PRELIMINARY DRAINAGE REPORT
FOR

Murphy Creek – Zante Street
AURORA, COLORADO
CASE NO. 1995-2002-12

Prepared for:
Brian Alpert
9335 E Harvard
Denver, CO 80231
Phone: 303-525-9347

Prepared by:

CORE Consultants, Inc.
3473 South Broadway
Englewood, CO 80113
Contact: Jessica N Kordziel, PE, CFM
Phone: 303-502-7287
CORE Project Number: 21-134

July 03, 2024

Approved For One Year From This Date	
______________________	
Aurora Water - Drainage Division	Date

Engineer's Statement:

I affirm that this report and plan for the final drainage design of the Murphy Creek – Zante Street Development was prepared by me (or under my direct supervision) in accordance with the provisions of the City of Aurora's Storm Drainage Design and Technical Criteria Manual for the owners thereof. I understand that the City of Aurora does not and will not assume liability for drainage facilities designed by others.

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For and On-behalf of CORE Consultants
Jessica N Kordziel, PE, CFM
Colorado Professional Engineer
License #0058212

NOTE: Preliminary Drainage Report approval is required prior to Civil Plan approval.

Table of Contents

A. INTRODUCTION ... 4
1. Location ... 4
2. Proposed Development ... 5
3. Changes to the MDR ... 5
4. Variances ... 5

B. HISTORIC DRAINAGE ... 6
1. Description of Property and Drainage Basin ... 6

C. DESIGN CRITERIA ... 7
1. Hydrologic Criteria ... 7
2. Hydraulic Criteria ... 9
1. General Concept ... 11
2. Specific Details ... 12

E. REFERENCES ... 20

F. APPENDICES ... 21

Appendices

Appendix A General Information
Appendix B Hydrologic Computations
Appendix C Hydraulic Computations
Appendix D Drainage Maps
Appendix E Reference Documents

A. INTRODUCTION

1. Location

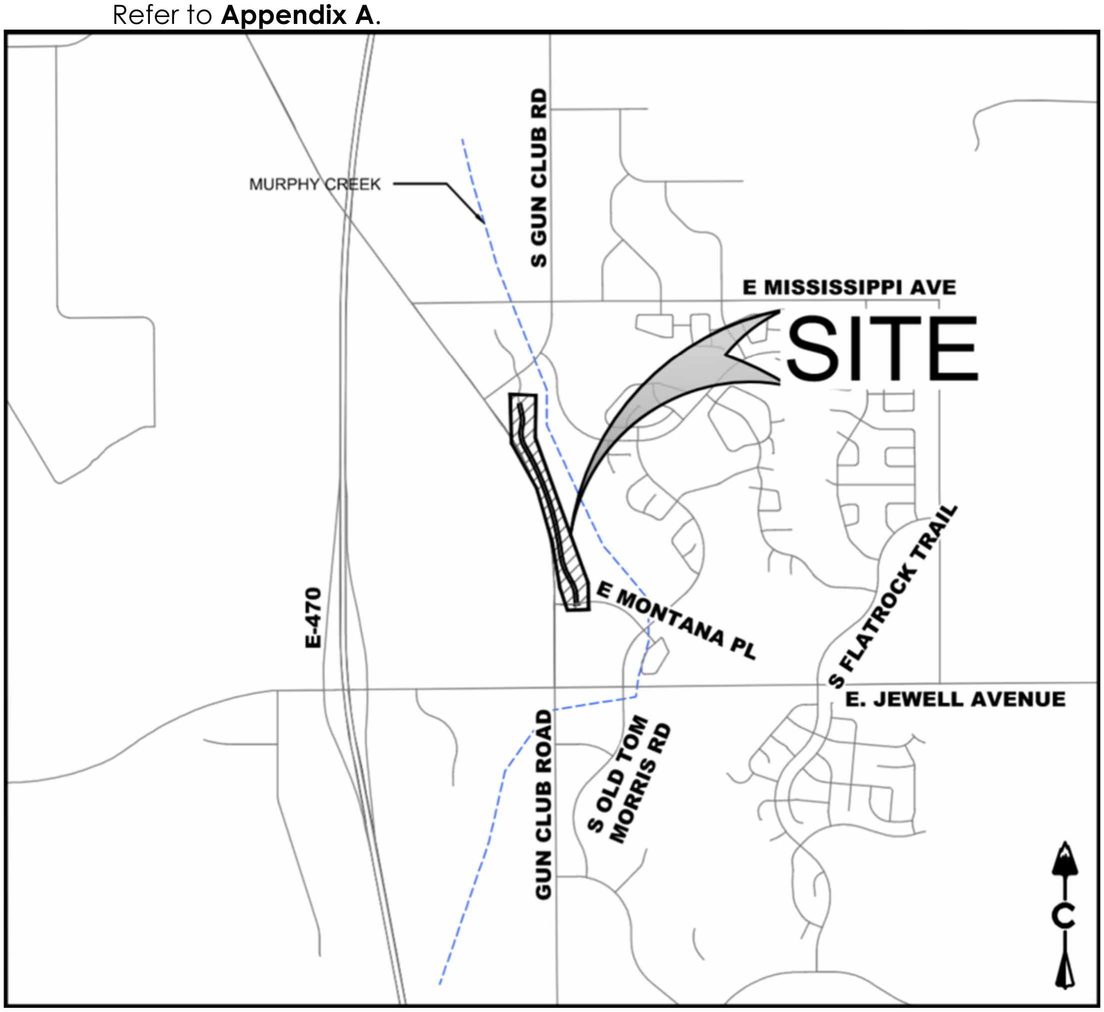
a. Adjacent Streets, Subdivision Name, Lot and Block, Site Plan Name

The proposed project is in the west half Section 19, Township 4 South, Range 65 West of the Sixth Principal Meridian, City of Aurora, County of Arapahoe, and State of Colorado. The project is bounded by E Montana Place to the South, Murphy Creek to the East, S Gun Club Road to the north and Gun Club Road to the west.

This site is surrounded by Gun Club Road ROW to the west (Master Plan 588191), an existing gas station/commercial plot to the north, Murphy Creek and the Murphy Creek Golf Course to the east (Murphy Creek LLC 1977-19-3-00-006 and City of Aurora 1977-19-3-01-001), and the Prose at Murphy Creek Filing 01 development and E Montana Place to the south (EDN 222255).

b. Vicinity Map

Refer to **Appendix A**.



2. Proposed Development

a. Development Description

This project proposes the development of Zante Street stretching from E Montana Place north to the existing Zante Street Stub which extends south from S Gun Club Road, past the existing gas station, where Zante Street currently dead ends. This development includes road grading for the proposed section of Zante Street, storm sewer within the road and two storm stubs for future development areas (see basins A4 and B8 in the basin descriptions below). Two ponds will be built with this project in anticipation of the future development areas (Commercial Developments) as well as Zante Street itself.

Full spectrum detention will be provided for the entire site with these two ponds, Pond A and Pond B. The subject property is approximately 20.9 acres and has a master-planned imperviousness percentage of 45% per the 2008 Murphy Creek Outfall Systems Planning Report. The total acreage intended to be treated in the proposed Full-Spectrum Pond facility is 20.9 acres with an overall imperviousness of 88.5% which incorporates additional roads, buildings, parking stalls, and walks which account for the increase in imperviousness onsite.

3. Changes to the MDR

a. Changes to the MDR

The only change to the MDR (Costin Engineering Consultants, 1996, Murphy Creek MDP) is the anticipated imperviousness of the proposed project site. The MDR anticipated that this site would have an imperviousness of 45%; after initial analysis, it is anticipated that this site will have an imperviousness of approximately 72.8%. The increase in imperviousness will be accounted for and treated within the two proposed detention ponds onsite. Proposed release rates will be less than 90% of the existing flows to Murphy Creek.

b. MDR Comments

There are no conditional approval comments on the approved MDR or MDR plan sheets.

4. Variances

a. Development Variances

There are no variances requested for this development.

B. HISTORIC DRAINAGE

1. Description of Property and Drainage Basin

a. Property Description – soils, topography, hydrologic soil groups, etc.
According to the United State Department of Agriculture Natural Resources Conservation Service (NRCS) National Cooperative Soil Survey, there are 4 soil types present onsite. Three of the onsite soils are identified as Fondis-Colby Silt Loams, Buick Loam, and Buick Loam and are classified as Hydrologic Soil Group C. Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure. These soils have a slow rate of water transmission. The remaining onsite soil is identified as Terrace Escarpments and is classified as Hydrologic Soil Group D. Group D soils have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

The slopes encountered within the site's limits are generally between 2%-10% with the area on the west side of the site, along Gun Club Road, containing steeper slopes approaching 4:1. In the existing condition, the site is undeveloped (native grasses, small shrubs) and has an imperviousness of 2%. The Master Planned (See **Appendix E**) imperviousness is 45% (commercial and multifamily), and the anticipated imperviousness with this development is approximately 72.8% (actual commercial, residential, roads, and broken-out analysis). The increase in imperviousness will increase runoff from the site, which will be detained in one of two proposed detention ponds onsite.

b. Major Drainageways
The site's existing topography slopes to the east to Murphy Creek. According to FEMA Flood Insurance Rate Map Panels #08005C0204K and #08005C0212K, dated December 17, 2010, the subject site is located with flood hazard Zone X. Zone X is defined as area outside the 0.2-percent-chance (or 500-year) flood. This site is directly to the west of Murphy Creek and its associated floodplain, however no impacts to the existing floodplain of Murphy Creek are expected. Refer to **Appendix A** for the applicable FEMA Flood Insurance Rate Maps.

c. Irrigation Facilities
There are no irrigation facilities on or near this site that will be impacted by local drainage.

d. Offsite Basins
In the existing condition, this site sheetflows east into Murphy Creek. Per the 2005 Murphy Creek Outfall Systems Planning Study by Moser and Associates (See **Appendix E** for excerpts), this site is a portion of Basin 111. Two offsite basins, shown on the Moser & Associates Murphy Creek Outfall Planning Study, indirectly impact the site. There are two culverts that are shown as associated with basin numbers 400 and 380; these will bypass the proposed development. The northernmost of the culverts is a 48" culvert expected to convey 91 cfs per the October 2008 Murphy Creek and Tributaries Watershed OSP. Per the Jewell

commons Master Plan, the southernmost 24" culvert is expected to convey 19.3 cfs. These flows will be expected to be passed through the project site and into Murphy Creek, per existing conditions.

e. Outfalls from the Site

There are two offsite basins that outfall via 48" and 24" culverts that cross SH30 and release into Murphy Creek. In the proposed condition, there will also be two outfalls from the site, one from each detention pond.

f. Major Studies

The following studies were referenced in the creation of this report:

- Master Drainage Plan for Murphy Creek, a Planned Community, COA EDN 980080 by Costin Engineering Consultants, Inc. 1999
- Final Drainage Study for Old Tom Morris Road Jewell Ave. to Club House Entrance, COA EDN 990214 by Costin Engineering Consultants, Inc. 1999
- Final Drainage Report Prose at Murphy Creek Filing No. 1, COA EDN 222255, CORE Consultants, September 2023
- Murphy Creek Outfall Systems Planning Study, City of Aurora, Urban Drainage and Flood Control District (MHFD), Moser and Associates Engineering, 2005
- Jewell Commons Parcel Master Drainage Study, COA EDN 204181, Peak Civil Consultants, 2003

C. DESIGN CRITERIA

1. Hydrologic Criteria

a. Rainfall source and P_1 identified (NOAA Atlas 14, used for Rational Method)

The One-Hour Precipitation Depths from the NOAA Atlas 14 for this site (See **Appendix A** for the NOAA Atlas 14 map and rainfall chart) were used for the minor and major storms (2 and 100-year events) in this report. Per Section 6.1.1 of the Aurora Storm Drainage Design & Technical Criteria Manual, the proposed design frequencies analyzed in this report are the 2-yr (minor) and 100-year (major) events based on the street designation. All storm sewer will be designed at a minimum to convey the 100-year event.

b. One-Hour Precipitation Depths

P_1 2-yr rainfall depth = 0.86 in
P_1 100-year rainfall depth = 2.47 in

c. Calculation method(s)

The Rational Method analysis of runoff coefficients was based on the type of proposed development outlined in the City of Aurora Drainage Criteria Manual (Table 5-5 and 5-6). Runoff coefficients used in the analysis were weighted according to the existing and proposed land uses in each basin or sub-basin and the time of concentration values have been calculated for each of the basins or sub-basins per City of Aurora Drainage Criteria Manual. Hydrologic calculations can be found in **Appendix B**.

d. Detention volume computation method(s)Per the "Detention/Retention" section of the Aurora Storm Drainage Design & Technical Criteria Manual, the site will be designed to meet Full Spectrum Detention based on MHFD's design requirements utilizing the MHFD-Detention design tool.

The three zones of the detention basin are as follows:

Zone 1: WQCV
Zone 2: EURV – Zone 1
Zone 3: 100-year – Zones 1 and 2

In addition, the maximum 100-year release rate, as defined in the Aurora Storm Drainage Design & Technical Criteria Manual, Section 10.4, shall be no more than 90 percent of the pre-development 100-year peak flow rate.

It is noted that both proposed ponds have been designed for both the interim and final buildout conditions. The pond grading shall remain the same for both ponds, but require updates to the outlet structures to ensure MHFD criteria is being met before and after future commercial development.

In the ultimate condition, the designed maximum 100-year release rate for Pond A (Basins A1-A4), is 10.0 cfs. This flow rate is 0.9 of the pre-development flow. The design maximum 100-year release rate for Basins B1-B9 through Pond B, is 9.5 cfs. This flow rate is 0.8 of the pre-development flow. The total resulting maximum 100-year release rate for all proposed onsite basins is 19.5 cfs. This is less than the predevelopment flow of 23.2 cfs.

Additionally, the total runoff from Basins OS1 and OS2 (3.7 cfs, which is being released offsite undetained) has been reduced from the pond allowable release rate, so that the entire developed release does not exceed the pre-development flows.

EXISTING VS PROPOSED RUNOFF							
Condition	**Acres**	**Total Direct Runoff 100-yr (cfs)**	**cfs/ Acre**	**Basins**	**Detained Release (cfs)**	**Undetained Release (cfs)**	**Total Actual Release (cfs)**
EXISTING	20.9	23.2	0.90	EX1-3	0	23.2	23.2
PROPOSED	20.9	106.1	6.19	A1-A4, B1-B9, OS1-OS2	15.8	3.7	19.5

Table 1 – Existing vs. Proposed Runoff

Storage and Water Quality Calculations can be found in **Appendix B.**

e. Reference sources other than USDCM
None Utilized.

2. Hydraulic Criteria

a. Identify design storm frequencies used for pipes and inlets, either public or private

Storm pipes and inlets shall be sized for the 100-year storm event. Inlets will be sized to utilize a maximum of 12 inches of ponding, if available, to capture the 100-year event. Bypass flow routing has been considered in design and is included in **Appendix C** within the UD-Inlet workbook. Street capacities have been included in this PDR and preliminary inlet sizing is presented for reference. Final inlet and pipe sizing will be presented in the FDR. No swales are proposed onsite at this time. All detention ponds onsite are designed to be full-spectrum detention in accordance with Aurora standards and MHFD standards.

b. Detention Facility Methodology

Both detention ponds onsite were sized using the MHFD UD-Detention workbook. The ponds are both full-spectrum detention and meet all criteria set forth by MHFD and City of Aurora.

c. Drainageway Corridor Widths

No drainageway corridors were designed or altered with his project.

d. FEMA Floodplains

According to FEMA Flood Insurance Rate Map Panels #08005C0204K and #08005C0212K, dated December 17, 2010, the subject site is located with flood hazard Zone X. Zone X is defined as area outside the 0.2-percent-chance (or 500-year) flood. This site is directly to the west of Murphy Creek and its associated floodplain, however no impacts to the existing floodplain of Murphy Creek are expected, and no CLOMRs or LOMCs are required with this project.

Murphy Creek is located east of the subject property. There are no areas of development which are anticipated to impinge upon the existing 100-year floodplain. The closest area of development to the existing floodplain is the north side of Zante Street, which although close in proximity to the published floodplain boundary line, is not close to impacting the published WSEL's of the drainageway. No impact is expected with this development. There are no improvements nor grading proposed within the defined floodplain.

e. Public/Private

All storm sewer, detention ponds, and pond outfalls onsite are private, and will be owned and maintained by the property owner.

f. Temporary Proposed Stormwater Infrastructure

There is no proposed temporary stormwater infrastructure onsite.

g. Hydraulic Analysis

StormCAD will be utilized with the FDR to route proposed runoff and size the proposed storm sewer systems onsite. Water surface profiles will be generated and are to be represented in the plans and conform with City of Aurora standards. The 2-year event will not surcharge the system at any point, and the 100-year event surcharging within the pipes will remain 1' below grade. The UD-Detention workbook, UD-Inlet Workbook, and a CORE-standard Rational

Method workbook were utilized in sizing the detention ponds, street and inlet capacities, and the hydrologic calculations for the site, respectively.

h. Additional References:

- Master Drainage Plan for Murphy Creek, a Planned Community, COA EDN 980080 by Costin Engineering Consultants, Inc. 1999.
- Final Drainage Report Prose at Murphy Creek Filing No. 1, COA EDN 222255, CORE Consultants, September 2023
- Murphy Creek Outfall Systems Planning Study, City of Aurora, Urban Drainage and Flood Control District (MHFD), Moser and Associates Engineering, 2005
- Jewell Commons Parcel Master Drainage Study, COA EDN 204181, Peak Civil Consultants, 2003
- Final Drainage Study for Old Tom Morris Road – Jewell Ave. to Club House Entrance, COA EDN 99021, Costin Engineering Consultants, Inc., Revised March 28 1999

D. DRAINAGE PLAN

1. General Concept

a. Drainage Concept and Patterns

The subject property is divided into 2 main basins, Basins A and B. In general, drainage is conveyed to the proposed Full Spectrum Detention ponds via sheet flow, curb and gutter, and underground storm sewer. Proposed drainage patterns are not anticipated to negatively impact historic runoff conditions. It is expected all major drainage infrastructure (pond, trunk storm line, roadway inlets, etc) will be completed in a single phase.

b. Changes to the MDR

The only change to the MDR (Costin Engineering Consultants, 1996, Murphy Creek MDP) is the anticipated imperviousness of the proposed project site. The MDR anticipated that this site would have an imperviousness of 45%; after initial analysis, it is anticipated that this site will have an imperviousness of approximately 88.5%. The increase in imperviousness will be accounted for and treated within the two proposed detention ponds onsite. Proposed release rates will be less than (90% of) the existing flows to Murphy Creek.

c. Changes to the PIP

There are no drainage changes to the PIP.

d. Conformance with the Site Plan

This report is being developed in tandem and is in general conformance with the Site Plan.

e. Offsite Basins and Overflows

Per the 2008 Murphy Creek Outfall Systems Planning Study by Moser and Associates (See **Appendix E** for excerpts), this site is a portion of Basin 111. Two offsite basins, shown on the Moser & Associates Murphy Creek Outfall Planning Study, indirectly impact the site. There are two culverts that are shown as associated with basin numbers 400 and 380; these will bypass the proposed development. The northernmost of the culverts is a 48" culvert expected to convey 91 cfs per the October 2008 Murphy Creek and Tributaries Watershed OSP. Per the Jewell Commons Master Plan, the southernmost 24" culvert is expected to convey 19.3 cfs. These flows will be expected to be passed through the project site and into Murphy Creek, per existing conditions. No emergency overflows are anticipated to flow to this site. Any future development in the planning area will require perpetuation of the existing drainage patterns of these culverts.

f. Coordination with Surrounding Developments

There are no changes to existing flow conditions and there are no changes to the MDR proposed with this development, so there has been no additional coordination with surrounding developments.

g. Outfalls from the Site

There are two proposed outfalls from this site, one from each of the proposed detention ponds. These two ponds, as discussed earlier in this report, will be allowed to release at a combined 90% of existing condition flows, minus the two small undetained basins that sheetflow to Murphy Creek. All flows in the proposed condition follow existing drainage patterns and outfall directly to Murphy Creek. There is no offsite infrastructure that these outfalls rely on.

h. Impacts on Neighboring Developments

The development of this site will have no impacts on upstream, downstream, or adjacent developments, as all stormwater release from the site will be at 90% of existing conditions, no offsite flows are barred from entering the site, and there are no emergency overflow routes from this site that would impact a neighboring site.

i. Water Quality

Water quality for the entire site is provided in one of two detention ponds onsite. The A basins are routed via sheet flow and storm sewer to Pond A, where water quality and full detention are provided, and over-detention is provided for Basin OS1. The B basins are routed via sheet flow and storm sewer to Pond B, where water quality and full detention are provided, and over-detention is provided for Basin OS2. The owner of the property shall own and maintain the two detention ponds onsite. This site does not rely on an offsite SCM.

2. Specific Details

a. Phasing Plan

This project will be completed in one phase, so no phasing plan is necessary.

b. Basin Descriptions

1. Offsite Basin Descriptions

Per the 2005 Murphy Creek Outfall Systems Planning Study by Moser and Associates (See Appendix E for excerpts), this site is a portion of Basin 111. Two offsite basins, shown on the Moser & Associates Murphy Creek Outfall Planning Study, indirectly impact the site. There are two culverts that are shown as associated with basin numbers 400 and 380; these will bypass the proposed development. The northernmost of the culverts is a 48" culvert expected to convey 91 cfs per the October 2008 Murphy Creek and Tributaries Watershed OSP. Per the Jewell commons Master Plan, the southernmost 24" culvert is expected to convey 19.3 cfs. These flows will be expected to be passed through the project site and into Murphy Creek, per existing conditions. Any future development in the planning area will require perpetuation of the existing drainage patterns of these culverts.

Proposed Basins OS1 & OS2

These basins consist of a portion of the off-site drainage east of the proposed Zante Street and contain landscape area. Runoff generated from these basins will be conveyed to Murphy Creek before traveling north under Gun Club Road culvert. Please note that the detention ponds onsite over-detain for OS1 and OS2 but do not accept flows from these basins.

2. Existing Basin Descriptions

Basin EX1 and EX2

These basins consist of the majority of the project site in the existing condition, which is the undeveloped land between Murphy Creek and the existing State

Highway 30 (Gun Club Road). Runoff from this area sheetflows to the east and into Murphy Creek.

Basin EX3

This basin consists of a small portion of E Montana Place, at the northeast corner of S Gun Club Road and E Montana Place. Runoff from this portion of road sheetflows to the curb and gutter, where the flows will round the corner to proposed Zante Street – in the existing condition, these flows exit the gutter from a mountable curb section and sheetflows into basin EX1.

3. Onsite Basin Descriptions

There are two onsite basins associated with the subject property as described below. Basins A and B are divided into a series of subbasins that are serviced by storm infrastructure that conveys flows to the proposed detention ponds onsite and then to Murphy Creek.

Basin A

Basin A is divided into 4 subbasins. Basin A consists of the southern portion of the site containing landscape areas, and Zante Street. All runoff from Basin A is conveyed via sheet flow, curb inlets, and associated storm infrastructure to the detention pond onsite.

Subbasins A2 and A3

These subbasins make up the paved portion of Zante Street along the southern half of the site. All curb inlets along this portion of Zante Street are designed to accommodate the 100-year event flows. Subbasin A3 includes the northern portion of E Montana Place.

The curb inlets and associated storm infrastructure convey flows from this series of subbasins to the detention pond onsite. In the event that all of these inlets become 100% clogged, runoff will continue to sheet flow to the east to subbasin A1 and into the detention pond onsite.

