cfs
Q =	12.5	60.4	cfs
V =	1.2	1.8	fps
V*d =	0.4	1.2	
R =	R = 1.00 0.70		
$Q_d =$	Q <sub>d</sub> = 12.5 42.1		

Q <sub>allow</sub> =	12.5	42.1	cfs
	Minor Storm	Major Storm	_
$d_{CROWN} =$	0.00	2.22	inches
d =	4.36	6.69	inches
$Q_d =$	12.5	42.1	cfs
R =	1.00	0.70	
V*d =	0.4	1.2	
V =	1.2	1.8	fps

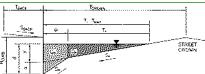
Introduction Allowable capacity is based on beptit criterion	MINOL SCOTT	1.10
MAJOR STORM Allowable Capacity is based on Depth Criterion Q <sub>allow</sub> =	12.5	
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet '	Inlet Managem	ent'
Major storm max, allowable capacity GOOD - greater than the design flow given on sheet '	Inlet Managem	ent'



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3.0	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	VV <sub>o</sub> = C <sub>f</sub> -G =	N/A	N/A	- '\
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.5)	C <sub>f</sub> -G =	0.10	0.10	
Street Hydraulics: OK - O < Allowable Street Capacity'	C <sub>f</sub> -C - 1	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	6.8	16.0	cfs
Water Spread Width	Q₀ −   T =	12.3	16.0	ft
Water Spread Width Water Depth at Flowline (outside of local depression)	1 = 1 d =	3.6	4.7	inches
Water Depth at Street Crown (or at T <sub>MAY</sub> )	- 1	0.0	0.3	inches
	d <sub>CROWN</sub> =		0.139	Inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.196		I
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	5.5	13.8	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.3	2.2	cfs
Discharge Behind the Curb Face	Q <sub>BACK</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.22	0.30	sq ft
Velocity within the Gutter Section W	. V <sub>w</sub> =	6.1	7.5	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.6	7.7	inches
Grate Analysis (Calculated)	. г	MINOR	MAJOR	٦.
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	
<u>Under No-Clogging Condition</u>	1	MINOR	MAJOR	٦.
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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
<u>Under Clogging Condition</u>		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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 <sub>e</sub> =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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 = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	_
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	$S_e = $	0.091	0.071	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	$L_T = $	16.42	28.60	ft
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	15.00	15.00	ft
Interception Capacity	$Q_i =$	6.7	11.8	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	ft
Actual Interception Capacity	<b>Q</b> a =	6.7	11.7	cfs
Carry-Over Flow = Q <sub>b(GRATE)</sub> -Q <sub>a</sub>	<b>Q</b> <sub>b</sub> =	0.1	4.3	cfs
Summary	<u></u>	MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.7	11.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.1	4.3	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	98	73	- %
20140	<u> </u>			

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

Project: Grandview Reserve
Inlet ID: Basin C-2 (DP 17a)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.02 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) nches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X =$ 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_X$ $\,Q_X\,$ cfs 11.5 11.5 Discharge within the Gutter Section W $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread 2.0 2.0 $Q_W =$ cfs QRACK = cfs $Q_T =$ cfs 13.5 13.5 Flow Velocity within the Gutter Section fps 1.2 V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.5 0.5 Maximum Capacity for 1/2 Street based on Allowable Depth Minor Storm Major Storm $T_{TH} =$ 15.6 29.4 $T_{XTH} =$ 14.7 28.6 E<sub>o</sub> = 0.079 0.153 Q<sub>X TH</sub> = cfs 10.6

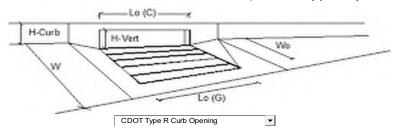
I laximam capacity for 1/2 burcet based on rinowable beput
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
Resultant Flow Depth at Street Crown (Safety Factor Applied)

$Q_X =$	10.6	53.9	cfs
Q <sub>W</sub> =	1.9	5.3	cfs
$Q_{BACK} =$	0.0	1.2	cfs
Q =	12.5	60.4	cfs
V =	1.2	1.8	fps
V*d =	0.4	1.2	
R =	1.00	0.70	
$Q_d =$	12.5	42.1	cfs
d =	4.36	6.69	inches
$d_{CROWN} =$	0.00	2.22	inches
-			_
	Minor Storm	Major Storm	_

cfs

MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

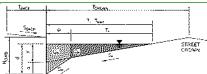
12.5 42.1 finor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management' lajor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Design Information (Input)		MINOR	MAJOR	1
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3.0	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t l
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> ''
Clogging Factor for a Single Unit Grate (typical film, value = 0.5)  Clogging Factor for a Single Unit Curb Opening (typical min, value = 0.1)	C <sub>f</sub> -G =	0.10	0.10	
Street Hydraulics: OK - O < Allowable Street Capacity'	<u> </u>	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	11.3	26.3	Tcfs T
Water Spread Width	√0 − I T = I	15.0	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.2	5.6	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	1.1	inches
Ratio of Gutter Flow to Design Flow	d <sub>CROWN</sub> =	0.160	0.116	- Inches
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	E <sub>0</sub> =	9.5	23.3	cfs
	Q <sub>x</sub> =			
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.8 0.0	3.0 0.0	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	6.9	8.5	sq ft
Velocity within the Gutter Section W	V <sub>W</sub> =		8.5	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	7.2 MINOR	MAJOR	inches
Grate Analysis (Calculated)	ı _F		N/A	Πft
Total Length of Inlet Grate Opening	_ L=	N/A		_π
Ratio of Grate Flow to Design Flow	$E_{o-GRATE} = $	N/A MINOR	N/A	_
Under No-Clogging Condition	у Г		MAJOR	76
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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	٦ ا
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	-
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	۱ .
Effective (unclogged) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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	4 <u>-</u>
Actual Interception Capacity	Q <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = Q <sub>0</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	a 1	MINOR	MAJOR	70.00
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.078	0.062	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> = [	22.86	39.13	_ft
Under No-Clogging Condition	. г	MINOR	MAJOR	ا ا
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L =	15.00	15.00	_ft
Interception Capacity	$Q_i = [$	9.6	15.3	cfs
Under Clogging Condition	r	MINOR	MAJOR	ا ا
Clogging Coefficient	CurbCoef =	1.31	1.31	-
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	<b>-</b>  _
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	_ft_
Actual Interception Capacity	<b>Q</b> <sub>a</sub> =	9.6	15.1	cfs
$Carry-Over Flow = Q_{b/GRATE} - Q_a$	Q <sub>b</sub> =	1.7	11.2	cfs
Summary	_ r	MINOR	MAJOR	ا ۔
Total Inlet Interception Capacity	Q =	9.6	15.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	1.7	11.2	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	85	57	%

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

Project: Grandview Reserve
Inlet ID: Basin C-4 (DP 17c)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 n<sub>BACK</sub> = Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.020 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X =$ 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>0</sub> = Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $W\left(Q_T - Q_X\right)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 10.3 10.3 1.8 1.8 $Q_W =$ cfs Q<sub>BACK</sub> = cfs Q<sub>T</sub> = cfs 12.1 12.1 Flow Velocity within the Gutter Section fps 1.1 1.1 V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.4 0.4 Maximum Capacity for 1/2 Street based on Allowable Depth

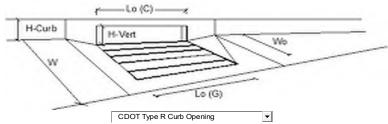
ı	Tidalitiditi Capacity for 1/2 Street based on Allowable Depth
	Theoretical Water Spread
	Theoretical Spread for Discharge outside the Gutter Section W (T - W)
	Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
	Theoretical Discharge outside the Gutter Section W, carried in Section TXTH
	Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
	Discharge within the Gutter Section W ( $Q_d$ - $Q_X$ )
	Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
	Total Discharge for Major & Minor Storm (Pre-Safety Factor)
	Average Flow Velocity Within the Gutter Section
	V*d Product: Flow Velocity Times Gutter Flowline Depth
	Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
	Max Flow Based on Allowable Depth (Safety Factor Applied)
	Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
	Resultant Flow Depth at Street Crown (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CRC}$
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{al}$
Mineral et al. and a little and a little COOR and a transfer de al. and a little an	All and the same of the same of

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	9.5	55.6	cfs
$Q_X =$	9.5	48.2	cfs
$Q_W =$	1.7	4.8	cfs
$Q_{BACK} =$	0.0	1.0	cfs
Q =	11.2	54.0	cfs
V =	1.1	1.6	fps
V*d =	0.4	1.0	
R =	1.00	0.83	
$Q_d =$	11.2	45.0	cfs
d =	4.36	7.17	inches
CROWN =	0.00	2.70	inches

the set IV-det Management					
allow =	11.2	45.0	cfs		
	Minor Storm	Major Storm			

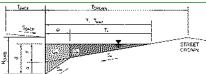
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management' Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Type	Design Information (Input)		MINOR	MAJOR	
Local Depression (additional to continuous gutter depression 'a)   Total Number of Units in the Intel (Grate or Curb Opening)   No		Type -			<b>1</b>
Total Number of Units in the Inlet (Grate or Curb Opening)		· · ·			inches
Length of a Single Unit Intel (Grate or Curt Opening)					
Worth of a Unit Grate (cannot be greater than W, Gutter Width)					
Clogging Factor for a Single Unit Grate (typical min. value = 0.1)					
Claodina Factor for a Single Unit Curb Opening (typical min, value = 0.1)					<b>⊣</b> '' ∥
Street Hydraulics: Ok O. <a< td=""><td></td><td></td><td></td><td></td><td></td></a<>					
Design Discharge for Half of Street (from Inlet Management)		<u> </u>			
Water Spread Midth		0 -[			T <sub>ofo</sub>
Water Depth at Flowline (outside of local depression)         d = 3.5         5.4         inches           Water Depth at Street Crown (or at T <sub>MAX</sub> )         d = 0.0         0.9         inches           Ratio of Gutter Flow to Design Flow         E = 0.200         0.121         cf           Discharge within the Gutter Section W, carried in Section Tx         Qx = 4.7         11.2         2.5         cfs           Discharge Behind the Curb Face         Qascx = 0.0         0.0         0.0         cfs         cfs         cfs           Discharge Behind the Curb Face         Qascx = 0.0         0.0         0.0         cfs					
Water Depth at Street Crown (or at T <sub>MO</sub> )   Bath of Outher Flow to Design Flow   E,					
Ratio of Gutter Flow to Design Flow		- 1			
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub> Discharge within the Gutter Section W  Q <sub>0</sub> = 1.2 2.5 cfs Discharge Behind the Curb Face Q <sub>0</sub> = 0.0 0.0 0.0 cfs Plow Area within the Gutter Section W  Q <sub>0</sub> = 0.2 0.34 sq ft V <sub>0</sub> = 5.4 7.3 fps Water Depth for Design Condition  Grate Analysis (Calculated)  Total Length of Inlet Grate Opening Ratio of Grate Flow to Design Flow Under No-Clogging Condition  Winder No-Clogging Condition  Winder No-Clogging Condition  R <sub>1</sub> = N/A N/A N/A Under No-Clogging Condition  R <sub>2</sub> = N/A N/A N/A Under No-Clogging Condition  Clogging Score for Multiple-unit Grate Inlet GrateClogging Confliction For Multiple-unit Grate Inlet Fifective (unclogged) Length of Multiple-unit Grate Inlet GrateClogging Condition  R <sub>3</sub> = N/A N/A N/A Rinimum Velocity Where Grate Splash-Over Begins Interception Rate of Siote Flow Under Clogging Condition					inches
Discharge within the Gutter Section W   Qward   Qwar					- efe
Discharge Behind the Curtb Face   Chow Are within the Gutter Section W					
Flow Area within the Gutter Section W					
Velocity within the Gutter Section W   Vw =   5.4   7.3   fps   Mater Depth for Design Condition   direx					
Water Depth for Design Condition					
Grate Analysis (Calculated)					
Total Length of Inlet Grate Opening   Ratio of Grate Flow to Design Flow   N/A   N		d <sub>lOCAL</sub> =			inches
Ratio of Grate Flow to Design Flow Under No-Clogging Condition Winimum Velocity Where Grate Splash-Over Begins Vo N/A N/A N/A N/A Interception Rate of Frontal Flow Interception Rate of Side Flow Interception Capacity Under No-Clogging Condition  GrateCoef Side Flow Interception Capacity Under Clogging Condition  GrateCoef Side Flow Interception Capacity Under Clogging Condition  GrateCoef Side Flow Interception Rate of Side Flow Interception Capacity Under Clogging Condition  GrateCoef Side Flow Interception Rate of Multiple-unit Grate Inlet GrateCoef Side Flow Interception Rate of Multiple-unit Grate Inlet GrateCoef Side Flow Interception Rate of Frontal Flow Interception Rate of Side Flow R Side F					٦. ا
Under No-Clogging Condition					_tt
Minimum Velocity Where Grate Splash-Over Begins	· · · · · · · · · · · · · · · · · · ·	$E_{o-GRATE} = [$			
Interception Rate of Frontal Flow Interception Rate of Side Flow Interception Rate of Side Flow Interception Capacity Qi = N/A N/A N/A Interception Capacity Clogging Condition Clogging Coefficient for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet Effective (unclogged) Length of Multiple-unit Grate Inlet Effective Length of Curb Opening are next d/s inlet)  Equivalent Slope Se, (based on grate carry-over) Equ		г			٦.
Interception Rate of Side Flow					fps
Interception Capacity Under Clogging Condition  GrateCoef = N/A N/A N/A Clogging Coefficient for Multiple-unit Grate Inlet Clogging Factor For Multiple-unit Curb Opening or next d/s inlet) Clogging Goefficient Clogging Coefficient Clogging Coefficient Clogging Coefficient Clogging Coefficient CurbCoef = 1.31 1.31 Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening or Slotted Inlet Clogging Factor For Multiple-unit Curb Opening Opening Factor For Multiple-unit Curb Opening Factor Factor Factor Factor Factor Factor Factor Factor F					<b>⊣</b>
Under Clogging Condition					
Clogging Coefficient for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet Clogging Factor for Multiple-unit Grate Inlet CfrateClog = N/A N/A  N/A N/A  Effective (unclogged) Length of Multiple-unit Grate Inlet  Minimum Velocity Where Grate Splash-Over Begins Vo = N/A N/A  N/A N/A  Interception Rate of Frontal Flow Interception Rate of Side Flow R <sub>T</sub> = N/A N/A  Actual Interception Capacity Q <sub>a</sub> = N/A N/A  Carry-Over Flow = Q <sub>a</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet) Q <sub>b</sub> = N/A N/A  Carry-Over Flow = Q <sub>a</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet) Q <sub>b</sub> = N/A N/A  Cfs  Curb Or Slotted Inlet Opening Analysis (Calculated)  Equivalent Slope S <sub>e</sub> (based on grate carry-over) S <sub>e</sub> = 0.093  O.064  Equivalent Slope S <sub>e</sub> (based on grate carry-over) S <sub>e</sub> = 0.093  O.064  If the Required Length L <sub>T</sub> to Have 100% Interception  L <sub>T</sub> = 14.91  Under No-Clogging Condition  MINOR  MAJOR  Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )  L = 14.91  15.00  Interception Capacity Q <sub>i</sub> = 5.8  13.6  Cfs  Under Cloaging Condition  CurbCoef = 1.31  Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet  CurbCoef = 1.31  Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet  CurbCoef = 1.4.34  Actual Interception Capacity Q <sub>a</sub> = 5.8  13.4  Cfs  Carry-Over Flow = Q <sub>h(GRATE)</sub> -Q <sub>a</sub> Q <sub>b</sub> = 0.0  Total Inlet Interception Capacity Q <sub>b</sub> = 0.0  Total Inlet Interception Capacity Q <sub>b</sub> = 0.0  Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_i = [$			cfs
Clogging Factor for Multiple-unit Grate Inlet					_
Effective (unclogged) Length of Multiple-unit Grate Inlet $L_e = N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A$					_
Minimum Velocity Where Grate Splash-Over Begins   V_0		- ·			
Interception Rate of Frontal Flow $R_f = N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A$					
Interception Rate of Side Flow					fps
Actual Interception Capacity $ \mathbf{Q_a} = \begin{array}{ c c c c c } & \mathbf{N/A} & \mathbf{N/A} & \mathbf{cfs} \\ \hline Carry-Over Flow & \mathbf{Q_a} & \mathbf{Corry-Over} & \mathbf{N/A} & \mathbf{N/A} & \mathbf{cfs} \\ \hline Curb or Slotted Inlet Opening Analysis (Calculated) & & & & & & & & & & \\ \hline Curb or Slotted Inlet Opening Analysis (Calculated) & & & & & & & & \\ \hline Equivalent Slope S_c (based on grate carry-over) & S_c = \begin{bmatrix} 0.093 & 0.064 & ft/ft \\ 0.094 & 0.064 & ft/ft \\ 0.095 & 0.083 & 0.064 & ft/ft \\ 0.095 & 0.093 & 0.064 & ft/ft \\ 0.096 & 0.094 & 0.064 & ft/ft \\ 0.096 & 0.094 & 0.094 & ft \\ 0.096 & 0.094 & 0.094 & 0.094 \\ 0.096 & 0.096 & 0.094 & 0.094 \\ 0.096 & 0.096 & 0.096 & 0.096 \\ $		' '			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		$R_x = 1$			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Q <sub>b</sub> =			cfs
Required Length $L_T$ to Have 100% Interception $L_T = \begin{bmatrix} 14.91 & 33.79 & \text{ft} \\ MINOR & MAJOR \\ Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T) L = \begin{bmatrix} 14.91 & 15.00 & \text{ft} \\ 14.91 & 15.00 & \text{ft} \\ 15.00 & \text{ft}$		-			_
Under No-Clogging Condition         MINOR         MAJOR           Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )         L = 14.91 15.00 ft           Interception Capacity         Q₁ = 5.8 13.6 cfs           Under Cloaging Condition         MINOR MAJOR           Clogging Coefficient         CurbCoef = 1.31 1.31 1.31 1.31 1.31 1.31 1.31 1.					
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		$L_T =$			_ft
Interception Capacity					_
Under Clogqing Condition         MINOR         MAJOR           Clogging Coefficient         CurbCoef = 1.31 1.31 1.31 1.31 1.31 1.31 1.31 1.					
Clogging Coefficient		$Q_i = [$			cfs
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet $ \begin{array}{c cccc} Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet \\ Effective (Unclogged) Length \\ Actual Interception Capacity \\ Carry-Over Flow = Q_{h/GRATFI}-Q_a \\ Summary \\ Total Inlet Interception Capacity \\ Q_a = 5.8 & 13.4 & cfs \\ Cfs \\ Summary \\ Total Inlet Interception Capacity \\ Q_b = 5.8 & 13.4 & cfs \\ Total Inlet Carry-Over Flow (flow bypassing inlet) \\ Q_b = 0.0 & 7.4 & cfs \\ C$					_
Effective (Unclogged) Length         Le = 14.34 14.3					_
Actual Interception Capacity       Qa = 5.8 13.4 cfs         Carry-Over Flow = Q <sub>MCGRATE</sub> -Qa       Qb = 0.0 7.4 cfs         Summary       MINOR         Total Inlet Interception Capacity       Q = 5.8 13.4 cfs         Total Inlet Carry-Over Flow (flow bypassing inlet)       Qb = 0.0 7.4 cfs					
	Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	_ft
Summary         MINOR         MAJOR           Total Inlet Interception Capacity         Q =         5.8         13.4         cfs           Total Inlet Carry-Over Flow (flow bypassing inlet)         Q <sub>b</sub> =         0.0         7.4         cfs		$Q_a = [$			_cfs
Total Inlet Interception Capacity $Q = \begin{bmatrix} 5.8 & 13.4 & cfs \\ Total Inlet Carry-Over Flow (flow bypassing inlet) & Q_b = \begin{bmatrix} 0.0 & 7.4 & cfs \\ 0.0 & 0.0 & 0.4 \end{bmatrix}$	Carry-Over Flow = Q <sub>h(GRATE)</sub> -Q <sub>a</sub>	<b>Q</b> <sub>b</sub> =			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet) $Q_b = 0.0$ 7.4 cfs					
		<b>Q</b> =[			cfs
Conture Percentage = $0.70_0$ = $0.000_0$ = $0.000_0$ = $0.000_0$ = $0.000_0$ = $0.000_0$ = $0.0000_0$ = $0.0000_0$ = $0.0000_0$ = $0.00000$ = $0.000000$ = $0.0000000000000000000000000000000000$	Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = $			
	Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	100	64	%

