



# **Soleana Subdivision**

## **Phase II Drainage Report SDP24-0010**

IMEG #20002764.00

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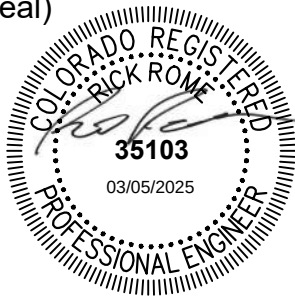
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## ENGINEERS CERTIFICATION

I affirm that this report and plan for the Phase II drainage design of Soleana Subdivision was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.

Rick Rome P.E.  
Registered Professional Engineer State  
Of Colorado No. 35103  
(Affix Seal)

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## **Soleana Subdivision Phase II Drainage Report**

### **GENERAL LOCATION AND DESCRIPTION**

#### **A. Site Location**

The project is located in the north half of Section 26 T7S R67W 6<sup>th</sup> PM and is currently unplatted land. The property is bounded on the east by the Diamond Ridge subdivision, on the south by the Cooper Hook subdivision with the Martinez property immediately south of that, and on the west by the Silver Heights subdivision. The property ownership is divided into two parcels submitted as a single project with the north half owned by Tierra Investors LLC and the southern portion owned by 455 Alexander LLC. The owners are the developers for the property. IMEG is the consulting engineer providing civil engineering services.

The proposed Soleana Subdivision is in the north half of Section 26, Township 7 South, Range 67 west of the 6th Principal Meridian in Douglas County, Colorado. The property is centrally located and includes portions of the NE  $\frac{1}{4}$  and the NW  $\frac{1}{4}$  of Section 26. The overall project boundary encompasses approximately 77.96 acres.

#### **B. Description of Property and Land Use**

The property encompasses approximately 77.96 acres that is generally sloped from east to west at grades ranging from 2% to 20% in the buildable areas, and some areas of significant slope along Diamond Ridge. The proposed development plan calls for a low density, low impact neighborhood with approximate  $\frac{1}{2}$  acre single family residential lots proposed.

Ground cover for the property includes scrub oaks, native grasses, and rock outcroppings. Site development will include over lot grading activities to optimize the use of available space and views from the subdivision. Open space areas will remain undisturbed to preserve the natural character of the community.

Soils on site are a combination of Kutch Sandy Loams (49.1%) and Stony steep land (50.9%). These soils are generally consistent with hydrologic soil group D.

The project area is historically tributary to East Plum Creek through two tributaries located at the north and south sides of the site. The north tributary drains through the Silver Heights neighborhood in an established drainage system including a combination of open channels and storm sewer to the confluence with East Plum Creek located approximately 1.5 miles west of the development. The south outfall drains through the Cooper Hook development through a 72" storm sewer that is part of the Tributary C to Plum Creek as modeled in the Flood Hazard Area Delineation and Master plan prepared for the Town of Castle Rock.

The site is in zone X as noted on FIRM Panel 08035C0186G Revised March 16, 2016. There are no irrigation ditches or canals adjacent to or impacted by this project. There is a designated FEMA floodplain that begins approximately 2500 feet west of the project boundary. The FHAD for Tributary C identifies flood limits along the southern boundary of the Cooper Hook property.

Development of the project includes 55 single-family detached lots ranging from half-acre to one acre in size. Additionally, there are 22 duplex units proposed to be built in the southwest corner of the site with access to Via Soleana Lane (AKA Brewer Court). These sites may be modified depending on market conditions and become single family residential lots at the time of final design. For this analysis, we have assumed impervious coverage with the development based on relative use.

Secondary emergency access will be provided from an extension of Alexander Place that will serve this development together with Lot 4 of the Cooper Hook development being planned in coordination with this project. This emergency access will also serve as the secondary water service for the development. The final configuration of this access may be coordinated with the adjacent development to optimize the benefit for both projects.

## DRAINAGE BASIN AND SUB-BASINS

### A. Major Drainage Basins

The project area spans two basins in the Plum Creek watershed. The northern region is associated with Tributary B to Plum Creek as identified in the Masterplan by CH2M Hill. The Soleana development is located in portions of Basin 22 and 23 of the Tributary B watershed. The tributary areas from Soleana in Basin 23 includes a small portion of the Diamond Ridge rear lot drainage and the northern region of Soleana which is currently tributary to the Silver Heights subdivision by way of sheet flow to the adjacent neighbors and concentrated flow beginning at the corner of the Douglas County Park property. This area has a documented history of creating localized flooding in the Silver Heights subdivision. As part of this project, the Soleana Subdivision grading plan will direct an additional 11.5 acres south to the Tributary C outfall in Basin 106 which will serve to mitigate potential impacts to the existing Silver Heights development.

The project area is described in the Tributary C and D Watershed Masterplan prepared by Respec Dated October 2014. The property itself is a part of sub-Basin 106. Basin 106 was estimated with approximately 97.5 acres at an approximate historic impervious coverage of 6.0%. This total includes approximately 47.9 acres of the proposed Soleana subdivision. Basin 106 also includes approximately 16 acres of lands expected to be developed with a higher density residential density, and existing facility for assisted living, and open space under ownership by the Town of Castle Rock.



Sub Basin 106 receives stormwater runoff from Sub basin 107. Sub Basin 107 represents the upper reach of the tributary area and is defined by a local ridgeline along the eastern and southern limits of the watershed. Ownership in the basin includes a combination of the following:

- 21.2 and 7.5 acres open space owned by the Town of Castle Rock
- approximately 15 acres of unincorporated lands under private ownership
- 7.9 acres of the Soleana development which is proposed as dedicated open space.
- 2.1 acres of existing large lot development from Diamond Ridge

The combined area for Basin 107 is 53.7 acres with a 2.7% impervious coverage. There are no changes proposed in this watershed resulting from the Soleana development.

The historic drainage basin was also reviewed using the USGS Streamstats application. This was done for comparison purposes to evaluate relative runoff flow rates establishing a range of major event flow rates to accommodate the naturalized condition of the offsite tributary areas.

The combined tributary area to the proposed combined pond at Design Point 28 as planned in the masterplan report is 162.7 acres including the intercepted flows from the northern portion of the development.

The watershed considered in this report includes the project area and surrounding regions that extends from the Silver Heights neighborhood on the west to the ridgeline with Diamond Ridge Estates to the east. The southern boundary of the site is generally located along Alexander Place, off East Allen Street. The southern limit of the watershed is the existing ridgeline located between 800 and 1300 feet south of the property. The north boundary is the approximate project property line. The watershed generally discharges along two flow paths going either north or south.

In addition, areas immediately adjacent to the property, this analysis considers properties to the south and east of the development that constitute the balance of the regional basin that is the upper reaches of the Tributary C to Plum Creek (Respec Basin 106). These properties include the Cooperhook property that is immediately adjacent to the Soleana subdivision to the south, the unplatted 8.4 acres immediately south of Cooperhook referred to in this report as the Martinez property in reference to the ownership (Martinez Real Estate Company LLC). The Thornton Property is located south and east of the property which is unincorporated and unplatted lands. In addition, the Town of Castle Rock owns Tract D of Metzler Ranch which includes 49.8 acres of open space trails in the uppermost limits of the watershed.

Basins A generally drains along its historic flow path to the north draining through the existing channel system that is part of the Silver Heights subdivision. This basin historically includes tributary areas to the east and proposed rear lot drainage along the western project boundary. Tributary runoff from this basin will be attenuated and treated for water quality and discharged



directly into the existing drainage channel directly north of the project in its historic flow path. The pond discharges near design point 3

Basins B, C, D, E and F generally drain south through the storm sewer constructed with the Cooper Hook development also identified as Tributary C. Historically a portion of the flow from Basin B would cross the western boundary as a sheet flow or surface concentrated flow over the adjacent lots in Silver Heights. This condition represented a drainage challenge for the downstream area as documented in the Silver Heights Drainage Study alternative solutions to Local Drainage Problems (Reference 4). The improvements associated with this development will concentrate the tributary flow areas identified with Reference 4 and direct them through a controlled flow path to a proposed pond and ultimately back into Plum Creek. This approach will significantly alleviate the impacts of stormwater to the downstream community. These basins discharge near design point 28 in a combined pond that attenuates historic tributary areas in addition to the redirected flow from historic Basin A.

There are no surface irrigation features that are impacted by the local drainage patterns described in this analysis. Stormwater runoff from this area drains west to Tributary "C" to Plum Creek located approximately 1 mile west of the project area.

The design of the major drainage features is based on assumptions related to specific detention requirements for the tributary areas. Volume requirements for basin A is established in Pond 1, Volume requirements for Basins B, C, D and E are identified in the proposed Pond 2. These basins are located within Sub Basin 106 as described in the Town FHAD and Master Plan Studies for Tributary C. Basin E is a historic hill side that will not be modified with this development and is part of sub-Basin 107 in the Tributary C FHAD and Masterplan. In addition, offsite flows from the Diamond Ridge subdivision are treated as pass through flows.

The final design of the watershed impervious coverage will be refined with the Phase 3 reports prepared through the Town of Castle Rock entitlement process. This will include but not be limited to updated impervious values based on the current MHFD published impervious chart 6-2. For this Phase II report, we have assumed a composite impervious coverage that includes the following.

- Open Space 2%
- Front Lot Drainage 30%
- Rear Lot Drainage 30%
- Duplex Areas 50%

### *Silver Heights Mitigation*

The existing outfall path for this area includes a combination of retention and overflow through the Silver Heights subdivision. The historic Basin A includes a total of 11.1 acres of tributary area including rear lot drainage from Diamond Ridge, and undeveloped areas. Additional flows



tributary to the Silver Heights subdivision includes direct flow from the historic Basin B area including a total of 12.5 acres that is tributary to the rear lots along the eastern boundary of the Silver Heights development.

The proposed improvements are designed to minimize existing drainage impacts to the Silver Heights subdivision as much as possible. This is accomplished by re-directing the historic Basin B area to the south intercepting flows that are historically tributary to Silver Heights in the Via Soleana Lane extension and directing those flows to the south through a defined storm sewer system. This takes existing drainage pressure from the central area of the Silver Heights subdivision. In addition, the historic area tributary from combined Basin A and B is reduced from 19.72 acres to 8.25 acres. The percent impervious is increased from 2% native to 15.2% representing the rear lot drainage from the lots fronting Brewer Court that could not be re-directed. These flows are further mitigated in a proposed extended detention basin addressing water quality, EURV and 100-year detention before releasing into the historic flow path being an existing channel section adjacent to the site.

Basin A Total Runoff Volume Comparison

| Event    | Historic    | Developed   |
|----------|-------------|-------------|
| WQCV     | 0 ac-ft     | 0.065 ac-ft |
| EURV     | 0 ac-ft     | 0.108 ac-ft |
| 2 Year   | 0.079 ac-ft | 0.134 ac-ft |
| 5 Year   | 0.315 ac-ft | 0.328 ac-ft |
| 100 Year | 1.485 ac-ft | 1.196 ac-ft |

Basin A Historic runoff comparison

| Event    | Historic       | Developed<br>To Pond | Pond<br>Release |
|----------|----------------|----------------------|-----------------|
| Area     | 11.06 ac       | 8.25 ac              |                 |
| 5 Year   | 1.7 cfs        | 3.1 cfs              | 0 cfs *         |
| 100 Year | 29.5 cfs ac-ft | 22.0 cfs             | 10.7 cfs        |

\* Pond 5 year release through EURV plate.

The table above indicates that there is an increase in the 2-year event runoff volume. The frequent event increase is mitigated by providing water quality treatment and EURV release that



stages stormwater release to the retention facility over a 72 hour period giving time for evaporation and infiltration to occur in the existing facility. It is also noteworthy that major event runoff total volume is significantly reduced. The combination of these improvements represents a net improvement to the overall impact to the Silver Heights neighborhood.

The outfall path for historic waters from Basin A through Silver Heights includes a combination of retention, overflow direct flow and local conveyance. The pond discharge from the Soleana development will discharge into the existing retention area on the Douglas County Park property as described above. The historic drainage pattern includes an emergency overflow and local drainage path that drains along the rear lot lines of the residential lots between Evalena Road and Bukey Street. The combined basin drains to the existing detention facility located near Harvey Street and Interstate 25. The combination of the detention facility in Basin A and the diversion of Basin B dramatically improves the existing drainage condition of historic flows entering the Silver Heights subdivision.

The Phase III drainage report will include a review of the impact of this development to the existing outfall system. It is noteworthy that the outfall system specific Tributary B to Plum Creek includes a combination of jurisdictional limits for both Douglas County and the Town of Castle Rock. The Town of Castle Rock jurisdictional areas include tributary runoff from Maher Ranch Filing 2 and amendments in the northern and eastern portion of the watershed, portions of the Soleana subdivision and area on the west side of Interstate 25 including the Outlets at Castle Rock. Douglas County jurisdictional boundaries include the Silver Heights subdivision and surrounding large lot parcels in those areas east of Interstate 25. The Phase III analysis will include a review of the pre-existing outfall path as compared to the impact of the flow reductions presented with the development of the Soleana subdivision.

## B. Minor Drainage Basins

### Basin A

The Basin A watershed represents the north region of the study area. Basin A is divided into three sub basins with Basin A1 representing the offsite tributary area and Basin A2 representing the onsite undeveloped area tributary to design point 2. Basin A3 represents rear lot drainage along the Via Soleana Lane extension tributary to design point 3. The basin historically drains directly to the existing channel in the Silver Heights subdivision. Developed areas will be intercepted and directed to Pond 1. Basin A includes a total of approximately 8.25 acres with 0.97 acres being tributary from offsite areas.

The rear lot drainage from Basin A3 will be intercepted in a proposed concrete channel that drains parallel to the existing shared property line with the Silver Heights subdivision. This preserves the historic flow path with a dramatically reduced tributary area resulting from the diversion of flow to Basin 106. A localized graded channel will



be installed to direct concentrated runoff to Pond 1 where water quality treatment and peak flow attenuation will occur. This interceptor channel will restrict stormwater runoff from crossing the existing properties to the west thereby mitigating potential flood impacts on the existing downstream properties. The proposed configuration will concentrate and direct flow from the rear lot drainage of 5 proposed lots directed to Pond 1. We understand that this approach is discouraged in the Town criterion, however we believe that this solution provides maximum protection for the existing properties to the west while limiting impact to the adjacent properties to the north by providing a clear conveyance path for stormwater runoff to Pond 1.

Basin A is the sole tributary area to Pond 1. The pond is proposed as an extended dry basin with WQCV, EURV and 100-year peak flow attenuation. Performance requirements for the pond are tabulated below.