Subbasins A1 and A4

Subbasins A1 and A4 consist of the western and eastern sides of the southern portion of Zante Street and are anticipated to be commercial development in the ultimate condition. Runoff sheet flows to the east. Subbasin A4 flows to subbasin A3, which flows to a curb inlet as described above. In the event that all of these inlets become 100% clogged, runoff will flow over the curb and sheet flow to the east to either the detention pond or directly to Murphy Creek and into the detention Pond A. Subbasin A1 sheet flows directly into the detention Pond A.

Basin B

Basin B is divided into 9 main subbasins that make up the northern portion of the site containing landscape areas, and Zante Street. All runoff from Basin B is conveyed via sheet flow, or curb inlets with associated storm infrastructure to the detention pond onsite and then to Murphy Creek

Subbasin B2, B3, B4, B5, B6, and B7

These subbasins make up the paved portion of Zante Street along the northern half of the site. All curb inlets along this portion of Zante Street are designed to accommodate the 100-year event flows.The curb inlets and associated storm infrastructure convey flows from this series of subbasins to the detention pond onsite. Subbasin B9 sheet flows directly to Pond B.

Subbasin B1

Subbasin B1 consists of one of the landscape areas east of Zante Street. Runoff is conveyed via sheet flow to Murphy Creek. The grades in this area are minimally modified and will consist of a 4:1 max slope directly adjacent to Zante Street. In the ultimate condition, subbasin B1 is anticipated to be commercial development and all runoff from this basin will enter the storm sewer system in Zante Street before being directed to the detention pond. No runoff will bypass the pond from this basin.

Subbasin B8

Subbasin B8 consists of a landscape area to the northwest of Zante Street and is will sheet flow to subbasin B7 within the limits of Zante Street. It will then continue to follow the drainage pattern outlined above for this subbasin. In the ultimate condition, subbasin B8 is anticipated to be commercial development.

Subbasin B9

Subbasin B9 is a landscape area adjacent to Zante Street that sheet flows to the detention Pond B. In the ultimate condition, subbasin B9 is anticipated to be commercial development and the proposed Pond B.

c. Summary Tables

RUNOFF SUMMARY TABLE							
DESIGN POINT	**BASIN**	**AREA (AC)**	**5-YEAR RUNOFF (CFS)**	**100-YEAR RUNOFF (CFS)**	**2-YEAR C VALUE**	**100-YEAR C VALUE**	**% IMPERVIOUS**
A1	A1	4.923	6.87	24.57	0.66	0.82	81.0%
A2	A2	0.708	1.62	5.18	0.78	0.87	95.0%
A3	A3	0.936	2.08	6.78	0.76	0.86	92.8%
A4	A4	1.586	2.57	9.28	0.65	0.81	80.0%
B1	B1	6.384	3.44	19.45	0.34	0.67	45.1%
B2	B2	0.624	1.25	3.99	0.78	0.87	95.0%
B3	B3	0.822	1.41	4.79	0.71	0.84	87.2%
B4	B4	0.566	1.04	3.54	0.71	0.84	87.5%
B5	B5	0.434	0.90	2.88	0.78	0.87	95.0%
B6	B6	0.411	0.94	3.01	0.78	0.87	95.0%
B7	B7	0.461	1.00	3.24	0.76	0.86	92.8%
B8	B8	1.360	2.55	9.22	0.65	0.81	80.0%
Total	B9	19.215	25.67	95.92	0.71	0.84	86.5%
OS1	OS1	0.33	0.62	2.22	0.65	0.81	80.0%
OS2	OS2	0.20	0.38	1.38	0.65	0.81	80.0%
EX1	EX1	8.04	0.43	21.63	0.03	0.50	5.0%
EX2	EX2	12.13	2.43	33.43	0.12	0.55	17.3%
EX3	EX3	0.20	0.46	1.46	0.78	0.87	95.0%

Table 2 – Runoff Summary Table

d. Full Spectrum Detention

Two MHFD Full Spectrum Pond facilities have been designed for the site to attenuate and treat flows with a 48-hour drain time (due to proximity to the Buckley Air Force Base runway). Pond A is designed to treat and attenuate an 8.5 acre developed basin with an imperviousness of 83.2% in the ultimate condition and 36.2% in the interim condition. The pond overdetains for but does not treat basin OS1, as described above. Pond B is designed to treat and attenuate a 12.4 acre developed basin with an imperviousness of 65.8% in the ultimate condition and 58.0% in the interim condition. The pond overdetains for but does not treat basin OS2, as described above.

All basins are detained or over-detained for in the ponds, including OS1 and OS2, which are not tributary to either pond. OS1 and OS2 collectively create 3.32 cfs of flow in the 100-year event, which is undetained and not tributary to either pond. However, each pond was sized to include the acreage and imperviousness of the two undetained basins. The basins tributary to the ponds include 20.4 'onsite' acres but the ponds were sized for the full 20.7 acres of disturbed site. The total predevelopment release rate is 23.2 cfs. The total proposed release rate is 19.5 cfs, which is 0.8 of the peak predevelopment release rate.

Pond Summary Table - POND A – Ultimate Condition								
Condition	**Required Volume**	**Provided Volume**	**Stage (ft)**	**Allowed Release Rate**	**Actual Release Rate**	**Release Orifice**	**Freeboard to Spillway (ft)**	**Freeboard to Berm Top (ft)**
Micropool	25 cf	134 cf	0	NA	NA	NA	8	10
WQCV	0.25ac-ft	0.25 ac-ft	3.74	>/=40 hr	43 hr	Orifice Plate	4.26	6.26
EURV	0.70ac-ft	0.70 ac-ft	6.30	<48 hr*	45 hr	Overflow Weir	1.7	3.7
Full Spectrum (100-yr)	1.01 ac-ft	1.01 ac-ft	7.57	<=10.3 cfs	10.0 cfs**	Outlet Pipe	0.43	2.43
Spillway	NA	1.61 ac-ft	8.00	29.1 cfs (Required)	29.1 cfs (Required)	Emergency Weir	0	2
100-Emergency	NA	NA	8.57	29.1 cfs	29.1 cfs (0.57' depth)	NA	NA	1.43
Berm Top	NA	1.8 ac-ft	10.0	NA	NA	NA	NA	0
*Due to being in proximity of an airport, the drain time for the entire pond must be less than 48 hours. **Pond A+B+ Basin OS1+OS2 = 17.05 cfs which is less than existing condition 18.48 cfs								

Table 3 – Pond A Data Table

Pond Summary Table - POND B – Ultimate Condition								
Condition	**Required Volume**	**Provided Volume**	**Stage (ft)**	**Allowed Release Rate**	**Actual Release Rate**	**Release Orifice**	**Freeboard to Spillway (ft)**	**Freeboard to Berm Top (ft)**
Micropool	25 cf	134 cf	0	NA	NA	NA	7.0	9.0
WQCV	0.27 ac-ft	0.27 ac-ft	2.69	>/=40 hr	41 hr	Orifice Plate	4.31	6.31
EURV	0.79 ac-ft	0.79 ac-ft	5.13	<48 hr*	44 hr	Orifice Plate	1.87	3.87
Full Spectrum (100-yr)	1.34 ac-ft	1.39 ac-ft	6.96	<=11.9 cfs	9.6 cfs**	Outlet Pipe	0.68	1.68
Spillway	NA	2.02 ac-ft	7.0	33.6 cfs (Required)	33.6 cfs (Required)	Emergency Weir	0	1.5
100-Emergency	NA	NA	7.47	33.6 cfs	33.6 cfs (0.47' depth)	NA	NA	1.03
Berm Top	NA	2.70 ac-ft	9	NA	NA	NA	NA	0
*Due to being in proximity of an airport, the drain time for the entire pond must be less than 48 hours. **Pond A+B+Basin OS1+OS2 = 17.05 cfs which is less than existing condition 18.48 cfs								

Table 4 – Pond B Data Table

A concrete trickle channel sloped at 0.5% has been designed to encourage draining of the pond and facilitate pond maintenance. The channel is required to contain 3% of the peak inflow of the 100-year event to the pond at any given inflow point.

A permanent micropool has been designed to promote sediment separation and containment. The micropool has been integrated into the proposed outlet structure. The MHFD requirements (USDCM Volume 3, T-5) for a micropool indicate that it must be at least 2.5' deep with 10 sf of area on the top.

An emergency spillway has been included in the drainage design to mitigate the unlikely event of inundation of the pond beyond the drainage capacity of the outlet structure's 100-yr event peak flow restricted conveyance, or in the case that elements of the outlet structure become clogged or silted in. The bottom of the spillway is elevated above the 100-year water surface ponding elevation of the detention basin. The emergency spillway has been sized to convey the undetained peak inflow of the 100-year event with one foot of freeboard to the top bank of the proposed facility.

The proposed pond outfalls for both ponds are designed to discharge to Murphy Creek via an outlet structure and associated storm pipe and riprap outlet pad.

e. Offsite Water Quality

There is no proposed offsite water quality intended for the treatment of runoff from this site.

f. Proposed Culverts

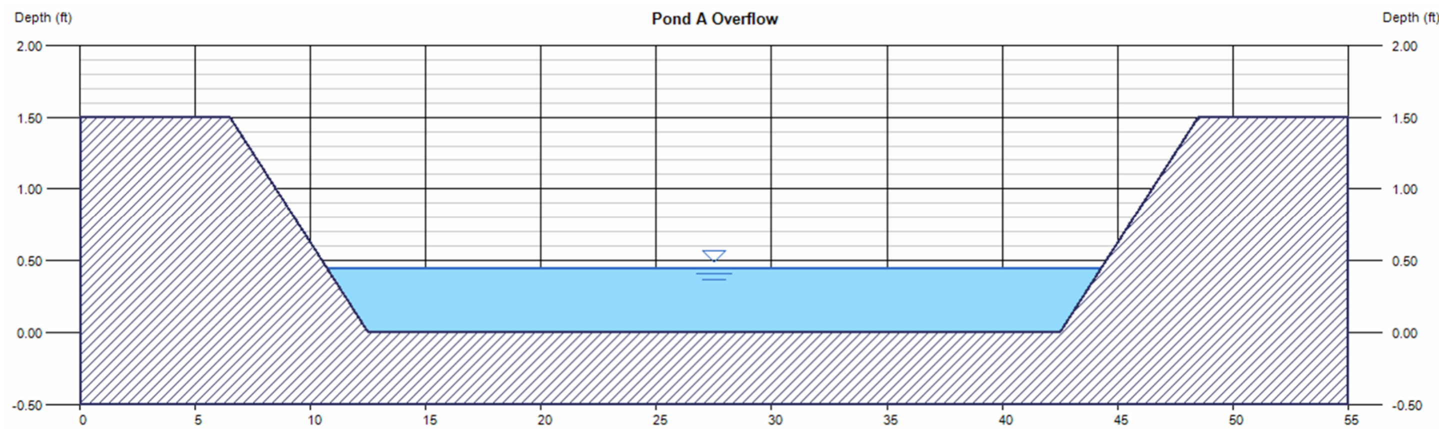
There are no proposed culverts on this site at this time. Storm Sewer will be sized with the Final Drainage Report.

g. Bridges

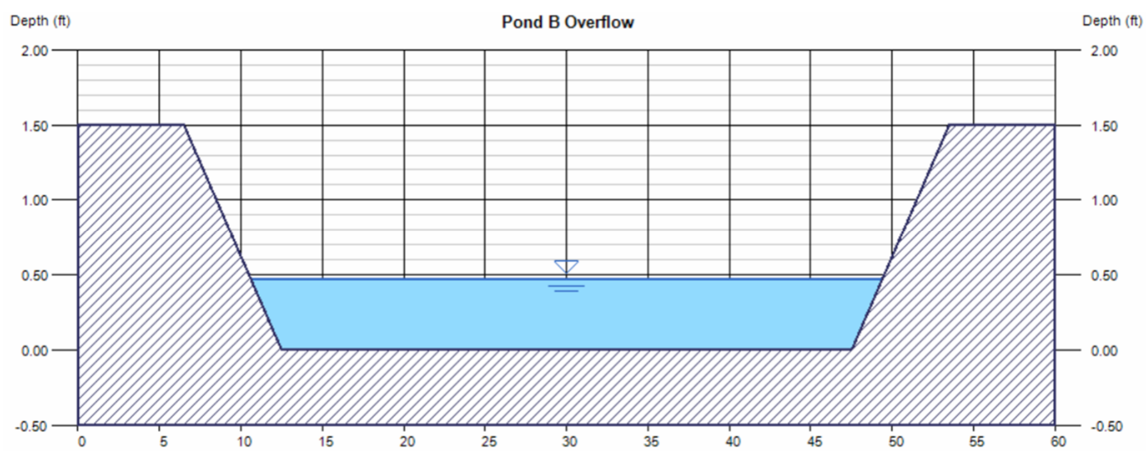
There are no proposed bridges for this site.

h. Emergency Overflows

There are three emergency overflows on this site, one for Pond A, Pond B, and a pair of sump inlets at Design Points A2 and A3. The emergency overflow for Pond A will need to pass the 100-year inflow for the pond, or 29.1 cfs. See below for the weir calculation that shows one foot freeboard as well as the weir passing the required flow. The weir is a 30' long, 1.5' deep weir with 4:1 side slopes.



The emergency overflow for Pond B will be required to pass the 100-year inflow for the pond, or 29.0 cfs. See below for the weir calculation that shows one foot freeboard as well as the weir passing the required flow. The weir is a 35' long, 1.5' deep weir with 4:1 side slopes.



Assuming a fully clogged condition at the two sump inlets, the overflow for the inlets will need to pass flows from Basins A2-A4, or 21.2 cfs. The cross section and flow calculation for this sump overflow can be found on sheet 1 of the proposed drainage maps, found in Appendix D of this report. It is noted that the fully-clogged system approach is conservative and is not required by the City criteria.

i. Swales, Ditches, and Channels

There are no ditches, channels, or swales currently proposed on this site.

j. Regional Channel

There are no regional channel improvements planned for this site.

k. Street Capacities

The 2-year event is contained within 4" of ponding in the gutter for all streets onsite, and the 100-year event will not pond beyond 12". For depth and spread calculations, please refer to the UD-Inlet workbook in the appendix of this report.

l. Permanent Sediment Control Measures (SCMs)

The only permanent sediment control measure on this site are the two proposed full spectrum detention ponds that provide water quality and sediment control for the entire site.

m. Compliance with MHFD

The drainage design for this site meets or exceeds requirements set forth by the MHFD and the City of Aurora. The detention pond release rates are within regulatory limits, the street spread and ponding depth of runoff flows are within regulation, and the storm sewer that will be designed with he FDR for this site will also be within regulation for both agencies. The drainage design included herein will control damage to existing and proposed structures and infrastructure. The proposed improvements will not negatively affect any upstream or downstream drainage facilities or other structures under both the existing and future buildout conditions.

n. Other Information

There are no other design issues of note for this project.

E. REFERENCES

A. City of Aurora Storm Drainage Design and Technical Criteria Manual, November 2023.

B. Mile High Flood District Urban Storm Drainage Criteria Manual, October 2019.

C. Web Soil Survey, Soil Survey Staff (Natural Resources Conservation Service), United States Department of Agriculture. Available online at the following link: https://websoilsurvey.sc.egov.usda.gov/. Accessed November 10, 2023.

D. Flood Insurance Rate Map (FIRM) No. #08005C0204K & 08005C0212K, Federal Emergency Management Agency, Revised March 16, 2016. Available online at the following link: https://msc.fema.gov/portal/home. Accessed November 16, 2021.

E. Jewell Commons Parcel Master Drainage Study, COA EN 204181, Peak Civil Consultants, 2003

F. Murphy Creek and Tributaries Watersheds – Outfall Systems Planning Phase B – Planning Report, Moser & Associates Engineering, Updated March 2021.

G. Murphy Creek Master Drainage Plan, EDN 980080, Costin Engineering Consultants, Inc, Updated April 14, 1998.

H. Final Drainage Report for Prose Murphy Creek Filing No. 1, CORE Consultants, Inc, September 2023.

I. Final Drainage Study for Old Tom Morris Road – Jewell Ave. to Club House Entrance, COA EDN 99021, Costin Engineering Consultants, Inc., Revised March 28 1999.

F. APPENDICES

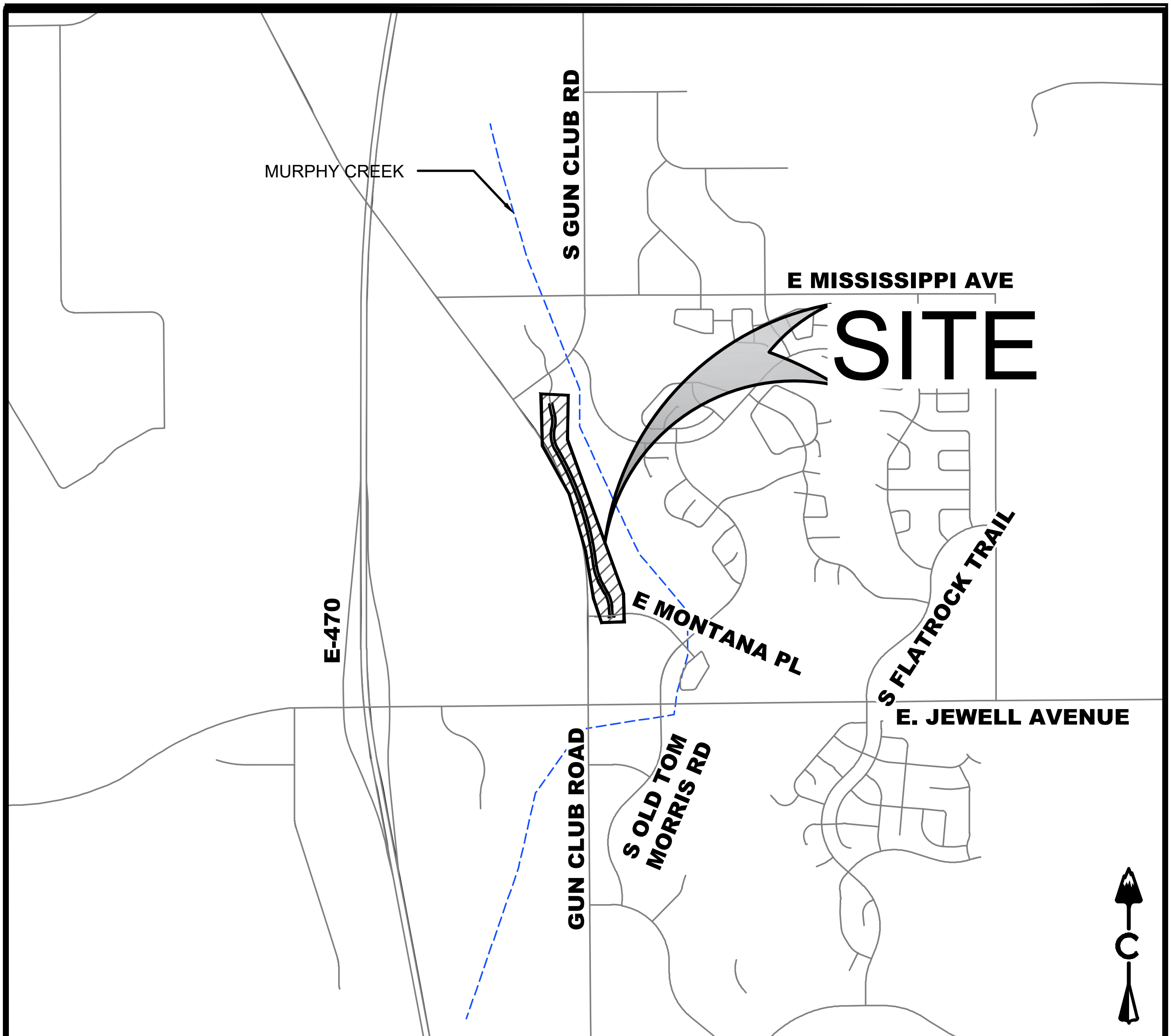
Appendix A – General Information
Appendix B – Hydrologic Computations
Appendix C – Hydraulic Computations
Appendix D – Drainage Maps
Appendix E – Reference Documents

APPENDIX A

General Information

- Vicinity Map
- Airport Detention Pond Buffer Map
- FEMA Firm Map
- Soils Report

Vicinity Map



CORE CONSULTANTS. INC.
LIVEYOURCORE.COM

SCALE:
N.T.S.

MURPHY CREEK - ZANTE STREET

VICINITY MAP

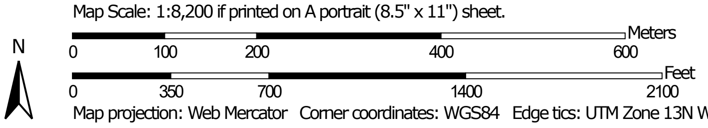
CREATED BY: JNK DATE: 11/10/2023

SHEET NUMBER
1
OF 1 SHEETS

JOB NUMBER
21-134

Hydrologic Soil Group—Arapahoe County, Colorado

Map Scale: 1:8,200 if printed on A portrait (8.5" x 11") sheet.



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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Arapahoe County, Colorado
Survey Area Data: Version 19, Aug 24, 2023

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

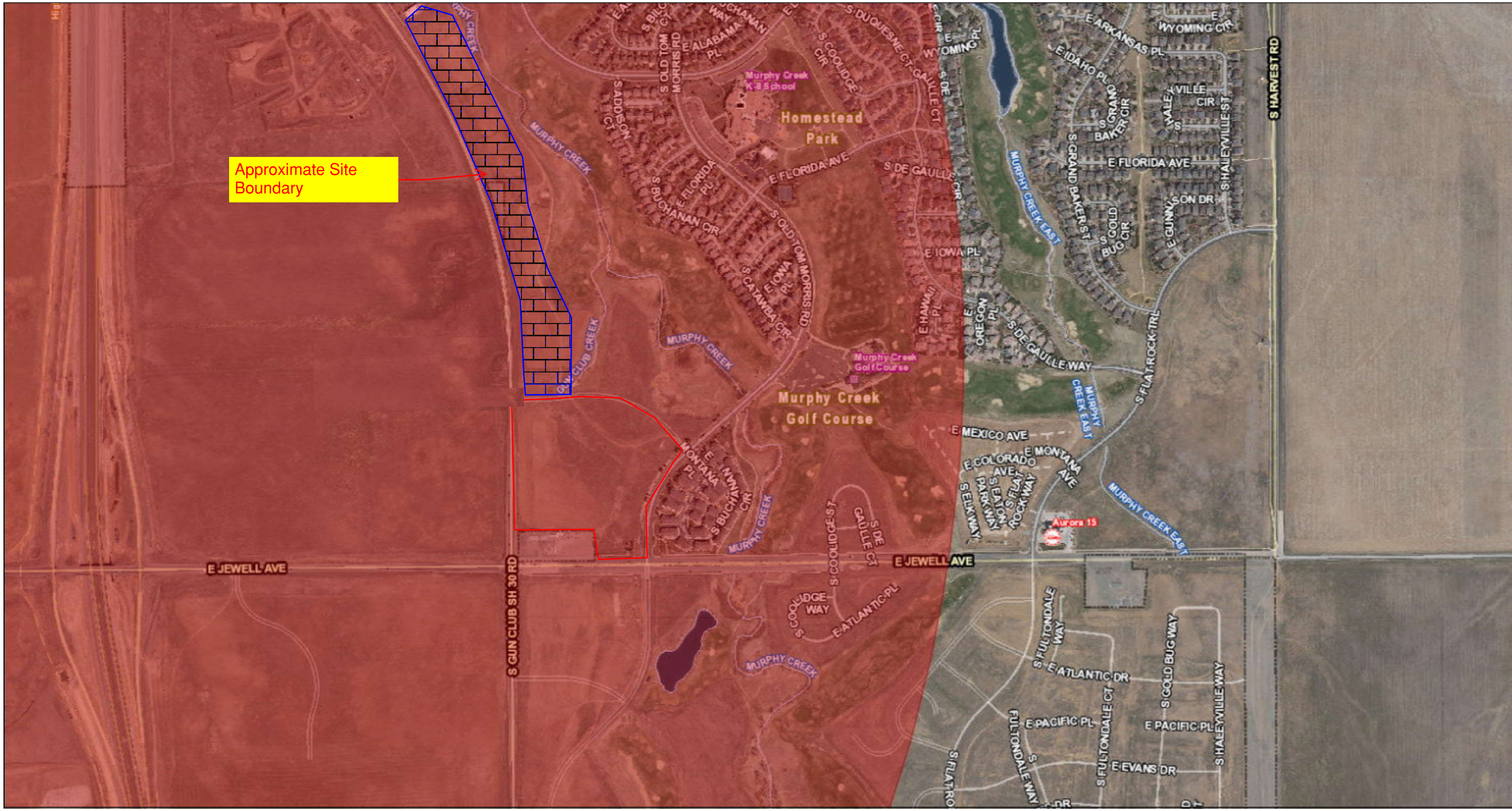
Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BvE	Bresser-Truckton sandy loams, 5 to 20 percent slopes	B	8.3	2.8%
BxC	Buick loam, 3 to 5 percent slopes	C	13.4	4.5%
BxD	Buick loam, 5 to 9 percent slopes	C	3.5	1.2%
FdB	Fondis silt loam, 1 to 3 percent slopes	C	62.5	21.2%
FoC	Fondis-Colby silt loams, 3 to 5 percent slopes	C	105.6	35.7%
Lv	Loamy alluvial land	B	8.1	2.7%
NlB	Nunn loam, 1 to 3 percent slopes	C	58.6	19.8%
Tc	Terrace escarpments	D	35.3	12.0%
Totals for Area of Interest			**295.3**	**100.0%**

ArcGIS Web Map



8/2/2022, 10:08:12 AM

Regional Airport Detention Pond Buffers

1:8,000

0 0.1 0.2 0.4 mi

0 0.15 0.3 0.6 km

ArcGIS Web AppBuilder
City of Aurora Data Download Disclaimer

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.