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

Project: Grandview Reserve
Inlet ID: Basin C-5 (DP 17d)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.015 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_X =$ 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $W\left(Q_T - Q_X\right)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 8.9 8.9 1.6 $Q_W =$ 1.6 cfs Q<sub>BACK</sub> = 0.0 cfs $Q_T =$ cfs 10.5 10.5 Flow Velocity within the Gutter Section fps 1.0 1.0 V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = Minor Storm Major Storm $T_{TH} = \Gamma$ 15.6

,
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

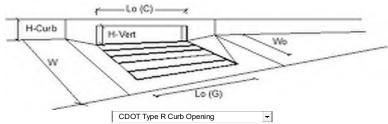
. 10	13.0	23.1	1
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	8.2	48.1	cfs
$Q_X =$	8.2	41.7	cfs
$Q_W =$	1.5	4.1	cfs
$Q_{BACK} =$	0.0	0.9	cfs
Q =	9.7	46.8	cfs
V =	0.9	1.4	fps
V*d =	0.3	0.9	
R =	1.00	1.00	
$Q_d =$	9.7	46.8	cfs
d =	4.36	7.68	inches
d <sub>CROWN</sub> =	0.00	3.22	inches

l	Resultant Flow Depth at Street Crown (Safety Factor Applied)
	MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

 Minor Storm
 Major Storm

 Qallow =
 9.7
 46.8
 cfs

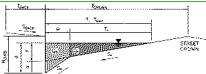
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Type of Inlet   Local Depression (additional to continuous gutter depression 'a')   a_{LOCAL}	MINOR MAJOR	) MINOR MAJOR	
Local Depression (additional to continuous gutter depression 'a')   alock			
Total Number of Units in the Inlet (Grate or Curb Opening)			
Length of a Single Unit Inlet (Grate or Curb Opening)			
Width of a Unit Grate (cannot be greater than W, Gutter Width)   W_0 = N/A N/A N/A   N/A   Clogging Factor for a Single Unit Grate (typical min. value = 0.5)   C_r-G = N/A N/A N/A   N/A N/A   N/A N/A   N/A N/A N/A   N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Street Hydraulics: OK - Q < Allowable Street Capacity'   Design Discharge for Half of Street (from Inlet Management)   Qo			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
$ \begin{array}{c} \text{Water Depth at Flowline (outside of local depression)} & d = \\ \text{Water Depth at Street Crown (or at $T_{\text{MAX}}$)$} & d_{\text{CROWN}} = \\ 0.0 & 1.1 & \text{inches} \\ \text{Ratio of Gutter Flow to Design Flow} & E_{_0} = \\ 0.193 & 0.116 \\ 0.193 & 0.116 \\ 0.116 & 0.193 & 0.116 \\ 0.116 & 0.193 & 0.116 \\ 0.116 & 0.193 & 0.116 \\ 0.116 & 0.193 & 0.116 \\ 0.116 & 0.193 & 0.116 \\ 0.116 & 0.193 & 0.116 \\ 0.117 & 0.116 & 0.193 & 0.116 \\ 0.117 & 0.117 & 0.117 & 0.117 \\ 0.117 & 0.117 & 0.117 \\ 0.117 & 0.117 & 0.117 \\ 0.117 & 0.117 & 0.117 \\ 0.117 & 0$			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Ratio of Gutter Flow to Design Flow   Discharge outside the Gutter Section W, carried in Section $T_x$ Qx = 4.4   17.9   Cfs   Discharge within the Gutter Section W   Qw = 1.1   2.3   Cfs   Discharge Behind the Curb Face   QBACK = 0.0			
Discharge outside the Gutter Section W, carried in Section $T_x$ $Q_x = 0.4.4  17.9  cfs$ Discharge within the Gutter Section W $Q_w = 1.1  2.3  cfs$ Discharge Behind the Curb Face $Q_{BACK} = 0.0  0.0  cfs$ Flow Area within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Within the Gutter Section W $Q_{W} = 0.22  0.36  sq ft$ Velocity Minor Malor  MINOR MAJOR  MAJOR  MINOR MAJOR  N/A	Chom Chom	C 1000	
Discharge within the Gutter Section W $Q_{W} = 1.1                                 $			
Discharge Behind the Curb Face $Q_{BACK} = 0.0 0.0 0.0$ cfs Flow Area within the Gutter Section W $Q_{BACK} = 0.02 0.36$ sq ft Velocity within the Gutter Section W $Q_{W} = 0.22 0.36$ sq ft Velocity within the Gutter Section W $Q_{W} = 0.02 0.36$ sq ft Velocity within the Gutter Section W $Q_{W} = 0.02 0.36$ sq ft Velocity within the Gutter Section W $Q_{W} = 0.02 0.36$ sq ft Velocity within the Gutter Section W $Q_{W} = 0.02 0.36$ sq ft Velocity within the Gutter Section W $Q_{W} = 0.02 0.36$ sq ft Velocity Willow Section W $Q_{W} = 0.02 0.36$ sq ft Velocity Willow Section W $Q_{W} = 0.02 0.36$ sq ft Velocity Inches Willow Section Section Capacity Section Capacity Section Secti			
Flow Area within the Gutter Section W Velocity within the Gutter Section W Velocity within the Gutter Section W Water Depth for Design Condition Grate Analysis (Calculated) Total Length of Inlet Grate Opening Ratio of Grate Flow to Design Flow Under No-Clogging Condition Winnor Win			
Velocity within the Gutter Section W   Very within the Gutter Design Condition   Care Analysis (Calculated)   Very within the Grate Opening   Care Analysis (Calculated)   Very within the Grate Opening   Care Analysis (Calculated)   Very within the Gutter Opening   Care Analysis (Calculated)   Very within the Grate Opening   Very with			
Water Depth for Design Condition			
Grate Analysis (Calculated)   MINOR MAJOR			
Total Length of Inlet Grate Opening Ratio of Grate Flow to Design Flow Under No-Clogging Condition Minimum Velocity Where Grate Splash-Over Begins Interception Rate of Frontal Flow Interception Rate of Side Flow Under Clogging Condition Region Side Flow Interception Capacity Under Clogging Condition Clogging Condition Clogging Condition Clogging Flow Interception Rate of Side Flow Region Side F			
Ratio of Grate Flow to Design Flow  Under No-Clogging Condition  Minimum Velocity Where Grate Splash-Over Begins  Interception Rate of Frontal Flow  Interception Rate of Side Flow  Interception Rate of Side Flow  Interception Rate of Side Flow  Interception Capacity  Under Clogging Condition  Clogging Condition  Clogging Coefficient for Multiple-unit Grate Inlet  Clogging Factor for Multiple-unit Grate Inlet  Clogging Factor for Multiple-unit Grate Inlet  Winder Clogging Coefficient for Multiple-unit Grate Inlet  Clogging Factor for Multiple-unit Grate Inlet  Winder Clogging Coefficient for Multiple-unit Grate Inlet  Clogging Factor for Multiple-unit Grate Inlet  Winder Clogging Factor F			
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$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		o divine	
Interception Rate of Frontal Flow   Interception Rate of Side Flow   Interception Rate of Side Flow   Interception Capacity   Under Clogging Condition   Clogging Coefficient for Multiple-unit Grate Inlet   Clogging Factor for Multiple-unit Grate Inlet   Interception Capacity   Interception Rate of Frontal Flow   Interception Rate of Frontal Flow   Interception Rate of Side Flow   Cattle Flow			
Interception Rate of Side Flow $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Interception Capacity $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Clogging Cefficient for Multiple-unit Grate Inlet			
Clogging Factor for Multiple-unit Grate Inlet			
Effective (unclogged) Length of Multiple-unit Grate Inlet $L_{e} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ ft Minimum Velocity Where Grate Splash-Over Begins $V_{o} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ Interception Rate of Frontal Flow $R_{c} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ Interception Rate of Side Flow $R_{c} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ Actual Interception Capacity $Q_{a} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ Cfs Carry-Over Flow = $Q_{o}$ - $Q_{o}$ (to be applied to curb opening or next d/s inlet) $Q_{b} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Interception Rate of Frontal Flow $R_{r} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ Interception Rate of Side Flow $R_{x} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$ Actual Interception Capacity $Q_{a} = \frac{N/A}{N/A} = \frac{N/A}{N$			
Interception Rate of Side Flow $R_x = N/A N/A $ Actual Interception Capacity $Q_a = N/A N/A $ cfs Carry-Over Flow $= Q_0 - Q_0$ (to be applied to curb opening or next d/s inlet) $Q_b = N/A N/A $ cfs			
Actual Interception Capacity  Carry-Over Flow = $Q_a = N/A$ $N/A$ $N/A$ $Cfs$ Carry-Over Flow = $Q_a - Q_a$ (to be applied to curb opening or next d/s inlet) $Q_b = N/A$ $N/A$ $Cfs$			
Carry-Over Flow = $Q_a$ - $Q_a$ (to be applied to curb opening or next d/s inlet) $Q_b = N/A$ $N/A$ cfs		° ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	
Equivalent Slope $S_e$ (based on grate carry-over) $S_e = 0.090$ 0.062 ft/ft			
Required Length $L_T$ to Have 100% Interception $L_T = \begin{bmatrix} 14.40 & 33.15 \end{bmatrix}$ ft			
Under No-Clogging Condition MINOR MAJOR			
Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$ ) $L = 14.40$ 15.00 ft			
Interception Capacity $Q_i = \begin{bmatrix} 5.5 & 13.4 & \text{cfs} \end{bmatrix}$			
Under Clogging Condition MINOR MAJOR			
Clogging Coefficient CurbCoef = 1.31 1.31			
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet CurbClog = 0.04 0.04			
Effective (Unclogged) Length $L_e = 14.34$ ft			
Actual Interception Capacity $Q_a = 5.5$ 13.2 cfs			
Carry-Over Flow = $Q_h = 0.0$ 7.0 cfs			
Summary MINOR MAJOR			
Total Inlet Interception Capacity Q = 5.5 13.2 cfs			
Total Inlet Carry-Over Flow (flow bypassing inlet) Q <sub>b</sub> = 0.0 7.0 cfs			
Capture Percentage = Q <sub>n</sub> /Q <sub>n</sub> = <b>C% = 100 65</b> %	C% = 100 65	= C% = 100 65 %	

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

Project: Grandview Reserve
Inlet ID: Basin C-6 (DP 17e)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.015 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_\chi$ Discharge within the Gutter Section W ( $Q_T$ - $Q_\chi$ ) $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 8.9 8.9 1.6 $Q_W =$ 1.6 cfs 0.0 QRACK = cfs Q<sub>T</sub> = cfs 10.5 10.5 fps 1.0 1.0 V\*d =

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Maximum Flow Based On Allowable Spread
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T <sub>X TH</sub>
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Cutter Section W (O O)

	Discharge within the Gutter Section W ( $Q_d - Q_X$ )
	Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
	Total Discharge for Major & Minor Storm (Pre-Safety Factor)
	Average Flow Velocity Within the Gutter Section
	V*d Product: Flow Velocity Times Gutter Flowline Depth
	Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
	Max Flow Based on Allowable Depth (Safety Factor Applied)
1	Pesultant Flow Denth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	8.2	48.1	cfs
$Q_X =$	8.2	41.7	cfs
$Q_W =$	1.5	4.1	cfs
$Q_{BACK} =$	0.0	0.9	cfs
Q =	9.7	46.8	cfs
V =	0.9	1.4	fps
V*d =	0.3	0.9	
R =	1.00	1.00	
$Q_d =$	9.7	46.8	cfs
d =	4.36	7.68	inches
d <sub>CROWN</sub> =	0.00	3.22	inches

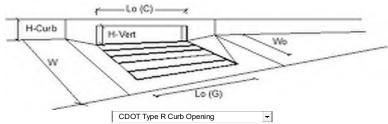
shoot (Tulet Management)				
$Q_{allow} =$	9.7	46.8	cfs	
	Minor Storm	Major Storm	_	

MAIOR STORM Allowable Capacity is based on Depth Criterion

Qallow = 9.7

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

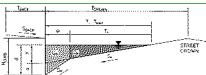
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Design Information (Input)		MINOR	MAJOR	1
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3.0	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	- ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> '` ∥
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	-
Street Hydraulics: OK - O < Allowable Street Capacity'	<u> </u>	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	3.3	11.7	cfs
Water Spread Width	√0 −   T =	10.3	16.0	ft
Water Spread Width Water Depth at Flowline (outside of local depression)	1 = 1 d =	3.1	4.6	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	0.2	inches
	d <sub>CROWN</sub> =		0.142	Inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.237		
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	2.5	10.1	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	0.8	1.7	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0 0.29	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.19		sq ft
Velocity within the Gutter Section W	. V <sub>w</sub> =	4.2	5.7	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.1	7.6	inches
Grate Analysis (Calculated)	. г	MINOR	MAJOR	ا ا
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	
<u>Under No-Clogging Condition</u>	,	MINOR	MAJOR	_ I
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
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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	<b>Q</b> <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	_
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	$S_e =$	0.106	0.072	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> =	10.30	23.52	∏ft ∥
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	10.30	15.00	ft
Interception Capacity	$Q_i =$	3.3	9.8	cfs
Under Clogging Condition	G 1	MINOR	MAJOR	<b>-</b>
Clogging Coefficient	CurbCoef =	1.31	1.31	7 I
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	<b></b>
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	⊣ <sub>ft</sub>
Actual Interception Capacity	Qa =	3.3	9.7	cfs
Carry-Over Flow = $Q_{h(GRATE)}$ - $Q_a$	Q <sub>b</sub> =	0.0	2.0	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.3	9.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.0	2.0	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	100	83	¬%
CONTRACT OF CONTRA	0,0 -1	100		1.15

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

Project: Grandview Reserve
Inlet ID: Basin C-8 (DP 17f)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.022 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm T<sub>MAX</sub> Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>O</sub> = Discharge outside the Gutter Section W, carried in Section $T_X$ $\,Q_X\,$ cfs 10.8 10.8 Discharge within the Gutter Section W $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread 1.9 1.9 $Q_W =$ cfs QRACK = cfs $Q_T =$ cfs 12.7 12.7 Flow Velocity within the Gutter Section fps V\*d = 0.4 Minor Storm Major Storm T<sub>TH</sub> = 15.6 29.4