Pond 1 Summary Detention Table

| EVENT | VOLUME      | RELEASE  | DEPTH   |
|-------|-------------|----------|---------|
| WQCV  | 0.040 ac-ft | 40 hour  | 3.81 ft |
| EURV  | 0.058 ac-ft | 70 hour  | 4.36 ft |
| V 100 | 0.311 ac-ft | 11.3 cfs | 5.90 ft |

A comparison of historic to proposed flow parameters is presented in the table below:

| Q 100 Historic | Q 100 Developed | V 100 Historic | V 100 Developed |
|----------------|-----------------|----------------|-----------------|
| 29.5 cfs       | 10.7 cfs        | 1.553 ac-ft    | 1.196 ac-ft     |

The results demonstrate a reduction in both peak rate and total volume to the outfall system through the Silver Heights subdivision as a result of the basin diversion from Tributary D to Tributary C. Basin A area is subject to review through Douglas County as the agency responsible for conveyance of public stormwater to Plum Creek.

The Phase III report will include a presentation of the impact of the Soleana development on the receiving outfall through the Silver Heights subdivision. It should be noted that the pre-existing conditions have been evaluated in prior reports that included implementation of infrastructure that addressed documented drainage constraints in the outfall area. These are noted in references 4, 5 and 6. The Phase II report will demonstrate compliance with these improvements and associated point source improvements that demonstrate improvements to the infrastructure along the historic flow path.



## Basin B

The Basin B watershed represents the north central area of the study limits. This Basin includes 24.63 acres that is bounded by Basin A on the north and Basin C on the south. The eastern boundary of the basin is Diamond Ridge Estates. Basin B includes approximately 0.97 acres being tributary from offsite areas. Sub Basins B1, B2 and B3 are directed south (DP 5 and 6) as additional areas tributary as an extension of Sub Basin 106 and represent approximately 11.47 acres of additional area tributary to proposed Pond 2. As previously mentioned, these areas are a basin diversion from Tributary B to Tributary C directing stormwaters away from the Silver Heights surface flow path to a more clearly defined outfall where flow rates can more easily be attenuated before releasing downstream. Runoff from Basin B is attenuated in proposed Pond 2.

Mitigation for the additional tributary area to Tributary C is accounted for by comparing predevelopment peak flow from the Masterplan to the proposed outfall configuration. Existing design flows from the masterplan are 181 cfs for Basin 106 and 98 cfs for Basin 107 for a combined flow of 279 cfs as a predevelopment baseline flow. The configuration of pond 2 will be determined using the MHFD Detention worksheet and maintaining a maximum release from the regional pond not to exceed the existing historic release as documented with the Masterplan study for the original tributary area. The final configuration will be documented with the Phase 3 drainage report and associated construction documents.

Sub-basins B1, B2 and B3 includes approximately are part of historic Basin A, that historically would sheet flow to the Silver Heights Subdivision. The improvements proposed with this development include a diversion of these flows to the south using the street and storm sewer along Via Soleana Lane to Pond 2. This proposal will alleviate the shallow flooding condition that Silver Heights currently experiences along the Tributary B outfall path.

The proposed Basin B area is collected in a combination of curb and gutter and storm sewer that is proposed in the extension of Via Soleana Lane that discharges to Pond 2. These flows discharge to a proposed forebay at the northwest corner of the pond which is proposed as an Extended Detention Basin constructed in the upper reaches of Tributary C to Plum Creek. Basins B4 thru B7 represented areas that are historically included in Regional Basin 106 and drain through tributary C to Plum Creek. Basin B enters the pond at DP 10 and exits the pond at DP 28.

## Basin C

The Basin C watershed is in the central region of the study area and includes approximately 42.9 acres. The proposed Basin C area is collected in a combination of curb and gutter and storm sewer that is proposed alignments for Luminara Court and Brisa Way that discharges to



Pond 2 at DP 27. The watershed is bounded by the ridgeline with Diamond Ridge Estates to the northeast. Basin B forms the northern boundary of Basin C. The southern boundary roughly follows Basin D to the South and the extension of Flamecrest Trail to the west. Basin C includes approximately 13.03 acres being tributary from offsite areas. Runoff from Basin C is attenuated in proposed Pond 2. The proposed alignment for Basin C includes two alternatives for access to the Pond. The first option as presented includes an extension of Luminara Street to Alexander Place through the Cooperhook property. This alignment represents the most efficient use of resources by streamlining and combining the flow path to a proposed forebay serving Basins C, D and E. This alternative is currently in negotiations with the adjacent property owners and will be finalized as a condition of approval. The alternative solution is to direct Basin C flows to the Pond in a storm sewer through Tract J and positioning the forebay structure in the northeast corner of the pond. Design points in Basin C are defined at key locations for inlet calculations

#### Basin D

The Basin D watershed is in the south-central region of the study area and includes approximately 17.8 acres. The watershed is bounded by the ridgeline with Diamond Ridge Estates to the northeast. Basin C forms the northern boundary of Basin D. The southern boundary roughly follows the property line with 382 Alexander Place. The southeastern boundary is Basin E. Basin D includes approximately 2.14 acres being tributary from offsite areas both upstream and downstream of the project development limit. Runoff from Basin D is attenuated in proposed Pond 2. Basin D drains sequentially between design points 24 and 27 to Pond 2.

#### Basin E

The Basin E watershed is in the southeastern region of the study area and includes approximately 7.94 acres. Basin E is located within the Masterplan Basin 107 and is tributary to Basin 106. The watershed is bounded by the ridgeline with Diamond Ridge Estates to the northeast. Basin D forms the northern boundary of Basin E. The southern boundary roughly follows the property line with 382 Alexander Place. Basin E includes approximately 4.07 acres being tributary from offsite areas. Runoff from Basin E is attenuated in proposed Pond 2. Basin E discharges to tributary C near design point 30

It is noteworthy that there is no development activity proposed in Basin E

#### Basin F

The Basin F watershed is in the southwestern region of the study area and includes approximately 0.97 acres. The watershed includes the approximate limits of lot 9. This basin is located at the top of the existing hill in the southwest corner of the development. Runoff from



this basin will sheet flow from design point 31 along its historic flow path to the south and be intercepted in an existing drainage swale at the top of the commercial retaining wall. This swale drains west toward Via Soleana Lane and is collected in an existing inlet at the top of the wall that is connected to the existing Tributary C drainage outfall system.

#### Tributary C Detention

Stormwater Runoff in the upper reaches of tributary C is captured in the existing channel and drains to the proposed location for Pond 2. This pond is located in regional basins 106 and serves both basins 106 and 107 and includes a total of 162.7 acres at a composite impervious coverage of 11.9%. The pond design assumes that developed tributary flows are provided from the Soleana property, the Cooperhook property, and the Martinez Property. The remainder of the watershed is treated as undeveloped. This pond is proposed as an extended detention basin serving the upper reaches of Tributary C to Plum Creek. The outfall will connect to an existing 72" RCP draining to the west through the existing commercial development.

Pond 2 Summary Detention Table

| EVENT | VOLUME      | RELEASE   | DEPTH   |
|-------|-------------|-----------|---------|
| WQCV  | 1.051 ac-ft | 40 hour   | 2.99 ft |
| EURV  | 1.633 ac-ft | 42 hour   | 3.86 ft |
| V 100 | 6.715 ac-ft | 219.8 cfs | 9.56 ft |

## DRAINAGE DESIGN CRITERIA

### A. Regulations

This analysis is prepared in accordance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual and The Town of Castle Rock Temporary Erosion and Sediment Control Manual. Supplemental data is developed using the Mile High Flood District Criteria Manuals Volumes 1 2 and 3 together with published worksheets for stormwater detention and inlet capacity sizing.

### B. Drainage Studies, Master Plans, Site Constraints

Design for this site also takes into consideration the Regional Basin Tributary C and D Masterplan and the Tributary C & D Flood Hazard area delineation reports addressing the regional flows crossing the Cooperhook subdivision. Immediately south of the Cooperhook subdivision is the Martinez property that includes approximately 6 acres of unplatted land. This analysis builds on the Phase 1 Drainage report for the Alexander Way subdivision. Previous reports in the area include the Design Report for Home Street/Evalena Road Interim Drainage improvements in the Silver Heights subdivision, the Silver Heights



Drainage Study alternative solution to local Drainage problems by Kirkham Michael from 1993, and the Phase III Drainage report for Silver Heights Collings Street, Harvey Street and Evalena Road by HKS dated September 2011.

### C. Hydrology

Hydrology for the site is evaluated using several methods to establish a reliable comparison of runoff and impact on the drainage system accounting for different types of terrain, offsite basin impacts and routing design flow through the development. For the development area, the rational method is used to street, inlet and storm sewer capacity. Given the relative size of the overall basin, the validity of the rational method was compared to a CUHP evaluation for the full watershed. This analysis was used to evaluate a major event time of concentration routing for evaluation of major event street capacity and inlet sizing. The CUHP analysis demonstrated a peak flow of 146 cfs at a time to peak of 40 minutes. A similar watershed includes basins B and C that route for a 45 minute time of concentration and generates a composite 100 year flow of 130.0 cfs. These total values are comparable and considered sufficient to justify the modeling methodology.

### D. Hydraulics

Hydraulics for the storm sewer system was evaluated for the 5 year and 100 year rainfall events using the Bently StormCAD software. Inlet Capacity was evaluated using the MHFD inlet worksheet. Stormwater routing for the major event basin was accomplished by taking the incremental increase in watershed size with the incremental increase in travel time to approximate total runoff in the system. Inlet capacity from upstream basins was subtracted for the composite flow in order to determine an appropriate street flow at each design point.

### E. Water Quality Enhancement

Water quality mitigation for volume is managed through recommendations for impervious coverage that minimize directly connected impervious areas, suggest alternatives for impervious paving, and support drought tolerant green spaces that optimize water usage for the site. In addition to source control, water quality enhancements can occur as part of the area detention proposed for the site and adjoining developments. This approach has the benefit of mitigating various particulate as sedimentation at fore bay structures and at the micro pool for the pond outlet.

The slope areas receiving stormwater runoff from the Diamond Ridge development may include isolated improvements for channelized areas where runoff is currently conveyed. This may include grass buffers, rock check structures, or formal channelization in localized areas for runoff management that control offsite tributary runoff prior to conveyance across the site using surface and piped conveyance solutions.



Water quality mitigation can be addressed through a series of techniques that may include minimizing directly connected impervious areas, identifying areas where grass buffers and infiltration can be encouraged, and source controls including community education for strategies as presented in the Water Efficiency Plan. This plan does not propose structural elements for source control.

There are nine locations identified in this analysis that include tributary areas across downstream lots that exceed the allowable 1.5 x area run-on in accordance with TCR section 3.1.5. In these areas a tract is provided that will be owned and maintained by the HOA for the purpose of drainage conveyance. These areas are identified as tracts A, L, M, N, O, P, Q, R, and S. For Tracts L thru R, the tributary flows are provided from a natural slope face along the eastern side of the project. In these areas, the HOA will work with the homebuilder to coordinate the final elevations and configuration of the channelized flow. Options for conveyance of run-on tributary areas may include concrete channels, rock lined channels or a similar surface reinforces channel lining appropriate to the application and adjacent custom lots. Tracts A and S will include a concrete channel as these areas have a more predictable lot configuration and flow patterns based on the topology of the site.

## STORMWATER MANAGEMENT FACILITY DESIGN

### A. Regulations:

This project is proposed in conformance with the Town of Castle Rock's Storm Drainage Design and Technical Criteria Manual and Stormwater Quality Regulations and supporting information from the Mile High Flood District Drainage Criteria Manuals Volumes 1, 2 and 3.

### B. Stormwater Conveyance Facilities

Stormwater conveyance is accommodated through a combination of curb and gutter flow together with inlets and storm sewer directed to local detention facilities. Inlet and storm sewer spacing is positioned to collect minor event runoff for pipe conveyance. Major event runoff is allowed to bypass a percentage of stormwater runoff in the street to the next downstream facility.

The proposed ponds 1 and 2 are presented as Extended Detention Basins to include staged detention and release of water quality capture volume for a 40 hour detention time frame, EURV addressing an approximate 70 hour attenuation process, and 100 year stormwater detention for peak flow attenuation. Water entering the pond is managed through a combination of forebays and release structured design in conformance with the Mile High Flood District criterion for sediment control and energy dissipation. Access and maintenance paths will be presented with Phase III design incorporating the final configuration for the outlet structure and design parameters.

Pond 1 discharges to the Plum Creek Tributary B outfall through the Silver Heights subdivision. Stormwater exiting the pond is discharged to the existing channel through a



proposed flared end section that will include rip rap outlet protection designed in accordance with the Mile High Flood District requirements. Emergency overflow is provided in the immediate vicinity of the outfall structure and is directly tributary to the existing outfall flow path for Tributary B.

Pond 2 discharges to the existing 72" RCP that was designed and installed in conjunction with the commercial development. This location serves as the regional connection for the upper limits of Basin 106 and is combined with developed flows from the commercial area. Emergency overflow is provided in the immediate vicinity of the outfall structure and is directly tributary to the existing outfall flow path for Tributary C. The flow path includes overflow through the parking lot area for the commercial development with intermittent areas collecting and redirecting overflows to the storm sewer outfall through a combination of inlets and storm sewers.

#### C. Stormwater Storage Facilities

Stormwater detention for the Phase 2 evaluation was accomplished by evaluating the full regional basins tributary to each pond. This includes the assumed development for the Cooperhook property and the Martinez properties at an assumed development rate together with the offsite tributary watershed described as Basin 107 in the Tributary C FHAD.

#### D. Water Quality Enhancement Best Management Practices

This analysis includes six primary watersheds as part of the analysis identified as Basins A, B, C, D, E and F.

Basin A drains through Pond 1 and is attenuated for Peak Flow and water quality. The historic flow path for Basin A is to the north through the Silver Heights subdivision.

Basins B, C, D, E and F drain through proposed Pond 2 and are attenuated for Peak Flow and water quality. The historic flow path for Basins B through F is a combination of the southerly outfall path as formalized with the development and an easterly sheet flow through the Silver Heights subdivision that is being corrected with the development of this project. To mitigate flow through these systems, we are proposing that these flows be directed south to combine with release flow from proposed Pond 2. Sufficient detention will be provided to account for the additional tributary area, and design release will be restricted to maintain predevelopment release from consistent with the original tributary areas. This approach is intended to minimize impact to the existing open channel system. Ultimate design release may be adjusted to minimize the peak condition tributary to the Cooper Hook storm sewer system.