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The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM 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.

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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/.

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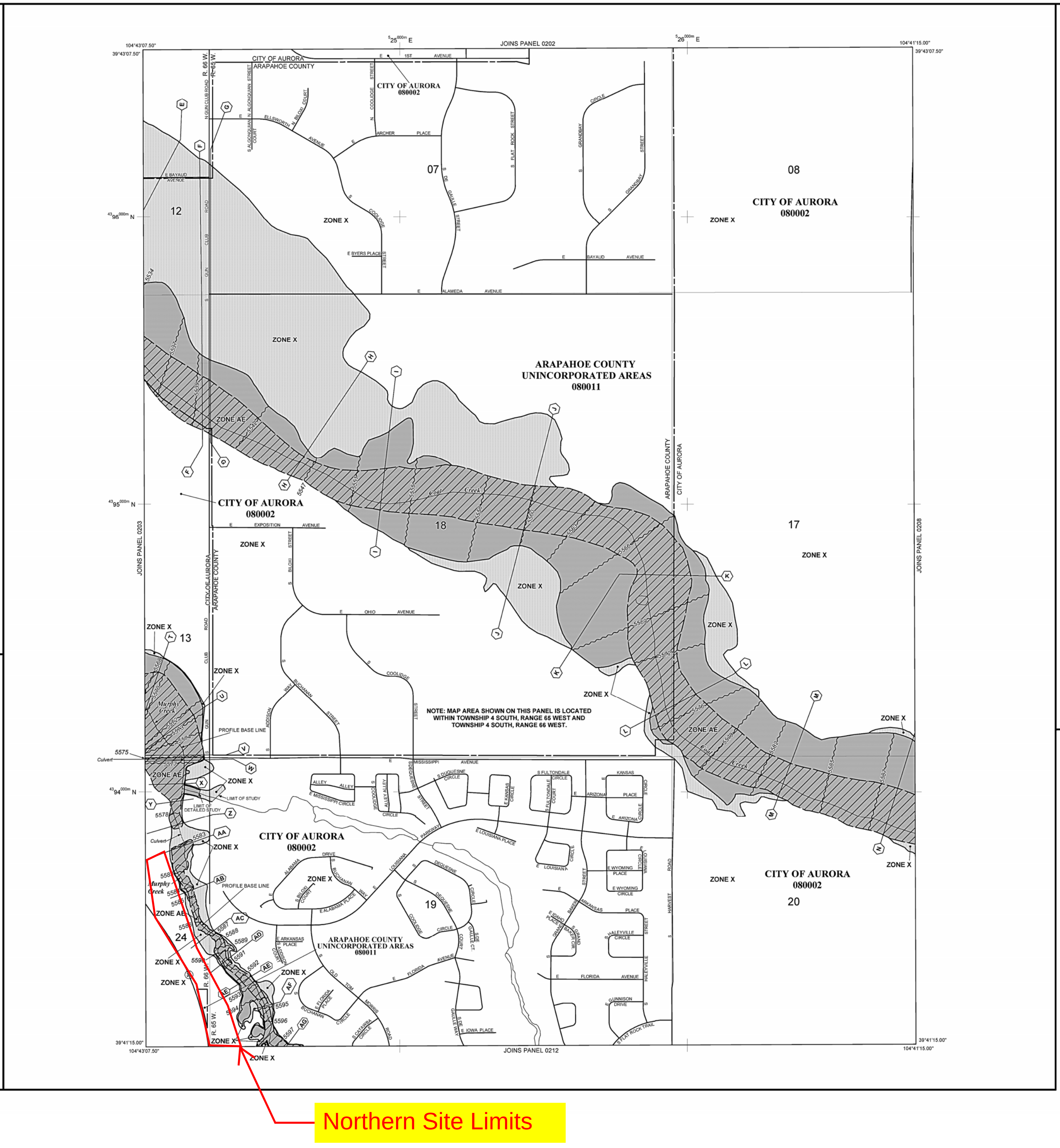
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

(A)———(A)	Cross section line
(23)- - - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 M	5000-foot grid ticks: New York State Plane coordinate system, east zone (FIPSZONE 3101), Transverse Mercator
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 17, 1989
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
March 4, 1991 December 3, 1993 August 16, 1995
December 17, 2010 - to update map format, to change Special Flood Hazard Areas, and to change Base Flood Elevations.

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MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0204K

FIRM
FLOOD INSURANCE RATE MAP
ARAPAHOE COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 204 OF 725
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ARAPAHOE COUNTY	080011	0204	K
AURORA, CITY OF	080002	0204	K

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

MAP NUMBER
08005C0204K

MAP REVISED
DECEMBER 17, 2010

Federal Emergency Management Agency

Southern Site Limits

NOTES TO USERS

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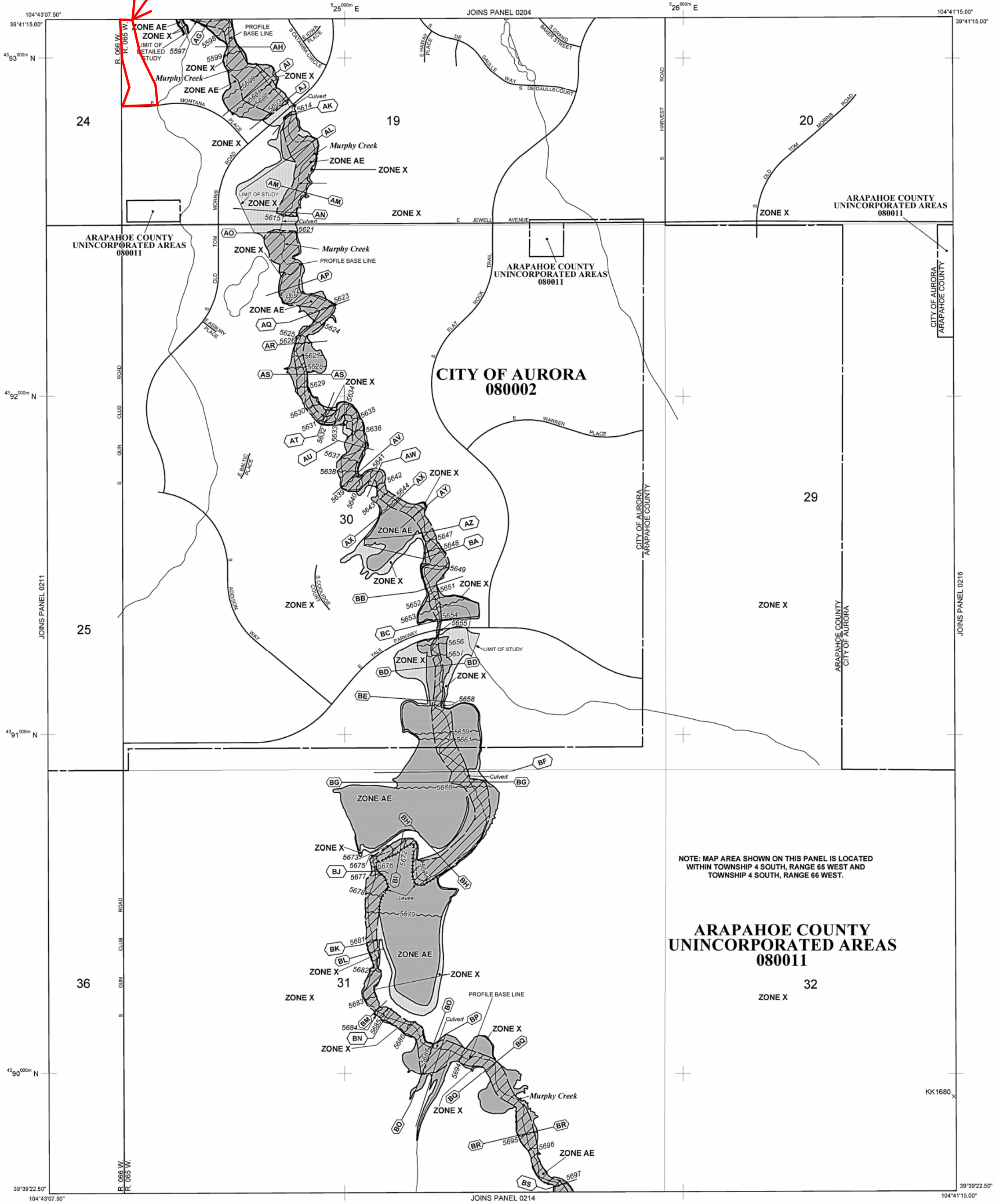

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OTHER FLOOD AREAS

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OTHER AREAS

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Floodway boundary

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

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

• M1.5 — River Mile

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FLOOD INSURANCE RATE MAP
April 17, 1989
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
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250 0 500 1000 FEET

150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

PANEL 0212K

FIRM
FLOOD INSURANCE RATE MAP

ARAPAHOE COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 212 OF 725

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ARAPAHOE COUNTY	080011	0212	K
AURORA, CITY OF	080002	0212	K

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MAP NUMBER 08005C0212K

MAP REVISED DECEMBER 17, 2010

Federal Emergency Management Agency

NOAA Atlas 14, Volume 8, Version 2
Location name: ???*
Latitude: 39.6845°, Longitude: -104.7207°
Elevation: 5654.24 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.228** (0.184-0.284)	**0.283** (0.228-0.352)	**0.380** (0.306-0.475)	**0.467** (0.374-0.586)	**0.598** (0.465-0.785)	**0.706** (0.535-0.935)	**0.821** (0.600-1.11)	**0.945** (0.661-1.31)	**1.12** (0.752-1.59)	**1.26** (0.821-1.80)
10-min	**0.334** (0.269-0.415)	**0.414** (0.334-0.516)	**0.557** (0.447-0.695)	**0.684** (0.547-0.858)	**0.875** (0.681-1.15)	**1.03** (0.783-1.37)	**1.20** (0.878-1.63)	**1.38** (0.968-1.92)	**1.64** (1.10-2.33)	**1.85** (1.20-2.64)
15-min	**0.407** (0.329-0.506)	**0.505** (0.408-0.629)	**0.679** (0.546-0.848)	**0.835** (0.667-1.05)	**1.07** (0.831-1.40)	**1.26** (0.955-1.67)	**1.47** (1.07-1.99)	**1.69** (1.18-2.34)	**2.00** (1.34-2.84)	**2.25** (1.47-3.22)
30-min	**0.559** (0.451-0.696)	**0.692** (0.558-0.862)	**0.927** (0.745-1.16)	**1.14** (0.910-1.43)	**1.45** (1.13-1.91)	**1.71** (1.30-2.27)	**1.99** (1.46-2.70)	**2.29** (1.60-3.18)	**2.71** (1.82-3.86)	**3.05** (1.99-4.37)
60-min	**0.700** (0.565-0.871)	**0.860** (0.693-1.07)	**1.14** (0.920-1.43)	**1.40** (1.12-1.76)	**1.79** (1.40-2.36)	**2.12** (1.61-2.81)	**2.47** (1.80-3.34)	**2.84** (1.99-3.95)	**3.38** (2.27-4.81)	**3.81** (2.48-5.45)
2-hr	**0.841** (0.683-1.04)	**1.03** (0.834-1.27)	**1.36** (1.10-1.69)	**1.67** (1.34-2.07)	**2.13** (1.67-2.78)	**2.52** (1.92-3.32)	**2.94** (2.17-3.96)	**3.39** (2.40-4.68)	**4.04** (2.74-5.70)	**4.57** (3.00-6.48)
3-hr	**0.928** (0.757-1.14)	**1.13** (0.917-1.39)	**1.48** (1.20-1.83)	**1.81** (1.46-2.25)	**2.31** (1.83-3.01)	**2.74** (2.10-3.59)	**3.19** (2.36-4.28)	**3.69** (2.62-5.06)	**4.40** (3.00-6.18)	**4.97** (3.28-7.02)
6-hr	**1.12** (0.917-1.36)	**1.35** (1.10-1.64)	**1.76** (1.43-2.15)	**2.13** (1.73-2.62)	**2.70** (2.14-3.48)	**3.18** (2.45-4.13)	**3.69** (2.75-4.90)	**4.25** (3.04-5.77)	**5.05** (3.46-7.02)	**5.69** (3.78-7.96)
12-hr	**1.38** (1.14-1.67)	**1.65** (1.36-2.00)	**2.13** (1.76-2.59)	**2.57** (2.10-3.13)	**3.21** (2.56-4.08)	**3.74** (2.90-4.80)	**4.30** (3.22-5.64)	**4.90** (3.52-6.58)	**5.75** (3.97-7.91)	**6.43** (4.31-8.90)
24-hr	**1.68** (1.39-2.01)	**2.00** (1.66-2.41)	**2.56** (2.12-3.08)	**3.04** (2.50-3.68)	**3.75** (2.99-4.70)	**4.32** (3.37-5.47)	**4.91** (3.70-6.36)	**5.54** (4.00-7.35)	**6.40** (4.45-8.70)	**7.08** (4.79-9.73)
2-day	**1.99** (1.66-2.37)	**2.35** (1.96-2.80)	**2.96** (2.46-3.54)	**3.48** (2.88-4.18)	**4.23** (3.39-5.24)	**4.82** (3.78-6.05)	**5.44** (4.12-6.97)	**6.08** (4.42-7.98)	**6.95** (4.87-9.35)	**7.64** (5.21-10.4)
3-day	**2.16** (1.82-2.57)	**2.54** (2.13-3.02)	**3.19** (2.66-3.79)	**3.73** (3.10-4.46)	**4.51** (3.64-5.56)	**5.13** (4.04-6.40)	**5.77** (4.39-7.35)	**6.43** (4.70-8.39)	**7.33** (5.16-9.80)	**8.03** (5.50-10.9)
4-day	**2.30** (1.94-2.72)	**2.70** (2.27-3.19)	**3.36** (2.82-3.99)	**3.93** (3.28-4.68)	**4.74** (3.83-5.82)	**5.38** (4.25-6.68)	**6.03** (4.61-7.66)	**6.72** (4.92-8.73)	**7.64** (5.39-10.2)	**8.36** (5.75-11.3)
7-day	**2.63** (2.23-3.10)	**3.07** (2.60-3.61)	**3.80** (3.20-4.48)	**4.42** (3.70-5.23)	**5.29** (4.30-6.45)	**5.98** (4.75-7.37)	**6.68** (5.13-8.41)	**7.40** (5.46-9.54)	**8.38** (5.96-11.1)	**9.14** (6.33-12.2)
10-day	**2.93** (2.49-3.44)	**3.40** (2.88-3.98)	**4.17** (3.53-4.90)	**4.83** (4.06-5.69)	**5.74** (4.68-6.96)	**6.46** (5.14-7.92)	**7.19** (5.54-9.00)	**7.94** (5.88-10.2)	**8.95** (6.39-11.8)	**9.73** (6.77-12.9)
20-day	**3.81** (3.26-4.43)	**4.34** (3.71-5.05)	**5.22** (4.44-6.08)	**5.96** (5.04-6.96)	**6.97** (5.71-8.36)	**7.76** (6.22-9.42)	**8.55** (6.64-10.6)	**9.36** (6.98-11.9)	**10.4** (7.50-13.6)	**11.3** (7.89-14.8)
30-day	**4.53** (3.88-5.23)	**5.14** (4.41-5.95)	**6.15** (5.25-7.13)	**6.97** (5.93-8.11)	**8.10** (6.66-9.64)	**8.96** (7.21-10.8)	**9.81** (7.65-12.1)	**10.7** (7.99-13.4)	**11.8** (8.52-15.2)	**12.6** (8.91-16.6)
45-day	**5.40** (4.65-6.22)	**6.17** (5.31-7.10)	**7.39** (6.34-8.53)	**8.38** (7.15-9.70)	**9.69** (7.98-11.4)	**10.7** (8.61-12.8)	**11.6** (9.08-14.2)	**12.6** (9.43-15.7)	**13.7** (9.96-17.6)	**14.6** (10.4-19.0)
60-day	**6.14** (5.30-7.03)	**7.06** (6.09-8.10)	**8.51** (7.32-9.78)	**9.66** (8.26-11.1)	**11.2** (9.20-13.1)	**12.3** (9.91-14.6)	**13.3** (10.4-16.2)	**14.3** (10.8-17.8)	**15.6** (11.3-19.8)	**16.5** (11.7-21.4)

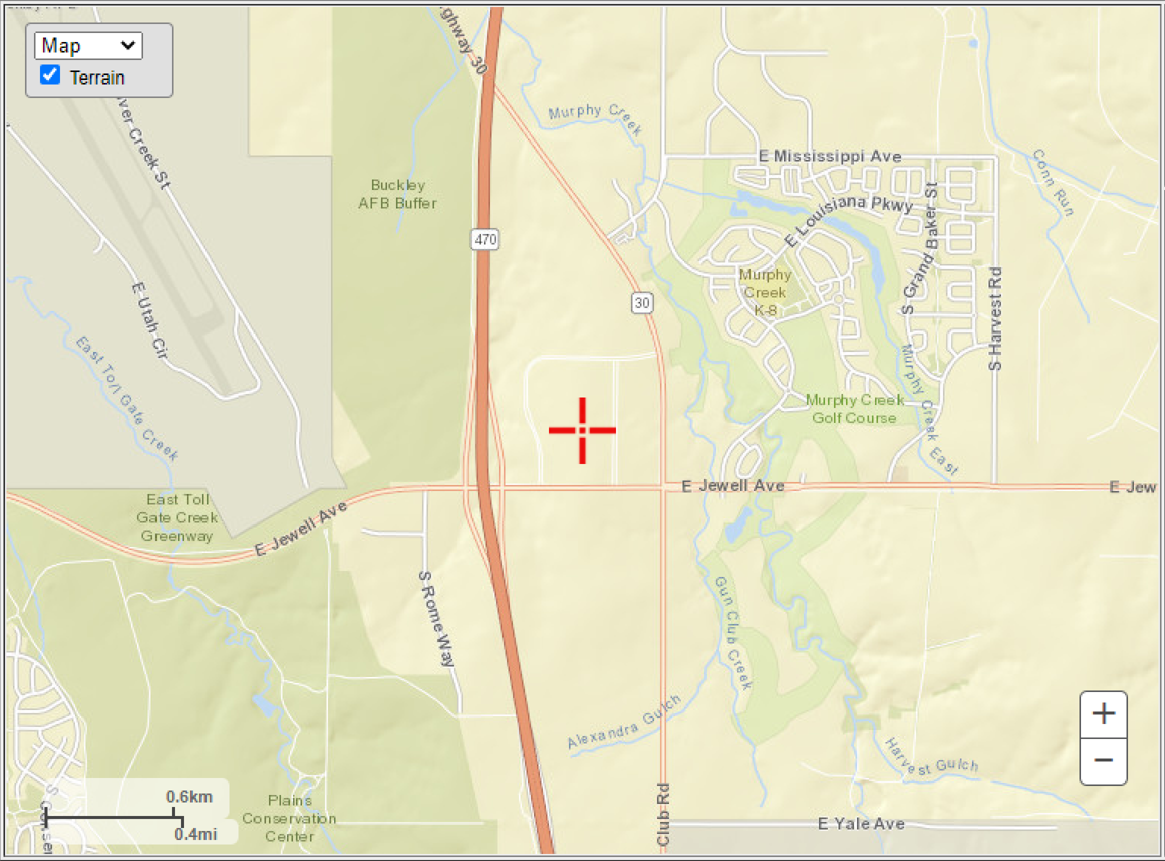
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



a) Select location
Move crosshair or double click

b) Click on station icon
☑ Show stations on map

Location information:
Name: Colorado*
Latitude: 39.6845°
Longitude: -104.7207°
Elevation: 5654.24 ft **

* Source: ESRI Maps
** Source: USGS

APPENDIX B

Hydrologic Computations

Zante Street - Final Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

IMPERVIOUS CALCULATIONS

-REFERENCE SDDTCM Table 5-5 and 5-6

		Residential & Commercial														
		Residential			Commercial				Landscape Area					Soil Type		
		Rural	Low & Medium Density	Industrial	Medium to High Density	Concrete	Paved Streets	Pond	Landscaping	Newly Graded Areas	Historic			Soil Type A Area	Soil Type B Area	Soil Type C/D Area
% Imperv.		35.00%	55.00%	75.00%	80.00%	95.00%	95.00%	100.00%	20.00%	65.00%	5.00%					
BASIN	Design Point	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Total Area (ac)	Percent Impervious	Area (ac)	Area (ac)	Area (ac)
A1	A1	-	-	-	4.68	-	-	0.24	-	-	-	4.92	81.0%	-	-	4.92
A2	A2	-	-	-	-	-	0.71	-	-	-	-	0.71	95.0%	-	-	0.71
A3	A3	-	-	-	-	-	0.87	-	-	0.07	-	0.94	92.8%	-	-	0.94
A4	A4	-	-	-	1.59	-	-	-	-	-	-	1.59	80.0%	-	-	1.59
B1	B1	-	-	2.07	1.49	-	-	-	-	-	2.83	6.38	45.1%	-	-	6.38
B2	B2	-	-	-	-	-	0.62	-	-	-	-	0.62	95.0%	-	-	0.62
B3	B3	-	-	-	-	-	0.61	-	-	0.21	-	0.82	87.2%	-	-	0.82
B4	B4	-	-	-	-	-	0.43	-	-	0.14	-	0.57	87.5%	-	-	0.57
B5	B5	-	-	-	-	-	0.43	-	-	-	-0	0.43	95.0%	-	-	0.43
B6	B6	-	-	-	-	-	0.41	-	-	-	-	0.41	95.0%	-	-	0.41
B7	B7	-	-	-	-	-	0.43	-	-	0.03	-	0.46	92.8%	-	-	0.46
B8	B8	-	-	-	1.36	-	-	-	-	-	-	1.36	80.0%	-	-	1.36
B9	B9	-	-	-	0.78	-	-	0.38	-	-	-	1.16	86.5%	-	-	1.16
OS1	OS1	-	-	-	0.33	-	-	-	-	-	-	0.33	80.0%	-	-	0.33
OS2	OS2	-	-	-	0.20	-	-	-	-	-	-	0.20	80.0%	-	-	0.20
EX1	EX1	-	-	-	-	-	-	-	-	-	8.04	8.04	5.0%	-	-	8.04
EX2	EX2	-	-	2.13	-	-	-	-	-	-	10.01	12.13	17.3%	-	-	12.13
EX3	EX3	-	-	-	-	-	0.20	-	-	-	-	0.20	95.0%	-	-	0.20