T<sub>X TH</sub> =

Q<sub>X TH</sub> =

E<sub>o</sub> =

 $Q_X =$ 

Q<sub>W</sub> =

Q = V =

R =

Q<sub>d</sub> =

V\*d =

Q<sub>BACK</sub>

14.7

0.153

10.0

10.0

1.8

11.8 1.1

0.4

1.00

11.8

4.36

28.6

0.079

58.3

50.6

1.1

56.6

1.7

0.77

43.8

6.96

cfs

cfs

cfs

cfs

cfs

fps

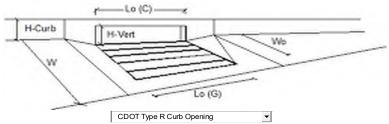
cfs

inches

inches

v^a Product: Flow velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance $T_{CROWN}$ )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

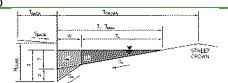
Minor storm max. allowable capacity GOOD - greater than the design flow given Major storm max. allowable capacity GOOD - greater than the design flow given				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q <sub>allow</sub> =	11.8	43.8	cfs
MINOR STORM Allowable Capacity is based on Depth Criterion		Minor Storm	Major Storm	
Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} =$	0.00	2.49	inche



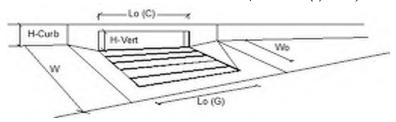
Design Information (Input)		MINOR	MAJOR	1
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3.0	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	- ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> '` ∥
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	-
Street Hydraulics: OK - Q < Allowable Street Capacity'	<u> </u>	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	8.6	20.0	cfs
Water Spread Width	√0 −   T =	13.8	16.0	ft
Water Spread Width Water Depth at Flowline (outside of local depression)	1 = 1 d =	3.9	5.2	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	- 1	0.0	0.7	inches
	d <sub>CROWN</sub> =	0.174		Inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =		0.125	
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	7.1	17.5	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.5	2.5	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.24	0.33	sq ft
Velocity within the Gutter Section W	V <sub>w</sub> =	6.1	7.5	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.9	8.2	inches
Grate Analysis (Calculated)	. г	MINOR	MAJOR	ا ا
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	
<u>Under No-Clogging Condition</u>	[	MINOR	MAJOR	٦. ا
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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 <sub>o</sub> =	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 = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	$Q_b =$	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	_	MINOR	Major	
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.083	0.065	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	$L_T = [$	19.17	32.97	ft
<u>Under No-Clogging Condition</u>	•	MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L =[	15.00	15.00	ft
Interception Capacity	$Q_i =$	8.0	13.3	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	7 I
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	7 I
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	⊤ft
Actual Interception Capacity	<b>Q</b> a =	8.0	13.1	cfs
Carry-Over Flow = Q <sub>b(GRATE)</sub> -Q <sub>a</sub>	Q <sub>b</sub> =	0.6	6.9	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	8.0	13.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	0.6	6.9	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	93	66	%
	<u> </u>			

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

Project: Grandview Reserve Inlet ID: Basin C-9a (DP17g)



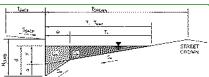
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  $S_{BACK} =$ 0.020 ft/ft Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  $n_{BACK} =$ 0.020 Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) ft/ft 0.083 Street Longitudinal Slope - Enter 0 for sump condition So ft/ft 0.020 Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 Allow Flow Depth at Street Crown (check box for yes, leave blank for no) V Maximum Capacity for 1/2 Street based On Allowable Spread Minor Storm Major Storm Water Depth without Gutter Depression (Eq. ST-2) 3.84 3.84 inches Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") inches d<sub>C</sub> = 0.8 0.8 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) inches 0.63 Water Depth at Gutter Flowline d = 4.47 4.47 inches Allowable Spread for Discharge outside the Gutter Section W (T - W)  $T_X =$ 15.2 15.2 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $E_0 =$ 0.149 0.149 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub> Q<sub>X</sub> = 10.3 10.3 cfs Discharge within the Gutter Section W  $(Q_T - Q_X)$ Q<sub>W</sub> = cfs 1.8 1.8 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Orack = 0.0 0.0 cfs Maximum Flow Based On Allowable Spread Q<sub>T</sub> = cfs 12.1 12.1 Flow Velocity within the Gutter Section 1.1 1.1 fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.4 Maximum Capacity for 1/2 Street based on Allowable Depth Minor Storm Major Storm T<sub>TH</sub> = Theoretical Water Spread 15.6 29.4 Theoretical Spread for Discharge outside the Gutter Section W (T - W) T<sub>X TH</sub> = 14.7 28.6 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>o</sub> = 0.153 0.079 Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ cfs Q<sub>X TH</sub> = 9.5 55.6 Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>) 9.5 1.7 cfs  $Q_x =$ 48.2 Discharge within the Gutter Section W (Q<sub>d</sub> - Q<sub>X</sub>) cfs Q<sub>W</sub> = 4.8 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) cfs Q<sub>BACK</sub> = 0.0 1.0 Total Discharge for Major & Minor Storm (Pre-Safety Factor) Q = 54.0 cfs 11.2 Average Flow Velocity Within the Gutter Section fps 1.1 1.6 V\*d Product: Flow Velocity Times Gutter Flowline Depth V\*d = 0.4 1.0 Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm R = 1.00 0.83 Max Flow Based on Allowable Depth (Safety Factor Applied)  $Q_d =$ 11.2 45.0 cfs Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) d = inches Resultant Flow Depth at Street Crown (Safety Factor Applied)  $d_{CROWN} =$ 0.00 2.70 linches MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion 11.2 45.0 cfs Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management lajor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Desire Information (Inner)		MINOD	MAJOR	
Design Information (Input)  CDOT Type R Curb Opening	I	MINOR	MAJOR Curb Opening	- I
Type of Inlet	Type =	CDOT Type R		
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	-l_, I
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<u> </u>
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR	MAJOR	٦. ا
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o =$	6.2	20.0	cfs
Water Spread Width	T =	12.4	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.6	5.3	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	$d_{CROWN} =$	0.0	0.8	inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.195	0.123	
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	$Q_x =$	5.0	17.5	cfs
Discharge within the Gutter Section W	$Q_w =$	1.2	2.4	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.22	0.34	sq ft
Velocity within the Gutter Section W	V <sub>w</sub> =	5.5	7.3	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.6	8.3	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L = [	N/A	N/A	ןft
Ratio of Grate Flow to Design Flow	E <sub>o-GRATE</sub> =	N/A	N/A	† I
Under No-Clogging Condition	0 0,01,12	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	∃ <sup>.,,,</sup>
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	<del>1</del>
Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	ا ته	MINOR	MAJOR	۱
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	ا ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	<del>-</del>
Effective (unclogged) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	ft I
Minimum Velocity Where Grate Splash-Over Begins	V <sub>0</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>0</sub> – R <sub>f</sub> =	N/A	N/A	-l' <sup>ips</sup>
'				-l
Interception Rate of Side Flow	R <sub>x</sub> =	N/A N/A	N/A N/A	ا ۔۔۔
Actual Interception Capacity	Q <sub>a</sub> =			cfs
Carry-Over Flow = Q <sub>0</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)	<b>Q</b> <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	ا ۔ ۔ ۔
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.091	0.065	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> = [	15.52	32.93	_ft
<u>Under No-Clogging Condition</u>	. 1	MINOR	MAJOR	٦. ا
Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$ )	L =	15.00	15.00	ft
Interception Capacity	$Q_i = [$	6.2	13.3	cfs
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	_
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	_
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	ft
Actual Interception Capacity	<b>Q</b> <sub>a</sub> =	6.2	13.1	cfs
Carry-Over Flow = Q <sub>b(GRATE)</sub> -Q <sub>a</sub>	Q <sub>b</sub> =	0.0	6.8	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.2	13.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	<b>Q</b> <sub>b</sub> =	0.0	6.8	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	100	66	%
N				

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

Project: Grandview Reserve Inlet ID: Basin C-9b (DP17h)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb T<sub>BACK</sub> = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft SBACK : Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{BACK} =$ Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> = linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.018 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.000 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm $T_{MAX}$ 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches inches a = 0.65 0.65 inches d = 4.10 4.10 T<sub>x</sub> = 15.2 0.151 15.2 0.151 E<sub>o</sub> = $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 0.0 0.0

Terdedi Bepar Bettreen editer Ep and editer riottime (abdail) E )
Gutter Depression (d <sub>C</sub> - (W * S <sub>x</sub> * 12))
Water Depth at Gutter Flowline
Allowable Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Discharge outside the Gutter Section W, carried in Section T <sub>X</sub>
Discharge within the Gutter Section W (Q <sub>T</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Maximum Flow Based On Allowable Spread
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
1

Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section TXTH
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W ( $Q_d$ - $Q_X$ )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

	Minor Storm	Major Storm	
$T_{TH} = $	17.2	32.6	ft
$T_{XTH} =$	16.4	31.7	ft
$E_0 = $	0.140	0.071	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X = [$	0.0	0.0	cfs
$Q_W = [$	0.0	0.0	cfs
$Q_{BACK} = $	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d = $	SUMP	SUMP	cfs
d =	·	· ·	inche
$d_{CROWN} =$			inche
_			_

 $Q_W =$ 

 $Q_{BACK} = Q_T =$ 

V\*d =

0.0

0.0 SUMP

0.0

0.0

0.0

0.0

SUMP

0.0

0.0

cfs

cfs

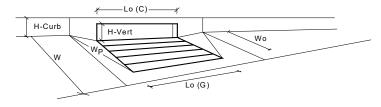
cfs

fps

MINOR STORM MAJOR STORM	Allowable	Capacity	is based	on	Depth	Criterion
MAJOR STORM	Allowable	Capacity	is based	on	Depth	Criterion

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

## INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

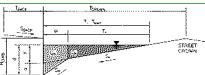


1	CDOT Type R Curb Opening				
	esign Information (Input)	_ =	MINOR	MAJOR	_
	pe of Inlet	Type =	CDOT Type R		
	ocal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
	umber of Unit Inlets (Grate or Curb Opening)	No =	4	4	Override Depth
	ater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	rate Information	_	MINOR	MAJOR	_
	ength of a Unit Grate	$L_o(G) =$	N/A	N/A	feet
Wi	idth of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Ar	rea Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
Clo	ogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_f(G) =$	N/A	N/A	
Gr	rate Weir Coefficient (typical value 2.15 - 3.60)	$C_w(G) =$	N/A	N/A	
Gr	rate Orifice Coefficient (typical value 0.60 - 0.80)	$C_0(G) =$	N/A	N/A	
lc.	urb Opening Information	٠, ١	MINOR	MAJOR	
	ength of a Unit Curb Opening	L <sub>0</sub> (C) =	5.00	5.00	feet
	eight of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	eight of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	ngle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	de Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
	ogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	-1000
	urb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) = C_o(C) = C_o(C)$	3.60	3.60	
	urb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (C) -	0.67	0.67	
	rate Flow Analysis (Calculated)		MINOR	MAJOR	_
	ogging Coefficient for Multiple Units	Coef =	N/A	N/A	
	ogging Factor for Multiple Units	Clog =	N/A	N/A	
	rate Capacity as a Weir (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
	terception without Clogging	$Q_{wi} =$	N/A	N/A	cfs
	terception with Clogging	$Q_{wa} =$	N/A	N/A	cfs
<u>G</u> r	rate Capacity as a Orifice (based on Modified HEC22 Method)	·	MINOR	MAJOR	
Int	terception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Int	terception with Clogging	$Q_{oa} =$	N/A	N/A	cfs
lGr	rate Capacity as Mixed Flow		MINOR	MAJOR	_
	terception without Clogging	Q <sub>mi</sub> =	N/A	N/A	□cfs
	terception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
	esulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Ci	urb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	ogging Coefficient for Multiple Units	Coef =	1.33	1.33	
	ogging Factor for Multiple Units	Clog =	0.03	0.03	
	urb Opening as a Weir (based on Modified HEC22 Method)	clog – L	MINOR	MAJOR	
	terception without Clogging	$Q_{wi} = \Gamma$	10.0	35.4	ີ່ cfs
	terception with Clogging terception with Clogging		9.7	34.3	cfs
		$Q_{wa} = $			Lis
	urb Opening as an Orifice (based on Modified HEC22 Method)	<u>с</u> г	MINOR	MAJOR	Tofo
	terception without Clogging	$Q_{oi} =$	33.6	43.9	cfs
	terception with Clogging	$Q_{oa} = L$	32.5	42.4	cfs
	urb Opening Capacity as Mixed Flow	_	MINOR	MAJOR	<b>-</b>
	terception without Clogging	$Q_{mi} =$	17.0	36.7	cfs
	terception with Clogging	Q <sub>ma</sub> =	16.5	35.5	cfs
Re	esulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	9.7	34.3	cfs
Re	esultant Street Conditions		MINOR	MAJOR	
	otal Inlet Length	L = [	20.00	20.00	feet
	esultant Street Flow Spread (based on street geometry from above)	T = [	17.2	32.6	ft.>T-Crown
	esultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.3	3.6	inches
1	•	C.C			<del>-</del>
م ا	ow Head Performance Reduction (Calculated)		MINOR	MAJOR	
	epth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	∏ft
	epth for Curb Opening Weir Equation		0.29	0.57	⊣¦t
		d <sub>Curb</sub> =	0.29		⊣'՝
	ombination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =		0.72	-
	urb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.67	0.88	4
Gr	rated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	
			MINOR	MAJOR	¬ -
IITo	otal Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	9.7	34.3	cfs
	nlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	5.9	29.5	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin C-7b (DP 18b)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.022 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>0</sub> = Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section $W\left(Q_T - Q_X\right)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 10.8 10.8 1.9 1.9 $Q_W =$ cfs QRACK = cfs $Q_T =$ cfs 12.7 12.7 Flow Velocity within the Gutter Section fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = Maximum Capacity for 1/2 Street based on Allowable Depth

I	Theoretical Water Spread
I	Theoretical Spread for Discharge outside the Gutter Section W (T - W)
ı	Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
ı	Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
I	Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
I	Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
ı	Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
ı	Total Discharge for Major & Minor Storm (Pre-Safety Factor)
ı	Average Flow Velocity Within the Gutter Section
ı	V*d Product: Flow Velocity Times Gutter Flowline Depth
ı	Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
ı	Max Flow Based on Allowable Depth (Safety Factor Applied)
ı	Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
ı	Resultant Flow Depth at Street Crown (Safety Factor Applied)

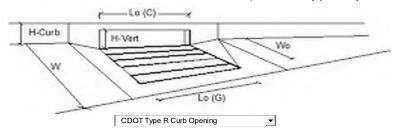
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$T_{TH} = $	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
E <sub>o</sub> =	0.153	0.079	
$Q_{XTH} =$	10.0	58.3	cfs
$Q_X = $	10.0	50.6	cfs
$Q_W = [$	1.8	5.0	cfs
$Q_{BACK} = $	0.0	1.1	cfs
Q =	11.8	56.6	cfs
V =	1.1	1.7	fps
V*d =	0.4	1.1	
R =	1.00	0.77	
$Q_d = $	11.8	43.8	cfs
d =	4.36	6.96	inches
d <sub>CROWN</sub> =	0.00	2.49	inches

 Minor Storm
 Major Storm

 Q<sub>allow</sub> =
 11.8
 43.8
 cfs

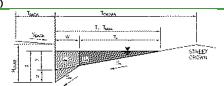
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



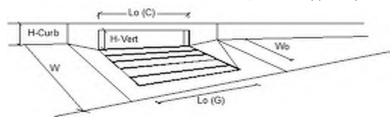
Docian Information (Input)		MINOR	MAJOR	
Design Information (Input) Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	· · · ·	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	a <sub>LOCAL</sub> = No =	3.0	3.0	inches
			5.00	-ft
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00		
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity	۰ ٦	MINOR	MAJOR	٦. ا
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o =$	11.0	26.4	cfs
Water Spread Width	T =	15.2	16.0	ft 
Water Depth at Flowline (outside of local depression)	d =	4.3	5.8	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	$d_{CROWN} = 1$	0.0	1.3	inches
Ratio of Gutter Flow to Design Flow	$E_o =$	0.158	0.113	
Discharge outside the Gutter Section W, carried in Section $T_x$	$Q_x =$	9.3	23.4	cfs
Discharge within the Gutter Section W	$Q_w =$	1.7	3.0	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W =$	0.27	0.37	sq ft
Velocity within the Gutter Section W	$V_W =$	6.5	8.1	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	7.3	8.8	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	
<u>Under No-Clogging Condition</u>	-	MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	$R_f =$	N/A	N/A	7
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Interception Capacity	$\hat{Q_i} =$	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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, =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>0</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	T'''
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	
Actual Interception Capacity	<b>Q</b> a =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>3.</b> 0	MINOR	MAJOR	10.0
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	$S_e = $	0.077	0.061	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> =	22.49	39.20	ft
Under No-Clogging Condition	-1 - [	MINOR	MAJOR	٦٠٠
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	15.00	15.00	∃ft
Interception Capacity	Q <sub>i</sub> =	9.5	15.3	cfs
Under Clogging Condition	Q <sub>i</sub> −[	MINOR	MAJOR	٦~،3
Clogging Coefficient	CurbCoef =	1.31	1.31	ا ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.04	0.04	<del> </del>
Effective (Unclogged) Length	Curbciog = [	14.34	14.34	ft
			14.34 <b>15.1</b>	cfs
Actual Interception Capacity	Q <sub>a</sub> =	9.4	11.3	
Carry-Over Flow = Q <sub>b(GRATF)</sub> -Q <sub>a</sub>	Q <sub>b</sub> =	1.6		cfs
Summary Total Talet Interception Conneits	<b>~</b> [	MINOR	MAJOR	ا ۔۔۔
Total Inlet Interception Capacity	Q =	9.4	15.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	1.6	11.3	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	85	57	%