The water quality facilities for the development are sized in accordance with Town of Castle Rock Criteria. In as much as possible, the improvements associated with this project will adhere to the four-step process for water quality mitigation described below. It is noteworthy that the scope of the improvements for this project are specific to the conveyance and attenuation infrastructure proposed with the public improvements. The finished lots will be sold as custom lots with site specific development improvements will be more clearly defined and are beyond the scope of this analysis.

#### Step 1 Reduce Runoff Volume.

Where possible, home builders are encouraged to employ strategies to limit the amount of directly connected impervious flow paths. Some solutions that have been successful for this goal include

This includes directing runoff from roof drainage to naturalized flow paths to encourage infiltration prior to discharge to the street and storm sewer system. Additional strategies may include

- Discharge roof drains and downspouts to a graded section on the lot. This may include turf, mulch or softscape material to encourage infiltration prior to discharge of runoff to the streets.
- Employ the use of previous or partially pervious surfaces for hardscape on the lot such as patios or driveways. This solution will likely require underdrain or foundation protection in accordance with the geotechnical requirements identified for the site.
- Homeowners may consider rain gardens or low impact development strategies that are incorporated into the landscape package at the time of permitting and design of the individual lots.

Step 2 Provide Water quality Capture Volume and Flood control via full spectrum detention. Both ponds proposed on this site employ a strategy of WQCV, EURV and 100 year peak flow attenuation. The ponds incorporate a weir plate and overflow structure intended to provide adequate pond staging time for dissolution of suspended solids as well as time to release flows at a reduced rate to approximate an equivalent urban runoff volume. These criteria are proposed in conformance with the Mike High Flood District recommendations.

#### Step 3: Utilize Stream channel stabilization techniques.

This project includes discharge to the North outfall (tributary B) through an existing channelized system. This outfall in significant areas drains along rear lot property lines across drainage easements through an established path. As such, there is little opportunity to provide physical improvements on the private lots, however part of the strategy is to reduce the volume of runoff by diverting options of the developed basin to the south as described in this report.



The south outfall for Tributary C is connected directly to the existing 72" piped outfall that conveys locally generated runoff from the developed basin across Interstate 25 before discharging to a surface channel as a tributary to Plum Creek.

Stormwater runoff in the upper reaches of Basin 106 will be collected and conveyed to Pond 2 being a shared facility.

#### Step 4 Source Control

As a residential development, pollutants and sources of illicit discharge will be consistent with residential waste. This will include sources such as vehicles, fertilizers and pesticides for yard maintenance.

During the construction phase, the project will employ strategies consistent with the Town of Castle Rock Temporary Erosion and Sediment Control program being prepared under a separate cover.

There are no wetlands associated with the Soleana Development.

Public storm sewer facilities are proposed in public right of way. As such, maintenance and inspection access is provided through the public road system proposed in accordance with Town of Castle Rock criteria. Pond maintenance access is provided along the combination to Tracts A, B and C for Pond 1 providing a corridor for piped access. Pond 2 maintenance access is provided from the Right of way for Alexander Place and Via Soleana Lane with a graded access tract that will be designed with the Phase III construction plans and associated report.

#### D. Floodplain Modification

Development along the Cooper Hook improvements is beyond the scope of this analysis; however a proposal is in development with this report to aggregate the stormwater improvements from the Master Planned basins 106 and 107 for a combined detention at the upper end of the existing 72" outfall pipe. This solution will include a detention and stormwater quality facility. This plan does not propose modifications to Tributary C to Plum Creek.

The final configuration will be evaluated with the Phase III report in conjunction with a hydrology and hydraulic evaluation for the pond area. The area is designated as a floodway in conjunction with the Tributary C FHAD and Masterplan which will likely require a floodplain permit for construction of the shared facility.

#### E. Additional Permitting Requirements

The project is not located on or adjacent to a FEMA designated Floodplain. The project does not impact designated wetlands or waters of the US. Therefore, there are no State or Federal



permitting requirements related to storm water that are required for this project. The site will be subject to Stormwater discharge permits for construction activities together with compliance with the Town of Castle Rock requirements for sediment control and stormwater discharge. The project will also be subject to review through Douglas County for the unincorporated properties to the north and west of the development.

A copy of the Critical Habitat for Preble's Meadow Jumping Mouse for Unit 9 West Plum Creek is provided in appendix D for reference demonstrating that designated Riparian Conservation zones are not impacted with any portion of the development.

## CONCLUSIONS

### A. Compliance with Standards

This analysis was developed in compliance with the Town of Castle Rock Stormwater criteria and includes site-specific revisions proposed for the improvement of offsite drainage conditions. The approach for stormwater detention is to regionalize the improvements to optimize the use of space in the overall watershed and to make the expenditure of resources as efficient as possible.

### B. Variances

This report includes a recommendation that we redirect 11.5 acres from Basin B to the south through the Cooper Hook storm sewer system. This recommendation alleviates some pressure from the existing Silver Heights Drainage system, however, poses as a deviation from the study completed by RESPEC. A degree of over detention may be necessary to mitigate this proposed diversion.

In addition, as part of the subsequent analysis for this site and the proposals for development on the adjacent areas, we may negotiate a combined drainage facility serving the local developments along Alexander Place. This determination will be complete with the presentation of the Phase 3 drainage study subsequent to this report. Pond Criteria and design flows in this report reflect the shared uses approach.

A third variance is requested addressing the exemption for Basin F1 representing lot 9 with the proposed development. This area as a final lot will be 1 acre or less in tributary area and that is located in an isolated portion of the watershed that is accessed from a flag configuration. The historic drainage includes a 20' natural fall across the lot to a localized low point on the property line of the existing lot. The proposal for discharge from this basin preserves the historic drainage patterns while minimizing areas of disturbance and untreated discharge.



## REFERENCES

1. Storm Drainage Design and Technical Criteria Manual, Town of Castle Rock, June 2019
2. Mile High Flood District Urban Storm Drainage Criteria Manual Volumes 1, 2 and 3
3. Phase III Drainage Report for Cooper Hook/Main Place Filing No. 1, Galloway Romero & Associates, August 2001
4. Silver Heights Drainage Study Alternative Solutions to Local Drainage Problems. Kirkham Michael and Associates, January 1994
5. Phase III Drainage Report for Silver Heights – Collins Street, Harvey Street and Evalena Road Drainage Improvements, Harris Kocher Smith September 8, 2011
6. Design Report for Home Street/Evalena Road Interim Drainage Improvements, Muller Engineering Company, July 2015
7. FIRM Panel number 08035C0186G Douglas County Colorado Dated March 16, 2016.
8. Flood Hazard Area Delineation Tributary C and D Watersheds – Respec, October 2014



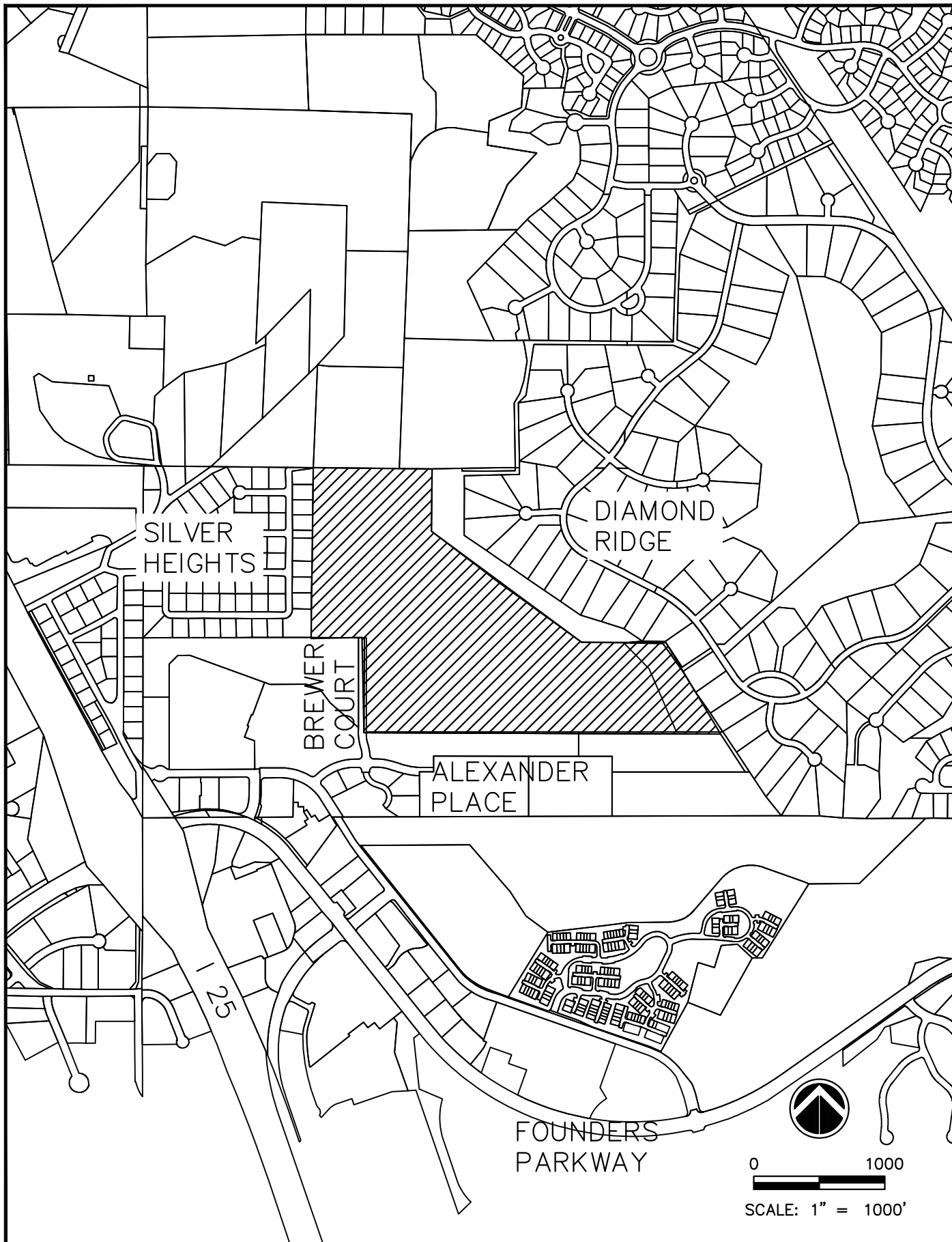
# Appendix A

Related Graphs Figures and Tables

- Vicinity Map
- FIRM Pannel
- FHAD Excerpts
- SCS soil survey



11/19/21 G:\2020\20002764.00\DESIGN\CIVIL\C3D\EXHIBITCONCEPT\20002764 VIC MAP.DWG



323 N. LEROUX STREET  
SUITE 201  
FLAGSTAFF, AZ 86001

PH: 928.255.0410  
www.imegcorp.com

ALEXANDER WAY

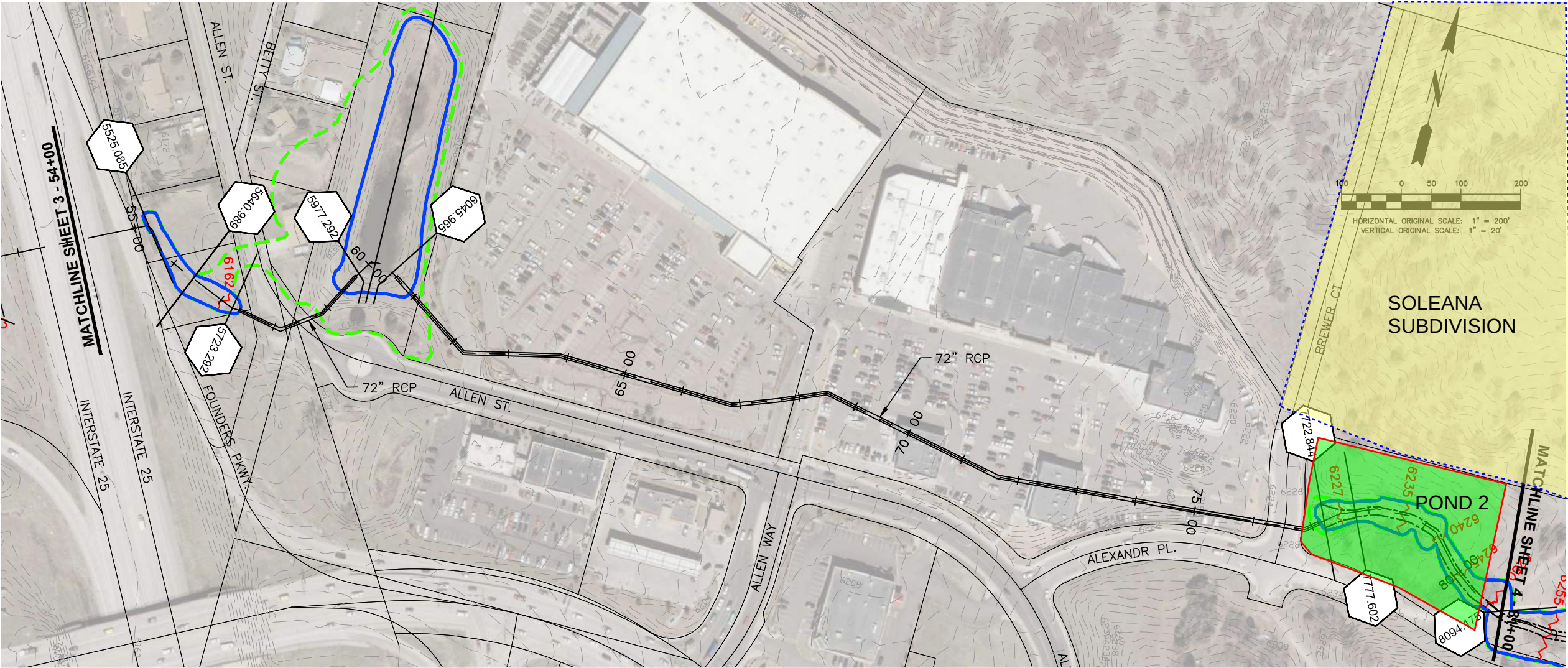
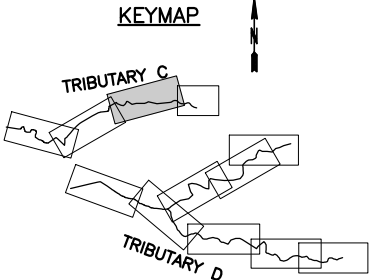
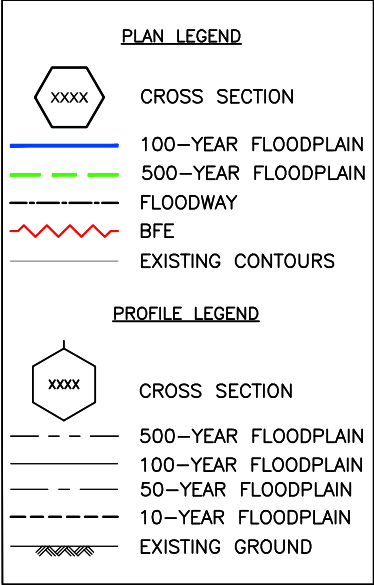
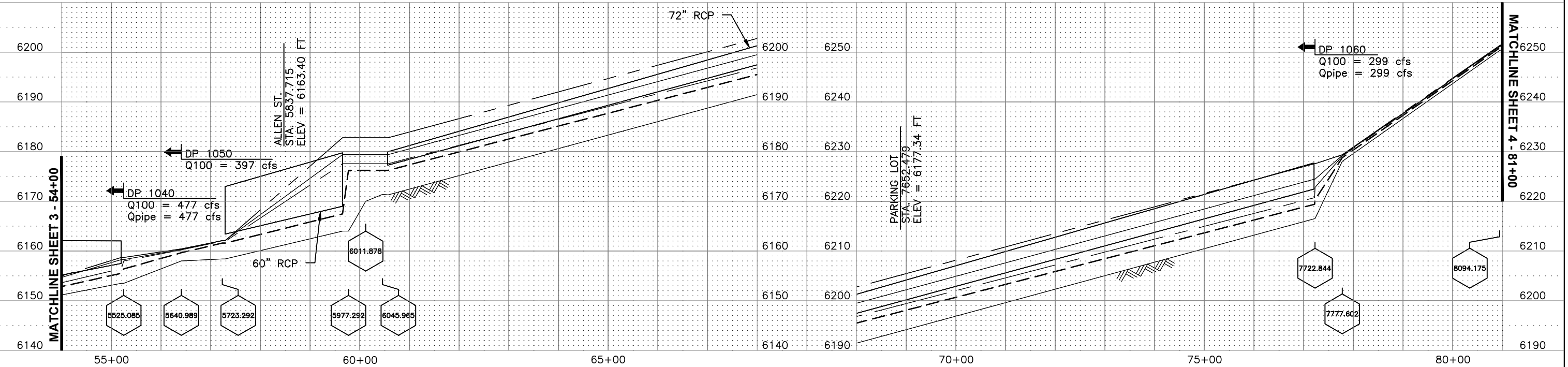
CASTLE ROCK, CO