Zante Street - Interim Condition Rational Calculations

CORE Project #: 21-164

Prepared By: CORE

IMPERVIOUS CALCULATIONS

-REFERENCE SDDTCM Table 5-5 and 5-6

BASIN	Design Point	Residential & Commercial – Residential – Rural	Residential & Commercial – Residential – Low & Medium Density	Residential & Commercial – Residential – Industrial	Residential & Commercial – Commercial – Medium to High Density	Concrete	Paved Streets	Pond	Landscape Area – Landscaping	Landscape Area – Newly Graded Areas	Historic	Total	Percent	Soil Type – Soil Type A Area	Soil Type – Soil Type B Area	Soil Type – Soil Type C/D Area
% Imperv.		35.00%	55.00%	75.00%	80.00%	95.00%	95.00%	100.00%	20.00%	65.00%	5.00%					
		Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Area (ac)	Impervious	Area (ac)	Area (ac)	Area (ac)
A1	A1	-	-	-	-	-	-	0.24	-	0.26	4.42	4.92	12.9%	-	-	4.92
A2	A2	-	-	-	-	-	0.71	-	-	-	-	0.71	95.0%	-	-	0.71
A3	A3	-	-	-	-	-	0.87	-	-	0.07	-	0.94	92.8%	-	-	0.94
A4	A4	-	-	-	-	-	-	-	-	0.49	1.10	1.59	23.5%	-	-	1.59
B1	B1	-	-	2.07	-	-	-	-	-	1.49	2.83	6.38	41.6%	-	-	6.38
B2	B2	-	-	-	-	-	0.62	-	-	-	-	0.62	95.0%	-	-	0.62
B3	B3	-	-	-	-	-	0.61	-	-	0.21	-	0.82	87.2%	-	-	0.82
B4	B4	-	-	-	-	-	0.43	-	-	0.14	-	0.57	87.5%	-	-	0.57
B5	B5	-	-	-	-	-	0.43	-	-	-	-0	0.43	95.0%	-	-	0.43
B6	B6	-	-	-	-	-	0.41	-	-	-	-	0.41	95.0%	-	-	0.41
B7	B7	-	-	-	-	-	0.43	-	-	0.03	-	0.46	92.8%	-	-	0.46
B8	B8	-	-	-	-	-	-	-	-	0.71	0.65	1.36	36.4%	-	-	1.36
B9	B9	-	-	-	-	-	-	0.38	-	0.78	-	1.16	76.4%	-	-	1.16
OS1	OS1	-	-	-	-	-	-	-	-	0.33	-	0.33	65.0%	-	-	0.33
OS2	OS2	-	-	-	-	-	-	-	-	0.20	-	0.20	65.0%	-	-	0.20
EX1	EX1	-	-	-	-	-	-	-	-	-	8.04	8.04	5.0%	-	-	8.04
EX2	EX2	-	-	2.13	-	-	-	-	-	-	10.01	12.13	17.3%	-	-	12.13
EX3	EX3	-	-	-	-	-	0.20	-	-	-	-	0.20	95.0%	-	-	0.20

Zante Street - Interim Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

COMPOSITE DEVELOPED BASIN
WEIGHTED "C" CALCULATIONS
-REFERENCE SDDTCM Table 5-7

i = % imperviousness/100 expressed as a decimal
C_A = Runoff coefficient for NRCS HSG A soils
C_B = Runoff coefficient for NRCS HSG B soils
C_{CD} = Runoff coefficient for NRCS HSG C and D soils.
Natural Resource Conservation Service (NRCS)

Basin ID	% Imperv.	i	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
			A	0.06	0.06	0.07	0.21						
A1	12.9%	0.13	B	0.08	0.09	0.16	0.49		4.92	0.08	0.14	0.23	0.54
			C or D	0.08	0.14	0.23	0.54	4.92					
			A	0.79	0.81	0.82	0.85						
A2	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.71	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.71					
			A	0.76	0.78	0.79	0.83						
A3	92.8%	0.93	B	0.77	0.79	0.81	0.86		0.94	0.76	0.80	0.82	0.86
			C or D	0.76	0.80	0.82	0.86	0.94					
			A	0.13	0.14	0.15	0.29						
A4	23.5%	0.24	B	0.15	0.18	0.25	0.54		1.59	0.16	0.23	0.31	0.58
			C or D	0.16	0.23	0.31	0.58	1.59					
			A	0.27	0.28	0.30	0.43						
B1	41.6%	0.42	B	0.30	0.33	0.39	0.62		6.38	0.31	0.38	0.44	0.65
			C or D	0.31	0.38	0.44	0.65	6.38					
			A	0.79	0.81	0.82	0.85						
B2	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.62	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.62					
			A	0.70	0.72	0.74	0.79						
B3	87.2%	0.87	B	0.72	0.74	0.76	0.84		0.82	0.71	0.75	0.78	0.84
			C or D	0.71	0.75	0.78	0.84	0.82					
			A	0.71	0.73	0.74	0.79						
B4	87.5%	0.88	B	0.72	0.74	0.77	0.84		0.57	0.71	0.75	0.78	0.84
			C or D	0.71	0.75	0.78	0.84	0.57					
			A	0.79	0.81	0.82	0.85						
B5	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.43	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.43					
			A	0.79	0.81	0.82	0.85						
B6	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.41	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.41					
			A	0.76	0.78	0.79	0.83						
B7	92.8%	0.93	B	0.77	0.79	0.81	0.86		0.46	0.76	0.80	0.82	0.86
			C or D	0.76	0.80	0.82	0.86	0.46					
			A	0.23	0.24	0.25	0.39						
B8	36.4%	0.36	B	0.26	0.29	0.35	0.60		1.36	0.27	0.33	0.40	0.63
			C or D	0.27	0.33	0.40	0.63	1.36					
			A	0.59	0.61	0.62	0.71						
B9	76.4%	0.76	B	0.61	0.64	0.68	0.79		1.16	0.61	0.66	0.70	0.80
			C or D	0.61	0.66	0.70	0.80	1.16					
			A	0.48	0.50	0.51	0.62						
OS1	65.0%	0.65	B	0.51	0.54	0.58	0.73		0.33	0.51	0.57	0.61	0.75
			C or D	0.51	0.57	0.61	0.75	0.33					
			A	0.48	0.50	0.51	0.62						
OS2	65.0%	0.65	B	0.51	0.54	0.58	0.73		0.20	0.51	0.57	0.61	0.75
			C or D	0.51	0.57	0.61	0.75	0.20					
			A	0.02	0.02	0.02	0.15						
EX1	5.0%	0.05	B	0.03	0.03	0.10	0.45		8.04	0.03	0.08	0.17	0.50
			C or D	0.03	0.08	0.17	0.50	8.04					
			A	0.09	0.09	0.10	0.24						
EX2	17.3%	0.17	B	0.11	0.13	0.20	0.51		12.13	0.12	0.18	0.26	0.55
			C or D	0.12	0.18	0.26	0.55	12.13					
			A	0.79	0.81	0.82	0.85						
EX3	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.20	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.20					

Zante Street - Interim Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

TIME OF CONCENTRATION CALCULATIONS | BASIN A

-REFERENCE UDFCD Vol.1 Section 2.4

SF-2

NRCS Conveyance factors, K -REFERENCE UDFCD Vol.1 RUNOFF Table 6-2

Heavy Meadow	3	Short Grass Pasture & Lawns	7	Grassed Waterway	15
Tillage/field	5	Nearly Bare Ground	10	Paved Area & Shallow Gutter	20

SUB-BASIN DATA			INITIAL / OVERLAND TIME			CHANNEL / TRAVEL TIME T(t)						T(c) CHECK (URBANIZED BASINS)		FINAL T(c)
DRAIN BASIN	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	% IMPER-VIOUS	USDCM Eq . 6-5	min.
A1	4.92	0.14	300	2.0	23.9	410	2.0	20	2.8	2.4	26.3	12.9%		26.3
A2	0.71	0.81	25	2.0	2.1	520	2.5	20	3.2	2.7	4.8	95.0%	12.3	5.0
A3	0.94	0.80	55	5.0	2.4	490	2.5	20	3.2	2.6	5.0	92.8%	12.6	5.0
A4	1.59	0.23	300	4.2	17.0	50	4.2	20	4.1	0.2	17.2	23.5%	22.3	17.2
B1	6.38	0.38	300	2.0	18.0	1100	3.0	20	3.5	5.3	23.3	41.6%	26.1	23.3
B2	0.62	0.81	30	2.0	2.3	820	1.5	20	2.4	5.6	7.8	95.0%	14.9	7.8
B3	0.82	0.75	50	2.0	3.6	820	1.5	20	2.4	5.6	9.1	87.2%	16.4	9.1
B4	0.57	0.75	45	2.5	3.1	580	1.2	20	2.2	4.4	7.5	87.5%	15.3	7.5
B5	0.43	0.81	45	2.5	2.6	580	1.2	20	2.2	4.4	7.0	95.0%	13.8	7.0
B6	0.41	0.81	40	2.5	2.4	540	3.0	20	3.5	2.6	5.0	95.0%	12.2	5.0
B7	0.46	0.80	50	2.5	2.9	560	3.0	20	3.5	2.7	5.6	92.8%	12.7	5.6
B8	1.36	0.33	250	15.0	9.0	50	2.0	20	2.8	0.3	9.2	36.4%	20.2	9.2
B9	1.16	0.66	300	2.0	10.9	150	2.0	20	2.8	0.9	11.8	76.4%	13.9	11.8
OS1	0.33	0.57	50	25.0	2.3	10	4.0	5	1.0	0.2	2.5	65.0%	15.0	5.0
OS2	0.20	0.57	65	25.0	2.7	15	4.0	5	1.0	0.3	2.9	65.0%	15.0	5.0
EX1	8.04	0.08	300	20.0	11.9	450	10.0	5	1.6	4.7	16.7	5.0%		16.7
EX2	12.13	0.18	300	20.0	10.7	800	10.0	5	1.6	8.4	19.2	17.3%		19.2
EX3	0.20	0.81	40	2.0	2.6	215	3.0	20	3.5	1.0	3.6	95.0%	10.8	5.0

Zante Street - Interim Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

RATIONAL METHOD PEAK RUNOFF

2-Year STORM Rainfall Depth-Duration-Frequency (1-hr) = **0.86**

SF-3

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	2yr Runoff COEFF	T(c) min	C x A	I in/hr	Q cfs
A1	A1	4.92	0.08	26.3	0.41	1.46	0.60
A2	A2	0.71	0.78	5.0	0.55	2.92	1.62
A3	A3	0.94	0.76	5.0	0.71	2.92	2.08
A4	A4	1.59	0.16	17.2	0.26	1.83	0.47
B1	B1	6.38	0.31	23.3	1.98	1.56	3.09
B2	B2	0.62	0.78	7.8	0.49	2.55	1.25
B3	B3	0.82	0.71	9.1	0.59	2.41	1.41
B4	B4	0.57	0.71	7.5	0.40	2.58	1.04
B5	B5	0.43	0.78	7.0	0.34	2.65	0.90
B6	B6	0.41	0.78	5.0	0.32	2.92	0.94
B7	B7	0.46	0.76	5.6	0.35	2.83	1.00
B8	B8	1.36	0.27	9.2	0.36	2.40	0.87
B9	B9	1.16	0.61	11.8	0.71	2.18	1.55
OS1	OS1	0.33	0.51	5.0	0.17	2.92	0.49
OS2	OS2	0.20	0.51	5.0	0.10	2.92	0.30
EX1	EX1	8.04	0.03	16.7	0.23	1.86	0.43
EX2	EX2	12.13	0.12	19.2	1.40	1.73	2.43
EX3	EX3	0.20	0.78	5.0	0.16	2.92	0.46

Zante Street - Interim Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

RATIONAL METHOD PEAK RUNOFF

100-YR STORM

SF-3 Rainfall Depth-Duration-Frequency (1-hr) = **2.47**

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	100YR RUNNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs
A1	A1	4.92	0.54	26.3	2.64	4.18	11.06
A2	A2	0.71	0.87	5.0	0.62	8.38	5.18
A3	A3	0.94	0.86	5.0	0.81	8.38	6.78
A4	A4	1.59	0.58	17.2	0.92	5.25	4.83
B1	B1	6.38	0.65	23.3	4.18	4.48	18.71
B2	B2	0.62	0.87	7.8	0.55	7.31	3.99
B3	B3	0.82	0.84	9.1	0.69	6.92	4.79
B4	B4	0.57	0.84	7.5	0.48	7.41	3.54
B5	B5	0.43	0.87	7.0	0.38	7.60	2.88
B6	B6	0.41	0.87	5.0	0.36	8.37	3.01
B7	B7	0.46	0.86	5.6	0.40	8.14	3.24
B8	B8	1.36	0.63	9.2	0.86	6.89	5.93
B9	B9	1.16	0.80	11.8	0.92	6.25	5.78
OS1	OS1	0.33	0.75	5.0	0.25	8.38	2.06
OS2	OS2	0.20	0.75	5.0	0.15	8.38	1.28
EX1	EX1	8.04	0.50	16.7	4.06	5.33	21.63
EX2	EX2	12.13	0.55	19.2	6.73	4.97	33.43
EX3	EX3	0.20	0.87	5.0	0.17	8.38	1.46

Zante Street - Final Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

COMPOSITE DEVELOPED BASIN WEIGHTED "C" CALCULATIONS
-REFERENCE SDDTCM Table 5-7

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i + 0.025$	$C_A = 0.78i + 0.110$	$C_A = 0.65i + 0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i + 0.057$	$C_B = 0.63i + 0.249$	$C_B = 0.56i + 0.328$	$C_B = 0.47i + 0.426$	$C_B = 0.37i + 0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i + 0.035$	$C_{C/D} = 0.74i + 0.132$	$C_{C/D} = 0.56i + 0.319$	$C_{C/D} = 0.49i + 0.393$	$C_{C/D} = 0.41i + 0.484$	$C_{C/D} = 0.32i + 0.588$

i = % imperviousness/100 expressed as a decimal
C_A = Runoff coefficient for NRCS HSG A soils
C_B = Runoff coefficient for NRCS HSG B soils
C_{CD} = Runoff coefficient for NRCS HSG C and D soils.
Natural Resource Conservation Service (NRCS)

Basin ID	% Imperv.	*i*	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
			A	0.64	0.66	0.67	0.74						
A1	81.0%	0.81	B	0.66	0.68	0.71	0.81		4.92	0.66	0.70	0.73	0.82
			C or D	0.66	0.70	0.73	0.82	4.92					
			A	0.79	0.81	0.82	0.85						
A2	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.71	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.71					
			A	0.76	0.78	0.79	0.83						
A3	92.8%	0.93	B	0.77	0.79	0.81	0.86		0.94	0.76	0.80	0.82	0.86
			C or D	0.76	0.80	0.82	0.86	0.94					
			A	0.63	0.65	0.66	0.73						
A4	80.0%	0.80	B	0.65	0.67	0.71	0.80		1.59	0.65	0.69	0.72	0.81
			C or D	0.65	0.69	0.72	0.81	1.59					
			A	0.30	0.31	0.33	0.46						
B1	45.1%	0.45	B	0.33	0.36	0.42	0.64		6.38	0.34	0.40	0.47	0.67
			C or D	0.34	0.40	0.47	0.67	6.38					
			A	0.79	0.81	0.82	0.85						
B2	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.62	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.62					
			A	0.70	0.72	0.74	0.79						
B3	87.2%	0.87	B	0.72	0.74	0.76	0.84		0.82	0.71	0.75	0.78	0.84
			C or D	0.71	0.75	0.78	0.84	0.82					
			A	0.71	0.73	0.74	0.79						
B4	87.5%	0.88	B	0.72	0.74	0.77	0.84		0.57	0.71	0.75	0.78	0.84
			C or D	0.71	0.75	0.78	0.84	0.57					
			A	0.79	0.81	0.82	0.85						
B5	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.43	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.43					
			A	0.79	0.81	0.82	0.85						
B6	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.41	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.41					
			A	0.76	0.78	0.79	0.83						
B7	92.8%	0.93	B	0.77	0.79	0.81	0.86		0.46	0.76	0.80	0.82	0.86
			C or D	0.76	0.80	0.82	0.86	0.46					
			A	0.63	0.65	0.66	0.73						
B8	80.0%	0.80	B	0.65	0.67	0.71	0.80		1.36	0.65	0.69	0.72	0.81
			C or D	0.65	0.69	0.72	0.81	1.36					
			A	0.70	0.71	0.73	0.78						
B9	86.5%	0.87	B	0.71	0.73	0.76	0.83		1.16	0.71	0.74	0.77	0.84
			C or D	0.71	0.74	0.77	0.84	1.16					
			A	0.63	0.65	0.66	0.73						
OS1	80.0%	0.80	B	0.65	0.67	0.71	0.80		0.33	0.65	0.69	0.72	0.81
			C or D	0.65	0.69	0.72	0.81	0.33					
			A	0.63	0.65	0.66	0.73						
OS2	80.0%	0.80	B	0.65	0.67	0.71	0.80		0.20	0.65	0.69	0.72	0.81
			C or D	0.65	0.69	0.72	0.81	0.20					
			A	0.02	0.02	0.02	0.15						
EX1	5.0%	0.05	B	0.03	0.03	0.10	0.45		8.04	0.03	0.08	0.17	0.50
			C or D	0.03	0.08	0.17	0.50	8.04					
			A	0.09	0.09	0.10	0.24						
EX2	17.3%	0.17	B	0.11	0.13	0.20	0.51		12.13	0.12	0.18	0.26	0.55
			C or D	0.12	0.18	0.26	0.55	12.13					
			A	0.79	0.81	0.82	0.85						
EX3	95.0%	0.95	B	0.79	0.81	0.83	0.87		0.20	0.78	0.81	0.84	0.87
			C or D	0.78	0.81	0.84	0.87	0.20					

Zante Street - Final Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

TIME OF CONCENTRATION CALCULATIONS | BASIN A

-REFERENCE UDFCD Vol.1 Section 2.4
SF-2

NRCS Conveyance factors, K -REFERENCE UDFCD Vol.1 RUNOFF Table 6-2

Heavy Meadow	3	Short Grass Pasture & Lawns	7	Grassed Waterway	15
Tillage/field	5	Nearly Bare Ground	10	Paved Area & Shallow Gutter	20

SUB-BASIN DATA			INITIAL / OVERLAND TIME			CHANNEL / TRAVEL TIME T(t)						T(c) CHECK (URBANIZED BASINS)		FINAL T(c)
DRAIN BASIN	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	% IMPER-VIOUS	USDCM Eq . 6-5	min.
A1	4.92	0.70	300	2.0	10.0	410	2.0	20	2.8	2.4	12.4	81.0%	14.6	12.4
A2	0.71	0.81	25	2.0	2.1	520	2.5	20	3.2	2.7	4.8	95.0%	12.3	5.0
A3	0.94	0.80	55	5.0	2.4	490	2.5	20	3.2	2.6	5.0	92.8%	12.6	5.0
A4	1.59	0.69	300	4.2	8.0	50	4.2	20	4.1	0.2	8.2	80.0%	12.6	8.2
B1	6.38	0.40	300	2.0	17.3	1100	3.0	20	3.5	5.3	22.6	45.1%	25.2	22.6
B2	0.62	0.81	30	2.0	2.3	820	1.5	20	2.4	5.6	7.8	95.0%	14.9	7.8
B3	0.82	0.75	50	2.0	3.6	820	1.5	20	2.4	5.6	9.1	87.2%	16.4	9.1
B4	0.57	0.75	45	2.5	3.1	580	1.2	20	2.2	4.4	7.5	87.5%	15.3	7.5
B5	0.43	0.81	45	2.5	2.6	580	1.2	20	2.2	4.4	7.0	95.0%	13.8	7.0
B6	0.41	0.81	40	2.5	2.4	540	3.0	20	3.5	2.6	5.0	95.0%	12.2	5.0
B7	0.46	0.80	50	2.5	2.9	560	3.0	20	3.5	2.7	5.6	92.8%	12.7	5.6
B8	1.36	0.69	250	15.0	4.8	50	2.0	20	2.8	0.3	5.1	80.0%	12.7	5.1
B9	1.16	0.74	300	2.0	8.8	150	2.0	20	2.8	0.9	9.7	86.5%	12.1	9.7
OS1	0.33	0.69	50	25.0	1.8	10	4.0	5	1.0	0.2	2.0	80.0%	12.4	5.0
OS2	0.20	0.69	65	25.0	2.1	15	4.0	5	1.0	0.3	2.3	80.0%	12.5	5.0
EX1	8.04	0.08	300	20.0	11.9	450	10.0	5	1.6	4.7	16.7	5.0%		16.7
EX2	12.13	0.18	300	20.0	10.7	800	10.0	5	1.6	8.4	19.2	17.3%		19.2
EX3	0.20	0.81	40	2.0	2.6	215	3.0	20	3.5	1.0	3.6	95.0%	10.8	5.0

Zante Street - Final Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

RATIONAL METHOD PEAK RUNOFF

2-Year STORM Rainfall Depth-Duration-Frequency (1-hr) = **0.86**

SF-3

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	2yr Runoff COEFF	T(c) min	C x A	I in/hr	Q cfs
A1	A1	4.92	0.66	12.4	3.23	2.13	6.87
A2	A2	0.71	0.78	5.0	0.55	2.92	1.62
A3	A3	0.94	0.76	5.0	0.71	2.92	2.08
A4	A4	1.59	0.65	8.2	1.02	2.51	2.57
B1	B1	6.38	0.34	22.6	2.17	1.59	3.44
B2	B2	0.62	0.78	7.8	0.49	2.55	1.25
B3	B3	0.82	0.71	9.1	0.59	2.41	1.41
B4	B4	0.57	0.71	7.5	0.40	2.58	1.04
B5	B5	0.43	0.78	7.0	0.34	2.65	0.90
B6	B6	0.41	0.78	5.0	0.32	2.92	0.94
B7	B7	0.46	0.76	5.6	0.35	2.83	1.00
B8	B8	1.36	0.65	5.1	0.88	2.91	2.55
B9	B9	1.16	0.71	9.7	0.82	2.35	1.93
OS1	OS1	0.33	0.65	5.0	0.21	2.92	0.62
OS2	OS2	0.20	0.65	5.0	0.13	2.92	0.38
EX1	EX1	8.04	0.03	16.7	0.23	1.86	0.43
EX2	EX2	12.13	0.12	19.2	1.40	1.73	2.43
EX3	EX3	0.20	0.78	5.0	0.16	2.92	0.46