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

Project: Grandview Reserve
Inlet ID: Basin C-7b (DP 18b)



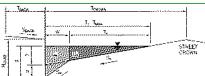
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  $S_{BACK} =$ 0.020 ft/ft Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  $n_{BACK} =$ 0.020 Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) ft/ft 0.083 Street Longitudinal Slope - Enter 0 for sump condition So ft/ft 0.022 Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 Allow Flow Depth at Street Crown (check box for yes, leave blank for no) V Maximum Capacity for 1/2 Street based On Allowable Spread Minor Storm Major Storm Water Depth without Gutter Depression (Eq. ST-2) 3.84 3.84 inches Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") inches d<sub>C</sub> = 0.8 0.8 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) inches 0.63 Water Depth at Gutter Flowline d = 4.47 4.47 inches Allowable Spread for Discharge outside the Gutter Section W (T - W)  $T_X =$ 15.2 15.2 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $E_0 =$ 0.149 0.149 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub> Q<sub>X</sub> = 10.8 10.8 cfs Discharge within the Gutter Section W  $(Q_T - Q_X)$ Q<sub>W</sub> = cfs 1.9 1.9 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Orack = 0.0 cfs 0.0 Maximum Flow Based On Allowable Spread Q<sub>T</sub> = 12.7 12.7 cfs Flow Velocity within the Gutter Section 1.2 1.2 fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.4 Maximum Capacity for 1/2 Street based on Allowable Depth Minor Storm Major Storm T<sub>TH</sub> = Theoretical Water Spread 15.6 29.4 Theoretical Spread for Discharge outside the Gutter Section W (T - W) T<sub>X TH</sub> = 14.7 28.6 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>o</sub> = 0.153 0.079 Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ cfs Q<sub>X TH</sub> = 10.0 58.3 Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>) cfs  $Q_x =$ 10.0 50.6 Discharge within the Gutter Section W (Q<sub>d</sub> - Q<sub>X</sub>) cfs Q<sub>W</sub> = 1.8 5.0 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) cfs Q<sub>BACK</sub> = 0.0 1.1 Total Discharge for Major & Minor Storm (Pre-Safety Factor) Q = cfs 11.8 56.6 Average Flow Velocity Within the Gutter Section fps 1.1 1.7 V\*d Product: Flow Velocity Times Gutter Flowline Depth V\*d = 0.4 1.1 Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm 1.00 R = 0.77 Max Flow Based on Allowable Depth (Safety Factor Applied)  $Q_d =$ 11.8 43.8 cfs Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) d = inches Resultant Flow Depth at Street Crown (Safety Factor Applied)  $d_{CROWN} =$ 0.00 2.49 linches MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion 11.8 43.8 cfs Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management lajor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



Design Information (Input)		MINOR	MAJOR	
Type of Inlet  CDOT Type R Curb Opening	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	T
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00	5.00	⊣ft I
Width of a Unit Grate (cannot be greater than W, Gutter Width)	w <sub>o</sub> =	N/A	N/A	⊣ft I
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>∃</b> ``
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o = $	11.0	26.4	□cfs
Water Spread Width	T =	15.2	16.0	∃ <sub>ft</sub> I
Water Depth at Flowline (outside of local depression)	d =	4.3	5.8	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	d <sub>CROWN</sub> =	0.0	1.3	inches
Ratio of Gutter Flow to Design Flow	E <sub>o</sub> =	0.158	0.113	- I
Discharge outside the Gutter Section W, carried in Section T <sub>v</sub>	O <sub>v</sub> =	9.3	23.4	cfs
Discharge within the Gutter Section W	$Q_w = 1$	1.7	3.0	cfs
Discharge Behind the Curb Face	Q <sub>BACK</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W = \begin{bmatrix} A_W & A_W & A_W \end{bmatrix}$	0.27	0.37	sq ft
Velocity within the Gutter Section W	V <sub>w</sub> =	6.5	8.1	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	7.3	8.8	inches
Grate Analysis (Calculated)	GIOLAI - I	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L = [	N/A	N/A	∃ft
Ratio of Grate Flow to Design Flow	E <sub>o-GRATE</sub> =	N/A	N/A	⊣'` ∥
Under No-Clogging Condition	LO-GRATE -	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>0</sub> – R <sub>f</sub> =	N/A	N/A	∃ <sup>ips</sup>
Interception Rate of Flow	$R_x = $	N/A	N/A	-
Interception Rate of Side Flow  Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	Qi -[	MINOR	MAJOR	_lus
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦ ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	-
Effective (unclogged) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	⊣ <sub>ft</sub> ∥
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	∃ <sup>ips</sup>
Interception Rate of Flow	$R_x = R_x$	N/A	N/A	-
Actual Interception Capacity	$Q_a =$	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>a</sub> = Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>Q</b> <sub>b</sub> − 1	MINOR	MAJOR	CIS
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.077	0.061	∏ft/ft
Required Length $L_T$ to Have 100% Interception	S <sub>e</sub> −   L <sub>T</sub> =	22.49	39.20	ft I
Under No-Clogging Condition	LT -[	MINOR	MAJOR	<b>⊣</b> '' ∥
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	15.00	15.00	Tft I
Interception Capacity	Q <sub>i</sub> =	9.5	15.00	cfs
Under Cloaging Condition	Ų −[	9.5 MINOR	MAJOR	_u°
Clogging Coefficient	CurbCoef =	1.31	1.31	٦ ا
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	-
Effective (Unclogged) Length	Curbciog = L	14.34	14.34	-  <sub>ft</sub>
Actual Interception Capacity	- F	9.4	15.1	cfs
Carry-Over Flow = Q <sub>b/GRATE/</sub> -Q <sub>a</sub>	Q <sub>a</sub> =	1.6	11.3	cfs
	<b>Q</b> <sub>b</sub> =	MINOR	MAJOR	CIS
Summary Total Inlet Interception Capacity	0-1	9.4	15.1	cfs
1 ' ' '	Q =			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet) Capture Percentage = $Q_a/Q_0$ =	Qь = С% =	1.6 85	11.3 57	
Capture rescentage = Qa/Qn =	C-70 =	65	<u> </u>	170

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

Project: Grandview Reserve
Inlet ID: Basin C-10 (DP 18c)



Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 Side Slope Behind Curb (leave blank for no conveyance credit behind curb) ft/ft  $S_{BACK} =$ 0.020 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  $n_{BACK} =$ 0.020 Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition  $S_0$ 0.000 ft/ft Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches 4.4 7.7 Check boxes are not applicable in SUMP conditions Maximum Capacity for 1/2 Street based On Allowable Spread Water Depth without Gutter Depression (Eq. ST-2) Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) Water Depth at Gutter Flowline Allowable Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Discharge outside the Gutter Section W, carried in Section T<sub>x</sub>

Discharge within the Gutter Section W  $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread Flow Velocity within the Gutter Section V\*d Product: Flow Velocity times Gutter Flowline Depth

Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Water Spread Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T<sub>XTH</sub> Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>) Discharge within the Gutter Section W  $(Q_d - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V\*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

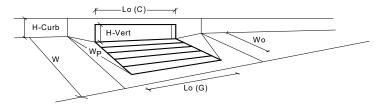
	Minor Storm	Major Storm	
y =	3.84	3.84	inches
$d_C =$	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
E <sub>O</sub> =	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	]
			_
	Minor Charm	Major Charm	

	Minor Storm	Major Storm	
T <sub>TH</sub> =	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
E <sub>O</sub> =	0.153	0.079	1
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W = $	0.0	0.0	cfs
$Q_{BACK} = [$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =[	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	1
$Q_d = $	SUMP	SUMP	cfs
d =			inches
$I_{CROWN} = [$			inches

Minor Storm Major Storm cfs

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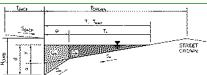
## INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



	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 <sub>local</sub> =	3.00	3.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =		3	∃ <sup></sup>
		·	3		→
	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 <sub>0</sub> (G) =	N/A	N/A	lfeet
	· · · · · · · · · · · · · · · · · · ·			/	
	Width of a Unit Grate	$W_o =$	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	<del>-</del>
				,	_
	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)	$C_0(G) =$	N/A	N/A	
	Curb Opening Information	٥٠, ٢	MINOR	MAJOR	_
		. (6) [			¬
	Length of a Unit Curb Opening	$L_o(C) = $	5.00	5.00	feet
	Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	3				
	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
ng 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_{D} =$	2.00	2.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	_
					-
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	<b>⊣</b>
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o(C) =$	0.67	0.67	
	Grate Flow Analysis (Calculated)		MINOR	MAJOR	
		C F			7
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	<b>⊣</b>
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	1
	Grate Capacity as a Weir (based on Modified HEC22 Method)	- L	MINOR	MAJOR	_
		0 -			T <sub>efe</sub>
	Interception without Clogging	$Q_{wi} = L$	N/A	N/A	cfs
	Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
	Interception without Clogging	0 -	N/A	N/A	cfs
		$Q_{oi} = $			
	Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	_	MINOR	MAJOR	<del></del>
	Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	ີ່ cfs
	priterception without clogging		IN/A	I IN/A	lci S
	II_				
	Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
			N/A N/A	N/A N/A	cfs cfs
	Resulting Grate Capacity (assumes clogged condition)	Q <sub>ma</sub> =	N/A	N/A	
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated)	Q <sub>ma</sub> = Q <sub>Grate</sub> =	N/A MINOR	N/A MAJOR	
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units	$Q_{ma} = Q_{Grate} = Q_{Grate}$ $Coef = Q_{Grate} = Q_{Grate}$	N/A MINOR 1.31	MAJOR 1.31	
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated)	Q <sub>ma</sub> = Q <sub>Grate</sub> =	N/A MINOR	N/A MAJOR	
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units	$Q_{ma} = Q_{Grate} = Q_{Grate}$ $Coef = Q_{Grate} = Q_{Grate}$	N/A MINOR 1.31 0.04	N/A MAJOR 1.31 0.04	
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method)	Q <sub>ma</sub> = QGrate = Coef = Clog = C	N/A MINOR 1.31 0.04 MINOR	N/A MAJOR 1.31 0.04 MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Curb Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging	$Q_{ma} = \frac{Q_{ma}}{Q_{Grate}} = \frac{Q_{ma}}{Q_{Grate}}$ $Coef = \begin{bmatrix} Clog = \end{bmatrix}$ $Q_{wi} = \begin{bmatrix} Q_{wi} = 0 \end{bmatrix}$	N/A MINOR 1.31 0.04 MINOR 7.5	N/A MAJOR 1.31 0.04 MAJOR 26.6	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method)	Q <sub>ma</sub> = QGrate = Coef = Clog = C	N/A MINOR 1.31 0.04 MINOR	N/A MAJOR 1.31 0.04 MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Curb Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Interception with Clogging	$Q_{ma} = \frac{Q_{ma}}{Q_{Grate}} = \frac{Q_{ma}}{Q_{Grate}}$ $Coef = \begin{bmatrix} Clog = \end{bmatrix}$ $Q_{wi} = \begin{bmatrix} Q_{wi} = 0 \end{bmatrix}$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2	N/A  MAJOR  1.31  0.04  MAJOR  26.6  25.4	cfs
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Curb Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Interception with Clogging  Curb Opening as an Orifice (based on Modified HEC22 Method)	$Q_{ma} = \mathbf{Q}_{Grate} = \mathbf{Q}_{Grate}$ $Coef = \begin{bmatrix} Clog = \end{bmatrix}$ $Q_{wi} = \begin{bmatrix} Q_{wi} = \end{bmatrix}$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR	N/A  MAJOR  1.31  0.04  MAJOR  26.6  25.4  MAJOR	cfs  cfs  cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging	$Q_{ma} = Q_{Grate} = Q_{Grate} = Q_{Grate} = Q_{wi} = Q_{wi} = Q_{oi} = Q$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2	N/A  MAJOR  1.31 0.04  MAJOR  26.6  25.4  MAJOR  32.9	cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Curb Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Interception with Clogging  Curb Opening as an Orifice (based on Modified HEC22 Method)	$Q_{ma} = \mathbf{Q}_{Grate} = \mathbf{Q}_{Grate}$ $Coef = \begin{bmatrix} Clog = \end{bmatrix}$ $Q_{wi} = \begin{bmatrix} Q_{wi} = \end{bmatrix}$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR	N/A  MAJOR  1.31  0.04  MAJOR  26.6  25.4  MAJOR	cfs  cfs  cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging	$Q_{ma} = Q_{Grate} = Q_{Grate} = Q_{Grate} = Q_{wi} = Q_{wi} = Q_{oi} = Q$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1	N/A  MAJOR  1.31 0.04  MAJOR  26.6 25.4  MAJOR  32.9 31.5	cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Curb Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Interception with Clogging  Curb Opening as an Orifice (based on Modified HEC22 Method)  Interception without Clogging  Interception without Clogging  Interception with Clogging  Interception with Clogging  Curb Opening Capacity as Mixed Flow	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{Grate} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \\ \\ Q_{oi} = \\ \\ Q_{oa} = \end{array}$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR	N/A  MAJOR  1.31 0.04  MAJOR  26.6 25.4  MAJOR  32.9 31.5  MAJOR	cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging	$\begin{aligned} Q_{ma} &= \\ \mathbf{Q}_{Grate} &= \\ \end{aligned}$ $\begin{aligned} &\text{Coef} &= \\ &\text{Clog} &= \\ \end{aligned}$ $\begin{aligned} Q_{wi} &= \\ Q_{wa} &= \\ \end{aligned}$ $\begin{aligned} Q_{oi} &= \\ \end{aligned}$ $\begin{aligned} Q_{oi} &= \\ \end{aligned}$ $Q_{oi} &= \\ \end{aligned}$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5	cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition)  Curb Opening Flow Analysis (Calculated)  Clogging Coefficient for Multiple Units  Clogging Factor for Multiple Units  Curb Opening as a Weir (based on Modified HEC22 Method)  Interception without Clogging  Interception with Clogging  Curb Opening as an Orifice (based on Modified HEC22 Method)  Interception without Clogging  Interception without Clogging  Interception with Clogging  Interception with Clogging  Curb Opening Capacity as Mixed Flow	$Q_{ma} = Q_{Grate} = Q_{Grate} = Q_{Grate} = Q_{wi} = Q_{wi} = Q_{oa} = Q$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3	cfs cfs cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging Interception with Clogging Interception with Clogging Interception with Clogging	$Q_{ma} = Q_{Grate} = Q_{Grate} = Q_{Grate} = Q_{wi} = Q_{wi} = Q_{oa} = Q$	N/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5	cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging Interception with Clogging Interception with Clogging Interception with Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition)	$\begin{aligned} Q_{ma} &= \\ \mathbf{Q}_{Grate} &= \\ \end{aligned}$ $\begin{aligned} &\text{Coef} &= \\ &\text{Clog} &= \\ \end{aligned}$ $\begin{aligned} Q_{wi} &= \\ Q_{wa} &= \\ \end{aligned}$ $\begin{aligned} Q_{oi} &= \\ \end{aligned}$ $\begin{aligned} Q_{oi} &= \\ \end{aligned}$ $Q_{oi} &= \\ \end{aligned}$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4	cfs cfs cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception with Clogging Interception with Clogging Interception without Clogging Interception without Clogging Interception without Clogging Interception with Clogging Interception with Clogging Interception with Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes clogged condition) Resultant Street Conditions	Q <sub>ma</sub> = Q <sub>Grate</sub> =   Q <sub>Grate</sub> =   Q <sub>Grate</sub> =   Q <sub>ob</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR	cfs cfs cfs cfs cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging Interception with Clogging Interception with Clogging Interception with Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition)	$Q_{ma} = Q_{Grate} = Q_{Grate} = Q_{Grate} = Q_{wi} = Q_{wi} = Q_{oa} = Q$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4	cfs cfs cfs cfs cfs cfs cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length	Q <sub>ma</sub> = Q <sub>Grate</sub> =   Q <sub>Grate</sub> =   Q <sub>Grate</sub> =   Q <sub>ob</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes clogged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above)	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{\text{Grate}} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \\ \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{\text{Curb}} = \\ \end{array}$ $\begin{array}{c} L = \\ \\ T = \\ \end{array}$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.6	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 29.4	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{\textbf{Grate}} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \\ \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{ma} = \\ \\ \mathbf{Q}_{curb} = \\ \end{array}$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Interception with Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{\text{Grate}} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \\ \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{\text{Curb}} = \\ \end{array}$ $\begin{array}{c} L = \\ \\ T = \\ \end{array}$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 0.0	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Interception with Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{\text{Grate}} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \\ \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{\text{Curb}} = \\ \end{array}$ $\begin{array}{c} L = \\ \\ T = \\ \end{array}$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 0.0	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes cloqued condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated)	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{\text{Grate}} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{ma} = \\ \\ \mathbf{Q}_{curb} = \end{array}$ $\begin{array}{c} L = \\ T = \\ \\ d_{CROWN} = \end{array}$	MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes clogged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{Grate} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \\ \\ Q_{oa} = \\ \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{Curb} = \\ \end{array}$ $\begin{array}{c} L = \\ \\ T = \\ \\ d_{CROWN} = \\ \\ \end{array}$	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A	N/A  MAJOR  1.31 0.04  MAJOR 26.6 25.4  MAJOR 32.9 31.5  MAJOR 27.5 26.3 25.4  MAJOR 15.00 29.4 3.2	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging Interception with Clogging Resulting Curb Opening Capacity (assumes cloqued condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated)	$\begin{array}{c} Q_{ma} = \\ \mathbf{Q}_{\text{Grate}} = \end{array}$ $\begin{array}{c} \text{Coef} = \\ \text{Clog} = \\ \\ Q_{wi} = \\ \\ Q_{wa} = \end{array}$ $\begin{array}{c} Q_{oi} = \\ Q_{oa} = \\ \\ Q_{ma} = \\ \\ \mathbf{Q}_{ma} = \\ \\ \mathbf{Q}_{curb} = \end{array}$ $\begin{array}{c} L = \\ T = \\ \\ d_{CROWN} = \end{array}$	MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception without Clogging Interception without Clogging Interception without Clogging Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown  Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation	Q <sub>ma</sub> = Q <sub>Grate</sub> =   Q <sub>Grate</sub> =   Q <sub>Grate</sub> =   Q <sub>oi</sub> =   Q <sub>curb</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.6 0.0 MINOR	N/A  MAJOR  1.31 0.04  MAJOR 26.6 25.4  MAJOR 32.9 31.5  MAJOR 27.5 26.3 25.4  MAJOR 15.00 29.4 3.2	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Rurb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41 0.67	N/A MAJOR 1.31 1.31 1.31 1.31 1.31 1.31 1.31 1.3	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Rurb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41	N/A MAJOR 1.31 0.04 MAJOR 26.6 25.4 MAJOR 32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41 0.67	N/A MAJOR 1.31 1.31 1.31 1.31 1.31 1.31 1.31 1.3	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.6 0.0 MINOR N/A 0.29 0.41 0.67 N/A	N/A  MAJOR  1.31 0.04  MAJOR 26.6 25.4  MAJOR 32.9 31.5  MAJOR 27.5 26.3  25.4  MAJOR 15.00	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Reurb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets Grated Inlet Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41 0.67 N/A MINOR	N/A  MAJOR  1.31  0.04  MAJOR  26.6  25.4  MAJOR  32.9  31.5  MAJOR  27.5  26.3  25.4  MAJOR  15.00  29.4  3.2  MAJOR  N/A  N/A  N/A  MAJOR  MAJOR	cfs
	Resulting Grate Capacity (assumes cloqued condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Curb Opening as an Orifice (based on Modified HEC22 Method) Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Resulting Curb Opening Capacity (assumes cloqged condition) Resultant Street Conditions Total Inlet Length Resultant Street Flow Spread (based on street geometry from above) Resultant Flow Depth at Street Crown Low Head Performance Reduction (Calculated) Depth for Grate Midwidth Depth for Curb Opening Weir Equation Combination Inlet Performance Reduction Factor for Long Inlets Curb Opening Performance Reduction Factor for Long Inlets	Q <sub>ma</sub> = Q <sub>Grate</sub> =	M/A MINOR 1.31 0.04 MINOR 7.5 7.2 MINOR 25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.6 0.0 MINOR N/A 0.29 0.41 0.67 N/A	N/A  MAJOR  1.31 0.04  MAJOR 26.6 25.4  MAJOR 32.9 31.5  MAJOR 27.5 26.3  25.4  MAJOR 15.00	cfs