VICINITY MAP

EXHIBIT



NAME: Z:\Castle Rock\TCR Planning Studies\CAD\Draw-Flood\Tributary C FHAD P & P.dwg  
PLOT DATE: Jul 25, 2014 9:26am



| NO. | DATE | DESCRIPTION | BY |
|-----|------|-------------|----|
|     |      |             |    |
|     |      |             |    |
|     |      |             |    |
|     |      |             |    |

|          |     |      |        |
|----------|-----|------|--------|
| DESIGNED | WPF | DATE | 7/8/13 |
| DRAWN    | ACT | DATE | 7/8/13 |
| CHECKED  | RCO | DATE | 7/8/13 |



720 S. COLORADO BLVD. SUITE 4105  
DENVER, CO 80246  
PH: (303) 757-3655

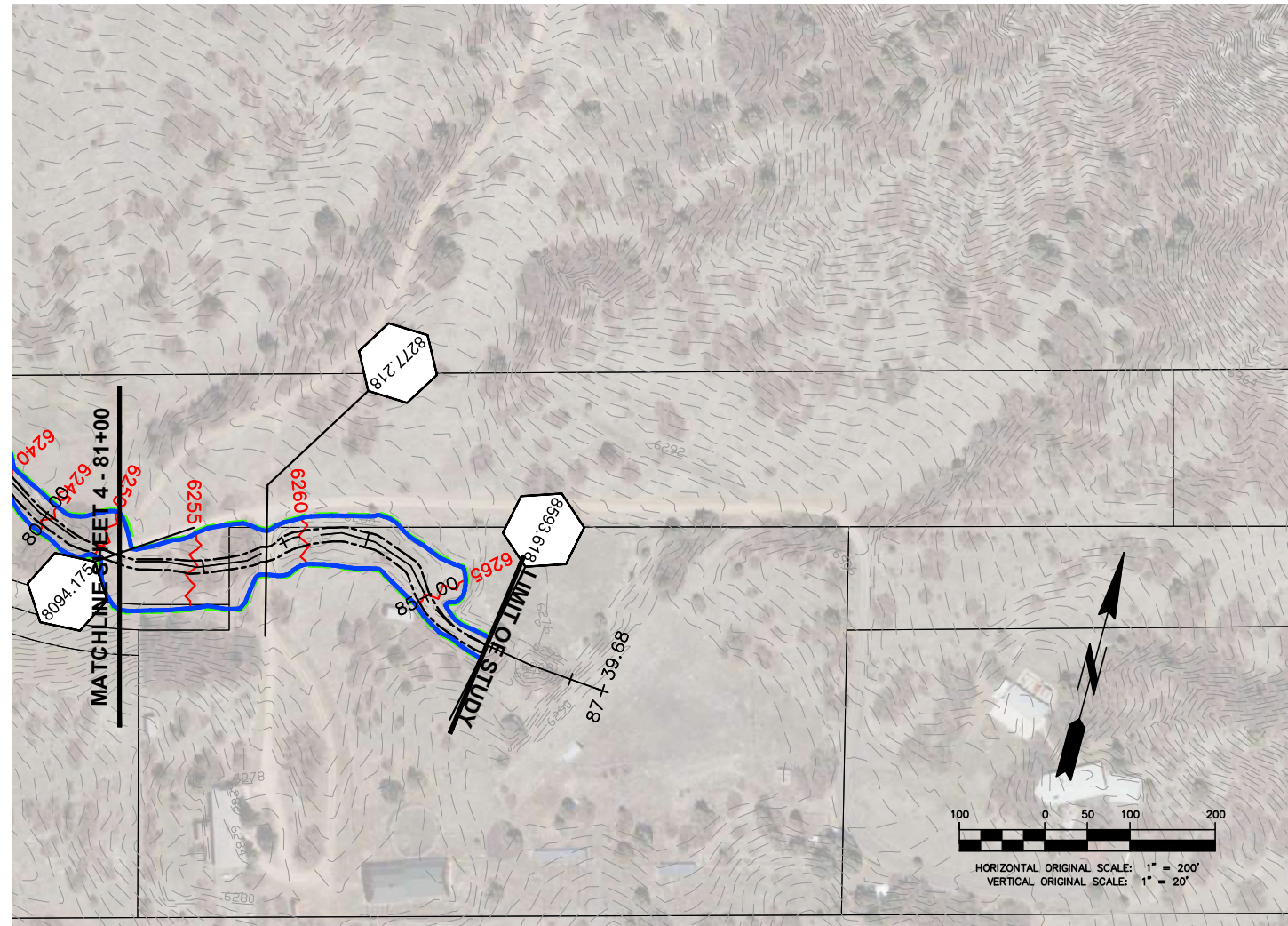
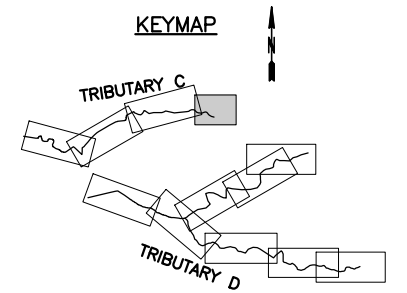
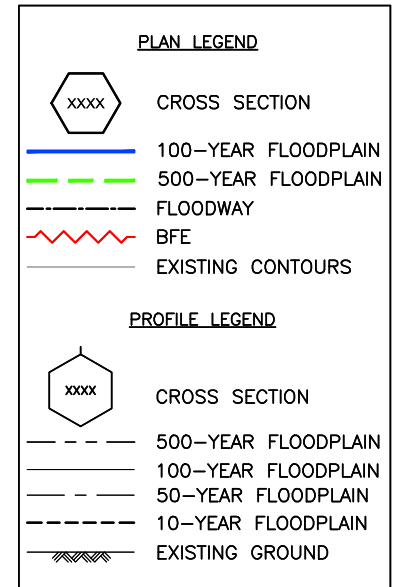
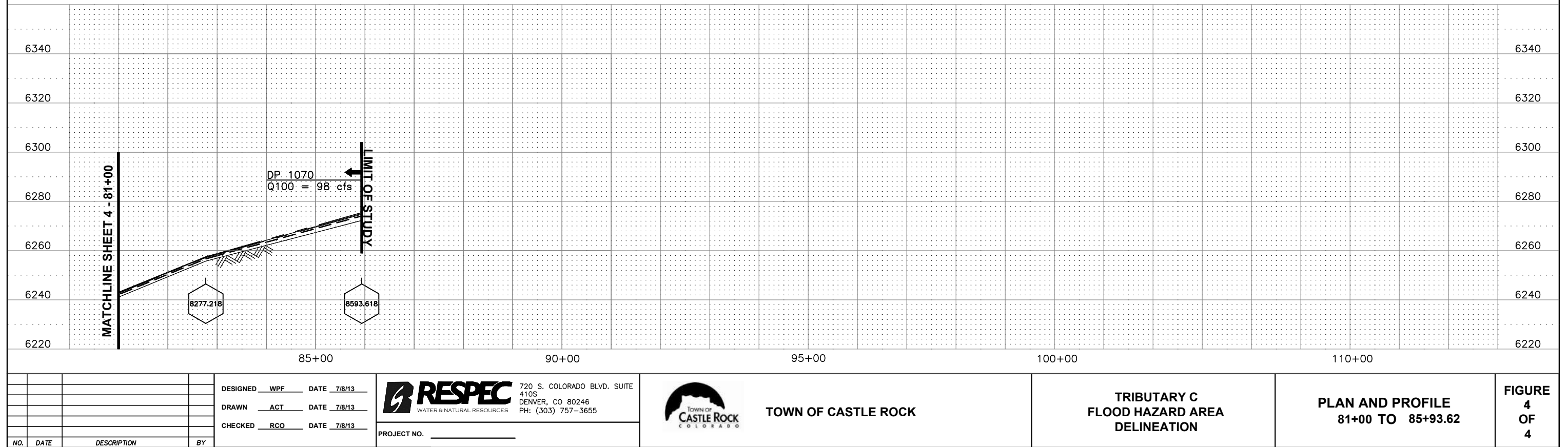


TOWN OF CASTLE ROCK

TRIBUTARY C  
FLOOD HAZARD AREA  
DELINEATION

PLAN AND PROFILE  
54+00 TO 81+00

FIGURE  
3  
OF  
4



# Soil Map—Castle Rock Area, Colorado



Map Scale: 1:5,990 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

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



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

12/15/2020  
Page 1 of 3

## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

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

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: Castle Rock Area, Colorado

Survey Area Data: Version 13, Jun 5, 2020

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

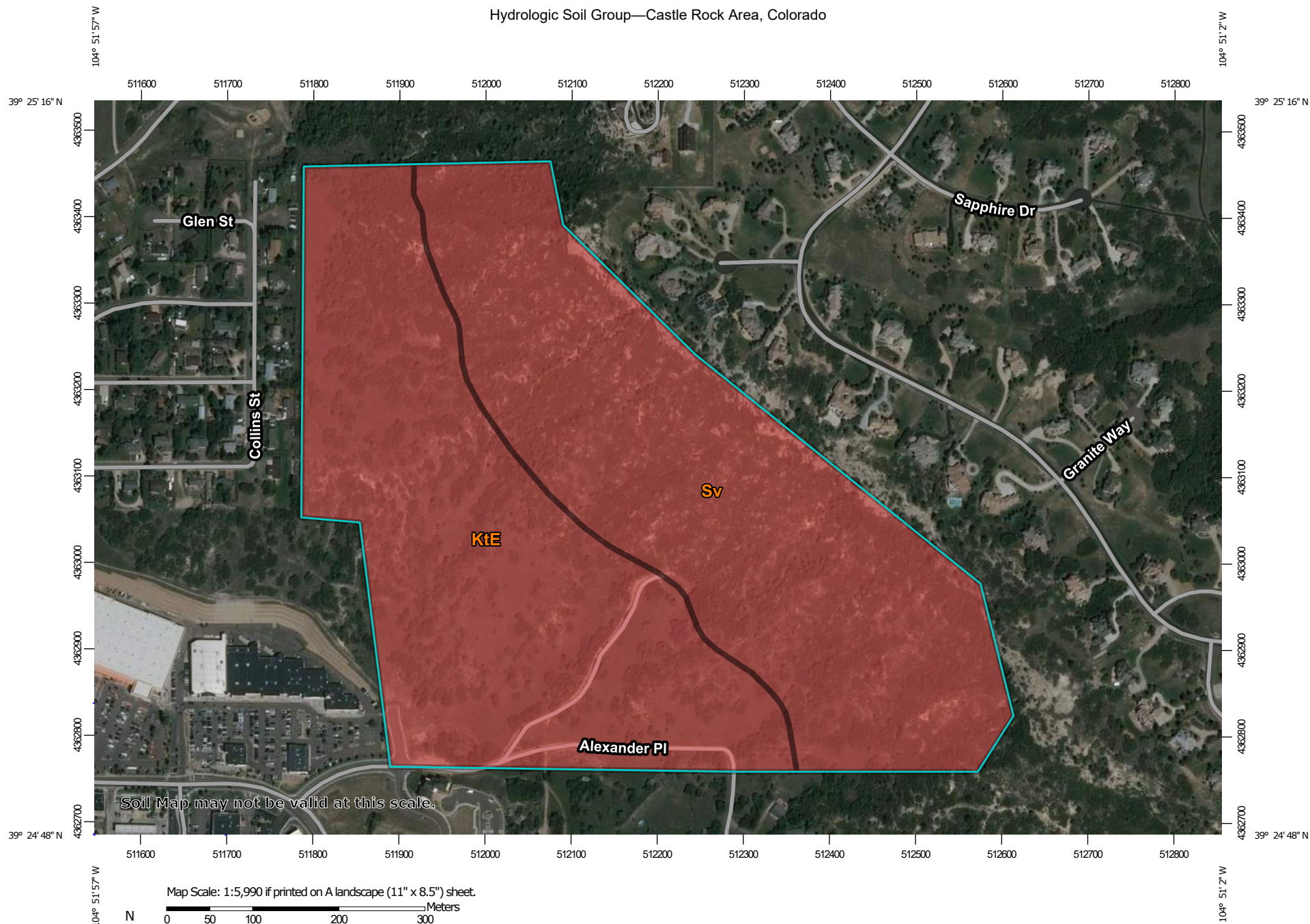
Date(s) aerial images were photographed: Jul 24, 2018—Nov 19, 2018