Zante Street - Final Condition Rational Calculations

CORE Project #: 21-164
Prepared By: CORE

RATIONAL METHOD PEAK RUNOFF
100-YR STORM

SF-3 Rainfall Depth-Duration-Frequency (1-hr) = **2.47**

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

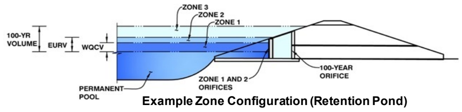
BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	100YR RUNNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs
A1	A1	4.92	0.82	12.4	4.02	6.12	24.57
A2	A2	0.71	0.87	5.0	0.62	8.38	5.18
A3	A3	0.94	0.86	5.0	0.81	8.38	6.78
A4	A4	1.59	0.81	8.2	1.29	7.21	9.28
B1	B1	6.38	0.67	22.6	4.27	4.55	19.45
B2	B2	0.62	0.87	7.8	0.55	7.31	3.99
B3	B3	0.82	0.84	9.1	0.69	6.92	4.79
B4	B4	0.57	0.84	7.5	0.48	7.41	3.54
B5	B5	0.43	0.87	7.0	0.38	7.60	2.88
B6	B6	0.41	0.87	5.0	0.36	8.37	3.01
B7	B7	0.46	0.86	5.6	0.40	8.14	3.24
B8	B8	1.36	0.81	5.1	1.10	8.35	9.22
B9	B9	1.16	0.84	9.7	0.97	6.75	6.57
OS1	OS1	0.33	0.81	5.0	0.27	8.38	2.22
OS2	OS2	0.20	0.81	5.0	0.16	8.38	1.38
EX1	EX1	8.04	0.50	16.7	4.06	5.33	21.63
EX2	EX2	12.13	0.55	19.2	6.73	4.97	33.43
EX3	EX3	0.20	0.87	5.0	0.17	8.38	1.46

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Zante Street**

Basin ID: **Pond A1 - Interim Condition**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	8.48	acres		
Watershed Length =	900	ft		
Watershed Length to Centroid =	450	ft		
Watershed Slope =	0.020	ft/ft		
Watershed Imperviousness =	32.60%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.113	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.253	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.86 in.) =	0.166	acre-feet	0.86	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	0.291	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	0.446	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	0.683	acre-feet		inches
50-yr Runoff Volume (P1 = 1.99 in.) =	0.891	acre-feet		inches
100-yr Runoff Volume (P1 = 2.47 in.) =	1.268	acre-feet	2.47	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.754	acre-feet		inches
Approximate 2-yr Detention Volume =	0.158	acre-feet		
Approximate 5-yr Detention Volume =	0.271	acre-feet		
Approximate 10-yr Detention Volume =	0.330	acre-feet		
Approximate 25-yr Detention Volume =	0.389	acre-feet		
Approximate 50-yr Detention Volume =	0.425	acre-feet		
Approximate 100-yr Detention Volume =	0.571	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.113	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.140	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.318	acre-feet
Total Detention Basin Volume =	0.571	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	25	0.001		
5601	--	1.00	--	--	--	643	0.015	334	0.008
5602	--	2.00	--	--	--	3,721	0.085	2,515	0.058
5603	--	3.00	--	--	--	4,898	0.112	6,825	0.157
5604	--	4.00	--	--	--	6,176	0.142	12,362	0.284
5605	--	5.00	--	--	--	7,555	0.173	19,228	0.441
5606	--	6.00	--	--	--	9,034	0.207	27,522	0.632
5607	--	7.00	--	--	--	10,614	0.244	37,346	0.857
5608 (SPILLWAY)	--	8.00	--	--	--	12,295	0.282	48,800	1.120
5609	--	9.00	--	--	--	14,073	0.323	61,984	1.423
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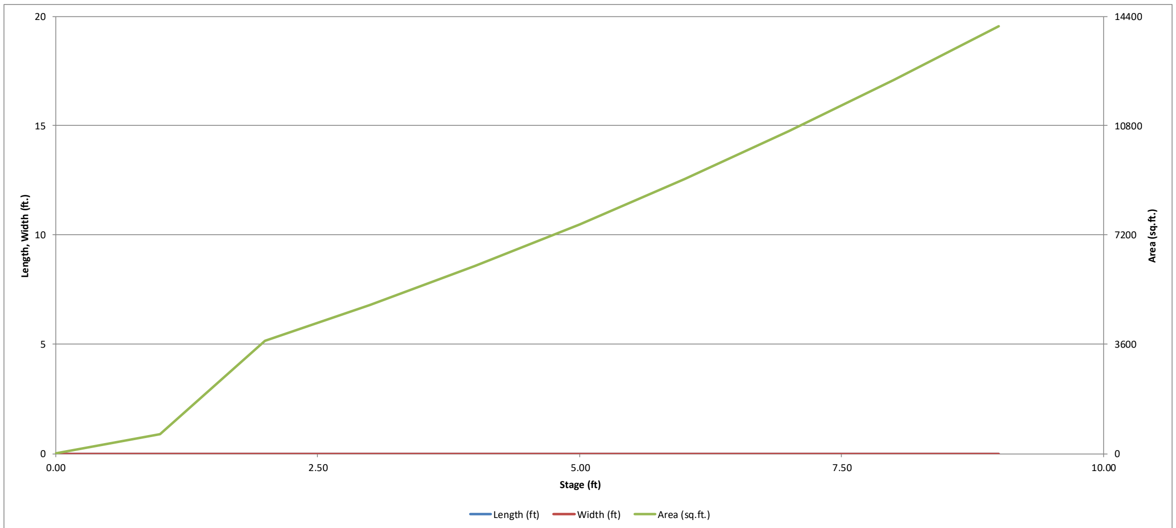
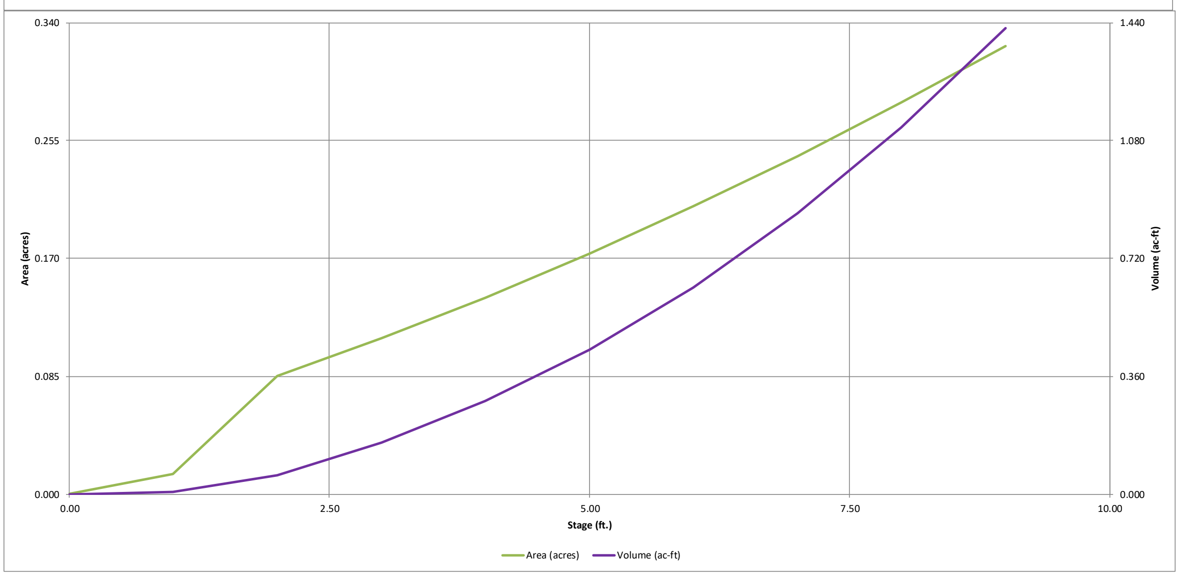
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



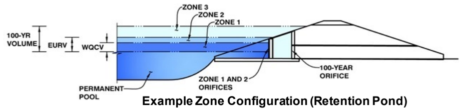


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Zante Street**

Basin ID: **Pond A1 - Final Condition**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	8.48	acres
Watershed Length =	900	ft
Watershed Length to Centroid =	450	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	83.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.247	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.695	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.86 in.) =	0.464	acre-feet	0.86	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	0.650	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	0.833	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	1.049	acre-feet		inches
50-yr Runoff Volume (P1 = 1.99 in.) =	1.266	acre-feet		inches
100-yr Runoff Volume (P1 = 2.47 in.) =	1.623	acre-feet	2.47	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	2.112	acre-feet		inches
Approximate 2-yr Detention Volume =	0.456	acre-feet		
Approximate 5-yr Detention Volume =	0.648	acre-feet		
Approximate 10-yr Detention Volume =	0.788	acre-feet		
Approximate 25-yr Detention Volume =	0.881	acre-feet		
Approximate 50-yr Detention Volume =	0.943	acre-feet		
Approximate 100-yr Detention Volume =	1.098	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.247	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.448	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.403	acre-feet
Total Detention Basin Volume =	1.098	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increement = [ ] ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	25	0.001		
5601	--	1.00	--	--	--	643	0.015	334	0.008
5602	--	2.00	--	--	--	3,721	0.085	2,515	0.058
5603	--	3.00	--	--	--	4,898	0.112	6,825	0.157
5604	--	4.00	--	--	--	6,176	0.142	12,362	0.284
5605	--	5.00	--	--	--	7,555	0.173	19,228	0.441
5606	--	6.00	--	--	--	9,034	0.207	27,522	0.632
5607	--	7.00	--	--	--	10,614	0.244	37,346	0.857
5608	--	8.00	--	--	--	12,295	0.282	48,800	1.120
5609	--	9.00	--	--	--	14,073	0.323	61,984	1.423
5610	--	10.00	--	--	--	15,967	0.367	77,004	1.768
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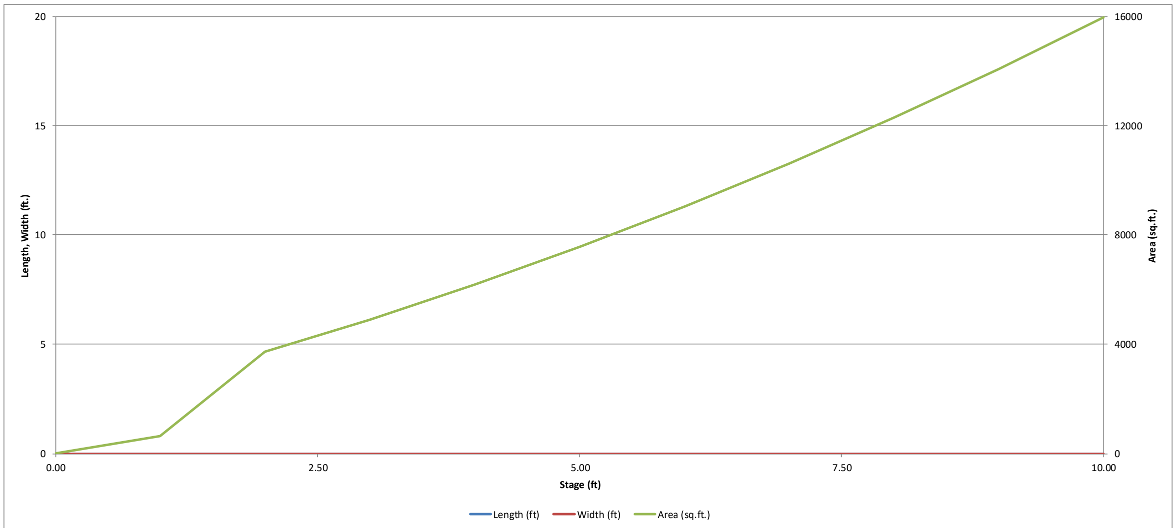
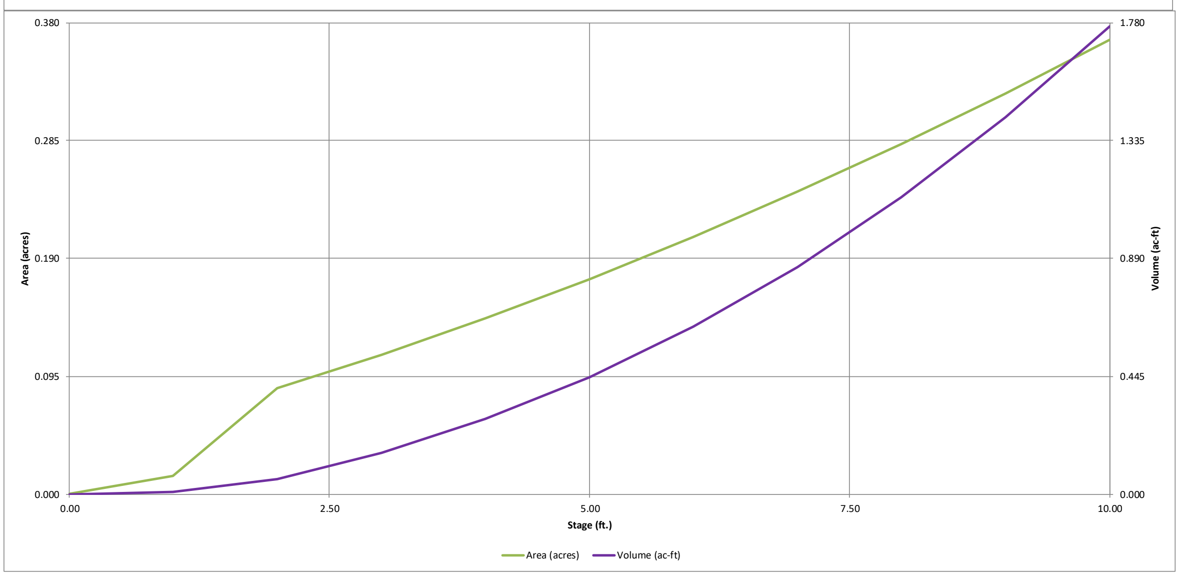
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



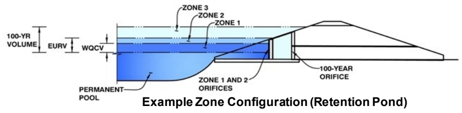


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Zante Street**

Basin ID: **Pond B - Interim Condition**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	12.43	acres		
Watershed Length =	1,850	ft		
Watershed Length to Centroid =	925	ft		
Watershed Slope =	0.025	ft/ft		
Watershed Imperviousness =	58.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.238	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.690	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.86 in.) =	0.481	acre-feet	0.86	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	0.716	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	0.970	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	1.313	acre-feet		inches
50-yr Runoff Volume (P1 = 1.99 in.) =	1.632	acre-feet		inches
100-yr Runoff Volume (P1 = 2.47 in.) =	2.186	acre-feet	2.47	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	2.924	acre-feet		inches
Approximate 2-yr Detention Volume =	0.444	acre-feet		
Approximate 5-yr Detention Volume =	0.675	acre-feet		
Approximate 10-yr Detention Volume =	0.811	acre-feet		
Approximate 25-yr Detention Volume =	0.919	acre-feet		
Approximate 50-yr Detention Volume =	0.992	acre-feet		
Approximate 100-yr Detention Volume =	1.223	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.238	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.452	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.533	acre-feet
Total Detention Basin Volume =	1.223	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	25	0.001		
5989	--	1.00	--	--	--	4,282	0.098	2,153	0.049
5990	--	2.00	--	--	--	5,785	0.133	7,186	0.165
5991	--	3.00	--	--	--	7,527	0.173	13,842	0.318
5992	--	4.00	--	--	--	9,516	0.218	22,363	0.513
5993	--	5.00	--	--	--	11,729	0.269	32,986	0.757
5994	--	6.00	--	--	--	14,057	0.323	45,879	1.053
5995 (SPILLWAY)	--	7.00	--	--	--	16,486	0.378	61,151	1.404
5996	--	8.00	--	--	--	19,015	0.437	78,901	1.811
5997 (BERM)	--	9.00	--	--	--	21,644	0.497	99,231	2.278
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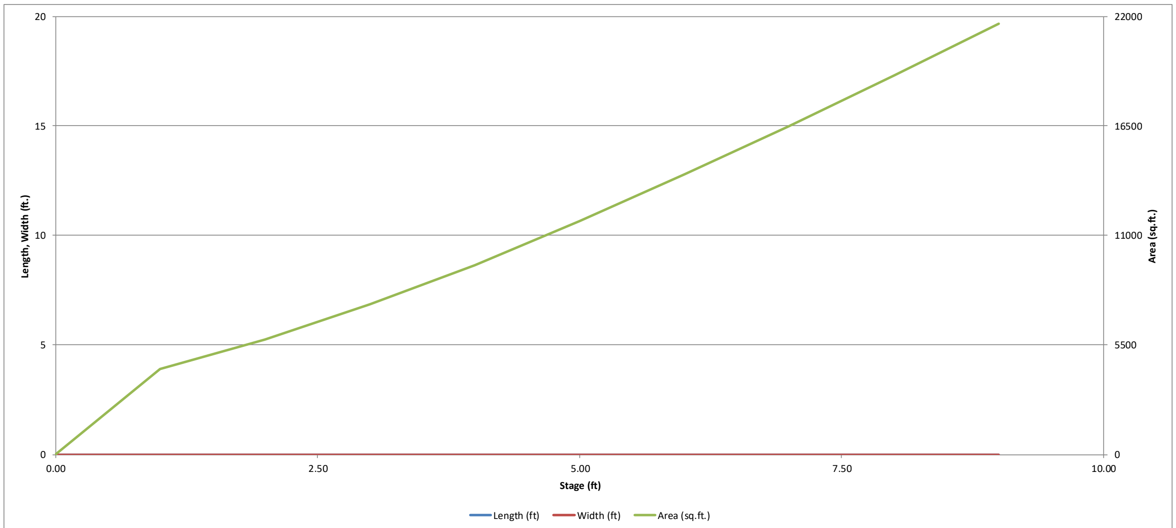
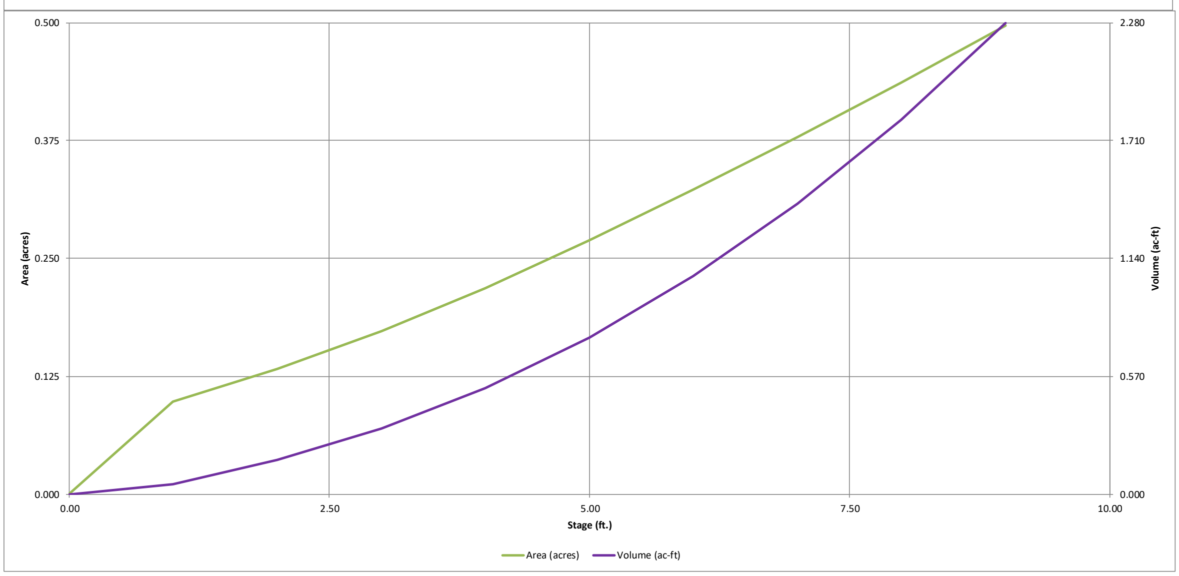
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



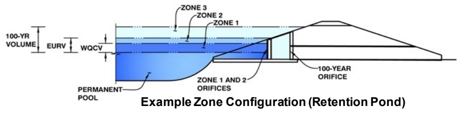


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Zante Street**

Basin ID: **Pond B - Final Condition**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	12.43	acres
Watershed Length =	1,850	ft
Watershed Length to Centroid =	925	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	65.80%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.266	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.791	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.86 in.) =	0.551	acre-feet	0.86	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	0.801	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	1.062	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	1.401	acre-feet		inches
50-yr Runoff Volume (P1 = 1.99 in.) =	1.723	acre-feet		inches
100-yr Runoff Volume (P1 = 2.47 in.) =	2.273	acre-feet	2.47	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.014	acre-feet		inches
Approximate 2-yr Detention Volume =	0.512	acre-feet		
Approximate 5-yr Detention Volume =	0.760	acre-feet		
Approximate 10-yr Detention Volume =	0.915	acre-feet		
Approximate 25-yr Detention Volume =	1.031	acre-feet		
Approximate 50-yr Detention Volume =	1.110	acre-feet		
Approximate 100-yr Detention Volume =	1.342	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.266	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.524	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.551	acre-feet
Total Detention Basin Volume =	1.342	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	25	0.001		
5989	--	1.00	--	--	--	4,282	0.098	2,153	0.049
5990	--	2.00	--	--	--	5,785	0.133	7,186	0.165
5991	--	3.00	--	--	--	7,527	0.173	13,842	0.318
5992	--	4.00	--	--	--	9,516	0.218	22,363	0.513
5993	--	5.00	--	--	--	11,729	0.269	32,986	0.757
5994	--	6.00	--	--	--	14,057	0.323	45,879	1.053
5995 (SPILLWAY)	--	7.00	--	--	--	16,486	0.378	61,151	1.404
5996	--	8.00	--	--	--	19,015	0.437	78,901	1.811
5997 (BERM)	--	9.00	--	--	--	21,644	0.497	99,231	2.278
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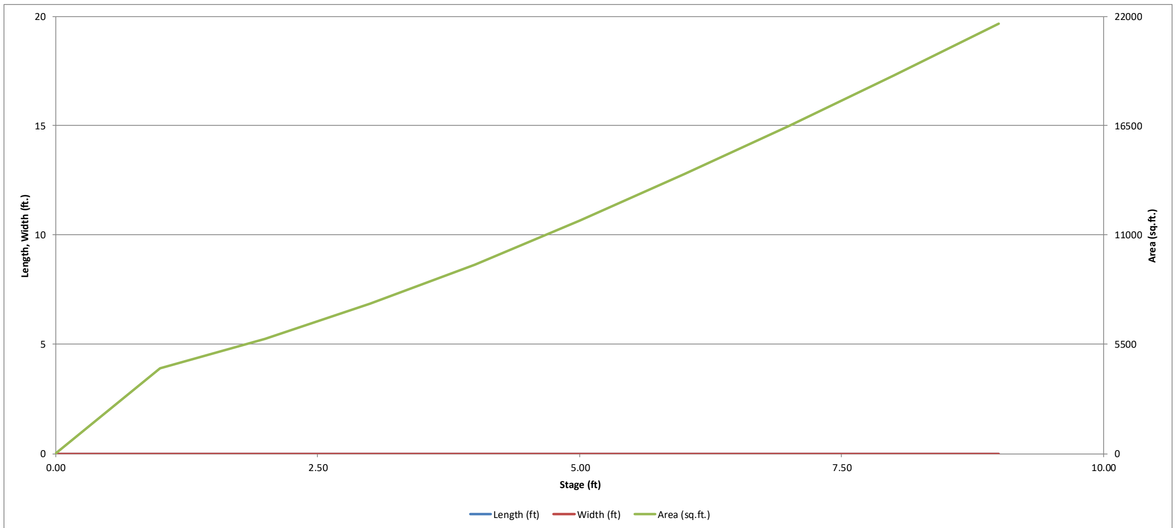
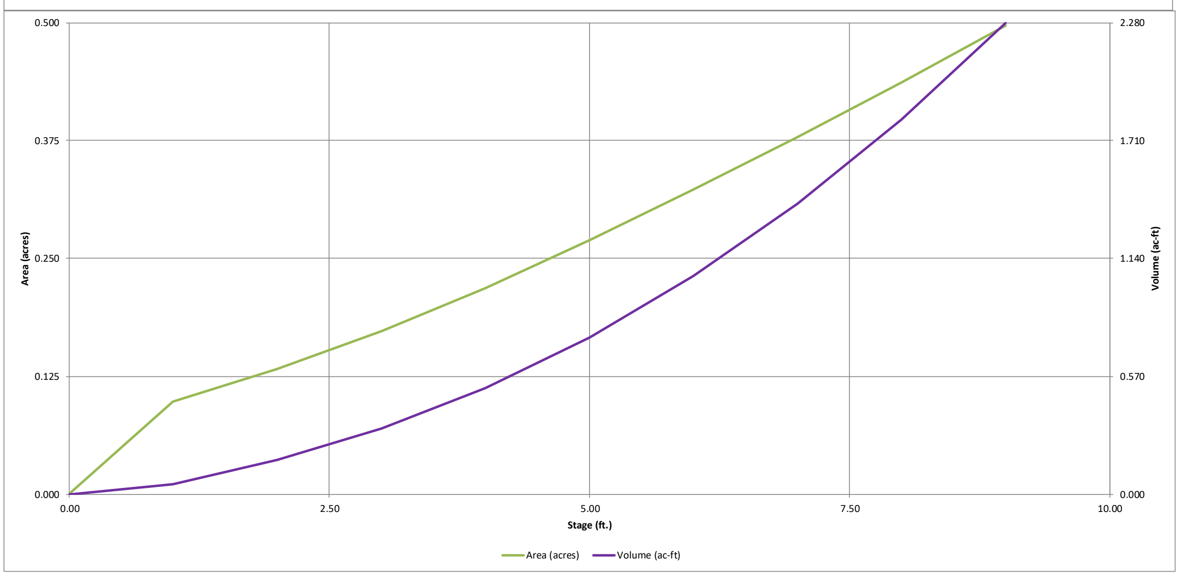
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