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

Project: Grandview Reserve
Inlet ID: Basin C-11 (DP 19)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> = Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 n<sub>BACK</sub> = Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 linches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 2.00 Gutter Width Street Transverse Slope $S_X =$ 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.000 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Max. Allowable Spread for Minor & Major Storm Max. Allowable Depth at Gutter Flowline for Minor & Major Storm Check boxes are not applicable in SUMP conditions

Maximum Capacity for 1/2 Street based On Allowable Spread
Water Depth without Gutter Depression (Eq. ST-2)
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")
Gutter Depression (d <sub>C</sub> - (W * S <sub>x</sub> * 12))
Water Depth at Gutter Flowline
Allowable Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>
Discharge within the Gutter Section W $(Q_T - Q_X)$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Maximum Flow Based On Allowable Spread
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth

Maximum Capacity for 1/2 Street based on Allowable Depth
Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section TXTH
Actual Discharge outside the Gutter Section W, (limited by distance $T_{CROWN}$ )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

	Minor Storm	Major Storm	
y =	3.84	3.84	inches
$d_C =$	2.0	2.0	inches
a =	1.51	1.51	inches
d =	5.35	5.35	inches
$T_X =$	14.0	14.0	ft
$E_0 =$	0.372	0.372	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
			_
	Minor Storm	Major Storm	_
$T_{TH} =$	11.9	25.7	ft
$T_{XTH} =$	9.9	23.7	ft
$E_0 =$	0.497	0.228	

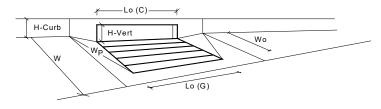
Major Storm

inches

	Minor Storm	Major Storm	
$T_{TH} =$	11.9	25.7	ft
$T_{XTH} =$	9.9	23.7	ft
$E_0 =$	0.497	0.228	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
$d_{CROWN} =$			inches

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

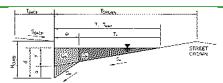
## INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening				
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R	Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	Override Depths
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
Grate Information		MINOR	MAJOR	<u></u>
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
Area Opening 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	
<u>Curb Opening Information</u>	_	MINOR	MAJOR	_
Length of a Unit Curb Opening	$L_o(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	$H_{throat} = $	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) = C <sub>o</sub> (C) =	3.60	3.60	_
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C₀ (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)	6 6 5	MINOR	MAJOR	7
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 Modified HEC22 Method)	۰ ٦	MINOR	MAJOR	7.4.
Interception without Clogging	$Q_{wi} =$	N/A	N/A	cfs cfs
Interception with Clogging Grate Capacity as a Orifice (based on Modified HEC22 Method)	$Q_{wa} = $	N/A MINOR	N/A MAJOR	_crs
Interception without Clogging	ο - Γ			ີ່ cfs
Interception without clogging  Interception with Clogging	Q <sub>oi</sub> =	N/A N/A	N/A N/A	cfs
Grate Capacity as Mixed Flow	$Q_{oa} = $	MINOR	MAJOR	_lus
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	່ີ⊂fs
Interception without clogging	Q <sub>mi</sub> – Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes cloqged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	Colate	MINOR	MAJOR	10.0
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	7
Clogging Factor for Multiple Units	Clog =	0.10	0.10	-
Curb Opening as a Weir (based on Modified HEC22 Method)	c.09 L	MINOR	MAJOR	_
Interception without Clogging	$Q_{wi} = \Gamma$	2.7	10.1	□cfs
Interception with Clogging	Q <sub>wa</sub> =	2.4	9.1	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)	CWa L	MINOR	MAJOR	
Interception without Clogging	$Q_{oi} = \Gamma$	8.4	11.0	cfs
Interception with Clogging	Q <sub>oa</sub> =	7.6	9.9	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	_
Interception without Clogging	$Q_{mi} = \Gamma$	4.4	9.8	cfs
Interception with Clogging	$Q_{ma} = \Gamma$	4.0	8.8	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	2.4	8.8	cfs
Resultant Street Conditions		MINOR	MAJOR	<u> </u>
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	11.9	25.7	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	2.3	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 <sub>Curb</sub> =	0.20	0.47	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.56	0.98	
Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	
	_			
		MINOR	MAJOR	_
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	2.4	8.8	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	1.0	2.3	cfs

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

Project: Grandview Reserve
Inlet ID: Basin C-12 (DP 20)



### Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

$T_{BACK} =$	7.5	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.020	1
		•
H	6.00	linch

$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
n <sub>STREET</sub> =	0.016	

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
	===	:-	_

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12))
Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_X$  Discharge within the Gutter Section  $W\left(Q_T - Q_X\right)$  Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

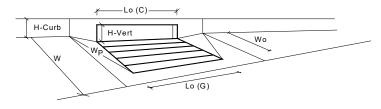
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor Storm	Major Storm	_
3.84	3.84	inches
0.8	0.8	inches
0.63	0.63	inches
4.47	4.47	inches
15.2	15.2	ft
0.149	0.149	
0.0	0.0	cfs
0.0	0.0	cfs
0.0	0.0	cfs
SUMP	SUMP	cfs
0.0	0.0	fps
0.0	0.0	
	3.84 0.8 0.63 4.47 15.2 0.149 0.0 0.0 SUMP 0.0	3.84 3.84 0.8 0.8 0.8 0.63 0.63 4.47 4.47 15.2 15.2 0.149 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inche
dcpown =			linches

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

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

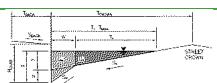


li e	CDOT Type R Curb Opening		MATRICO	144100	
	Design Information (Input)	T [	MINOR	MAJOR Curb Opening	-
	Type of Inlet	Type =	3.00	Curb Opening	inches
	ocal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> = No =	3.00	3.00	Override Depth:
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	Politility Deptil - [	MINOR	MAJOR	linches
	ength of a Unit Grate	$L_{o}(G) = \Gamma$	N/A	N/A	∏feet
	Vidth of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	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 <sub>w</sub> (G) =	N/A	N/A	_
	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	-
	Curb Opening Information	G <sub>0</sub> (G)	MINOR	MAJOR	
	ength of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	5.00	feet
	Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	C <sub>f</sub> (C) =	0.10	0.10	
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>o</sub> (C) =	0.67	0.67	-
	Grate Flow Analysis (Calculated)	-0 (-)	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	7
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	1
	Grate Capacity as a Weir (based on Modified HEC22 Method)	Glog – L	MINOR	MAJOR	_
	nterception without Clogging	$Q_{wi} = \Gamma$	N/A	N/A	ີ່ lcfs
	nterception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	Qwa − L	MINOR	MAJOR	
	nterception without Clogging	Q <sub>oi</sub> =	N/A	l N/A	Tcfs
	nterception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	40a - L	MINOR	MAJOR	٦٠٠٥
	nterception without Clogging	$Q_{mi} = \Gamma$	N/A	N/A	ີ່ lcfs
	nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
İ	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	<u> </u>
	Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	7
	Clogging Factor for Multiple Units	Clog =	0.10	0.10	-
	Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
	nterception without Clogging	$Q_{wi} = $	3.7	10.1	cfs
	nterception with Clogging	Q <sub>wa</sub> =	3.4	9.1	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	CWG L	MINOR	MAJOR	_
	nterception without Clogging	$Q_{oi} = \Gamma$	8.4	11.0	cfs
	nterception with Clogging	Q <sub>oa</sub> =	7.6	9.9	cfs
	Curb Opening Capacity as Mixed Flow	200	MINOR	MAJOR	
	nterception without Clogging	$Q_{mi} = \Gamma$	5.2	9.8	cfs
	nterception with Clogging	Q <sub>ma</sub> =	4.7	8.8	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	3.4	8.8	cfs
	Resultant Street Conditions		MINOR	MAJOR	
	otal Inlet Length	L =	5.00	5.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	3.2	inches
		· · · · <u>-</u>		•	_
	ow Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	∏ft
	Depth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.56	0.98	
	Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	1.00	1.00	7
	Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	1
`		Grate _	•	, ,	
			MINOR	MAJOR	
П	Total Inlet Interception Capacity (assumes clogged condition)	<b>Q</b> <sub>a</sub> =	3.4	8.8	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	2.9	6.7	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

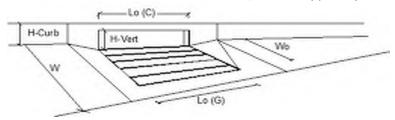
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Grandview Reserve
Inlet ID: Basin D-1 (DP 22)



Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 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 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) ft/ft 0.083 Street Longitudinal Slope - Enter 0 for sump condition So ft/ft 0.010 Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 Allow Flow Depth at Street Crown (check box for yes, leave blank for no) V Maximum Capacity for 1/2 Street based On Allowable Spread Minor Storm Major Storm Water Depth without Gutter Depression (Eq. ST-2) 3.84 3.84 inches Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") inches d<sub>C</sub> = 0.8 0.8 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) inches 0.63 Water Depth at Gutter Flowline d = 4.47 4.47 inches Allowable Spread for Discharge outside the Gutter Section W (T - W)  $T_X =$ 15.2 15.2 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $E_0 =$ 0.149 0.149 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub> Q<sub>X</sub> = 7.3 7.3 cfs Discharge within the Gutter Section W  $(Q_T - Q_X)$ Q<sub>W</sub> = 1.3 1.3 cfs Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Orack = 0.0 0.0 cfs Maximum Flow Based On Allowable Spread Q<sub>T</sub> = cfs 8.5 8.5 Flow Velocity within the Gutter Section 0.8 0.8 fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.3 Maximum Capacity for 1/2 Street based on Allowable Depth Minor Storm Major Storm T<sub>TH</sub> = Theoretical Water Spread 15.6 29.4 Theoretical Spread for Discharge outside the Gutter Section W (T - W) T<sub>X TH</sub> = 14.7 28.6 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>o</sub> = 0.153 0.079 Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ cfs Q<sub>X TH</sub> = 6.7 39.3 Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>) cfs  $Q_x =$ 6.7 34.1 Discharge within the Gutter Section W (Q<sub>d</sub> - Q<sub>X</sub>) 3.4 1.2 cfs Q<sub>W</sub> = Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) cfs Q<sub>BACK</sub> = 0.0 0.7 Total Discharge for Major & Minor Storm (Pre-Safety Factor) 7.9 Q = cfs 38.2 Average Flow Velocity Within the Gutter Section 0.8 fps 1.2 V\*d Product: Flow Velocity Times Gutter Flowline Depth V\*d = 0.3 0.7 Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm 1.00 1.00 R = Max Flow Based on Allowable Depth (Safety Factor Applied)  $Q_d =$ 7.9 38.2 cfs Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) d = 7.68 inches Resultant Flow Depth at Street Crown (Safety Factor Applied) d<sub>CROWN</sub> = 0.00 3.22 linches MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion 7.9 38.2 Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management lajor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

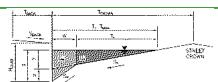
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Daving Information (Inna)		MINOD	MAJOR	1
Design Information (Input)  CDOT Type R Curb Opening  ▼	I	MINOR	MAJOR Curb Opening	- I
Type of Inlet	Type =	CDOT Type R		
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =		2	<b>-</b>
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00	5.00	_ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	4
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR	MAJOR	٦. ا
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o =$	5.4	12.7	cfs
Water Spread Width	T =	13.4	16.0	_lft
Water Depth at Flowline (outside of local depression)	d =	3.9	5.1	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	d <sub>CROWN</sub> =	0.0	0.6	inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.179	0.128	<b>」</b>
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	$Q_x =  $	4.4	11.1	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.0	1.6	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W = [$	0.24	0.32	sq ft
Velocity within the Gutter Section W	V <sub>w</sub> =[	4.1	5.0	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.9	8.1	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 <sub>o-GRATE</sub> =	N/A	N/A	7
Under No-Clogging Condition		MINOR	MAJOR	<b>-</b>
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	∃'' <sup></sup>
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	┪
Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	٠ - ١	MINOR	MAJOR	J
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦ ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	┪
Effective (unclogged) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	⊣ <sub>ft</sub> ∥
Minimum Velocity Where Grate Splash-Over Begins	V <sub>0</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	∃ <sup>'p3</sup>
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	<del> </del>
Actual Interception Capacity	$Q_a =$	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_0$ (to be applied to curb opening or next d/s inlet)	Q <sub>a</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	<b>Q</b> <sub>b</sub> − 1	MINOR	MAJOR	ICIS
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.085	0.066	∏ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	- 1	14.30	24.81	Hrt I
	$L_T = [$			J <sup>II</sup> L
Under No-Clogging Condition		MINOR	MAJOR	ا ہ
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L =	10.00	10.00	ft -f-
Interception Capacity	$Q_i =  $	4.8	7.7	cfs
<u>Under Clogging Condition</u>	GLG 6 1	MINOR	MAJOR	ا ا
Clogging Coefficient	CurbCoef =	1.25	1.25	4
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	<b>↓</b> .
Effective (Unclogged) Length	L <sub>e</sub> =	9.37	9.37	_lft
Actual Interception Capacity	<b>Q</b> <sub>a</sub> =	4.7	7.5	cfs
Carry-Over Flow = Q <sub>h/GRATE)</sub> -Q <sub>a</sub>	Q <sub>b</sub> =	0.7	5.2	cfs
<u>Summary</u>		MINOR	MAJOR	_
Total Inlet Interception Capacity	Q =	4.7	7.5	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.7	5.2	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	87	59	%
·				