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

## Map Unit Legend

| Map Unit Symbol                    | Map Unit Name                            | Acres in AOI | Percent of AOI |
|------------------------------------|------------------------------------------|--------------|----------------|
| KtE                                | Kutch sandy loam, 5 to 20 percent slopes | 47.8         | 49.1%          |
| Sv                                 | Stony steep land                         | 49.5         | 50.9%          |
| <b>Totals for Area of Interest</b> |                                          | <b>97.3</b>  | <b>100.0%</b>  |

# Hydrologic Soil Group—Castle Rock Area, Colorado



Map Scale: 1:5,990 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

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



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

12/15/2020  
Page 1 of 4

## 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: Castle Rock Area, Colorado  
 Survey Area Data: Version 13, Jun 5, 2020

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

Date(s) aerial images were photographed: Jul 24, 2018—Nov 19, 2018

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 |
|------------------------------------|------------------------------------------|--------|--------------|----------------|
| KtE                                | Kutch sandy loam, 5 to 20 percent slopes | D      | 47.8         | 49.1%          |
| Sv                                 | Stony steep land                         | D      | 49.5         | 50.9%          |
| <b>Totals for Area of Interest</b> |                                          |        | <b>97.3</b>  | <b>100.0%</b>  |

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

# Appendix B

## Hydrologic Calculations

- Historic Basins
- Phase 2 Rational Calculations
- Tract Flow Calculations
- Masterplan Excerpts



**Soleana**  
**Phase II Drainage Report**  
**Historic Basins A and B**

**STANDARD FORM SF-2**

REFERENCE MHFD TABLE 6-2

**Runoff Calculations****Time of Concentration**

Watercourse Coefficient

Heavy Meadow 2.5

Short Grass Pasture &amp; Lawns 7.0

Grassed Waterway 15.0

Tillage/field 5.0

Nearly Bare Ground 10.0

Paved Area &amp; Shallow Gutter 20.0

|              | SUB-BASIN DATA |          |       |      | INITIAL / OVERLAND TIME |         |          | TRAVEL TIME T(t) |         |        |              |           | T(c) CHECK (URBANIZED BASINS) |              |        | FINAL T(c) |
|--------------|----------------|----------|-------|------|-------------------------|---------|----------|------------------|---------|--------|--------------|-----------|-------------------------------|--------------|--------|------------|
| DESIGN POINT | DRAIN BASIN    | AREA ac. | % I   | C(5) | Length ft.              | Slope % | T(i) min | Length ft.       | Slope % | Coeff. | Velocity fps | T(t) min. | COMP. T(c)                    | TOTAL LENGTH | EQ 6-5 | min.       |
| 1            | HA             | 11.06    | 2.0%  | 0.05 | 70                      | 2.0     | 12.8     | 240              | 10.0    | 2.5    | 0.8          | 5.1       | 17.9                          | 310          | 25.8   | 17.9       |
| 2            | HB             | 12.42    | 2.0%  | 0.05 | 200                     | 10.0    | 12.6     | 400              | 10.0    | 2.5    | 0.8          | 8.4       | 21.0                          | 600          | 26.0   | 21.0       |
| 3            | DA             | 8.15     | 15.2% | 0.16 | 70                      | 2.0     | 11.4     | 240              | 10.0    | 2.5    | 0.8          | 5.1       | 16.5                          | 310          | 23.6   | 16.5       |

**Soleana**  
**Phase II Drainage Report**  
**Historic Basins A and B**

**STANDARD FORM SF-3**REFERENCE: MHFD Volume 1**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 1.43

(Rational Method Procedure)

**Design Storm 5 Year**

| BASIN INFORMATION |             |          |              | DIRECT RUNOFF |       |         |       | TOTAL RUNOFF |           |         |       | REMARKS |
|-------------------|-------------|----------|--------------|---------------|-------|---------|-------|--------------|-----------|---------|-------|---------|
| DESIGN POINT      | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | T(c) min     | SUM C x A | I in/hr | Q cfs |         |
| 1                 | HA          | 11.06    | 0.05         | 17.9          | 0.57  | 2.98    | 1.7   |              |           |         |       | HA HB   |
| 2                 | HB          | 12.42    | 0.05         | 21.0          | 0.64  | 2.74    | 1.7   | 21.0         | 1.21      | 2.74    | 3.3   |         |
| 3                 | DA          | 8.15     | 0.16         | 16.5          | 1.30  | 3.10    | 4.0   |              |           |         |       |         |

**Soleana**  
**Phase 2 Drainage Report**

**STANDARD FORM SF-2**

REFERENCE MHFD TABLE 6-2

Watercourse Coefficient

**Runoff Calculations**

Heavy Meadow 2.5

Short Grass Pasture &amp; Lawns 7.0

Grassed Waterway 15.0

**Time of Concentration**

Tillage/field 5.0

Nearly Bare Ground 10.0

Paved Area &amp; Shallow Gutter 20.0

| DESIGN POINT | SUB-BASIN DATA |          |       |      | INITIAL / OVERLAND TIME |         |          | TRAVEL TIME T(t) |         |        |              | T(t) min. | T(c) CHECK (URBANIZED BASINS) |              |        | FINAL T(c) |
|--------------|----------------|----------|-------|------|-------------------------|---------|----------|------------------|---------|--------|--------------|-----------|-------------------------------|--------------|--------|------------|
|              | DRAIN BASIN    | AREA ac. | % I   | C(5) | Length ft.              | Slope % | T(i) min | Length ft.       | Slope % | Coeff. | Velocity fps |           | COMP. T(c)                    | TOTAL LENGTH | EQ 6-5 | min.       |
| 1            | A1             | 0.97     | 4.9%  | 0.07 | 70                      | 2.0     | 12.5     | 240              | 10.0    | 2.5    | 0.8          | 5.1       | 17.6                          | 310          | 25.3   | 17.6       |
| 2            | A2             | 2.22     | 2.0%  | 0.05 | 200                     | 10.0    | 12.6     | 400              | 10.0    | 2.5    | 0.8          | 8.4       | 21.0                          | 600          | 26.0   | 21.0       |
| 3            | A3             | 5.06     | 18.3% | 0.18 | 70                      | 2.0     | 11.1     | 250              | 10.0    | 7.0    | 2.2          | 1.9       | 13.0                          | 320          | 23.0   | 13.0       |
| 4            | B1             | 0.97     | 3.8%  | 0.07 | 200                     | 10.0    | 12.4     | 400              | 10.0    | 10.0   | 3.2          | 2.1       | 14.5                          | 600          | 25.7   | 14.5       |
| 5            | B2             | 8.07     | 18.9% | 0.19 | 300                     | 10.0    | 13.4     | 800              | 1.0     | 20.0   | 2.0          | 6.7       | 20.1                          | 1100         | 24.4   | 20.1       |
| 6            | B3             | 4.10     | 30.0% | 0.28 | 250                     | 5.0     | 13.9     | 400              | 5.0     | 20.0   | 4.5          | 1.5       | 15.4                          | 650          | 21.3   | 15.4       |
| 7            | B4             | 0.83     | 30.0% | 0.28 | 100                     | 2.0     | 11.9     | 550              | 5.0     | 20.0   | 4.5          | 2.0       | 13.9                          | 650          | 21.3   | 13.9       |
| 8            | B5             | 4.01     | 40.9% | 0.37 | 200                     | 10.0    | 8.8      | 800              | 8.0     | 20.0   | 5.7          | 2.4       | 11.2                          | 1000         | 19.4   | 11.2       |
| 9            | B6             | 1.24     | 49.9% | 0.44 | 50                      | 2.0     | 6.7      | 600              | 5.0     | 20.0   | 4.5          | 2.2       | 8.9                           | 650          | 17.8   | 8.9        |
| 10           | B7             | 2.04     | 27.7% | 0.26 | 50                      | 2.0     | 8.6      | 650              | 8.0     | 20.0   | 5.7          | 1.9       | 10.5                          | 700          | 21.6   | 10.5       |
| 11           | B8             | 2.59     | 30.0% | 0.28 | 50                      | 2.0     | 8.4      | 650              | 8.0     | 20.0   | 5.7          | 1.9       | 10.3                          | 700          | 21.2   | 10.3       |
| 12           | B9             | 1.09     | 30.0% | 0.28 | 200                     | 10.0    | 9.8      | 800              | 8.0     | 20.0   | 5.7          | 2.4       | 12.2                          | 1000         | 21.3   | 12.2       |
| 13           | C1.1           | 5.79     | 5.2%  | 0.08 | 200                     | 5.0     | 15.5     | 700              | 6.0     | 7.0    | 1.7          | 6.8       | 22.3                          | 900          | 25.7   | 22.3       |
| 14           | C1.2           | 7.40     | 12.8% | 0.14 | 100                     | 10.0    | 8.2      | 900              | 6.0     | 7.0    | 1.7          | 8.7       | 16.9                          | 1000         | 24.5   | 16.9       |
| 15           | C2.1           | 3.72     | 5.2%  | 0.08 | 250                     | 5.0     | 17.3     | 250              | 8.0     | 7.0    | 2.0          | 2.1       | 19.4                          | 500          | 25.4   | 19.4       |
| 16           | C2.2           | 4.99     | 4.7%  | 0.07 | 150                     | 5.0     | 13.5     | 400              | 5.0     | 7.0    | 1.6          | 4.3       | 17.8                          | 550          | 25.6   | 17.8       |

**Soleana**  
**Phase 2 Drainage Report**



REFERENCE MHFD TABLE 6-2

Watercourse Coefficient

**Runoff Calculations**

Heavy Meadow 2.5

Short Grass Pasture &amp; Lawns 7.0

Grassed Waterway 15.0

**Time of Concentration**

Tillage/field 5.0

Nearly Bare Ground 10.0

Paved Area &amp; Shallow Gutter 20.0

| DESIGN POINT | SUB-BASIN DATA |          |       |      | INITIAL / OVERLAND TIME |         |          | TRAVEL TIME T(t) |         |        |              | T(t) min. | T(c) CHECK (URBANIZED BASINS) |              |        | FINAL T(c) min. |
|--------------|----------------|----------|-------|------|-------------------------|---------|----------|------------------|---------|--------|--------------|-----------|-------------------------------|--------------|--------|-----------------|
|              | DRAIN BASIN    | AREA ac. | % I   | C(5) | Length ft.              | Slope % | T(i) min | Length ft.       | Slope % | Coeff. | Velocity fps |           | COMP. T(c)                    | TOTAL LENGTH | EQ 6-5 |                 |
| 17           | C2.3           | 3.67     | 4.4%  | 0.07 | 250                     | 5.0     | 17.4     | 150              | 8.0     | 7.0    | 2.0          | 1.3       | 18.7                          | 400          | 25.5   | 18.7            |
| 18           | C2.4           | 6.72     | 11.7% | 0.13 | 250                     | 10.0    | 13.0     | 550              | 5.0     | 7.0    | 1.6          | 5.9       | 18.9                          | 800          | 24.6   | 18.9            |
| 19           | C3             | 1.98     | 30.0% | 0.28 | 200                     | 10.0    | 9.8      | 550              | 5.0     | 20.0   | 4.5          | 2.0       | 11.8                          | 750          | 21.3   | 11.8            |
| 20           | C4             | 2.15     | 30.1% | 0.28 | 200                     | 10.0    | 9.8      | 550              | 5.0     | 20.0   | 4.5          | 2.0       | 11.8                          | 750          | 21.3   | 11.8            |
| 21           | C5             | 4.72     | 30.0% | 0.28 | 200                     | 10.0    | 9.9      | 550              | 5.0     | 20.0   | 4.5          | 2.0       | 11.9                          | 750          | 21.3   | 11.9            |
| 22           | C6             | 0.58     | 30.2% | 0.28 | 100                     | 2.0     | 11.9     | 1550             | 8.0     | 20.0   | 5.7          | 4.6       | 16.5                          | 1650         | 21.6   | 16.5            |
| 23           | C7             | 1.18     | 14.7% | 0.16 | 30                      | 2.0     | 7.5      | 150              | 8.0     | 20.0   | 5.7          | 0.4       | 7.9                           | 180          | 23.6   | 7.9             |
| 24           | D1             | 2.14     | 17.6% | 0.18 | 200                     | 2.0     | 18.9     | 200              | 10.0    | 10.0   | 3.2          | 1.1       | 20.0                          | 400          | 23.2   | 20.0            |
| 25           | D2             | 6.28     | 7.7%  | 0.10 | 200                     | 10.0    | 12.0     | 700              | 2.0     | 20.0   | 2.8          | 4.1       | 16.1                          | 900          | 25.7   | 16.1            |
| 26           | D3             | 1.74     | 30.0% | 0.28 | 50                      | 2.0     | 8.4      | 700              | 2.0     | 20.0   | 2.8          | 4.1       | 12.5                          | 750          | 21.6   | 12.5            |
| 27           | D4             | 3.81     | 50.0% | 0.44 | 30                      | 2.0     | 5.2      | 500              | 4.0     | 20.0   | 4.0          | 2.1       | 7.3                           | 530          | 17.8   | 7.3             |
| 28           | D5             | 3.83     | 23.5% | 0.23 | 150                     | 10.0    | 9.1      | 350              | 10.0    | 10.0   | 3.2          | 1.8       | 10.9                          | 500          | 22.2   | 10.9            |
| 29           | E1             | 3.35     | 2.0%  | 0.05 | 150                     | 10.0    | 10.9     | 650              | 10.0    | 10.0   | 3.2          | 3.4       | 14.3                          | 800          | 26.1   | 14.3            |
| 30           | E2             | 4.59     | 2.0%  | 0.05 | 150                     | 10.0    | 10.9     | 450              | 10.0    | 10.0   | 3.2          | 2.4       | 13.3                          | 600          | 26.0   | 13.3            |
| 31           | F1             | 0.97     | 30.1% | 0.28 | 150                     | 10.0    | 8.5      | 450              | 10.0    | 10.0   | 3.2          | 2.4       | 10.9                          | 600          | 21.1   | 10.9            |
|              |                |          |       |      |                         |         |          |                  |         |        |              |           |                               |              |        |                 |