APPENDIX C

Hydraulic Computations

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

INLET NAME	Inlet A2	Inlet A3	Inlet B2
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.6	2.1	1.3
Major Q_{Known} (cfs)	5.2	6.8	4.0

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

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

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.6**	**2.1**	**1.3**
Major Total Design Peak Flow, Q (cfs)	**5.2**	**6.8**	**4.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.1

FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet B3	Inlet B5	Inlet B4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.4	0.9	1.0
Major Q_{Known} (cfs)	4.8	3.0	3.5

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	Inlet B2	Inlet B3
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.1	0.4

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.4**	**0.9**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**4.8**	**3.1**	**3.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.4	0.9	0.1

FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet B6	Inlet B7
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.9	1.0
Major Q_{Known} (cfs)	3.0	3.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	Inlet B5	Inlet B4
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.9	0.1

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.9**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**3.9**	**3.3**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.1	0.0

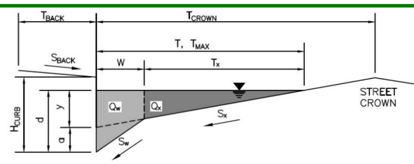
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet A2



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

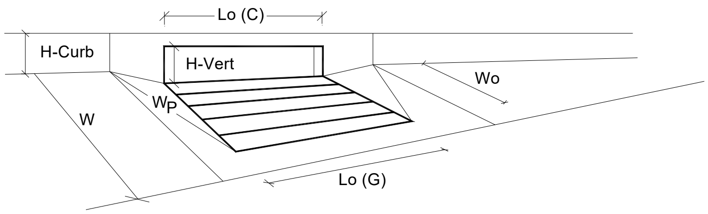
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.5	5.8	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	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 MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	3.0	5.6	cfs
Interception with Clogging	Q_{wa} =	2.7	5.0	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	8.5	9.6	cfs
Interception with Clogging	Q_{oa} =	7.7	8.7	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	4.7	6.8	cfs
Interception with Clogging	Q_{ma} =	4.2	6.1	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**2.7**	**5.0**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	12.5	18.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	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} =	0.21	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**2.7**	**5.0**	**cfs**
WARNING: Inlet Capacity < Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	1.6	5.2	cfs

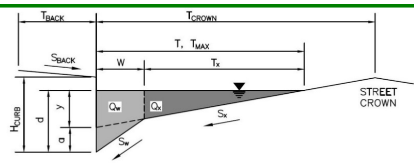
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet A3



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

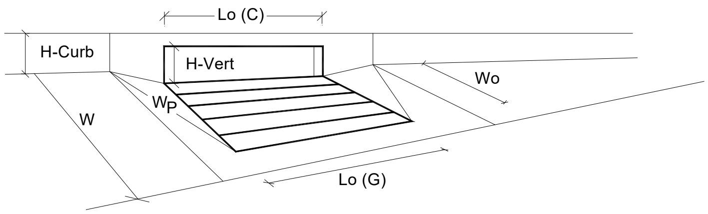
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.5	5.8	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.06	0.06	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

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

Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	3.9	8.2	cfs
Interception with Clogging	Q_{wa} =	3.7	7.9	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	17.0	19.2	cfs
Interception with Clogging	Q_{oa} =	16.4	18.5	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.6	11.7	cfs
Interception with Clogging	Q_{ma} =	7.3	11.2	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.7**	**7.9**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	12.5	18.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	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} =	0.21	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.83	0.92	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.7**	**7.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.1	6.8	cfs

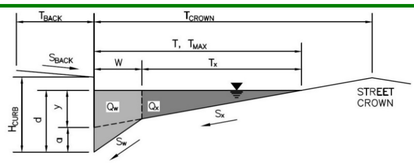
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet B2



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches	
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft	
Gutter Width	W =	2.00	ft	
Street Transverse Slope	S_X =	0.020	ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013		

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	3.5	9.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.9	4.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**6.4**	**14.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	5.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.9	2.8	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.1	10.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.1	10.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.8	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	5.8	15.6	cfs
Average Flow Velocity Within the Gutter Section	V =	4.7	6.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.8	3.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**5.8**	**15.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.50	6.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.17	inches

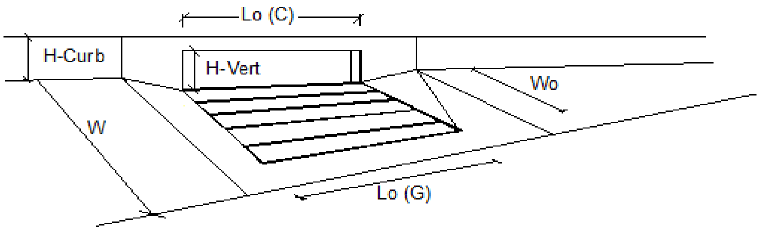
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**14.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.30 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.3	4.0	cfs
Water Spread Width	T =	6.0	10.6	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	4.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.823	0.550	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.2	1.8	cfs
Discharge within the Gutter Section W	Q_w =	1.1	2.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.32	0.51	sq ft
Velocity within the Gutter Section W	V_W =	3.3	4.3	fps
Water Depth for Design Condition	d_{LOCAL} =	5.9	7.0	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	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.175	0.123	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.42	11.28	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.42	10.00	ft
Interception Capacity	Q_i =	1.3	3.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	5.42	9.63	ft
Actual Interception Capacity	**Q_a =**	**1.3**	**3.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.3**	**3.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**97**	**%**

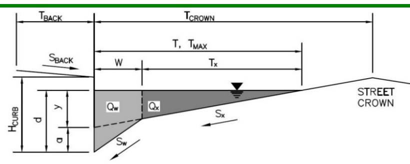
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet B3



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	3.5	9.5	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	2.9	4.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**6.4**	**14.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	5.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.9	2.8	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.1	10.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.1	10.7	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	2.8	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	5.8	15.6	cfs
Average Flow Velocity Within the Gutter Section	V =	4.7	6.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.8	3.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**5.8**	**15.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.50	6.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.17	inches

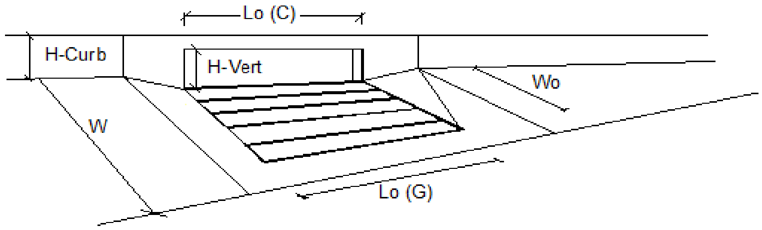
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**14.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.80 cfs on sheet 'Inlet Management'

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.4	4.8	cfs
Water Spread Width	T =	6.2	11.5	ft
Water Depth at Flowline (outside of local depression)	d =	3.0	4.3	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.804	0.512	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.3	2.3	cfs
Discharge within the Gutter Section W	Q_w =	1.1	2.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.34	0.54	sq ft
Velocity within the Gutter Section W	V_W =	3.4	4.5	fps
Water Depth for Design Condition	d_{LOCAL} =	6.0	7.3	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	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.171	0.116	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.68	12.72	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.68	10.00	ft
Interception Capacity	Q_i =	1.4	4.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	5.68	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.4**	**4.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.4**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.4**	**4.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**92**	**%**

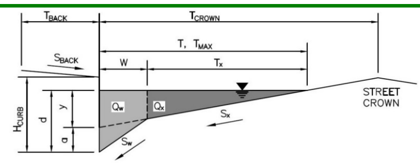
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet B5



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.008		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	2.8	7.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.3	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**5.1**	**11.2**	**cfs**
Flow Velocity within the Gutter Section	V =	3.8	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.5	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	2.4	8.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	2.4	8.4	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.2	3.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.6	12.3	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	4.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	2.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.6**	**12.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.50	6.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.17	inches

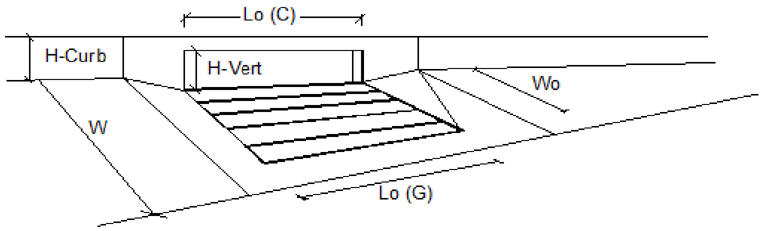
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**4.6**	**11.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.90 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.13 cfs on sheet 'Inlet Management'

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.9	3.1	cfs
Water Spread Width	T =	5.5	10.5	ft
Water Depth at Flowline (outside of local depression)	d =	2.8	4.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.855	0.552	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	1.4	cfs
Discharge within the Gutter Section W	Q_w =	0.8	1.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.31	0.51	sq ft
Velocity within the Gutter Section W	V_W =	2.5	3.4	fps
Water Depth for Design Condition	d_{LOCAL} =	5.8	7.0	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	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**

Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.181	0.124	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.01	9.00	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.01	5.00	ft
Interception Capacity	Q_i =	0.9	2.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.10	0.10	
Effective (Unclogged) Length	L_e =	4.01	4.50	ft
Actual Interception Capacity	**Q_a =**	**0.9**	**2.2**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.9**	**cfs**

Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.9**	**2.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.9**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**71**	**%**

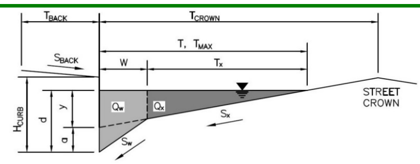
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet B4



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.008	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	3.4	9.2	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	2.8	4.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**6.2**	**13.8**	**cfs**
Flow Velocity within the Gutter Section	V =	4.7	5.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.8	2.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.0	10.3	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.0	10.3	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	2.7	4.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	5.6	15.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.6	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.7	2.9	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**5.6**	**15.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.50	6.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.17	inches

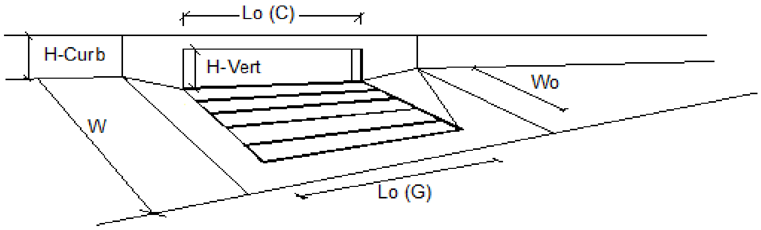
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.6**	**13.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.00 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.88 cfs on sheet 'Inlet Management'

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.0	3.9	cfs
Water Spread Width	T =	5.1	10.6	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	4.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.880	0.550	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	1.7	cfs
Discharge within the Gutter Section W	Q_w =	0.9	2.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.29	0.51	sq ft
Velocity within the Gutter Section W	V_W =	3.0	4.2	fps
Water Depth for Design Condition	d_{LOCAL} =	5.7	7.0	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	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.185	0.123	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.60	11.07	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.60	10.00	ft
Interception Capacity	Q_i =	1.0	3.8	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.60	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.0**	**3.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**3.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**97**	**%**

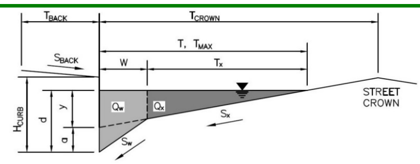
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet B6



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	17.9	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	5.5	8.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.1**	**26.7**	**cfs**
Flow Velocity within the Gutter Section	V =	9.1	10.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.5	5.3	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	5.7	20.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	5.7	20.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	5.2	9.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	10.9	29.4	cfs
Average Flow Velocity Within the Gutter Section	V =	8.9	11.2	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.3	5.6	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6$"	R =	1.00	0.60	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**10.9**	**17.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.50	5.17	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

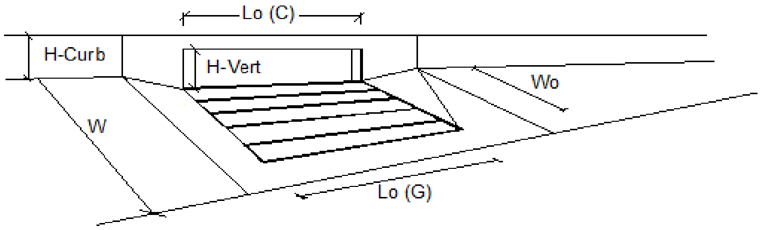
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.9**	**17.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.90 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.90 cfs on sheet 'Inlet Management'

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.9	3.9	cfs
Water Spread Width	T =	2.2	7.7	ft
Water Depth at Flowline (outside of local depression)	d =	2.0	3.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	0.705	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	1.2	cfs
Discharge within the Gutter Section W	Q_w =	0.9	2.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.17	0.39	sq ft
Velocity within the Gutter Section W	V_W =	5.2	7.0	fps
Water Depth for Design Condition	d_{LOCAL} =	5.0	6.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.153	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.46	10.87	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.46	10.00	ft
Interception Capacity	Q_i =	0.9	3.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.46	9.61	ft
Actual Interception Capacity	**Q_a =**	**0.9**	**3.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.9**	**3.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**98**	**%**

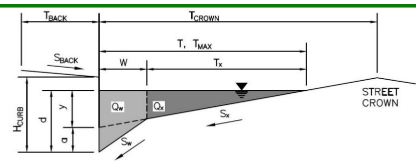
FOR REFERENCE ONLY - SEE CIVIL PLANS FOR DESIGN INFORMATION

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: Zante Street
Inlet ID: Inlet B7



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.5	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.12	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.63	5.83	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	11.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.456	0.330	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	17.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.5	8.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.1**	**26.7**	**cfs**
Flow Velocity within the Gutter Section	V =	9.1	10.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.5	5.3	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.5	18.7	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.5	16.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.475	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	5.7	20.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	5.7	20.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.2	9.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	10.9	29.4	cfs
Average Flow Velocity Within the Gutter Section	V =	8.9	11.2	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.3	5.6	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.60	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**10.9**	**17.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.50	5.17	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

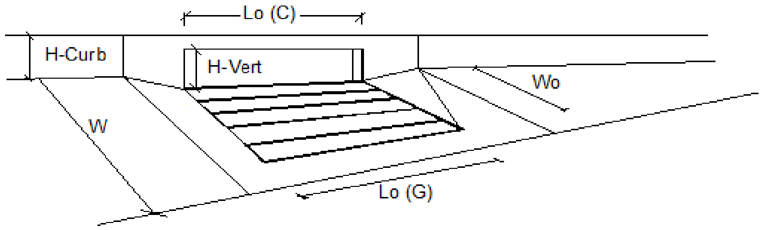
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.9**	**17.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.00 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.30 cfs on sheet 'Inlet Management'

PRELIMINARY ANALYSIS.
REFER TO THE CIVIL PLANS FOR DESIGN INFORMATION.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.0	3.3	cfs
Water Spread Width	T =	2.2	7.1	ft
Water Depth at Flowline (outside of local depression)	d =	2.0	3.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	0.746	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.8	cfs
Discharge within the Gutter Section W	Q_w =	1.0	2.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.18	0.37	sq ft
Velocity within the Gutter Section W	V_W =	5.7	6.7	fps
Water Depth for Design Condition	d_{LOCAL} =	5.0	6.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.160	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.71	9.76	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.71	9.76	ft
Interception Capacity	Q_i =	1.0	3.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.71	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.0**	**3.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**3.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

APPENDIX D

Drainage Maps

BENCHMARK
CITY OF AURORA BENCHMARK 4S6519NW001
BENCHMARK IS A 3-INCH DIAMETER CAP, STAMPED "CITY OF AURORA LS 16419 -1986" SET IN A RANGE BOX. BENCHMARK IS EAST OF GUN CLUB ROAD ½ MILE SOUTH OF MISSISSIPPI AVENUE. BENCHMARK IS ALSO THE MONUMENT FOR THE 1 / 4 CORNER COMMON TO SECTIONS 24 / 19 R661|65W, T4S. PUBLISHED ELEVATION = 5608.25' NAVD88.

NOTES:

1. APPROVAL OF THIS DOCUMENT BY CITY OF AURORA DOES NOT IMPLY APPROVAL FOR ANY OFFSITE WORK ON ADJACENT PRIVATE PROPERTY. IT IS THE OWNER'S RESPONSIBILITY TO COORDINATE WITH ADJACENT PROPERTY OWNERS AND OBTAIN ALL NECESSARY APPROVALS AND EASEMENTS FOR SUCH WORK. IF APPROVALS ARE NOT OBTAINED BY THE START OF CONSTRUCTIONS, REVISIONS TO CIVIL PLANS WILL BE REQUIRED.
2. CITY OR AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH MUST BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
3. THERE IS A FLUVIAL STUDY WHICH ILLUSTRATES THAT THERE MAY BE ADVERSE IMPACTS TO THIS STUDY AREA FROM MOVEMENT FROM THE ADJACENT CREEK. THE DEVELOPER ACKNOWLEDGES THAT UNTIL BANK STABILIZATION IS IMPLEMENTED THAT THERE ARE CONCEPTUAL RISKS TO THE SITE.
4. ALL STORM INFRASTRUCTURE IS PUBLIC AND SIZED FOR THE 100 YEAR STORM, UNLESS OTHERWISE NOTED.
5. ZANTE STREET IS ENTIRELY VERTICAL CATCH CURB.
6. ANY FUTURE DEVELOPMENT IN THE PLANNING AREA WILL REQUIRE PERPETUATION OF EMERGENCY OVERFLOWS THROUGH THEIR SITE.
7. NO WORK IS ALLOWED IN THE FLOODPLAIN WITHOUT A FLOODPLAIN DEVELOPMENT PERMIT. NO WORK IS ALLOWED WITHIN THE FLOODWAY WITHOUT A CLOMR OR A NO RISE ANALYSIS INCLUDED WITHIN THE FLOODPLAIN DEVELOPMENT PERMIT.

LEGEND

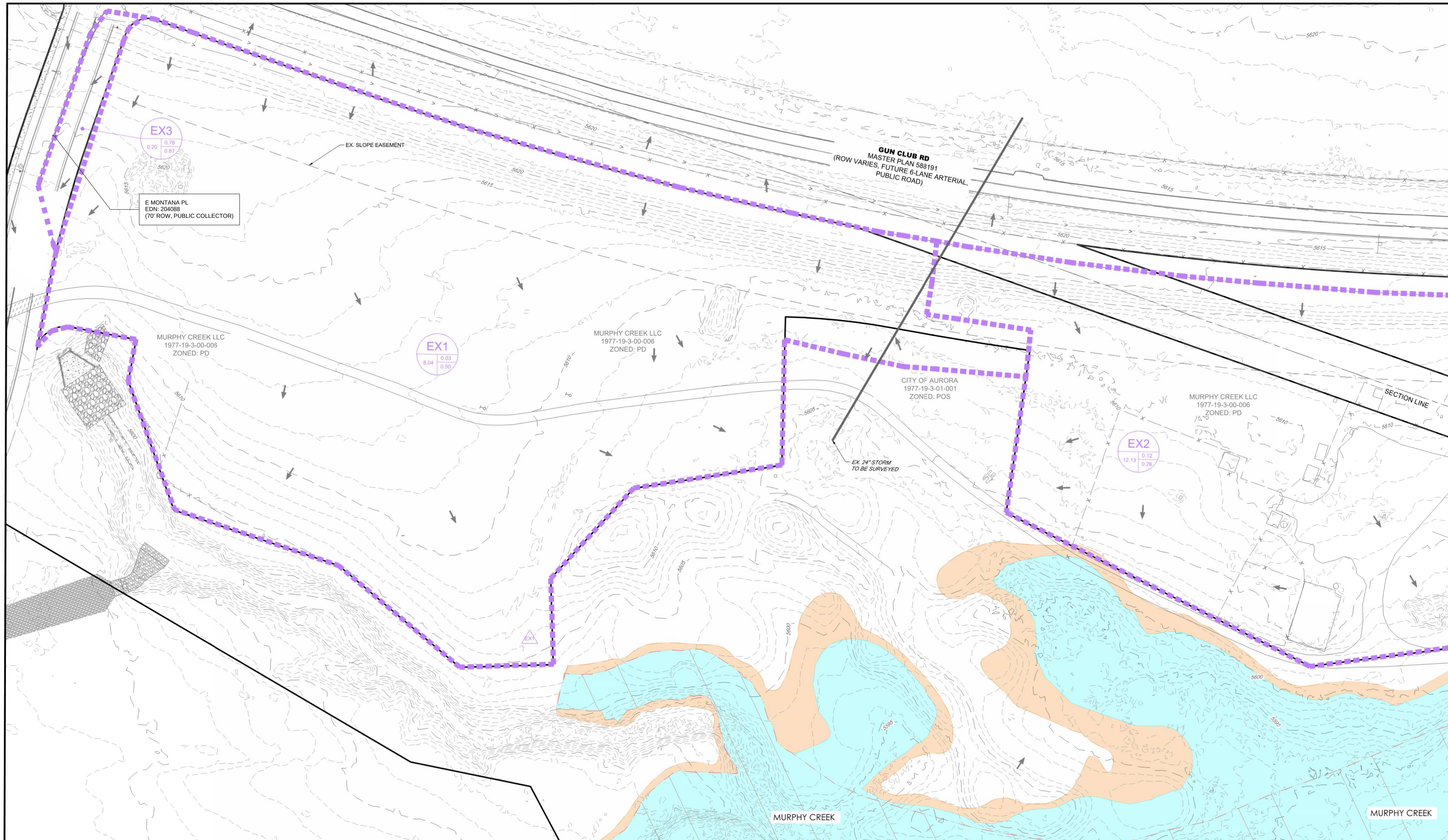
EXISTING / PROPOSED
AREA XX.X | 0.45 | 0.60
BASIN DESIGNATION
2 YEAR COEFFICIENTS
100 YEAR COEFFICIENTS
DESIGN POINT
DIRECTIONAL FLOW ARROW
EMERGENCY OVERFLOW ROUTE
PROPOSED DRAINAGE BASIN
EXISTING DRAINAGE BASIN
5280 PROPOSED MAJOR CONTOUR
5279 PROPOSED MINOR CONTOUR
5280 EXISTING MAJOR CONTOUR
5279 EXISTING MINOR CONTOUR
PROPOSED STORM & STUB OUT
EXISTING STORM & STUB OUT
EXISTING STORM TO BE SURVEYED
STORM MANHOLES
STORM INLETS
FES, FOREBAY, & TRICKLE CHANNEL
CRUSHER FINES MAINTENANCE ACCESS
RIPRAP
EASEMENT
DRAINAGE EASEMENT
RIGHT OF WAY (R.O.W.)
CENTERLINE
PROJECT BOUNDARY
EX. 100 YR FLOODPLAIN ZONE X
EX. 100 YR FLOODPLAIN ZONE AE
100 YR FLOODWAY

0 50' 100'
1 inch = 50 ft.