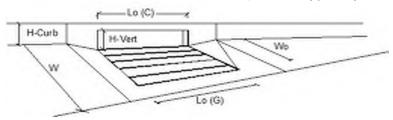
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Grandview Reserve
Inlet ID: Basin D-2 (DP 23)



Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 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 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) ft/ft 0.083 Street Longitudinal Slope - Enter 0 for sump condition So ft/ft 0.010 Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 Allow Flow Depth at Street Crown (check box for yes, leave blank for no) V Maximum Capacity for 1/2 Street based On Allowable Spread Minor Storm Major Storm Water Depth without Gutter Depression (Eq. ST-2) 3.84 3.84 inches Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") inches d<sub>C</sub> = 0.8 0.8 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) inches 0.63 Water Depth at Gutter Flowline d = 4.47 4.47 inches Allowable Spread for Discharge outside the Gutter Section W (T - W)  $T_X =$ 15.2 15.2 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $E_0 =$ 0.149 0.149 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub> Q<sub>X</sub> = 7.3 7.3 cfs Discharge within the Gutter Section W  $(Q_T - Q_X)$ Q<sub>W</sub> = 1.3 1.3 cfs Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Orack = 0.0 0.0 cfs Maximum Flow Based On Allowable Spread Q<sub>T</sub> = cfs 8.5 8.5 Flow Velocity within the Gutter Section 0.8 0.8 fps V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = 0.3 Maximum Capacity for 1/2 Street based on Allowable Depth Minor Storm Major Storm T<sub>TH</sub> = Theoretical Water Spread 15.6 29.4 Theoretical Spread for Discharge outside the Gutter Section W (T - W) T<sub>X TH</sub> = 14.7 28.6 ft Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>o</sub> = 0.153 0.079 Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ cfs Q<sub>X TH</sub> = 6.7 39.3 Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>) cfs  $Q_x =$ 6.7 34.1 Discharge within the Gutter Section W (Q<sub>d</sub> - Q<sub>X</sub>) 3.4 1.2 cfs Q<sub>W</sub> = Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) cfs Q<sub>BACK</sub> = 0.0 0.7 Total Discharge for Major & Minor Storm (Pre-Safety Factor) 7.9 Q = cfs 38.2 Average Flow Velocity Within the Gutter Section 0.8 fps 1.2 V\*d Product: Flow Velocity Times Gutter Flowline Depth V\*d = 0.3 0.7 Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm 1.00 1.00 R = Max Flow Based on Allowable Depth (Safety Factor Applied)  $Q_d =$ 7.9 38.2 cfs Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) d = 7.68 inches Resultant Flow Depth at Street Crown (Safety Factor Applied) d<sub>CROWN</sub> = 0.00 3.22 linches MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion 7.9 38.2 Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management lajor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

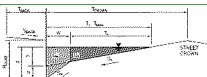
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Desire Information (Insurt)		MINOR	MAJOR	
Design Information (Input)  CDOT Type R Curb Opening	T [			- I
Type of Inlet	Type =	CDOT Type R		
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =		2	- <u> </u>
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>0</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	4
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR	MAJOR	٦. ا
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_o =$	1.7	4.0	cfs
Water Spread Width	T =	8.6	12.0	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	3.5	inches
Water Depth at Street Crown (or at T <sub>MAX</sub> )	$d_{CROWN} =$	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.287	0.202	╛
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	$Q_x =$	1.2	3.2	cfs
Discharge within the Gutter Section W	$Q_w =$	0.5	0.8	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W = $	0.16	0.21	sq ft
Velocity within the Gutter Section W	V <sub>W</sub> =	3.1	3.8	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	5.7	6.5	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 <sub>o-GRATE</sub> =	N/A	N/A	1
Under No-Clogging Condition	0 0,0112	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	∃ <sup>,,,,</sup> ,
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	┪
Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	ا ته	MINOR	MAJOR	J.,
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦ ا
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	┪
Effective (unclogged) Length of Multiple-unit Grate Inlet	L <sub>e</sub> =	N/A	N/A	f <sub>ft</sub>
Minimum Velocity Where Grate Splash-Over Begins	V <sub>0</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	V <sub>0</sub> – R <sub>f</sub> =	N/A	N/A	-l' <sup>ips</sup>
ll '				-l
Interception Rate of Side Flow	R <sub>x</sub> =	N/A N/A	N/A N/A	ا ۔۔۔
Actual Interception Capacity	Q <sub>a</sub> =			cfs
Carry-Over Flow = Q <sub>o</sub> -Q <sub>a</sub> (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	ا ء	MINOR	MAJOR	ا مر
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.124	0.094	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	$L_T = [$	6.67	11.75	_ft
Under No-Clogging Condition		MINOR	MAJOR	ا ،
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L =	6.67	10.00	_ft
Interception Capacity	$Q_i = [$	1.7	3.9	cfs
<u>Under Clogging Condition</u>	,	MINOR	MAJOR	, l
Clogging Coefficient	CurbCoef =	1.25	1.25	<u> </u>
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	_
Effective (Unclogged) Length	L <sub>e</sub> =	9.37	9.37	ft
Actual Interception Capacity	<b>Q</b> <sub>a</sub> =	1.7	3.8	cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - $Q_a$	Q <sub>b</sub> =	0.0	0.2	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =[	1.7	3.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	0.2	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>o</sub> =	C% =	100	96	%
	·			

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

Project: Grandview Reserve
Inlet ID: Basin D-3 (DP 24)



Gutter Geometry: Maximum Allowable Width for Spread Behind Curb 7.5 Side Slope Behind Curb (leave blank for no conveyance credit behind curb) ft/ft  $S_{BACK} =$ 0.020 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  $n_{BACK} =$ 0.020 Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> : inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition  $S_0$ 0.000 ft/ft Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.016  $n_{STREET} =$ Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm linches  $d_{MAX} =$ 4.4 7.7 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 (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") inches d<sub>C</sub> = 0.8 0.8 Gutter Depression ( $d_C$  - (W \*  $S_x$  \* 12)) inches 0.63 Water Depth at Gutter Flowline d = 4.47 4.47 inches Allowable Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  $T_X =$ 15.2 15.2 ft  $E_0 =$ 0.149 0.149 Discharge outside the Gutter Section W, carried in Section T<sub>x</sub> Q<sub>X</sub> = 0.0 0.0 cfs Discharge within the Gutter Section W  $(Q_T - Q_X)$ Q<sub>W</sub> = cfs 0.0 0.0 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Orack : cfs 0.0 0.0 Maximum Flow Based On Allowable Spread cfs Q<sub>T</sub> = SUMP SUMF Flow Velocity within the Gutter Section 0.0 0.0 lfps V\*d Product: Flow Velocity times Gutter Flowline Depth Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Water Spread Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section T<sub>XTH</sub> Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

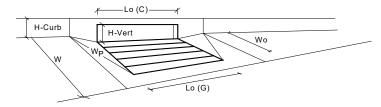
Discharge within the Gutter Section W  $(Q_d - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V\*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

	0.0	0.0	I, b2
V*d =	0.0	0.0	]
_	Minor Storm	Major Storm	_
$T_{TH} = [$	15.6	29.4	ft
$T_{XTH} = [$	14.7	28.6	ft
$E_0 = $	0.153	0.079	1
$Q_{XTH} = [$	0.0	0.0	cfs
$Q_X = $	0.0	0.0	cfs
$Q_W = $	0.0	0.0	cfs
Q <sub>BACK</sub> =	0.0	0.0	cfs
Q =[	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	1
R =	SUMP	SUMP	
$Q_d = [$	SUMP	SUMP	cfs
d =	•		inches
$d_{CROWN} = [$			inches

Minor Storm Major Storm cfs

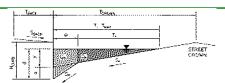
# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



li De	esign Information (Input		MINOR	MAJOR	
	pe of Inlet CDOT Type R Curb Opening	Type =	CDOT Type R	Curb Opening	1
Loc	cal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
Nu	mber of Unit Inlets (Grate or Curb Opening)	No =	3	3	1
- 11	ater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	ate Information	ronding Depar –	MINOR	MAJOR	Override Depths
	ngth of a Unit Grate	$L_{0}(G) = \Gamma$	N/A	I N/A	feet
	dth of a Unit Grate		N/A	N/A	feet
- 11		$W_o =$			1 reet
	ea Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	_
	ogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_f(G) =$	N/A	N/A	4
	ate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Gra	ate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o(G) =$	N/A	N/A	
Cu	<u>rb Opening Information</u>		MINOR	MAJOR	
Ler	ngth of a Unit Curb Opening	L₀ (C) =	5.00	5.00	feet
Hei	ight of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Hei	ight of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	gle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63,40	degrees
	le Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
	ogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	- Iccc
		$C_f(C) =$			4
	rb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	4
	rb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>o</sub> (C) =	0.67	0.67	
	ate Flow Analysis (Calculated)	_	MINOR	MAJOR	_
	ogging Coefficient for Multiple Units	Coef =	N/A	N/A	╛
	ogging Factor for Multiple Units	Clog =	N/A	N/A	_
<u>G</u> ra	ate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	_
Int	erception without Clogging	$Q_{wi} = \Gamma$	N/A	N/A	7cfs
	erception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
	ate Capacity as a Orifice (based on Modified HEC22 Method)	-Cwa L	MINOR	MAJOR	J
	rerception without Clogging	Q <sub>oi</sub> =	N/A	N/A	ີ່ cfs
	erception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
	ate Capacity as Mixed Flow	Qoa - L	MINOR	MAJOR	Tris
		ο Γ			٦_4_
	erception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
- 11	erception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
	sulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
	rb Opening Flow Analysis (Calculated)	_	MINOR	MAJOR	7
	ogging Coefficient for Multiple Units	Coef =	1.31	1.31	1
	ogging Factor for Multiple Units	Clog =	0.04	0.04	_
Cu	rb Opening as a Weir (based on Modified HEC22 Method)	_	MINOR	MAJOR	_
Int	erception without Clogging	Q <sub>wi</sub> =	7.5	26.6	cfs
Int	erception with Clogging	Q <sub>wa</sub> =	7.2	25.4	cfs
	rb Opening as an Orifice (based on Modified HEC22 Method)	e L			_
			MINOR	MAJOR	
IIII	ercention without Clogging	Ω., =Γ	MINOR 25.2	MAJOR 32.9	7cfs
	erception with Clogging	$Q_{oi} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	25.2	32.9	cfs
Int	erception with Clogging	$Q_{oi} = \begin{bmatrix} Q_{oi} & Q_{oa} \end{bmatrix}$	25.2 24.1	32.9 31.5	cfs cfs
Int <u>Cu</u>	erception with Clogging I <u>rb Opening Capacity as Mixed Flow</u>	Q <sub>oa</sub> =	25.2 24.1 MINOR	32.9 31.5 MAJOR	_cfs
Into <u>Cu</u> Into	rerception with Clogging  Irb Opening Capacity as Mixed Flow  Irb Opening Capacity as Mixed Flow  Irception without Clogging	$Q_{oa} = \begin{bmatrix} & & & & & & & & & & & & & & & & & &$	25.2 24.1 MINOR 12.8	32.9 31.5 MAJOR 27.5	cfs cfs
Into <u>Cu</u> Into Into	rerception with Clogging  Irb Opening Capacity as Mixed Flow  Rerception without Clogging  Rerception with Clogging	$Q_{oa} = \begin{bmatrix} Q_{mi} = Q_{ma} \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2	32.9 31.5 MAJOR 27.5 26.3	cfs cfs cfs
Into <u>Cu</u> Into Into Res	rerception with Clogging  Irb Opening Capacity as Mixed Flow  rerception without Clogging  rerception with Clogging  sulting Curb Opening Capacity (assumes clogged condition)	$Q_{oa} = \begin{bmatrix} & & & & & & & & & & & & & & & & & &$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b>	32.9 31.5 MAJOR 27.5 26.3 25.4	cfs cfs
Into Cu Into Into Res Res	rerception with Clogging  Irb Opening Capacity as Mixed Flow erception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions	$Q_{oa} = \begin{bmatrix} \\ Q_{mi} = \\ Q_{ma} = \\ Q_{curb} = \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR	32.9 31.5 MAJOR 27.5 26.3 <b>25.4</b> MAJOR	cfs cfs cfs cfs
Into Cu Into Into Res Tot	rerception with Clogging  Irb Opening Capacity as Mixed Flow erception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultiant Street Conditions tal Inlet Length	$Q_{oa} = \begin{bmatrix} \\ Q_{mi} = \\ Q_{ma} = \\ \\ Q_{curb} = \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00	cfs cfs cfs cfs cfs
Into Cu Into Into Res Tot	rerception with Clogging  Irb Opening Capacity as Mixed Flow erception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions	$Q_{oa} = \begin{bmatrix} \\ Q_{mi} = \\ Q_{ma} = \\ Q_{curb} = \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR	32.9 31.5 MAJOR 27.5 26.3 <b>25.4</b> MAJOR	cfs cfs cfs cfs
Into Cu Into Into Res Tot Res	rerception with Clogging  Irb Opening Capacity as Mixed Flow erception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultiant Street Conditions tal Inlet Length	$Q_{oa} = \begin{bmatrix} \\ Q_{mi} = \\ Q_{ma} = \\ \\ Q_{curb} = \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00	cfs cfs cfs cfs cfs
Into Cu Into Into Res Tot Res	rerception with Clogging rb Opening Capacity as Mixed Flow reception without Clogging rerception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above)	$\begin{aligned} Q_{oa} &= \begin{bmatrix} Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \\ \mathbf{Q} &= \begin{bmatrix} L &= \\ T &= \end{bmatrix} \end{aligned}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4	cfs cfs cfs cfs cfs feet ft.>T-Crown
Into Cu Into Into Res Res Tot Res	rerception with Clogging  Irb Opening Capacity as Mixed Flow rerception without Clogging rerception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown	$\begin{aligned} Q_{oa} &= \begin{bmatrix} Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \\ \mathbf{Q} &= \begin{bmatrix} L &= \\ T &= \end{bmatrix} \end{aligned}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2	cfs cfs cfs cfs cfs feet ft.>T-Crown
Into Cu Into Into Res Res Tot Res Res	rerception with Clogging  Irb Opening Capacity as Mixed Flow erception without Clogging erception with Clogging sulting Curb Opening Capacity (assumes cloqqed condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown  W Head Performance Reduction (Calculated)	$\begin{aligned} Q_{oa} &= \begin{bmatrix} Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \\ & & L &= \\ T &= \\ d_{CROWN} &= \end{bmatrix} \end{aligned}$	25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR	cfs cfs cfs cfs cfs fest ft.>T-Crown inches
Into Cu Into Into Into Into Into Into Into Into	reception with Clogging rb Opening Capacity as Mixed Flow reception without Clogging reception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown  w Head Performance Reduction (Calculated) pth for Grate Midwidth	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{Curb} &= \end{bmatrix} \\ & L &= \\ T &= \\ d_{CROWN} &= \end{bmatrix} \\ \\ d_{Grate} &= \begin{bmatrix} \\ \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A	cfs cfs cfs cfs cfs feet ft.>T-Crown inches
Into Cu Into Into Into Into Into Into Into Into	rerception with Clogging rb Opening Capacity as Mixed Flow rerception without Clogging rerception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown  W Head Performance Reduction (Calculated) pth for Grate Midwidth pth for Curb Opening Weir Equation	$\begin{aligned} Q_{oa} &= \begin{bmatrix} Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \\ & & & \\ L &= \\ T &= \\ d_{CROWN} &= \end{bmatrix} \end{aligned}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0	32.9 31.5 MAJOR 27.5 26.3 <b>25.4</b> MAJOR 15.00 29.4 3.2 MAJOR N/A	cfs cfs cfs cfs cfs fest ft.>T-Crown inches
Into Cu Into Into Into Into Into Into Into Into	rerception with Clogging rb Opening Capacity as Mixed Flow rerception without Clogging rerception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown w Head Performance Reduction (Calculated) pth for Curb Opening Weir Equation mbination Inlet Performance Reduction Factor for Long Inlets	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{courb} &= \end{bmatrix} \\ &= \begin{bmatrix} \\ L &= \\ \\ T &= \\ \\ d_{CROWN} &= \end{bmatrix} \\ &= \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A 0.57 0.72	cfs cfs cfs cfs cfs feet ft.>T-Crown inches
Into Cu Into Into Into Into Into Into Into Into	rerception with Clogging  Irb Opening Capacity as Mixed Flow rerception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown  W Head Performance Reduction (Calculated) pth for Grate Midwidth pth for Curb Opening Weir Equation mbination Inlet Performance Reduction Factor for Long Inlets rb Opening Performance Reduction Factor for Long Inlets	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \end{aligned}$ $L = \begin{bmatrix} T &= \\ d_{CROWN} &= \end{bmatrix}$ $d_{Grate} &= \begin{bmatrix} d_{Grate} &= \\ d_{Curb} &= \end{bmatrix}$ $RF_{Combination} &= \\ RF_{Curb} &= \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A 0.57 0.72	cfs cfs cfs cfs cfs feet ft.>T-Crown inches
Into Cu Into Into Into Into Into Into Into Into	rerception with Clogging rb Opening Capacity as Mixed Flow rerception without Clogging rerception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown w Head Performance Reduction (Calculated) pth for Curb Opening Weir Equation mbination Inlet Performance Reduction Factor for Long Inlets	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{courb} &= \end{bmatrix} \\ &= \begin{bmatrix} \\ L &= \\ \\ T &= \\ \\ d_{CROWN} &= \end{bmatrix} \\ &= \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A 0.57 0.72	cfs cfs cfs cfs cfs feet ft.>T-Crown inches
Into Cu Into Into Into Into Into Into Into Into	rerception with Clogging  Irb Opening Capacity as Mixed Flow rerception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown  W Head Performance Reduction (Calculated) pth for Grate Midwidth pth for Curb Opening Weir Equation mbination Inlet Performance Reduction Factor for Long Inlets rb Opening Performance Reduction Factor for Long Inlets	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \end{aligned}$ $L = \begin{bmatrix} T &= \\ d_{CROWN} &= \end{bmatrix}$ $d_{Grate} &= \begin{bmatrix} d_{Grate} &= \\ d_{Curb} &= \end{bmatrix}$ $RF_{Combination} &= \\ RF_{Curb} &= \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41 0.67 N/A	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A 0.57 0.72 0.88 N/A	cfs cfs cfs cfs cfs feet ft.>T-Crown inches
Into Cu Into Into Reservation	rerception with Clogging rb Opening Capacity as Mixed Flow rerception without Clogging rerception with Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Freet Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown w Head Performance Reduction (Calculated) pth for Grate Midwidth pth for Curb Opening Weir Equation mbination Inlet Performance Reduction Factor for Long Inlets rb Opening Performance Reduction Factor for Long Inlets ated Inlet Performance Reduction Factor for Long Inlets	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \\ L &= \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} \\ d_{CROWN} &= \end{bmatrix} \\ d_{Grate} &= \begin{bmatrix} \\ \\ \\ \\ \\ \end{bmatrix} \\ RF_{Combination} &= \\ RF_{Cratb} &= \\ RF_{Grate} &= \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 7.2 MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41 0.67 N/A MINOR	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A 0.57 0.72 0.88 N/A MAJOR	cfs cfs cfs cfs feet ft.>T-Crown inches
Into Cu Into Into Reservation	rerception with Clogging  Irb Opening Capacity as Mixed Flow rerception without Clogging sulting Curb Opening Capacity (assumes clogged condition) sultant Street Conditions tal Inlet Length sultant Street Flow Spread (based on street geometry from above) sultant Flow Depth at Street Crown  W Head Performance Reduction (Calculated) pth for Grate Midwidth pth for Curb Opening Weir Equation mbination Inlet Performance Reduction Factor for Long Inlets rb Opening Performance Reduction Factor for Long Inlets	$\begin{aligned} Q_{oa} &= \begin{bmatrix} \\ Q_{mi} &= \\ Q_{ma} &= \\ Q_{curb} &= \end{bmatrix} \end{aligned}$ $L = \begin{bmatrix} T &= \\ d_{CROWN} &= \end{bmatrix}$ $d_{Grate} &= \begin{bmatrix} d_{Grate} &= \\ d_{Curb} &= \end{bmatrix}$ $RF_{Combination} &= \\ RF_{Curb} &= \end{bmatrix}$	25.2 24.1 MINOR 12.8 12.2 <b>7.2</b> MINOR 15.00 15.6 0.0 MINOR N/A 0.29 0.41 0.67 N/A	32.9 31.5 MAJOR 27.5 26.3 25.4 MAJOR 15.00 29.4 3.2 MAJOR N/A 0.57 0.72 0.88 N/A	cfs cfs cfs cfs cfs feet ft.>T-Crown inches