**Soleana**  
**Phase 2 Drainage Report**

**STANDARD FORM SF-3**REFERENCE: MHFD Volume 1**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 1.43

(Rational Method Procedure)

**Design Storm 5 Year**

| BASIN INFORMATION |             |          |              | DIRECT RUNOFF |       |         |       | Travel Time |              |         | TOTAL RUNOFF |           |         |       | REMARKS    |
|-------------------|-------------|----------|--------------|---------------|-------|---------|-------|-------------|--------------|---------|--------------|-----------|---------|-------|------------|
| DESIGN POINT      | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | Length ft   | Velocity fps | Tt Min. | T(c) min     | SUM C x A | I in/hr | Q cfs |            |
| 1                 | A1          | 0.97     | 0.07         | 17.6          | 0.07  | 3.01    | 0.2   |             |              |         |              |           |         |       |            |
| 2                 | A2          | 2.22     | 0.05         | 21.0          | 0.11  | 2.74    | 0.3   |             |              |         | 21.0         | 0.19      | 2.74    | 0.5   | A1, A2     |
| 3                 | A3          | 5.06     | 0.18         | 13.0          | 0.94  | 3.47    | 3.2   |             |              |         | 21.0         | 1.12      | 2.74    | 3.1   | A1 thru A3 |
| 4                 | B1          | 0.97     | 0.07         | 14.5          | 0.06  | 3.30    | 0.2   |             |              |         |              |           |         |       |            |
| 5                 | B2          | 8.07     | 0.19         | 20.1          | 1.53  | 2.81    | 4.3   | 1100.0      | 2.0          | 9.2     | 29.2         | 1.60      | 2.28    | 3.6   | B1, B2     |
| 6                 | B3          | 4.10     | 0.28         | 15.4          | 1.15  | 3.21    | 3.7   | 650.0       | 4.5          | 2.4     | 31.7         | 2.75      | 2.17    | 6.0   | B1 thru B3 |
| 7                 | B4          | 0.83     | 0.28         | 13.9          | 0.23  | 3.36    | 0.8   |             |              |         | 31.7         | 2.98      | 2.17    | 6.5   | B1 thru B4 |
| 8                 | B5          | 4.01     | 0.37         | 11.2          | 1.49  | 3.70    | 5.5   | 1000.0      | 5.7          | 2.9     | 34.6         | 4.47      | 2.06    | 9.2   | B1 thru B5 |
| 9                 | B6          | 1.24     | 0.44         | 8.9           | 0.55  | 4.04    | 2.2   |             |              |         | 34.6         | 3.54      | 2.06    | 7.3   | B1 thru B6 |
| 10                | B7          | 2.04     | 0.26         | 10.5          | 0.53  | 3.79    | 2.0   |             |              |         | 34.6         | 4.07      | 2.06    | 8.4   | B1 thru B7 |
| 11                | B8          | 2.59     | 0.28         | 10.3          | 0.73  | 3.82    | 2.8   |             |              |         |              |           |         |       |            |
| 12                | B9          | 1.09     | 0.28         | 12.2          | 0.31  | 3.57    | 1.1   | 1000.0      | 2.4          | 7.1     | 17.4         | 1.03      | 3.02    | 3.1   | B8, B9     |
|                   |             |          |              |               |       |         |       |             |              |         | 34.6         | 6.59      | 2.06    | 13.6  | B1 thru B9 |
| 13                | C1.1        | 5.79     | 0.08         | 22.3          | 0.45  | 2.65    | 1.2   |             |              |         |              |           |         |       |            |
| 14                | C1.2        | 7.40     | 0.14         | 16.9          | 1.04  | 3.06    | 3.2   | 1000.0      | 1.7          | 9.7     | 32.0         | 1.49      | 2.16    | 3.2   | C1.1, C1.2 |
| 15                | C2.1        | 3.72     | 0.08         | 19.4          | 0.29  | 2.86    | 0.8   |             |              |         |              |           |         |       |            |
| 16                | C2.2        | 4.99     | 0.07         | 17.8          | 0.37  | 2.99    | 1.1   | 550.0       | 1.6          | 5.9     | 25.3         | 0.66      | 2.48    | 1.6   | C2.1,2.2   |

**Soleana**  
**Phase 2 Drainage Report**



REFERENCE: MHFD Volume 1

**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 1.43

(Rational Method Procedure)

**Design Storm 5 Year**

| BASIN INFORMATON |             |          |              | DIRECT RUNOFF |       |         |       | Travel Time |              |         | TOTAL RUNOFF |           |         |       | REMARKS    |
|------------------|-------------|----------|--------------|---------------|-------|---------|-------|-------------|--------------|---------|--------------|-----------|---------|-------|------------|
| DESIGN POINT     | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | Length ft   | Velocity fps | Tt Min. | T(c) min     | SUM C x A | I in/hr | Q cfs |            |
| 17               | C2.3        | 3.67     | 0.07         | 18.7          | 0.26  | 2.92    | 0.8   |             |              |         |              |           |         |       |            |
| 18               | C2.4        | 6.72     | 0.13         | 18.9          | 0.88  | 2.90    | 2.5   | 800.0       | 1.6          | 8.5     | 33.8         | 1.79      | 2.09    | 3.7   | C2         |
|                  |             |          |              |               |       |         |       |             |              |         | 33.8         | 3.28      | 2.09    | 6.9   | C1 thru C2 |
| 19               | C3          | 1.98     | 0.28         | 11.8          | 0.56  | 3.61    | 2.0   |             |              |         | 33.8         | 3.84      | 2.09    | 8.0   | C1 thru C3 |
| 20               | C4          | 2.15     | 0.28         | 11.8          | 0.61  | 3.61    | 2.2   | 750.0       | 4.5          | 2.8     | 36.6         | 4.44      | 1.99    | 8.8   | C1 thru C4 |
| 21               | C5          | 4.72     | 0.28         | 11.9          | 1.33  | 3.60    | 4.8   | 750.0       | 4.5          | 2.8     | 39.4         | 5.77      | 1.90    | 11.0  | C1 thru C5 |
| 22               | C6          | 0.58     | 0.28         | 16.5          | 0.16  | 3.10    | 0.5   | 800.0       | 5.7          | 2.4     | 41.7         | 5.93      | 1.83    | 10.9  | C1 thru C6 |
| 23               | C7          | 1.18     | 0.16         | 7.9           | 0.18  | 4.21    | 0.8   |             |              |         | 41.7         | 6.1       | 1.83    | 11.2  | C1 thru C7 |
| 24               | D1          | 2.14     | 0.18         | 20.0          | 0.38  | 2.82    | 1.1   |             |              |         |              |           |         |       |            |
| 25               | D2          | 6.28     | 0.10         | 16.1          | 0.62  | 3.14    | 1.9   | 900.0       | 2.8          | 5.3     | 25.3         | 1.00      | 2.48    | 2.5   | D1,D2      |
| 26               | D3          | 1.74     | 0.28         | 12.5          | 0.49  | 3.52    | 1.7   | 750.0       | 2.8          | 4.4     | 29.7         | 1.49      | 2.26    | 3.4   | D1 thru D3 |
| 27               | D4          | 3.81     | 0.44         | 7.3           | 1.69  | 4.34    | 7.4   | 530.0       | 4.0          | 2.2     | 31.9         | 3.18      | 2.16    | 6.9   | D1 thru D4 |
| 28               | D5          | 3.83     | 0.23         | 10.9          | 0.87  | 3.73    | 3.3   | 500.0       | 3.2          | 2.6     | 34.5         | 4.06      | 2.06    | 8.4   | D1 thru D6 |
| 29               | E1          | 3.35     | 0.05         | 14.3          | 0.17  | 3.32    | 0.6   |             |              |         |              |           |         |       |            |
| 30               | E2          | 4.59     | 0.05         | 13.3          | 0.24  | 3.43    | 0.8   | 600.0       | 3.2          | 3.2     | 17.5         | 0.41      | 3.01    | 1.2   | E1,E2      |
| 31               | F1          | 0.97     | 0.28         | 10.9          | 0.27  | 3.74    | 1.0   |             |              |         |              |           |         |       |            |
|                  |             | 67.8     |              |               |       |         |       |             |              |         | 41.7         | 12.71     | 1.83    | 23.3  | Sum B & C  |

**Soleana**  
**Phase 2 Drainage Report**

**STANDARD FORM SF-3**REFERENCE: MHFD Volume 1**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 2.60

(Rational Method Procedure)

**Design Storm 100 Year**

| BASIN INFORMATON |             |          |              | DIRECT RUNOFF |       |         |       | TOTAL RUNOFF |           |         |       | REMARKS    |
|------------------|-------------|----------|--------------|---------------|-------|---------|-------|--------------|-----------|---------|-------|------------|
| DESIGN POINT     | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | T(c) min     | SUM C x A | I in/hr | Q cfs |            |
| 1                | A1          | 0.97     | 0.50         | 17.6          | 0.49  | 5.47    | 2.7   |              |           |         |       |            |
| 2                | A2          | 2.22     | 0.49         | 21.0          | 1.09  | 4.98    | 5.4   | 21.0         | 1.58      | 4.98    | 7.9   | A1, A2     |
| 3                | A3          | 5.06     | 0.56         | 13.0          | 2.83  | 6.31    | 17.8  | 21.0         | 4.41      | 4.98    | 22.0  | A1 thru A3 |
| 4                | B1          | 0.97     | 0.50         | 14.5          | 2.49  | 6.00    | 14.9  |              |           |         |       |            |
| 5                | B2          | 8.07     | 0.56         | 20.1          | 4.53  | 5.11    | 23.1  | 29.2         | 7.02      | 4.14    | 29.1  | B1, B2     |
| 6                | B3          | 4.10     | 0.61         | 15.4          | 2.49  | 5.83    | 14.5  | 31.7         | 9.51      | 3.95    | 37.6  | B1 thru B3 |
| 7                | B4          | 0.83     | 0.61         | 13.9          | 0.50  | 6.11    | 3.1   | 31.7         | 10.01     | 3.95    | 39.6  | B1 thru B4 |
| 8                | B5          | 4.01     | 0.65         | 11.2          | 2.61  | 6.73    | 17.6  | 34.6         | 12.63     | 3.74    | 47.3  | B1 thru B5 |
| 9                | B6          | 1.24     | 0.69         | 8.9           | 0.85  | 7.34    | 6.3   | 34.6         | 10.87     | 3.74    | 40.7  | B1 thru B6 |
| 10               | B7          | 2.04     | 0.60         | 10.5          | 1.22  | 6.89    | 8.4   | 34.6         | 12.09     | 3.74    | 45.3  | B1 thru B7 |
| 11               | B8          | 2.59     | 0.61         | 10.3          | 1.57  | 6.95    | 10.9  |              |           |         |       |            |
| 12               | B9          | 1.09     | 0.61         | 12.2          | 0.66  | 6.49    | 4.3   | 17.4         | 2.23      | 5.49    | 12.3  | B8, B9     |
|                  |             |          |              |               |       |         |       | 34.6         | 24.94     | 3.74    | 93.4  | B1 thru B9 |
| 13               | C1.1        | 5.79     | 0.51         | 22.3          | 2.93  | 4.83    | 14.1  |              |           |         |       |            |
| 14               | C1.2        | 7.40     | 0.54         | 16.9          | 3.97  | 5.56    | 22.1  | 32.0         | 6.90      | 3.92    | 27.1  | C1.1, C1.2 |
| 15               | C2.1        | 3.72     | 0.51         | 19.4          | 1.88  | 5.20    | 9.8   |              |           |         |       |            |
| 16               | C2.2        | 4.99     | 0.50         | 17.8          | 2.51  | 5.44    | 13.7  | 25.3         | 4.39      | 4.50    | 19.8  | C2.1,2.2   |

**Soleana**  
**Phase 2 Drainage Report**



REFERENCE: MHFD Volume 1

**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 2.60

(Rational Method Procedure)

**Design Storm 100 Year**

| BASIN INFORMATON |             |          |              | DIRECT RUNOFF |       |         |       | TOTAL RUNOFF |           |         |       | REMARKS    |
|------------------|-------------|----------|--------------|---------------|-------|---------|-------|--------------|-----------|---------|-------|------------|
| DESIGN POINT     | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | T(c) min     | SUM C x A | I in/hr | Q cfs |            |
| 17               | C2.3        | 3.67     | 0.50         | 18.7          | 1.84  | 5.30    | 9.8   |              |           |         |       |            |
| 18               | C2.4        | 6.72     | 0.53         | 18.9          | 3.57  | 5.27    | 18.8  | 33.8         | 9.81      | 3.80    | 37.3  | C2         |
|                  |             |          |              |               |       |         |       | 33.8         | 16.70     | 3.80    | 63.5  | C1 thru C2 |
| 19               | C3          | 1.98     | 0.61         | 11.8          | 1.20  | 6.56    | 7.9   | 33.8         | 17.91     | 3.80    | 68.0  | C1 thru C3 |
| 20               | C4          | 2.15     | 0.61         | 11.8          | 1.31  | 6.56    | 8.6   | 36.6         | 19.21     | 3.62    | 69.5  | C1 thru C4 |
| 21               | C5          | 4.72     | 0.61         | 11.9          | 2.86  | 6.54    | 18.7  | 39.4         | 22.08     | 3.46    | 76.3  | C1 thru C5 |
| 22               | C6          | 0.58     | 0.61         | 16.5          | 0.35  | 5.64    | 2.0   | 41.7         | 22.43     | 3.33    | 74.8  | C1 thru C6 |
| 23               | C7          | 1.18     | 0.54         | 7.9           | 0.64  | 7.66    | 4.9   | 41.7         | 23.1      | 3.33    | 76.9  | C1 thru C7 |
| 24               | D1          | 2.14     | 0.56         | 20.0          | 1.19  | 5.12    | 6.1   |              |           |         |       |            |
| 25               | D2          | 6.28     | 0.52         | 16.1          | 3.24  | 5.70    | 18.5  | 25.3         | 4.43      | 4.50    | 19.9  | D1,D2      |
| 26               | D3          | 1.74     | 0.61         | 12.5          | 1.06  | 6.41    | 6.8   | 29.7         | 5.48      | 4.11    | 22.5  | D1 thru D3 |
| 27               | D4          | 3.81     | 0.69         | 7.3           | 2.62  | 7.89    | 20.7  | 31.9         | 8.11      | 3.93    | 31.9  | D1 thru D4 |
| 28               | D5          | 3.83     | 0.58         | 10.9          | 2.22  | 6.78    | 15.1  | 34.5         | 10.33     | 3.75    | 38.7  | D1 thru D6 |
| 29               | E1          | 3.35     | 0.49         | 14.3          | 1.65  | 6.03    | 9.9   |              |           |         |       |            |
| 30               | E2          | 4.59     | 0.49         | 13.3          | 2.26  | 6.24    | 14.1  | 17.5         | 3.91      | 5.48    | 21.4  | E1,E2      |
| 31               | F1          | 0.97     | 0.61         | 10.9          | 0.59  | 6.80    | 4.0   |              |           |         |       |            |
|                  |             |          |              |               |       |         |       | 41.7         | 40.00     | 3.33    | 133.3 | Sum B & C  |