HALF-PLOT

RUNOFF SUMMARY TABLE
DIRECT RUNOFF

DESIGN POINT	BASIN	AREA (AC)	2-Year RUNOFF (CFS)	100-Year RUNOFF (CFS)
EX1	EX1	8.04	0.43	21.63
EX2	EX2	12.13	2.43	33.43
EX3	EX3	0.20	0.46	1.46



CORE

CORE CONSULTANTS, INC.
3473 S. BROADWAY
ENGLEWOOD, CO 80113
303.703.4444
LIVEYOURCORE.COM

LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTUCTURE

Know what's below. Call before you dig. 811

#	REVISION DESCRIPTION	DATE	BY

MURPHY CREEK - ZANTE STREET
AURORA, COLORADO

EXISTING DRAINAGE PLAN 1

NOT FOR CONSTRUCTION

DESIGNED BY: GP
DRAWN BY: GP
CHECKED BY: JK

JOB NO. 21-134

SHEET 1

2021-09-11 (4:30 PM) X:\21-134 Murphy Creek\Civil\CAD\Plans\Zante Street\Drainage Ex Drainage Basins.dwg

BENCHMARK
CITY OF AURORA BENCHMARK 4S6519NW001
BENCHMARK IS A 3-INCH DIAMETER CAP, STAMPED "CITY OF AURORA LS 16419 -1986" SET IN A RANGE BOX. BENCHMARK IS EAST OF GUN CLUB ROAD ½ MILE SOUTH OF MISSISSIPPI AVENUE. BENCHMARK IS ALSO THE MONUMENT FOR THE 1 / 4 CORNER COMMON TO SECTIONS 24 / 19 R661|65W, T4S. PUBLISHED ELEVATION = 5608.25' NAVD88.

NOTES:

1. APPROVAL OF THIS DOCUMENT BY CITY OF AURORA DOES NOT IMPLY APPROVAL FOR ANY OFFSITE WORK ON ADJACENT PRIVATE PROPERTY. IT IS THE OWNER'S RESPONSIBILITY TO COORDINATE WITH ADJACENT PROPERTY OWNERS AND OBTAIN ALL NECESSARY APPROVALS AND EASEMENTS FOR SUCH WORK. IF APPROVALS ARE NOT OBTAINED BY THE START OF CONSTRUCTIONS, REVISIONS TO CIVIL PLANS WILL BE REQUIRED.
2. CITY OR AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH MUST BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
3. THERE IS A FLUVIAL STUDY WHICH ILLUSTRATES THAT THERE MAY BE ADVERSE IMPACTS TO THIS STUDY AREA FROM MOVEMENT FROM THE ADJACENT CREEK. THE DEVELOPER ACKNOWLEDGES THAT UNTIL BANK STABILIZATION IS IMPLEMENTED THAT THERE ARE CONCEPTUAL RISKS TO THE SITE.
4. ALL STORM INFRASTRUCTURE IS PUBLIC AND SIZED FOR THE 100 YEAR STORM, UNLESS OTHERWISE NOTED.
5. ZANTE STREET IS ENTIRELY VERTICAL CATCH CURB.
6. ANY FUTURE DEVELOPMENT IN THE PLANNING AREA WILL REQUIRE PERPETUATION OF EMERGENCY OVERFLOWS THROUGH THEIR SITE.
7. NO WORK IS ALLOWED IN THE FLOODPLAIN WITHOUT A FLOODPLAIN DEVELOPMENT PERMIT. NO WORK IS ALLOWED WITHIN THE FLOODWAY WITHOUT A CLOMR OR A NO RISE ANALYSIS INCLUDED WITHIN THE FLOODPLAIN DEVELOPMENT PERMIT.

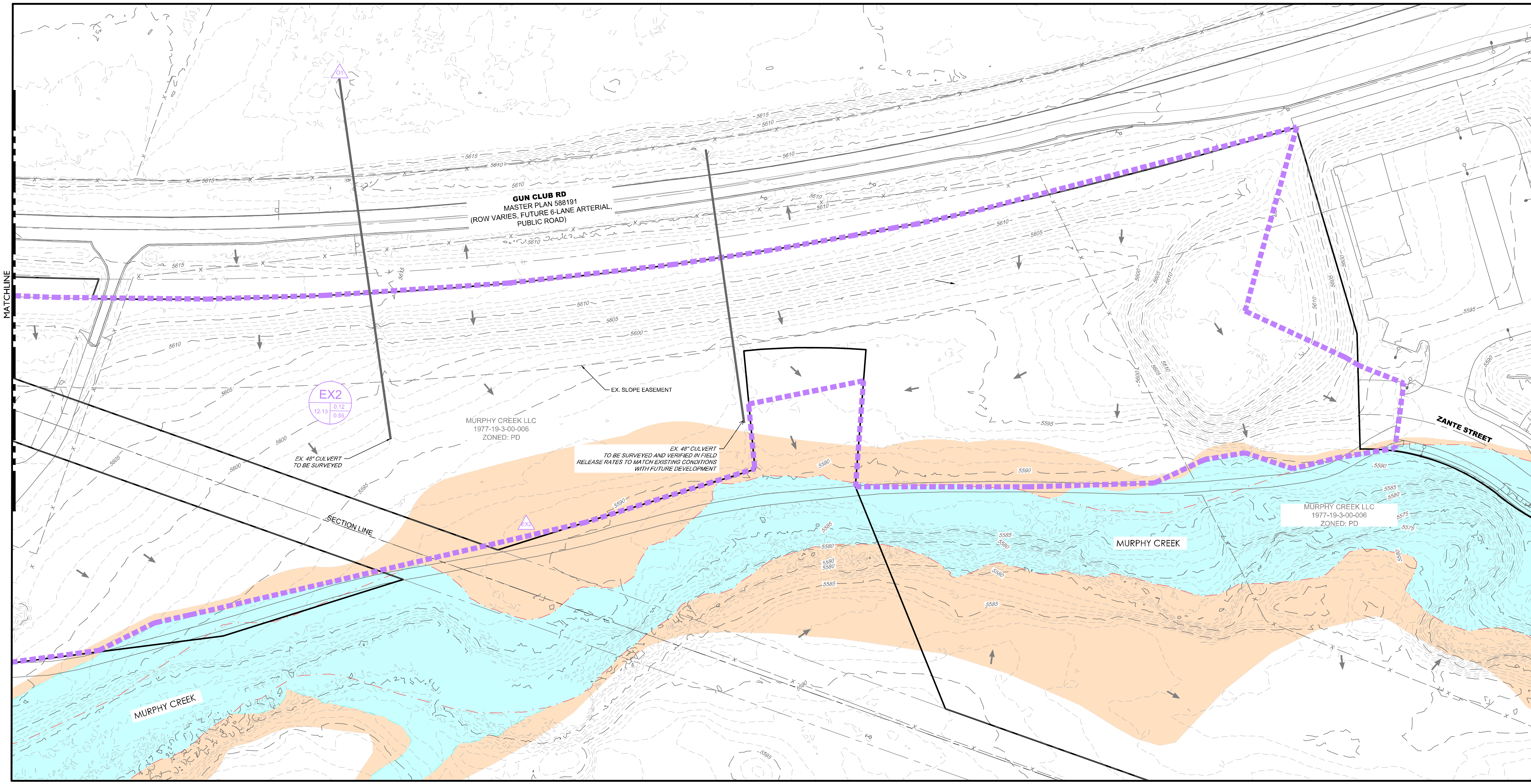
LEGEND

EXISTING | PROPOSED

- BASIN DESIGNATION
- 2 YEAR COEFFICIENTS
- 100 YEAR COEFFICIENTS
- DESIGN POINT
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ROUTE
- PROPOSED DRAINAGE BASIN
- EXISTING DRAINAGE BASIN
- PROPOSED MAJOR CONTOUR (5280)
- PROPOSED MINOR CONTOUR (5279)
- EXISTING MAJOR CONTOUR (5280)
- EXISTING MINOR CONTOUR (5279)
- PROPOSED STORM & STUB OUT
- EXISTING STORM & STUB OUT
- EXISTING STORM TO BE SURVEYED
- STORM MANHOLES
- STORM INLETS
- FES, FOREBAY, & TRICKLE CHANNEL
- CRUSHER FINES MAINTENANCE ACCESS
- RIPRAP
- EASEMENT
- DRAINAGE EASEMENT
- RIGHT OF WAY (R.O.W.)
- CENTERLINE
- PROJECT BOUNDARY
- EX. 100 YR FLOODPLAIN ZONE X
- EX. 100 YR FLOODPLAIN ZONE AE
- 100 YR FLOODWAY

0 50' 100'
1 inch = 50 ft.

HALF-PLOT



LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTUCTURE

CORE CONSULTANTS, INC.
3473 S. BROADWAY
ENGLEWOOD, CO 80113
303.703.4444
LIVEYOURCORE.COM

Know what's below. Call before you dig.

#	REVISION DESCRIPTION	DATE	BY

MURPHY CREEK - ZANTE STREET
AURORA, COLORADO

EXISTING DRAINAGE PLAN 2

NOT FOR CONSTRUCTION

DESIGNED BY: GP
DRAWN BY: GP
CHECKED BY: JK

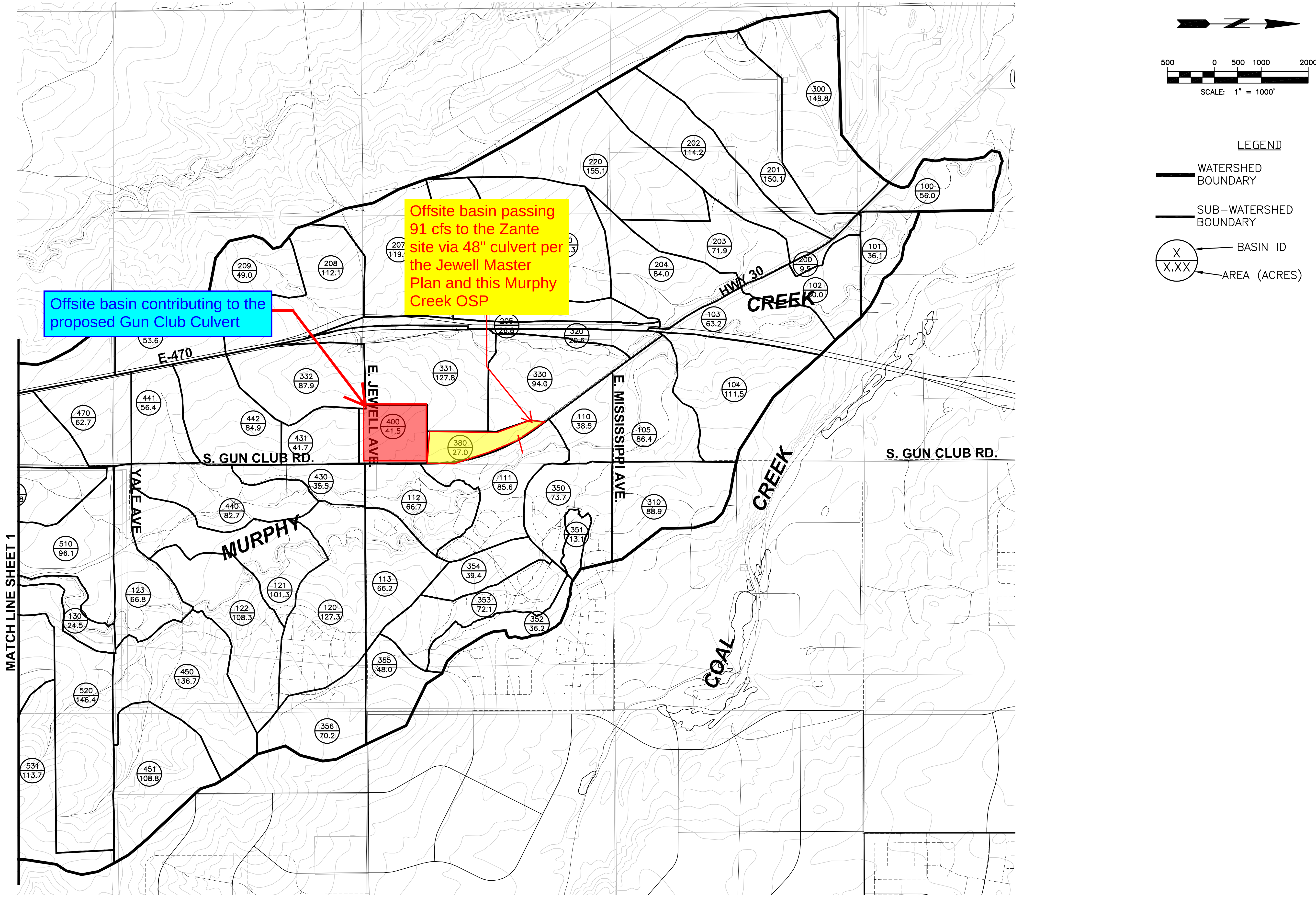
JOB NO. 21-134

SHEET 2

X:\21-134 Murphy Creek\Civil\CAD\Plans\Zante Street\Drainage Ex Drainage Basins.dwg
2021-09-11 (4:30 PM)

APPENDIX E

Reference Documents



MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	TTC	DATE	10/11/05
DRAWN	THT	DATE	12/22/05
CHECKED	RCO	DATE	12/23/05
REVISED		DATE	

CITY OF AURORA
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

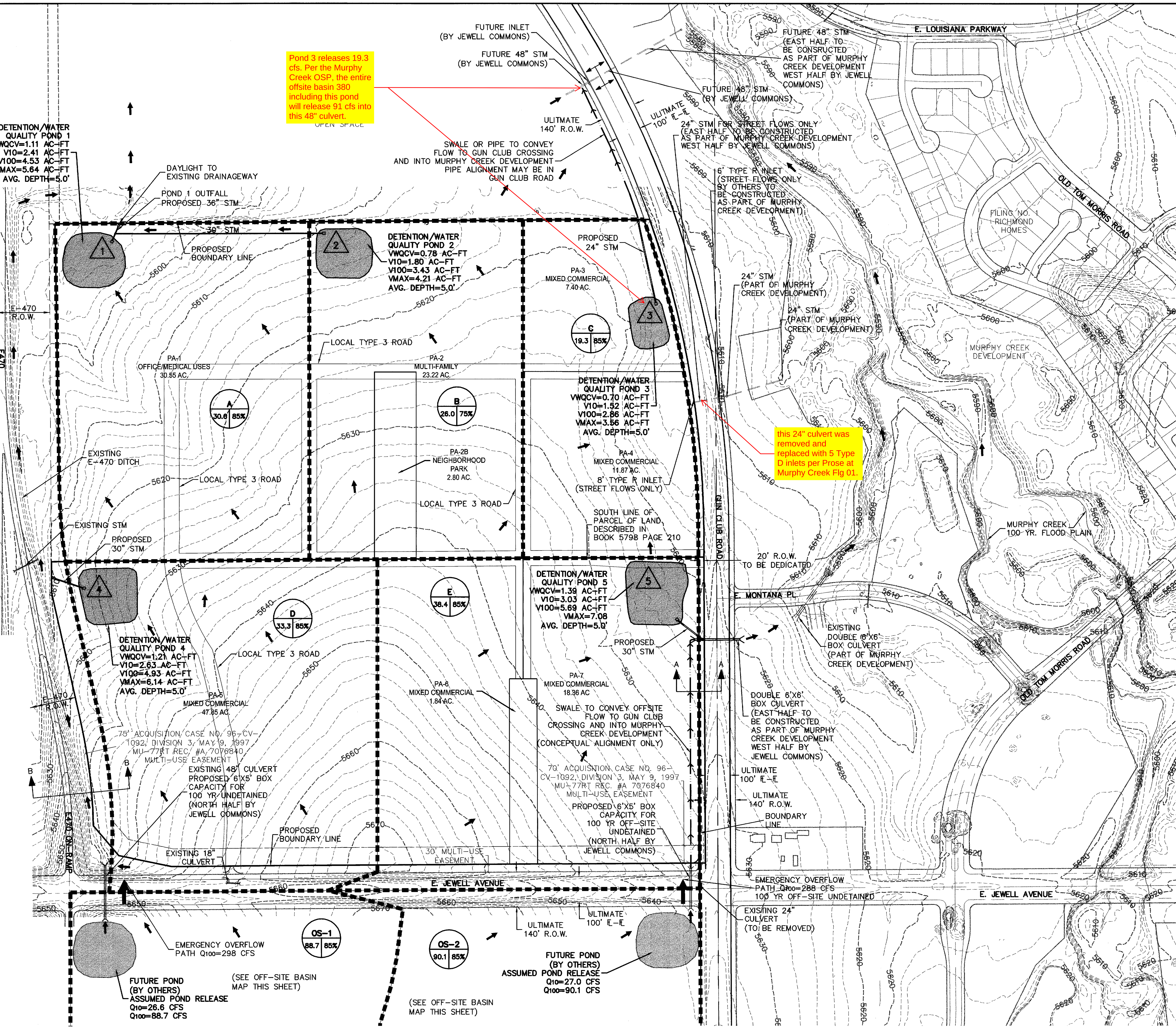
MURPHY CREEK OUTFALL SYSTEMS PLANNING STUDY

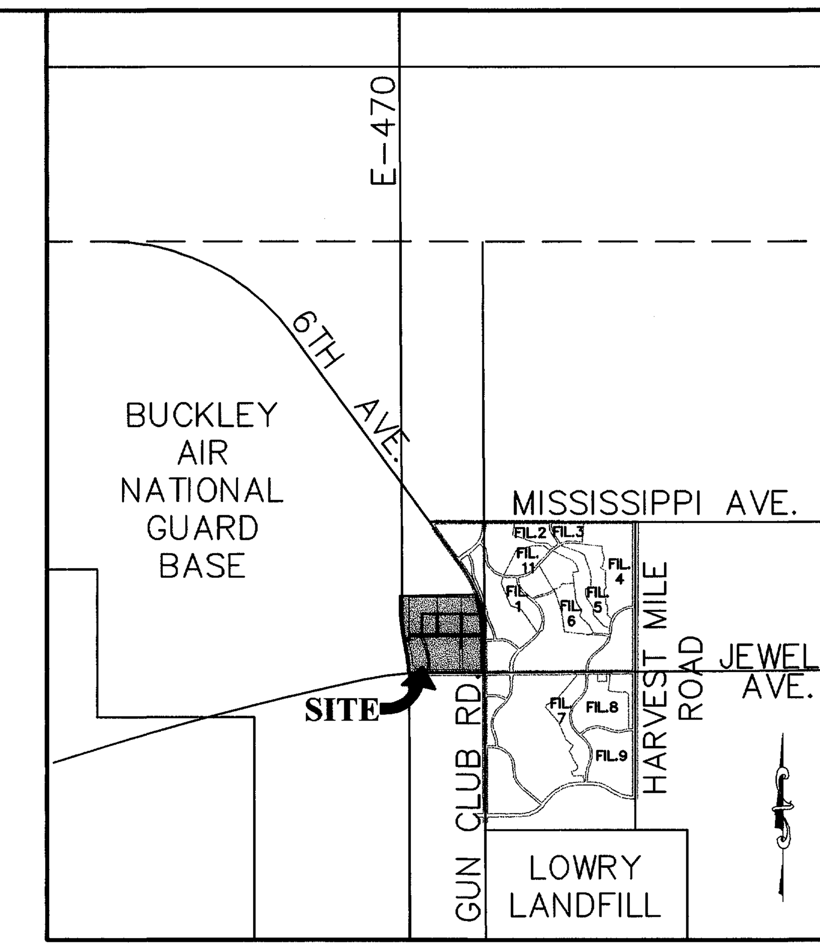
SUB-WATERSHED BOUNDARIES

FIGURE 3-1.2

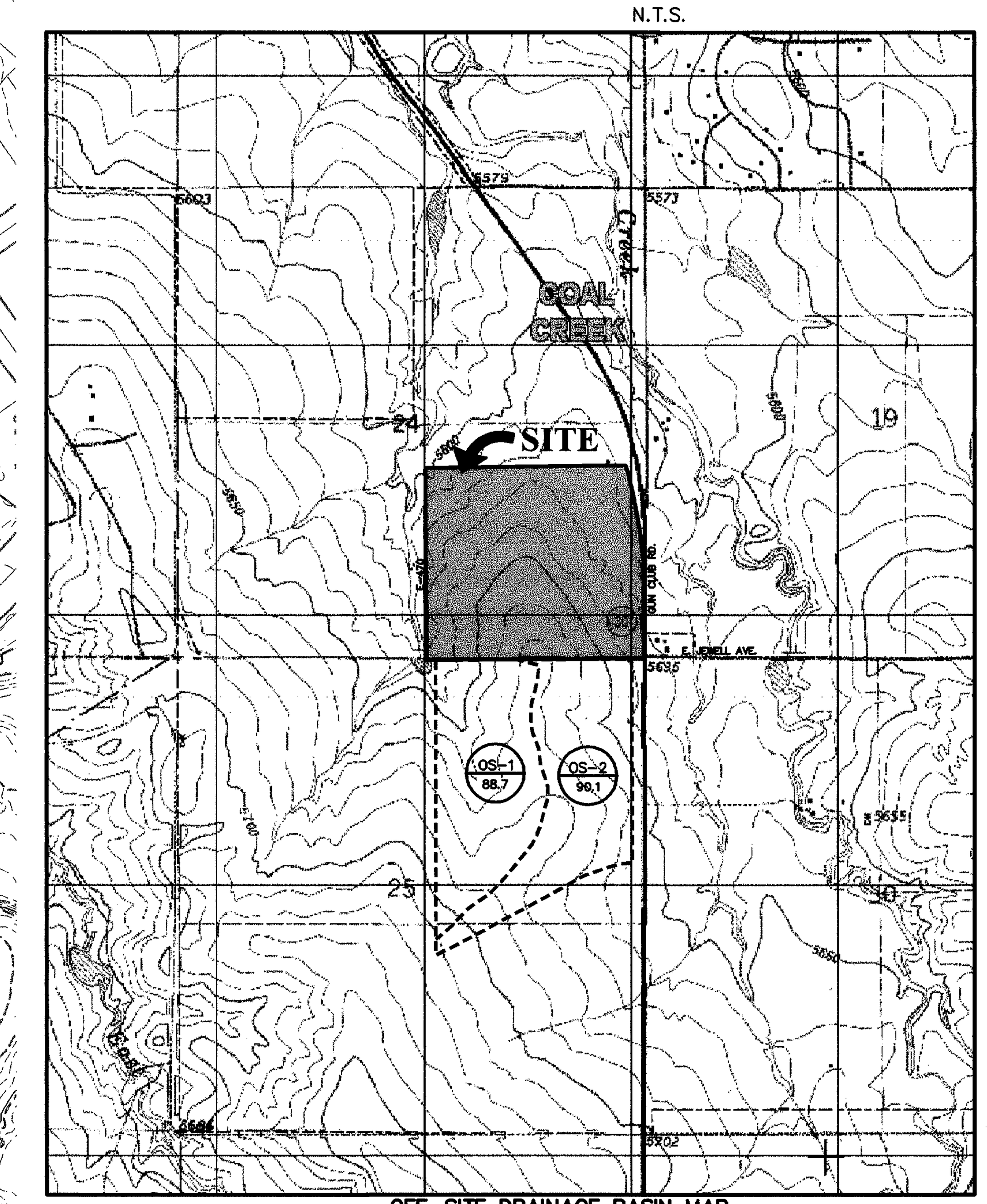
NAME: Z:\UDFCD PLANNING\Murphy Creek\OSP\CAD_MC_OSP\dwg\Prelim\S3 Hydrologic Analysis\Figure 3-1.1 Subwatershed Boundaries.dwg
PLOT DATE: Sep 25, 2008 3:25pm

204181 1/1





VICINITY MAP
N.T.S.