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

Project: Grandview Reserve
Inlet ID: Basin D-4 (DP 25)



## Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

$S_{BACK} =$	0.020	ft/ft
n <sub>BACK</sub> =	0.020	
H <sub>CURB</sub> =	6.00	inch

7.5

T<sub>BACK</sub> =

$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
nctorer =	0.016	

Minor Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
	===	5-	

Major Storm

\_\_ft

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12))
Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_X$  Discharge within the Gutter Section  $W\left(Q_T - Q_X\right)$  Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

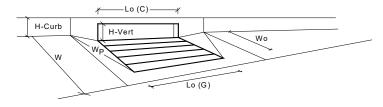
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

d <sub>C</sub> = a =	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
E <sub>o</sub> =	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
T <sub>X TH</sub> =	14.7	28.6	ft
E <sub>o</sub> =	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
dcpown =			linches

Λ	_ F	CHMD	CHMD	cfc
		Minor Storm	Major Storm	

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

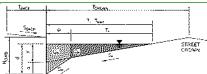


i e	CDOT Type R Curb Opening				
	Design Information (Input)	_ =	MINOR	MAJOR	_
	Type of Inlet	Type =	CDOT Type R		
	ocal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	Override Depth
	Vater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	_	MINOR	MAJOR	_
	ength of a Unit Grate	L <sub>0</sub> (G) =	N/A	N/A	feet
	Vidth of a Unit Grate	$W_o =$	N/A	N/A	feet
	Area Opening 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 <sub>w</sub> (G) =	N/A	N/A	
G	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	
	Curb Opening Information	_	MINOR	MAJOR	
L	ength of a Unit Curb Opening	$L_{o}(C) = \Gamma$	5.00	5.00	feet
⊦	Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
- ∥⊦	Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	-
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	
	Curb Opening Well Coefficient (typical value 2.3 3.7)  Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (C) =	0.67	0.67	_
	Grate Flow Analysis (Calculated)	-0 (-)	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	_
	Clogging Factor for Multiple Units	Cloq =	N/A	N/A	4
		ciog = [	MINOR		
	Grate Capacity as a Weir (based on Modified HEC22 Method)	۰ ٦		MAJOR	¬ .
	nterception without Clogging	$Q_{wi} =$	N/A	N/A	cfs
	nterception with Clogging	$Q_{wa} =$	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	-	MINOR	MAJOR	_
	nterception without Clogging	$Q_{oi} =$	N/A	N/A	cfs
	nterception with Clogging	$Q_{oa} = $	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	_	MINOR	MAJOR	_
	nterception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
	nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
R	Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)	_	MINOR	MAJOR	
C	Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
	Dogging Factor for Multiple Units	Clog =	0.06	0.06	
	Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	_
I	nterception without Clogging	$Q_{wi} = \Gamma$	6.1	20.2	cfs
	nterception with Clogging	Q <sub>wa</sub> =	5.7	18.9	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
	nterception without Clogging	$Q_{oi} = \Gamma$	16.8	21.9	cfs
	nterception with Clogging	Q <sub>oa</sub> =	15.7	20.6	cfs
	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	J=-7
	nterception without Clogging	Q <sub>mi</sub> =	9.4	19.6	cfs
	nterception with Clogging	Q <sub>mi</sub> = Q <sub>ma</sub> =	8.8	18.3	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	5.7	18.3	- cfs
쁾	Resultant Street Conditions	*Curb =	MINOR	MAJOR	10.3
		L=[			Teast
	Total Inlet Length	- L	10.00	10.00 29.4	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6 0.0		ft.>T-Crown
_ ∥ <sup>R</sup>	Resultant Flow Depth at Street Crown	$d_{CROWN} =$	0.0	3.2	inches
∥,	au Hand Doufermanne Doduction (C-11-t1)		MINIOD	M4300	
	ow Head Performance Reduction (Calculated)		MINOR	MAJOR	٦,
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	_
	Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.82	1.00	_
G	Grated Inlet Performance Reduction Factor for Long Inlets	$RF_{Grate} =$	N/A	N/A	_
		_	MINOR	MAJOR	_
⊤	otal Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	5.7	18.3	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	3.3	7.7	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin E-1 (DP 27)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line H<sub>CURB</sub> = 6.00 inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) 0.083 ft/ft Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) $S_0 =$ 0.033 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm Max. Allowable Spread for Minor & Major Storm 16.0 $T_{MAX}$ Max. Allowable Depth at Gutter Flowline for Minor & Major Storm 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 (Eq. ST-2) inches 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) 0.149 E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_X$ $\,Q_X\,$ cfs 13.2 13.2 Discharge within the Gutter Section W $(Q_T - Q_X)$ Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread 2.3 2.3 $Q_W =$ cfs QRACK = cfs $Q_T =$ cfs 15.5 15.5 Flow Velocity within the Gutter Section fps 1.4 1.4 V\*d Product: Flow Velocity times Gutter Flowline Depth V\*d = <u>Maximum Capacity for 1/2 Street based on Allowable Depth</u> Theoretical Water Spread Minor Storm Major Storm T<sub>TH</sub> = 15.6 29.4 T<sub>X TH</sub> = 14.7 28.6 E<sub>o</sub> = 0.153 0.079 Q<sub>X TH</sub> = 12.2 cfs 71.4 $Q_X =$ 12.2 cfs 2.2 cfs $Q_W =$ 6.1 1.3

Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section TXTH
Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d > 6") Stor

Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

N 4 2					2000	
MAJOF	STORM	Allowable	Capacity	is based	on Dep	oth Criterion oth Criterion
MINOF	RSTORM	Allowable	Capacity	is based	on Dep	oth Criterion

	Minor Storm	Major Storm	
Q <sub>allow</sub> =	14.4	38.8	cfs
on sheet '	Inlet Managen	ent'	-

14.4

1.00

14.4

4.36

0.00

cfs

cfs

fps

cfs

inches

69.4

2.1

0.56

38.8

6.15

QRACK

Q = V =

V\*d = R =

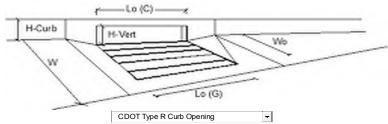
 $Q_d =$ 

 $d_{CROWN} =$ 

d =

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

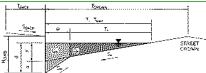
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3.0	- Inches
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣¦t
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> '` ∥
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'	G-C - 1	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	9.8	22.9	cfs
Water Spread Width	√0 −   T =	13.4	16.0	- ft
Water Spread Width Water Depth at Flowline (outside of local depression)	1 = 1 d =	3.9	5.1	inches
Water Depth at Street Crown (or at T <sub>Max</sub> )	- 1	0.0	0.6	inches
	d <sub>CROWN</sub> =			- Inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.179	0.128	- of o
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	8.1	20.0	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.8	2.9	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	_cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.24	0.32	sq ft
Velocity within the Gutter Section W	V <sub>w</sub> =	7.4	9.1	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.9	8.1	inches
Grate Analysis (Calculated)	. г	MINOR	MAJOR	٦. ا
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	
<u>Under No-Clogging Condition</u>	[	MINOR	MAJOR	٦. ا
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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
<u>Under Clogging Condition</u>	,	MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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 <sub>e</sub> =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	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	<b>Q</b> <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	<b>Q</b> <sub>b</sub> =	N/A	N/A	cfs
<u>Curb or Slotted Inlet Opening Analysis (Calculated)</u>	_	MINOR	Major	
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S <sub>e</sub> =	0.085	0.067	ft/ft
Required Length $L_T$ to Have 100% Interception	$L_T = [$	20.77	35.88	ft
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$ )	L =[	15.00	15.00	ft
Interception Capacity	$Q_i = [$	8.8	14.3	cfs
<u>Under Clogging Condition</u>	•	MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	ft
Actual Interception Capacity	$Q_a =$	8.8	14.1	cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - $Q_a$	Q <sub>b</sub> =	1.0	8.8	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	8.8	14.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	1.0	8.8	cfs
Capture Percentage = Q <sub>a</sub> /Q <sub>0</sub> =	C% =	89	62	%
100 100				

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

Project: Grandview Reserve
Inlet ID: Basin E-2 (DP 28)



#### Gutter Geometry: Maximum Allowable Width for Spread Behind Curb TRACK = Side Slope Behind Curb (leave blank for no conveyance credit behind curb) 0.020 ft/ft S<sub>BACK</sub> Manning's Roughness Behind Curb (typically between 0.012 and 0.020) 0.020 $n_{\text{BACK}}$ Height of Curb at Gutter Flow Line 6.00 H<sub>CURB</sub> = inches Distance from Curb Face to Street Crown T<sub>CROWN</sub> = 16.0 Gutter Width 0.83 Street Transverse Slope S<sub>X</sub> = 0.020 ft/ft Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) Street Longitudinal Slope - Enter 0 for sump condition Manning's Roughness for Street Section (typically between 0.012 and 0.020) 0.083 ft/ft $S_0 =$ 0.03 ft/ft n<sub>STREET</sub> = 0.016 Minor Storm Major Storm T<sub>MAX</sub> Max. Allowable Spread for Minor & Major Storm 16.0 16.0 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm inches Allow Flow Depth at Street Crown (check box for yes, leave blank for no) 100 Maximum Capacity for 1/2 Street based On Allowable Spread Minor Storm Major Storm Water Depth without Gutter Depression (Eq. ST-2) inches 3.84 3.84 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") $d_C =$ 0.8 inches Gutter Depth between Gutter Lip and Gutter Depression ( $d_C - (W * S_x * 12))$ Water Depth at Gutter Flowline inches a = 0.63 0.63 inches d = 4.47 4.47 Allowable Spread for Discharge outside the Gutter Section W (T - W) T<sub>x</sub> = 15.2 0.149 15.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E<sub>0</sub> = 0.149 Discharge outside the Gutter Section W, carried in Section $T_X$ Discharge within the Gutter Section W ( $Q_T - Q_X$ ) $\boldsymbol{Q}_{\boldsymbol{X}}$ cfs 13.6 13.6 2.4 2.4 $Q_W =$ cfs Q<sub>BACK</sub> = cfs Q<sub>T</sub> = cfs 16.0 16.0 fps

Discharge within the dutter section w (Q <sub>T</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Maximum Flow Based On Allowable Spread
Flow Velocity within the Gutter Section
V*d Product: Flow Velocity times Gutter Flowline Depth
Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Water Spread
Theoretical Spread for Discharge outside the Gutter Section W (T - W)
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{XTH}$
Actual Discharge outside the Gutter Section W, (limited by distance $T_{CROWN}$ )

Actual Discharge outside the Gutter Section W, (limited by distance T <sub>CROWN</sub> )
Discharge within the Gutter Section W (Q <sub>d</sub> - Q <sub>X</sub> )
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
Total Discharge for Major & Minor Storm (Pre-Safety Factor)
Average Flow Velocity Within the Gutter Section
V*d Product: Flow Velocity Times Gutter Flowline Depth
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm
Max Flow Based on Allowable Depth (Safety Factor Applied)
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
Resultant Flow Depth at Street Crown (Safety Factor Applied)

MINOR STORM	Allowable Capacity is based on Depth Criterion Allowable Capacity is based on Depth Criterion	
MAJOR STORM	Allowable Capacity is based on Depth Criterion	

	1.5	1.5	Liba
V*d =	0.5	0.5	
	Minor Storm	Major Storm	_
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} = $	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	12.6	73.5	cfs
$Q_X =$	12.6	63.8	cfs
$Q_W = $	2.3	6.3	cfs
$Q_{BACK} =$	0.0	1.4	cfs
Q =	14.8	71.4	cfs
V =	1.4	2.2	fps
V*d =	0.5	1.4	
R =	1.00	0.53	
$Q_d =$	14.8	38.1	cfs
d =	4.36	6.04	inches
$d_{CROWN} =$	0.00	1.57	inches

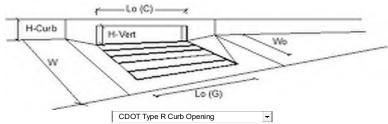
V*d =	0.5	1.4	
R =	1.00	0.53	
$Q_d =$	14.8	38.1	cfs
d =	4.36	6.04	inches
ROWN =	0.00	1.57	inches
	Minor Storm	Major Storm	

38.1

cfs

Q<sub>allow</sub> = 14.8 Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

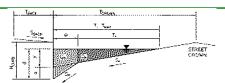
# INLET ON A CONTINUOUS GRADE MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	1
Type of Inlet	Type =		Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3.0	
Length of a Single Unit Inlet (Grate or Curb Opening)	L <sub>o</sub> =	5.00	5.00	- ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W <sub>0</sub> =	N/A	N/A	⊣'t I
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	<b>⊣</b> '` ∥
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -C =	0.10	0.10	-
Street Hydraulics: OK - Q < Allowable Street Capacity'	<u> </u>	MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i> )	$Q_0 = $	10.1	23.6	cfs
Water Spread Width	√0 −   T =	13.4	16.0	ft
Water Spread Width Water Depth at Flowline (outside of local depression)	1 = 1 d =	3.9	5.1	inches
Water Depth at Street Crown (or at T <sub>Max</sub> )	- 1	0.0	0.6	inches
	d <sub>CROWN</sub> =			Inches
Ratio of Gutter Flow to Design Flow	E <sub>0</sub> =	0.179	0.128	
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	8.3	20.6	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	1.8	3.0	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	0.24	0.32	sq ft
Velocity within the Gutter Section W	. V <sub>w</sub> =	7.6	9.3	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	6.9	8.1	inches
Grate Analysis (Calculated)	. г	MINOR	MAJOR	ا ا
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	
<u>Under No-Clogging Condition</u>	,	MINOR	MAJOR	_ I
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
<u>Under Clogging Condition</u>		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	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	<b>Q</b> <sub>a</sub> =	N/A	N/A	cfs
Carry-Over Flow = $Q_0$ - $Q_a$ (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	_
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	$S_e =$	0.085	0.067	ft/ft
Required Length L <sub>T</sub> to Have 100% Interception	L <sub>T</sub> =	21.17	36.56	ft
<u>Under No-Clogging Condition</u>		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L <sub>T</sub> )	L = [	15.00	15.00	ft
Interception Capacity	$Q_i =$	9.0	14.5	cfs
Under Clogging Condition	G 1	MINOR	MAJOR	<b>-</b>
Clogging Coefficient	CurbCoef =	1.31	1.31	7 I
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.04	0.04	<b></b>
Effective (Unclogged) Length	L <sub>e</sub> =	14.34	14.34	⊣ <sub>ft</sub>
Actual Interception Capacity	Qa =	8.9	14.3	cfs
Carry-Over Flow = $Q_{h(GRATE)}$ - $Q_a$	Q <sub>b</sub> =	1.2	9.3	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	8.9	14.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> =	1.2	9.3	cfs
Capture Percentage = $Q_a/Q_0$ =	C% =	88	61	¬%
	<u> </u>		·	