**Soleana**  
**Phase II Drainage Report**  
**Historic Basins A and B**

**STANDARD FORM SF-3**REFERENCE: MHFD Volume 1**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 2.60

(Rational Method Procedure)

**Design Storm 100 Year**

| BASIN INFORMATION |             |          |              | DIRECT RUNOFF |       |         |       | TOTAL RUNOFF |           |         |       | REMARKS |
|-------------------|-------------|----------|--------------|---------------|-------|---------|-------|--------------|-----------|---------|-------|---------|
| DESIGN POINT      | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | T(c) min     | SUM C x A | I in/hr | Q cfs |         |
| 1                 | HA          | 11.06    | 0.49         | 17.9          | 5.44  | 5.42    | 29.5  |              |           |         |       | HA HB   |
| 2                 | HB          | 12.42    | 0.49         | 21.0          | 6.11  | 4.98    | 30.4  | 21.0         | 11.56     | 4.98    | 57.6  |         |
| 3                 | DA          | 8.15     | 0.55         | 16.5          | 4.45  | 5.65    | 25.1  |              |           |         |       |         |

**Soleana Tract flow calculations**  
**Phase 2 Drainage Report**

**STANDARD FORM SF-2**

REFERENCE MHFD TABLE 6-2

Watercourse Coefficient

**Runoff Calculations**

Heavy Meadow 2.5

Short Grass Pasture &amp; Lawns 7.0

Grassed Waterway 15.0

**Time of Concentration**

Tillage/field 5.0

Nearly Bare Ground 10.0

Paved Area &amp; Shallow Gutter 20.0

| Tract | SUB-BASIN DATA |          |       |      | INITIAL / OVERLAND TIME |         |          | TRAVEL TIME T(t) |         |        |              | T(t) min. | T(c) CHECK (URBANIZED BASINS) |              |        | FINAL T(c) |
|-------|----------------|----------|-------|------|-------------------------|---------|----------|------------------|---------|--------|--------------|-----------|-------------------------------|--------------|--------|------------|
|       | Lots           | AREA ac. | % I   | C(5) | Length ft.              | Slope % | T(i) min | Length ft.       | Slope % | Coeff. | Velocity fps |           | COMP. T(c)                    | TOTAL LENGTH | EQ 6-5 | min.       |
| A     | 1-8            | 2.73     | 30.0% | 0.28 | 200                     | 25.0    | 7.3      | 600              | 2.0     | 20.0   | 2.8          | 3.5       | 10.8                          | 800          | 21.6   | 10.8       |
| M     | 48-49          | 6.47     | 7.7%  | 0.10 | 200                     | 3.0     | 18.0     | 600              | 10.0    | 15.0   | 4.7          | 2.1       | 20.1                          | 800          | 25.1   | 20.1       |
| N     | 50-51          | 3.68     | 5.2%  | 0.08 | 200                     | 3.0     | 18.4     | 430              | 20.0    | 15.0   | 6.7          | 1.1       | 19.5                          | 630          | 25.4   | 19.5       |
| O     | 51-52          | 1.94     | 5.2%  | 0.08 | 200                     | 3.0     | 18.4     | 530              | 15.0    | 15.0   | 5.8          | 1.5       | 19.9                          | 730          | 25.4   | 19.9       |
| P     | 52-53          | 4.07     | 5.2%  | 0.08 | 200                     | 3.0     | 18.4     | 430              | 15.0    | 15.0   | 5.8          | 1.2       | 19.6                          | 630          | 25.4   | 19.6       |
| L     | 39             | 1.48     | 4.7%  | 0.07 | 100                     | 10.0    | 8.7      | 420              | 15.0    | 15.0   | 5.8          | 1.2       | 9.9                           | 520          | 25.4   | 9.9        |
| Q     | 36-37          | 2.45     | 4.7%  | 0.07 | 200                     | 3.0     | 18.4     | 470              | 15.0    | 15.0   | 5.8          | 1.3       | 19.7                          | 670          | 25.5   | 19.7       |
| R     | 36             | 1.37     | 3.8%  | 0.07 | 200                     | 3.0     | 18.6     | 430              | 15.0    | 15.0   | 5.8          | 1.2       | 19.8                          | 630          | 25.6   | 19.8       |
| S     | 11-13          | 1.15     | 30.0% | 0.28 | 140                     | 20.0    | 6.5      | 270              | 2.0     | 20.0   | 2.8          | 1.6       | 8.1                           | 410          | 21.3   | 8.1        |

**Soleana Tract flow calculations**  
**Phase 2 Drainage Report**

**STANDARD FORM SF-3**REFERENCE: MHFD Volume 1**Runoff Calculations**

Rainfall Depth-Duration-Frequency (1-hr) = 2.60

(Rational Method Procedure)

**Design Storm 100 Year**

| BASIN INFORMATION |             |          |              | DIRECT RUNOFF |       |         |       | TOTAL RUNOFF |           |         |       | REMARKS |
|-------------------|-------------|----------|--------------|---------------|-------|---------|-------|--------------|-----------|---------|-------|---------|
| DESIGN POINT      | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min      | C x A | I in/hr | Q cfs | T(c) min     | SUM C x A | I in/hr | Q cfs |         |
| A                 | 1-8         | 2.73     | 0.61         | 10.8          | 1.66  | 6.81    | 11.3  |              |           |         |       |         |
| M                 | 48-49       | 6.47     | 0.52         | 20.1          | 3.34  | 5.10    | 17.0  |              |           |         |       |         |
| N                 | 50-51       | 3.68     | 0.51         | 19.5          | 1.86  | 5.19    | 9.6   |              |           |         |       |         |
| O                 | 51-52       | 1.94     | 0.51         | 19.9          | 0.98  | 5.13    | 5.0   |              |           |         |       |         |
| P                 | 52-53       | 4.07     | 0.51         | 19.6          | 2.06  | 5.16    | 10.6  |              |           |         |       |         |
| L                 | 39          | 1.48     | 0.50         | 9.9           | 0.75  | 7.06    | 5.3   |              |           |         |       |         |
| Q                 | 36-37       | 2.45     | 0.50         | 19.7          | 1.23  | 5.15    | 6.3   |              |           |         |       |         |
| R                 | 36          | 1.37     | 0.50         | 19.8          | 0.69  | 5.14    | 3.5   |              |           |         |       |         |
| S                 | 11-13       | 1.15     | 0.61         | 8.1           | 0.70  | 7.61    | 5.3   |              |           |         |       |         |

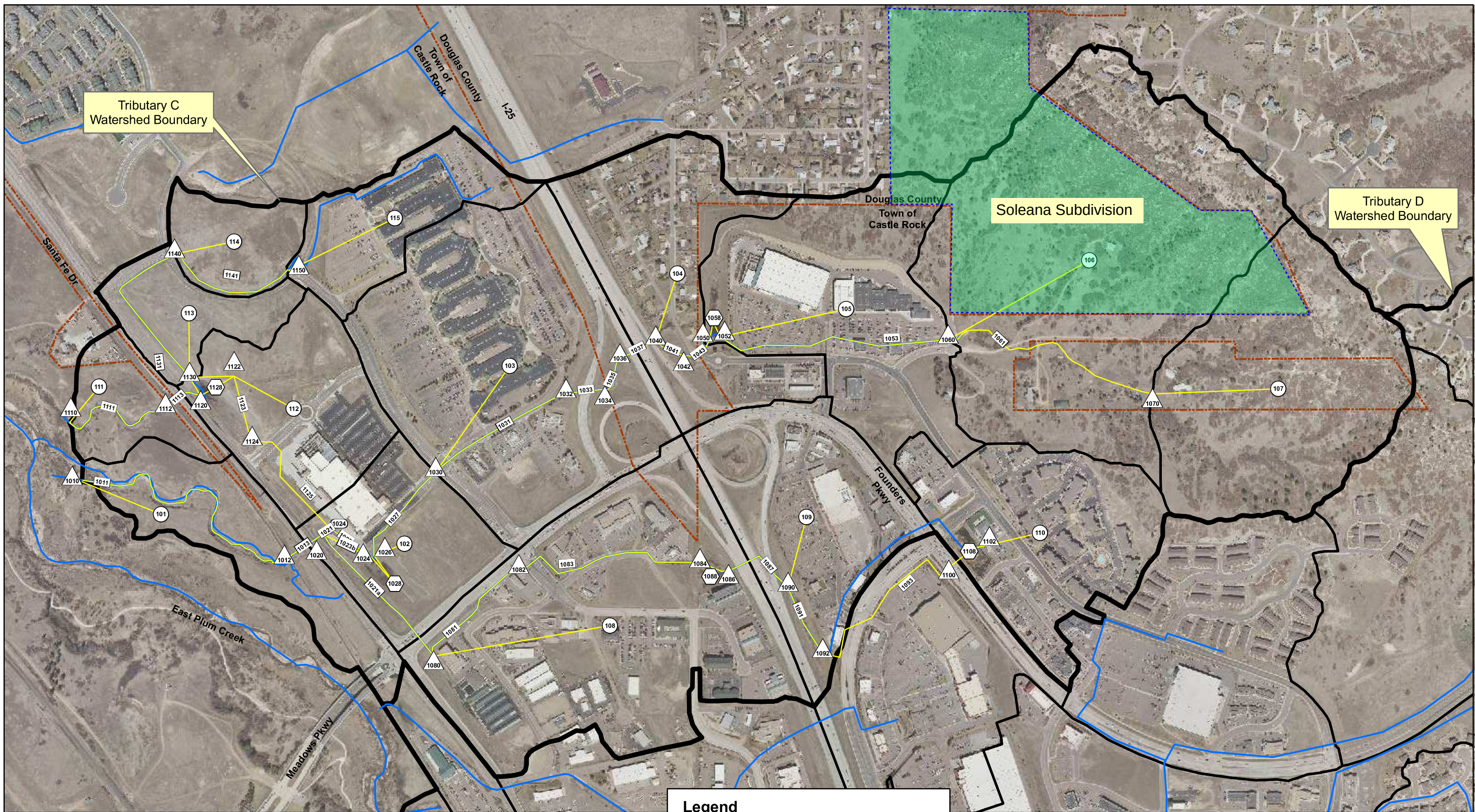
Table B-4 - Land Use by Subwatershed - Tributary C

Future

| Subwatershed ID | Subwatershed Area (Acres) | Subwatershed Imperviousness (%) | Subwatershed Land Use Breakdown (Acres) |                               |                                |                          |                                       |                          |              |
|-----------------|---------------------------|---------------------------------|-----------------------------------------|-------------------------------|--------------------------------|--------------------------|---------------------------------------|--------------------------|--------------|
|                 |                           |                                 | Open Space / Agricultural / Vacant (2%) | Single Family Large Lot (20%) | Multi-Family Residential (60%) | General Commercial (70%) | General / Restricted Commercial (85%) | General Commercial (95%) | Roads (100%) |
| 101             | 25.5                      | 39.8                            | 15.5                                    | 0.0                           | 0.0                            | 0.0                      | 1.2                                   | 0.0                      | 8.8          |
| 102             | 24.0                      | 63.3                            | 7.9                                     | 0.0                           | 0.0                            | 0.0                      | 5.0                                   | 5.7                      | 5.4          |
| 103             | 72.0                      | 89.3                            | 4.5                                     | 0.0                           | 0.0                            | 0.0                      | 9.5                                   | 37.4                     | 20.6         |
| 104             | 37.7                      | 51.7                            | 3.2                                     | 18.1                          | 0.0                            | 0.0                      | 3.9                                   | 0.0                      | 12.5         |
| 105             | 48.1                      | 61.3                            | 13.1                                    | 1.3                           | 0.4                            | 0.0                      | 30.5                                  | 0.0                      | 2.9          |
| 106             | 97.5                      | 14.9                            | 73.5                                    | 11.5                          | 0.5                            | 0.0                      | 10.4                                  | 0.0                      | 1.6          |
| 107             | 53.7                      | 2.9                             | 51.5                                    | 2.1                           | 0.0                            | 0.0                      | 0.1                                   | 0.0                      | 0.0          |
| 108             | 76.3                      | 88.7                            | 0.9                                     | 0.0                           | 0.0                            | 0.0                      | 51.8                                  | 0.0                      | 23.6         |
| 109             | 37.0                      | 84.0                            | 3.1                                     | 0.0                           | 0.0                            | 0.0                      | 19.0                                  | 0.0                      | 14.9         |
| 110             | 37.2                      | 64.3                            | 4.4                                     | 0.0                           | 17.9                           | 0.0                      | 11.9                                  | 0.0                      | 3.0          |
| 111             | 12.4                      | 74.2                            | 2.1                                     | 0.0                           | 0.0                            | 0.0                      | 7.7                                   | 0.0                      | 2.7          |
| 112             | 28.4                      | 78.7                            | 1.2                                     | 0.0                           | 0.0                            | 14.8                     | 0.0                                   | 9.3                      | 3.1          |
| 113             | 13.7                      | 70.0                            | 0.0                                     | 0.0                           | 0.0                            | 11.5                     | 0.0                                   | 0.0                      | 0.0          |
| 114             | 11.5                      | 70.0                            | 0.0                                     | 0.0                           | 0.0                            | 13.7                     | 0.0                                   | 0.0                      | 0.0          |
| 115             | 19.5                      | 95.5                            | 0.0                                     | 0.0                           | 0.0                            | 0.0                      | 0.2                                   | 16.9                     | 2.3          |
| Total           | 594.6                     | 58.1                            | 181.0                                   | 33.0                          | 18.7                           | 40.0                     | 151.3                                 | 69.3                     | 101.2        |