OFF-SITE DRAINAGE BASIN MAP
N.T.S.

NO.	REVISION	DATE	BY
1	PER CITY COMMENTS	03/23/04	BJ
2	PER CITY COMMENTS	06/08/04	RD

JEWELL COMMONS PARCEL

MASTER DRAINAGE MAP

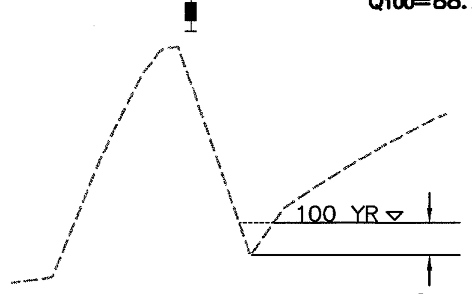
DEVELOPER
RONCAR, LLC
6708 S. WOLFF CT.
LITTLETON, COLORADO
(303) 770-0200
(303) 220-8027 fax
CONTACT: MICHAEL SHELDON

PEAK CIVIL CONSULTANTS
CIVIL ENGINEERING & LAND DEVELOPMENT SERVICES
2828 SPEER BLVD., SUITE 201
DENVER, COLORADO 80211
(720) 855-3859 (720) 855-3860 fax
CONTACT: JEFF FRENCH
Email: jfrench@peakcivil.com

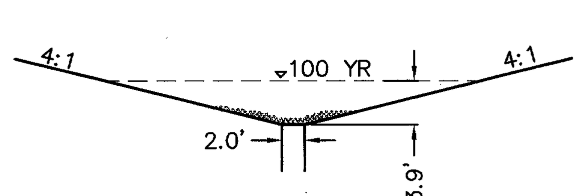
COLORADO REGISTERED PROFESSIONAL ENGINEER 32615 07/16/04

LEGEND

PROPERTY BOUNDARY
PROPOSED RIGHT OF WAY
CONCEPTUAL PARCEL BOUNDARY
BASIN DESIGNATION
BASIN IMPERVIOUS PERCENT
BASIN AREA IN ACRES
DESIGN POINT
MAJOR DRAINAGE BASIN BOUNDARY
CONCEPTUAL STORM SEWER
6500 EXISTING CONTOUR
FLOW DIRECTION



EXISTING SWALE SECTION B-B
N.T.S.



SECTION A-A
N.T.S.

NOTES:

1. PONDS SHOWN HEREON ARE SCHEMATIC ONLY. ACTUAL SIZE SHAPE AND LOCATION WILL VARY AS SITE DESIGN PROGRESSES.
2. GUN CLUB CROSSING LOCATIONS ARE CONSISTENT WITH THE MURPHY CREEK MASTER DRAINAGE STUDY (REFERENCE NO. 5).
3. THE LOCAL STREET ALIGNMENT SHOWN HEREON IS NOT APPROVED BY THIS PLAN.

POND RELEASE TABLE

			DEVELOPED FLOW		POND RELESE	
DESIGN POINT	BASIN	AREA	Q10 (CFS)	Q100 (CFS)	Q10 (CFS)	Q100 (CFS)
1	A	30.6	77.1	129.7	9.2	30.6
2	B	26.0	65.5	105.0	7.8	26.0
3	C	19.3	59.4	109.6	5.8	19.3
4	D	33.3	85.1	143.9	10.0	33.3
5	E	38.4	96.8	162.8	11.5	38.4

200 0 200 400
(IN FEET)
1 inch = 200 ft.

CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOBSITE. THE CITY OF AURORA THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO OTHER RESPONSIBILITY OTHER THAN AS STATED ABOVE FOR COMPLETENESS AND/OR ACCURACY.

Approved for One Year From this Date 8-18-04

City Engineer — Date 8-4-04

Utilities Department — Date 8-11-04

DATE: 07/22/03
JOB NO: 03.06
DRAWN BY: RD
APPROVED:
CADD FILE: 03.06/.../MAST-DRAIN

1

980080 2/4

Legend

Limits of 100 Year Floodplain

BASIN DESIGNATION - CUHP DESIGN AREA ACRES

PROPOSED CULVERT

CUHP DRAINAGE BASIN BOUNDARY

MINOR BASIN BOUNDARY

PROPOSED DRAINAGEWAY

GRADE CONTROL DROP STRUCTURE (AND GOLF CART CROSSING WHERE SHOWN)

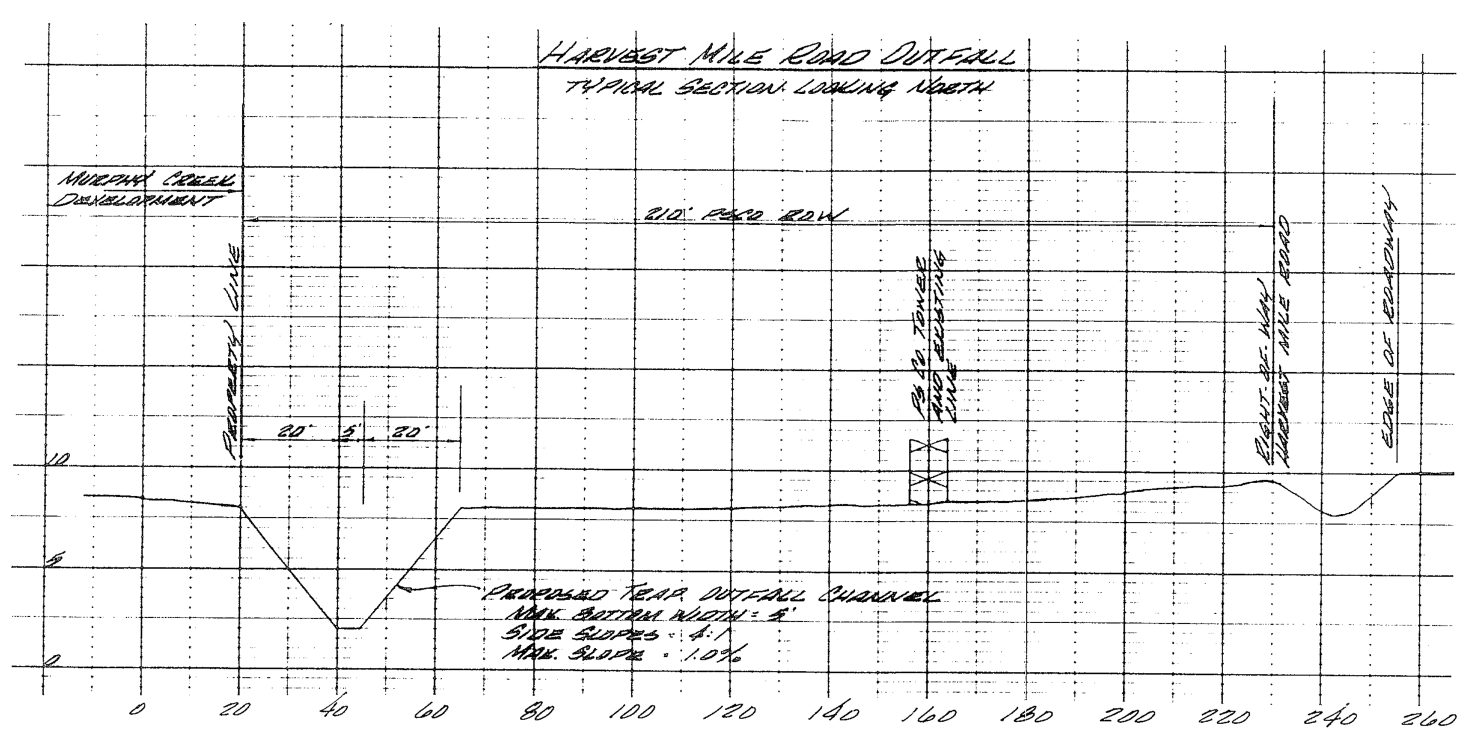
MURPHY CREEK

PRELIMINARY STORM PIPING PLAN (SHEET 1 OF 2)

CITY OF AURORA

HOMESTEAD AT MURPHY CREEK GOLF COURSE

MURPHY CREEK L.L.C.



NOTE: FOR DETAILS & NOTES SEE SHEET 3 OF 4

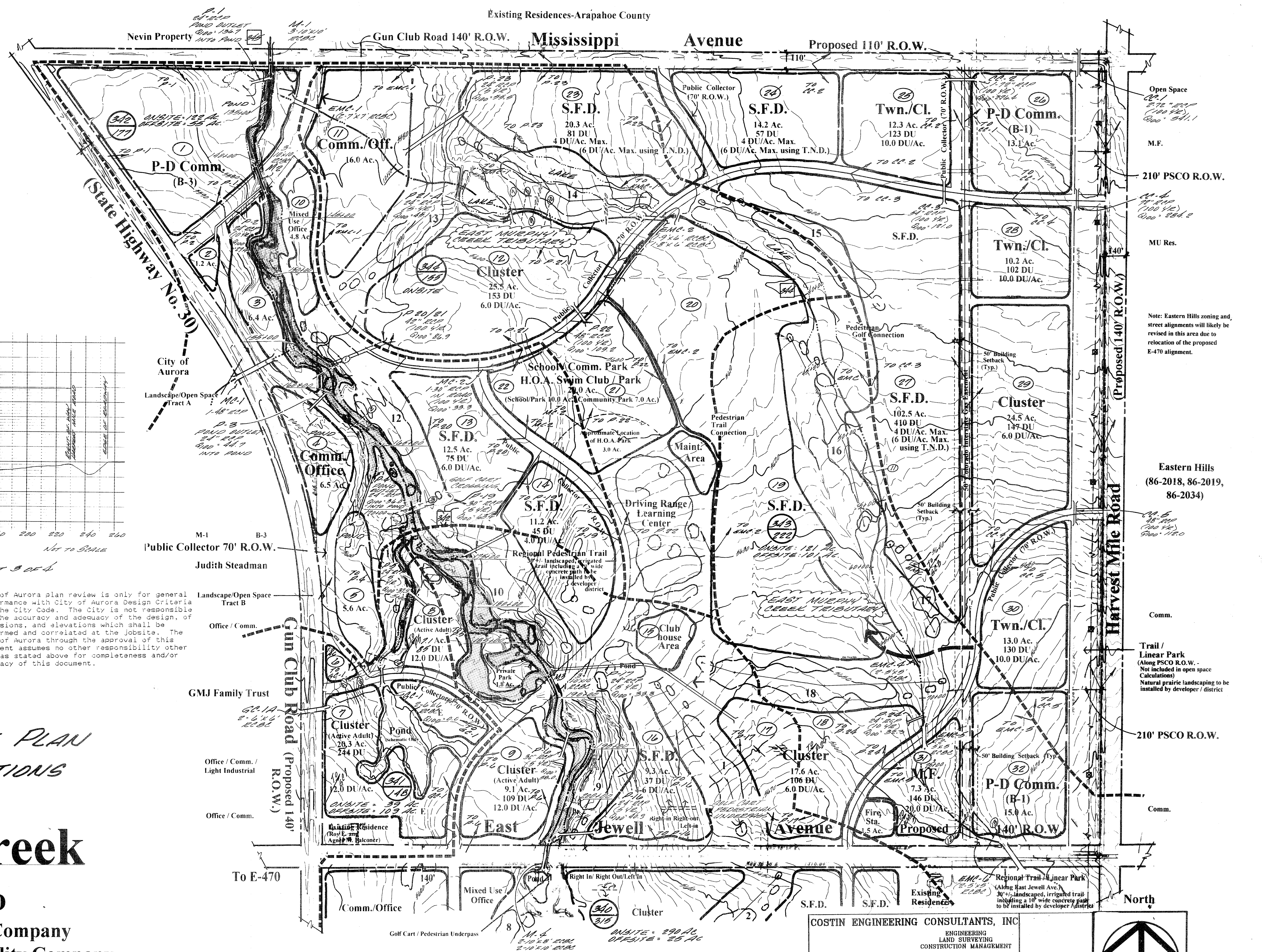
APPROVED FOR ONE YEAR FROM THIS DATE 5-6-98

Director of Public Works — Date 4/22/98

Director of Utilities — Date 4/27/98

City of Aurora plan review is only for general conformance with City of Aurora Design Criteria and the City Code. The City is not responsible for the accuracy and adequacy of the design, of dimensions, and elevations which shall be confirmed and correlated at the jobsite. The City of Aurora through the approval of this document assumes no other responsibility other than as stated above for completeness and/or accuracy of this document.

MASTER DRAINAGE PLAN PROPOSED CONDITIONS



Murphy Creek

Aurora, Colorado

Gun Club Limited Liability Company
Murphy Creek Limited Liability Company
7591 East Maple Avenue Suite 326
Greenwood Village, Colorado 80111
(303) 770-0200

This reproducible sepia is a facsimile of a signed and sealed print transmitted to the City of Aurora. 2/17/98

Land Planner:
David A. Clinger and Associates Ltd.
21759 Cabrini Boulevard
Golden, Colorado 80401
(303) 526-9126

Engineer:
Costin Engineering Consultants
6801 South Emporia Street Suite 205
Englewood, Colorado 80112
(303) 790-4969

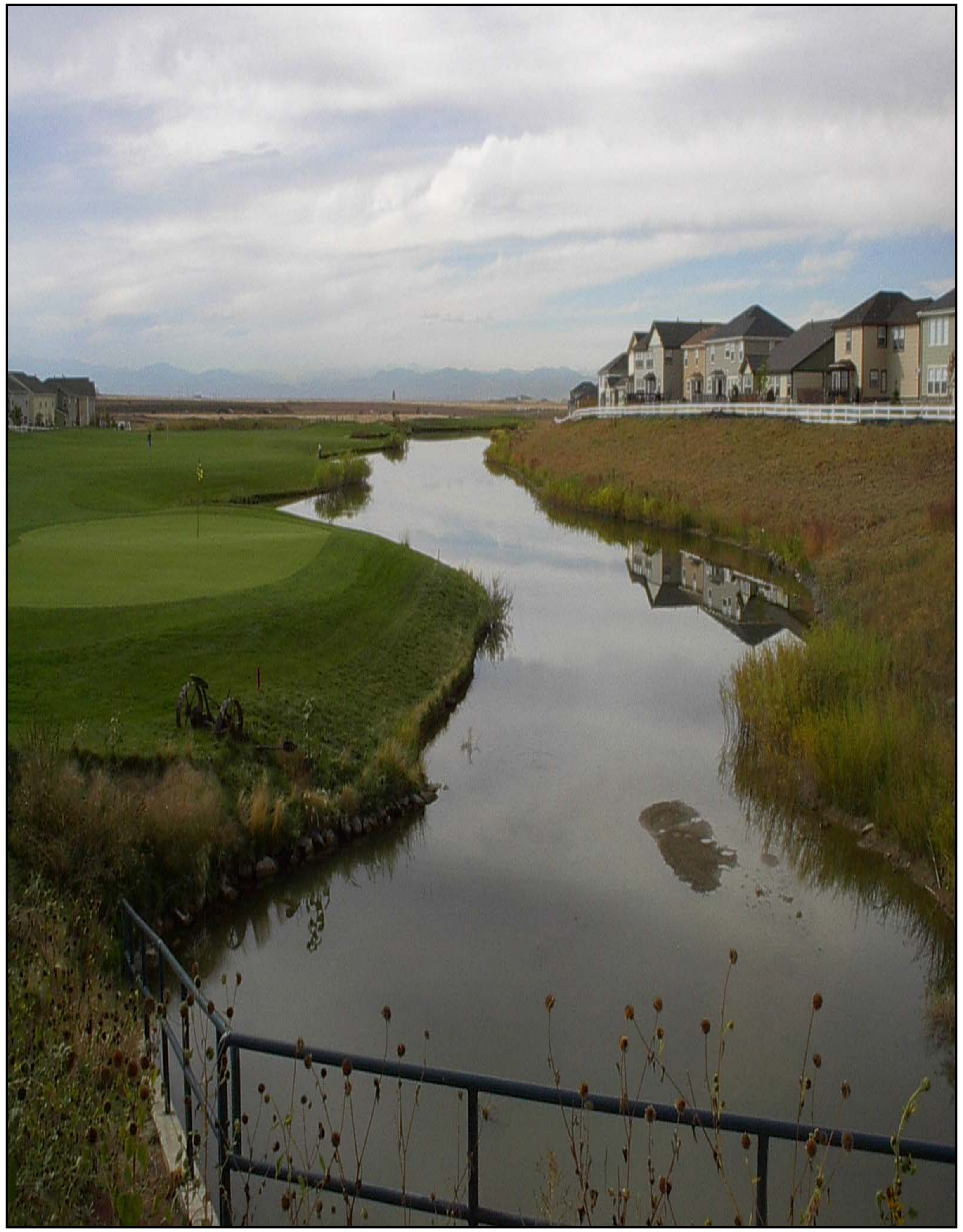
Golf Course Architect:
Kenneth M. Kavanaugh
6655 North Canyon Crest Dr. #4120
Tucson, Arizona 85718
(602) 323-8232

COSTIN ENGINEERING CONSULTANTS, INC
ENGINEERING
LAND SURVEYING
CONSTRUCTION MANAGEMENT
6801 S. Emporia Street, Suite 205
Englewood, Colorado 80112
PH (303) 790-4969

MURPHY CREEK
MASTER DRAINAGE PLAN
PROPOSED CONDITIONS

DATE 1-30-96
PROJ. NO. 197
SHEET 2 OF 4
SCALE 1" = 300'

980080 2/4



MURPHY CREEK AND TRIBUTARIES WATERSHEDS

OUTFALL SYSTEMS PLANNING
PHASE B – PLANNING REPORT

Project Sponsors:

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF AURORA

UPDATED 03/2021:
A Fluvial Hazard Zone (FHZ) Mapping Analysis was completed in January 2021 for Murphy Creek from Yale Avenue to the Sand Creek Confluence. This analysis was accompanied by a conceptual design for the area between approximately Jewell Avenue and Yale Avenue. This correlates to approximately Station 215+00 through 312+00 of Reach 6 in this OSP. The Conceptual Design section and Appendices F and G of this OSP have been updated with the pertinent information from the conceptual design.

Prepared by:

MOSER & associates ENGINEERING

720 South Colorado Boulevard
Suite 410 S
Denver, Colorado 80246
phone (303) 757-3655

October 2008

TABLE B-5 Continued
Future Land-Use Conditions
Peak Flow Summary

Conduit Element	Location	Peak Flows (cfs)						
		2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	100-Yr MP*
1606re		304	573	760	1272	1573	1948	1948
1625re		273	502	658	1073	1338	1631	1631
1635re		276	470	595	904	1145	1351	1351
1636re		249	423	535	794	989	1480	1480
1637re		229	375	466	667	824	978	978
1655re		152	255	320	463	574	684	684
1665re		40	66	83	120	149	177	177
2045re		427	695	855	1232	1520	1815	1660
2046re		352	552	669	939	1149	1360	1282
2075re		281	437	527	724	882	1036	1016
2085re		190	291	349	464	561	651	651
2095re		65	98	116	151	181	211	211
2205re		90	159	198	289	362	427	300
2305re		93	151	185	255	316	371	304
3105re		38	70	89	137	173	208	208
3205re		12	19	23	32	38	45	45
3315re		173	266	322	444	534	639	202
3325re		81	123	147	202	244	284	262
3505re		89	180	241	390	501	627	560
3515re		80	159	209	333	425	525	483
3516re		75	143	185	291	368	452	418
3545re		5	15	21	37	48	60	60
3555re		63	108	134	200	249	299	278
3565re		59	94	113	156	189	222	209
3805re		28	41	49	65	78	91	91
4005re		55	83	99	129	156	181	339
4305re		65	103	123	167	209	241	67
4315re		57	86	102	133	177	177	194
4405re		110	202	259	387	484	592	583
4415re		50	76	91	126	153	179	166

*** MP = Master Plan peak flows**

Conduit Element	Location	Peak Flows (cfs)						
		2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	100-Yr MP*
4425re		52	100	125	190	238	292	292
4435re		47	77	88	117	143	168	168
4515re		7	40	59	110	147	184	173
4705re		4	28	47	93	128	168	168
4715re		3	20	30	57	77	97	97
5025re		3	22	37	72	99	131	131
5035re		3	17	26	49	66	85	85
5115re		2	24	38	75	102	130	129
5125re		10	79	123	232	312	398	396
5315re		5	42	63	117	156	196	196
5505re		27	160	251	470	633	804	804
5515re		1	13	19	36	48	60	60
5525re		23	108	162	303	406	516	516
5535re		3	39	64	122	165	212	212
5545re		2	18	29	56	75	96	96
5555re		21	86	126	231	308	388	388
5565re		19	39	50	76	96	115	115
6005re		5	58	92	183	249	321	321
6015re		4	39	61	116	156	197	197
6205re		3	30	47	90	122	154	154
6305re		3	23	35	64	83	104	104
6505re		4	24	37	68	91	114	114
7015re		26	101	148	272	362	457	457
7025re		32	100	142	243	317	393	393
7035re		26	69	93	151	195	238	238
7105re		5	20	30	58	78	98	98
7205re		0	32	54	116	158	201	201
7515re		23	30	34	58	85	116	116
7525re		139	210	255	340	413	480	480
7615re		27	53	71	115	147	179	179
7705re		105	170	214	305	379	446	446