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

Project: Grandview Reserve
Inlet ID: Basin E-3 (DP 29)



## Gutter Geometry

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

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

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
пстреет =	0.016	Ī

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
•		<u> </u>	-

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12))
Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section  $T_X$  Discharge within the Gutter Section  $W\left(Q_T - Q_X\right)$  Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

V\*d Product: Flow Velocity times Gutter Flowline Depth

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

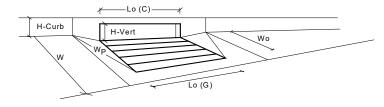
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
y =	3.84	3.84	inches
d <sub>C</sub> =	0.8	0.8	inches
a =	0.63	0.63	inches
d =	4.47	4.47	inches
$T_X =$	15.2	15.2	ft
E <sub>o</sub> =	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	

	Minor Storm	Major Storm	
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
d <sub>CROWN</sub> =			inches

		Minor Storm	Major Storm	
Λ	_ F	CHMD	CHMD	ofe

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)

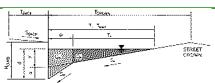


	CDOT Type R Curb Opening  ▼				
	Design Information (Input)		MINOR	MAJOR	
	Type of Inlet	Type =		Curb Opening	
	Local Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
			4	3.00	override Depths
	Number of Unit Inlets (Grate or Curb Opening)	No =	4.4	7.7	
	Water Depth at Flowline (outside of local depression)	Ponding Depth =			inches
	<u>Grate Information</u>		MINOR	MAJOR	٦.
	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
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	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)	$\ddot{C}_{o}(G) =$	N/A	N/A	
	Curb Opening Information	-0(-)	MINOR	MAJOR	-
	Length of a Unit Curb Opening	L <sub>0</sub> (C) =	5.00	5.00	Tfeet
	Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
	Height of Curb Orifice Throat in Inches		6.00	6.00	inches
		H <sub>throat</sub> =			
	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
rning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o(C) =$	0.67	0.67	
	Grate Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	7
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Grate Capacity as a Weir (based on Modified HEC22 Method)	C.09 L	MINOR	MAJOR	_
	Interception without Clogging	Q <sub>wi</sub> =	N/A	N/A	7cfs
	Interception with Clogging  Interception with Clogging		N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	$Q_{wa} = $	MINOR	MAJOR	
		۰ ٦			٦,
	Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
	Interception with Clogging	$Q_{oa} = \lfloor$	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 <sub>ma</sub> =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	7
	Clogging Factor for Multiple Units	Clog =	0.03	0.03	
	Curb Opening as a Weir (based on Modified HEC22 Method)	C.09 L	MINOR	MAJOR	_
	Interception without Clogging	$Q_{wi} = \Gamma$	10.0	35.4	<b>∃cfs</b>
	Interception with Clogging		9.7	34.3	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	$Q_{wa} = $	MINOR		ال ال
		^ F		MAJOR	T <sub>ofo</sub>
	Interception without Clogging	$Q_{oi} =$	33.6	43.9	cfs
	Interception with Clogging	$Q_{oa} = L$	32.5	42.4	cfs
	<u>Curb Opening Capacity as Mixed Flow</u>		MINOR	MAJOR	<b>-</b>
	Interception without Clogging	$Q_{mi} =$	17.0	36.7	cfs
	Interception with Clogging	Q <sub>ma</sub> =	16.5	35.5	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	$Q_{Curb} =$	9.7	34.3	cfs
	Resultant Street Conditions		MINOR	MAJOR	
	Total Inlet Length	L = [	20.00	20.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	т = Г	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	3.2	inches
		CROWN		_	
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	∃ft.
	Depth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	∃ft .
	Combination Inlet Performance Reduction Factor for Long Inlets		0.41	0.72	Η'`
		RF <sub>Combination</sub> =		_	-
	Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.67	0.88	-
	Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	_
			MINOR	MAJOD	
		_	MINOR	Major	_
	Total Inlat Interception Conneits (accum	A - I	0.7	2/12	cfc
	Total Inlet Interception Capacity (assumes clogged condition)  Inlet Capacity IS GOOD for Minor and Major Storms(>O PEAK)	$Q_a = Q_{PEAK REQUIRED} = Q_{PEAK REQUIRED}$	<b>9.7</b> 8.2	<b>34.3</b> 32.1	<b>cfs</b> cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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

Project: Grandview Reserve
Inlet ID: Basin E-4 (DP 30)



# Gutter Geometry

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

$T_{BACK} =$	7.5	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.020	
•		-
$H_{CURB} =$	6.00	linches

TCURB =	6.00	inche
$T_{CROWN} =$	16.0	ft
W =	0.83	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
NCTREET =	0.016	

Minor Storm

3.84

0.8

0.63

4.47

15.2

 $d_C =$ 

a =

d =

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	16.0	ft
$d_{MAX} =$	4.4	7.7	inches
		<i>f</i> -	_

Major Storm

3.84

0.63

4.47

nches

inches

inches inches

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

Water Depth without Gutter Depression (Eq. ST-2)

Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")

Gutter Depression (d<sub>C</sub> - (W \* S<sub>x</sub> \* 12)) Water Depth at Gutter Flowline

Allowable Spread for Discharge outside the Gutter Section W (T - W)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Discharge outside the Gutter Section W, carried in Section T<sub>X</sub>

Disch

Disch

Maxir Flow

narge within the Gutter Section W ( $Q_T - Q_X$ )	$Q_W =$	0.0
harge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0
imum Flow Based On Allowable Spread	$Q_T =$	SUMP
Velocity within the Gutter Section	V =	0.0
Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0

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

Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)

Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{X\,TH}$ 

Actual Discharge outside the Gutter Section W, (limited by distance T<sub>CROWN</sub>)

Discharge within the Gutter Section W  $(Q_d - Q_X)$ 

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section

V\*d Product: Flow Velocity Times Gutter Flowline Depth

Slope-Based Depth Safety Reduction Factor for Major & Minor (d  $\geq$  6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)

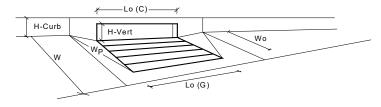
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion

$E_0 =$	0.149	0.149	
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
$Q_T =$	SUMP	SUMP	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
			_
	Minor Storm	Major Storm	_
$T_{TH} =$	15.6	29.4	ft
$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs

$T_{XTH} =$	14.7	28.6	ft
$E_0 =$	0.153	0.079	
$Q_{XTH} =$	0.0	0.0	cfs
$Q_X =$	0.0	0.0	cfs
$Q_W =$	0.0	0.0	cfs
$Q_{BACK} =$	0.0	0.0	cfs
Q =	0.0	0.0	cfs
V =	0.0	0.0	fps
V*d =	0.0	0.0	
R =	SUMP	SUMP	
$Q_d =$	SUMP	SUMP	cfs
d =			inches
$d_{CROWN} =$			inches

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

# INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



	CDOT Type R Curb Opening				
	Design Information (Input)	_	MINOR	MAJOR	_
	Type of Inlet	Type =	CDOT Type R	Curb Opening	
	ocal Depression (additional to continuous gutter depression 'a' from above)	a <sub>local</sub> =	3.00	3.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	4	4	Override Depth
	Nater Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	_	MINOR	MAJOR	<del></del>
Įι	ength of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
١	Nidth of a Unit Grate	W <sub>0</sub> =	N/A	N/A	feet
1	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	_
	Curb Opening Information	G0 (G)	MINOR	MAJOR	
	ength of a Unit Curb Opening	L <sub>0</sub> (C) =	5.00	5.00	∏feet
	Height of Vertical Curb Opening in Inches	* * * *	6.00	6.00	inches
	Height of Curb Orifice Throat in Inches	H <sub>vert</sub> =	6.00		inches
		H <sub>throat</sub> =		6.00	
	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
	Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o(C) =$	0.67	0.67	
	Grate Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
lla	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
	Interception without Clogging	$Q_{wi} = \Gamma$	N/A	N/A	□cfs
	Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	Qwa - L	MINOR	MAJOR	
		ο Γ			7-6-
	nterception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
	nterception with Clogging	$Q_{oa} = $	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	_	MINOR	MAJOR	_
	nterception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
	nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
F	Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
I	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
llo	Clogging Factor for Multiple Units	Cloq =	0.03	0.03	
	Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
	Interception without Clogging	$Q_{wi} = \Gamma$	10.0	35.4	□cfs
	Interception with Clogging	Q <sub>wa</sub> =	9.7	34.3	cfs
		Qwa - L			
	Curb Opening as an Orifice (based on Modified HEC22 Method)	O -	MINOR 33.6	MAJOR 43.9	ີ່ cfs
	nterception without Clogging	$Q_{oi} =$			
	Interception with Clogging	$Q_{oa} = L$	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	<b>-</b>
	nterception without Clogging	$Q_{mi} = $	17.0	36.7	cfs
	nterception with Clogging	Q <sub>ma</sub> =	16.5	35.5	cfs
F	Resulting Curb Opening Capacity (assumes cloqged condition)	Q <sub>Curb</sub> =	9.7	34.3	cfs
Ī	Resultant Street Conditions		MINOR	MAJOR	
	Fotal Inlet Length	L = [	20.00	20.00	feet
	Resultant Street Flow Spread (based on street geometry from above)		15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	3.2	inches
'	accumant non population of our crown	GCROWN -	0.0	J.2	
١,	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
		, г			٦4
	Depth for Grate Midwidth	d <sub>Grate</sub> =	N/A	N/A	_ft
	Depth for Curb Opening Weir Equation	d <sub>Curb</sub> =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.41	0.72	_
	Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.67	0.88	┙
	Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Grate</sub> =	N/A	N/A	_
					_
			MINOR	MAJOR	
	Fotal Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> = [	9.7	34.3	cfs
ll-					

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

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= 0.035

Wednesday, May 4 2022

## **BASIN D-7 SWALE**

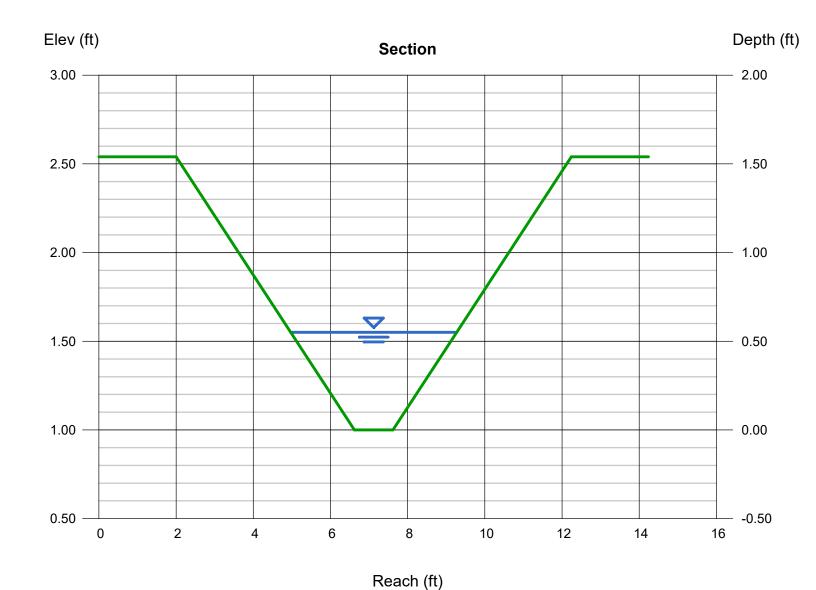
Trapezoidal	
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.54
Invert Elev (ft)	= 1.00
Slone (%)	= 2.00

**Calculations** 

N-Value

Compute by: Known Q Known Q (cfs) = 4.00

Highlighted		
Depth (ft)	=	0.55
Q (cfs)	=	4.000
Area (sqft)	=	1.46
Velocity (ft/s)	=	2.74
Wetted Perim (ft)	=	4.48
Crit Depth, Yc (ft)	=	0.51
Top Width (ft)	=	4.30
EGL (ft)	=	0.67



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### **SWALE BASIN A-1**

Trapezoidal	l
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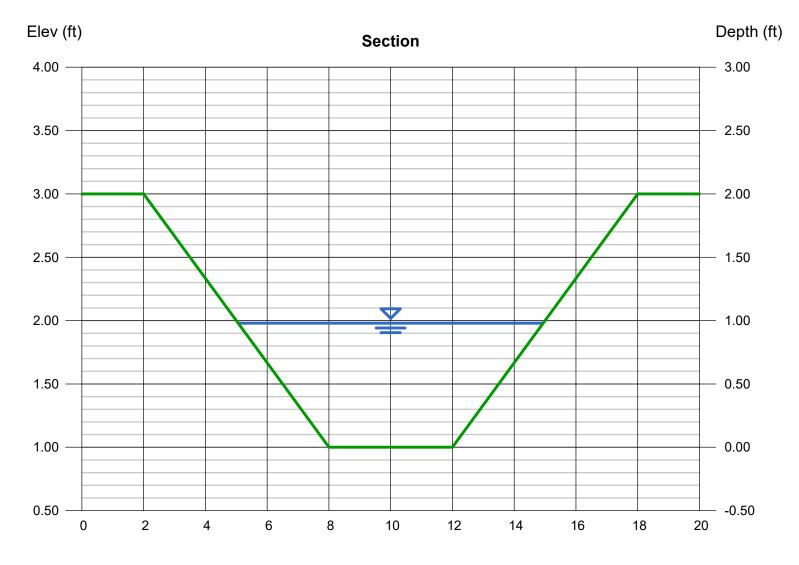
Bottom Width (ft) = 4.00 Side Slopes (z:1) = 3.00, 3.00 Total Depth (ft) = 2.00 Invert Elev (ft) = 1.00 Slope (%) = 2.00 N-Value = 0.035

## **Calculations**

Compute by: Known Q Known Q (cfs) = 31.10

## Highlighted

Depth (ft) = 0.98Q (cfs) = 31.10 Area (sqft) = 6.80Velocity (ft/s) = 4.57 Wetted Perim (ft) = 10.20Crit Depth, Yc (ft) = 0.97Top Width (ft) = 9.88EGL (ft) = 1.31



Reach (ft)

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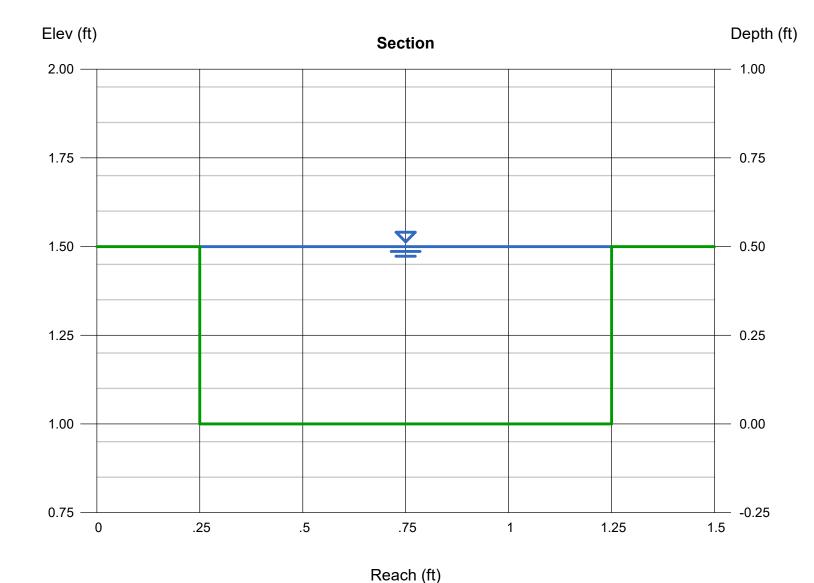
## Sidewalk Chase C-7a

Rectangular Bottom Width (ft) Total Depth (ft)	= 1.00 = 0.50	
Invert Elev (ft) Slope (%) N-Value	= 1.00 = 2.00 = 0.013	

Calculations

Compute by: Known Q Known Q (cfs) = 3.20





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## **SWALE BASIN C-7a**

	ez		

Bottom Width (ft) = 1.00 Side Slopes (z:1) = 3.00, 3.00 Total Depth (ft) = 1.50 Invert Elev (ft) = 1.00 Slope (%) = 2.00 N-Value = 0.035

## **Calculations**

Compute by: Known Q Known Q (cfs) = 3.20

## Highlighted

= 0.49Depth (ft) Q (cfs) = 3.200Area (sqft) = 1.21 Velocity (ft/s) = 2.64Wetted Perim (ft) = 4.10Crit Depth, Yc (ft) = 0.45Top Width (ft) = 3.94EGL (ft) = 0.60