Existing

| Subwatershed ID | Subwatershed Area (Acres) | Subwatershed Imperviousness (%) | Subwatershed Land Use Breakdown (Acres) |                               |                                |                                       |                          |              |
|-----------------|---------------------------|---------------------------------|-----------------------------------------|-------------------------------|--------------------------------|---------------------------------------|--------------------------|--------------|
|                 |                           |                                 | Open Space / Agricultural / Vacant (2%) | Single Family Large Lot (20%) | Multi-Family Residential (60%) | General / Restricted Commercial (85%) | General Commercial (95%) | Roads (100%) |
| 101             | 25.5                      | 35.7                            | 16.7                                    | 0.0                           | 0.0                            | 0.0                                   | 0.0                      | 8.8          |
| 102             | 24.0                      | 46.0                            | 13.0                                    | 0.0                           | 0.0                            | 0.0                                   | 5.7                      | 5.4          |
| 103             | 72.0                      | 84.8                            | 8.4                                     | 0.0                           | 0.0                            | 5.6                                   | 37.4                     | 20.6         |
| 104             | 37.7                      | 51.7                            | 3.2                                     | 18.1                          | 0.0                            | 3.9                                   | 0.0                      | 12.5         |
| 105             | 48.1                      | 57.4                            | 15.4                                    | 1.3                           | 0.4                            | 28.2                                  | 0.0                      | 2.9          |
| 106             | 97.5                      | 6.0                             | 83.9                                    | 11.5                          | 0.5                            | 0.0                                   | 0.0                      | 1.6          |
| 107             | 53.7                      | 2.7                             | 51.6                                    | 2.1                           | 0.0                            | 0.0                                   | 0.0                      | 0.0          |
| 108             | 76.3                      | 82.6                            | 6.5                                     | 0.0                           | 0.0                            | 46.2                                  | 0.0                      | 23.6         |
| 109             | 37.0                      | 84.0                            | 3.1                                     | 0.0                           | 0.0                            | 19.0                                  | 0.0                      | 14.9         |
| 110             | 37.2                      | 64.3                            | 4.4                                     | 0.0                           | 17.9                           | 11.9                                  | 0.0                      | 3.0          |
| 111             | 12.4                      | 29.6                            | 8.8                                     | 0.0                           | 0.0                            | 1.0                                   | 0.0                      | 2.7          |
| 112             | 28.4                      | 43.3                            | 16.0                                    | 0.0                           | 0.0                            | 0.0                                   | 9.3                      | 3.1          |
| 113             | 13.7                      | 20.9                            | 11.0                                    | 0.0                           | 0.0                            | 0.0                                   | 0.0                      | 2.6          |
| 114             | 11.5                      | 7.8                             | 10.9                                    | 0.0                           | 0.0                            | 0.0                                   | 0.0                      | 0.7          |
| 115             | 19.5                      | 94.6                            | 0.2                                     | 0.0                           | 0.0                            | 0.0                                   | 16.9                     | 2.3          |
| Total           | 594.6                     | 49.1                            | 253.2                                   | 33.0                          | 18.7                           | 115.8                                 | 69.3                     | 104.5        |



0 187.5 375 750 1,125 1,500 Feet

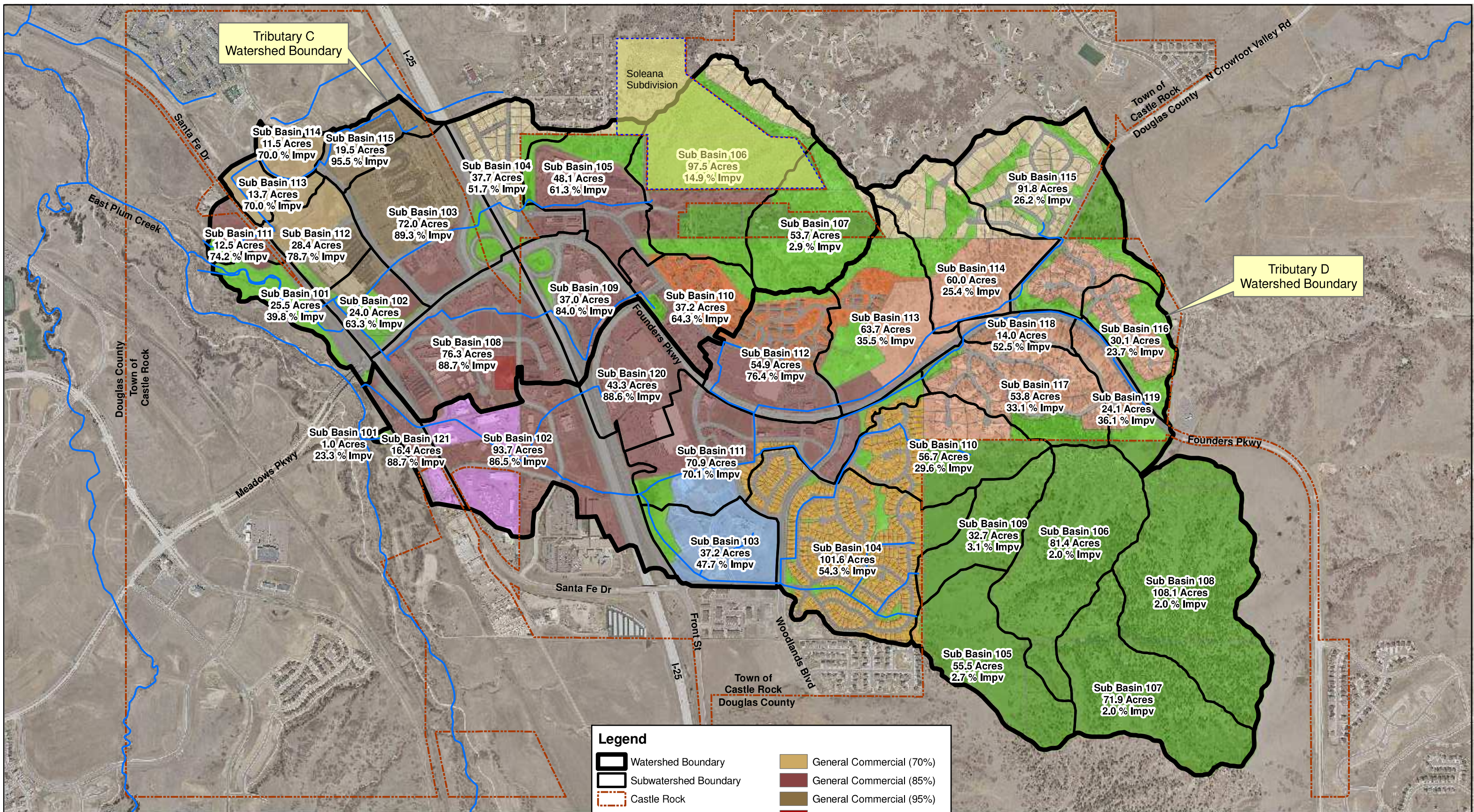


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Denver, CO 80246  
303-757-3655  
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#### Legend

|  |                       |  |              |
|--|-----------------------|--|--------------|
|  | Watershed Boundary    |  | Basin ID     |
|  | Subwatershed Boundary |  | Design Point |
|  | Castle Rock           |  | Detention    |
|  | Streams               |  | Conveyance   |
|  | Conveyance Link       |  | Diversion    |

Tributary C - EPA SWMM Connectivity  
Figure A-7  
Tributary C and Tributary D  
Tributary Watersheds Master Plan



0 380 760 1,520 2,280 3,040 Feet

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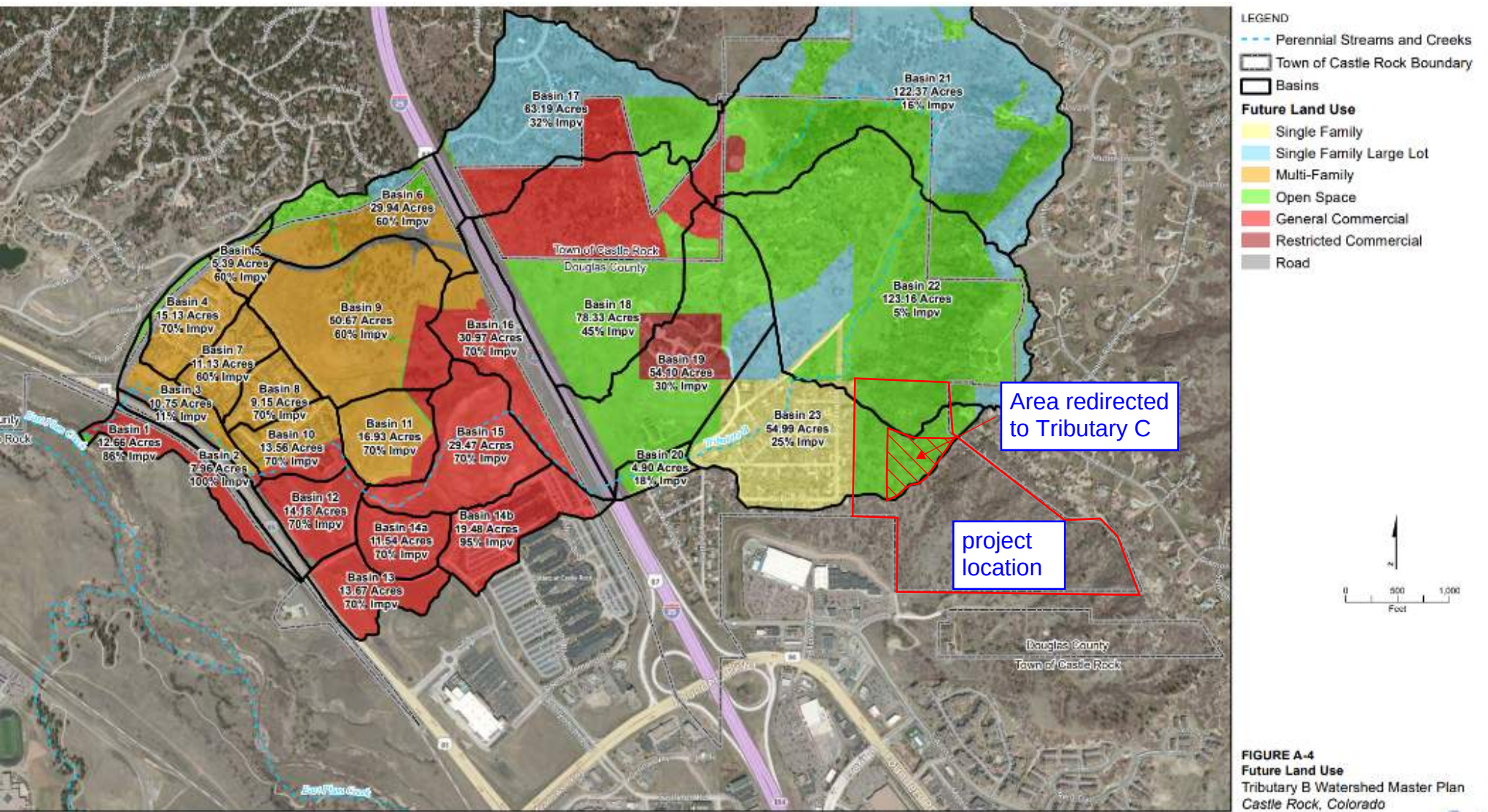
Future Land Use  
Figure A-5  
Tributary C and Tributary D  
Tributary Watersheds Master Plan

Table B-9 CUHP Subwatershed Peak Flows - Tributary C

| Catchment<br>Name/ID | 2-Yr            |          |            |          | 5-Yr            |          |            |          | 10-Yr           |          |            |          | 25-Yr        |          |            |          | 50-Yr           |          |               |          | 100-Yr          |          |               |          | 500-Yr          |          |            |          |
|----------------------|-----------------|----------|------------|----------|-----------------|----------|------------|----------|-----------------|----------|------------|----------|--------------|----------|------------|----------|-----------------|----------|---------------|----------|-----------------|----------|---------------|----------|-----------------|----------|------------|----------|
|                      | Exist.<br>(cfs) | Vol (cf) | Fut. (cfs) | Vol (cf) | Exist.<br>(cfs) | Vol (cf) | Fut. (cfs) | Vol (cf) | Exist.<br>(cfs) | Vol (cf) | Fut. (cfs) | Vol (cf) | Exist. (cfs) | Vol (cf) | Fut. (cfs) | Vol (cf) | Exist.<br>(cfs) | Vol (cf) | Fut.<br>(cfs) | Vol (cf) | Exist.<br>(cfs) | Vol (cf) | Fut.<br>(cfs) | Vol (cf) | Exist.<br>(cfs) | Vol (cf) | Fut. (cfs) | Vol (cf) |
| 101                  | 9               | 36,095   | 11         | 40,225   | 16              | 64,901   | 19         | 69,475   | 20              | 85,091   | 24         | 89,784   | 124,095      | 32       | 128,599    | 37       | 38              | 145,900  | 43            | 150,502  | 47              | 182,948  | 53            | 187,414  | 60              | 235,271  | 67         | 240,145  |
| 102                  | 14              | 40,382   | 23         | 56,422   | 24              | 67,123   | 35         | 85,686   | 30              | 85,066   | 42         | 104,793  | 122,609      | 46       | 141,299    | 59       | 53              | 142,938  | 68            | 161,874  | 65              | 177,192  | 82            | 195,280  | 83              | 226,575  | 101        | 245,057  |
| 103                  | 124             | 219,476  | 131        | 231,416  | 172             | 309,631  | 180        | 324,592  | 202             | 367,912  | 210        | 383,921  | 469,416      | 261      | 484,663    | 267      | 295             | 530,288  | 300           | 545,730  | 348             | 624,651  | 353           | 639,052  | 425             | 768,957  | 429        | 783,824  |
| 104                  | 36              | 71,360   | 36         | 71,350   | 60              | 114,488  | 60         | 114,476  | 75              | 143,315  | 75         | 143,302  | 200,682      | 107      | 200,670    | 107      | 124             | 232,413  | 124           | 232,402  | 151             | 285,150  | 151           | 285,140  | 190             | 362,454  | 190        | 362,445  |
| 105                  | 56              | 105,639  | 60         | 111,341  | 91              | 164,355  | 95         | 170,706  | 110             | 203,165  | 114        | 209,704  | 272,757      | 151      | 278,923    | 155      | 173             | 313,576  | 177           | 319,832  | 209             | 379,139  | 213           | 384,989  | 259             | 475,910  | 264        | 481,952  |
| 106                  | 16              | 41,532   | 25         | 68,541   | 49              | 136,050  | 62         | 169,804  | 68              | 207,733  | 82         | 244,047  | 359,687      | 118      | 394,958    | 137      | 142             | 439,992  | 163           | 476,405  | 181             | 587,036  | 206           | 621,642  | 237             | 781,352  | 267        | 818,072  |
| 107                  | 7               | 17,892   | 7          | 18,140   | 25              | 68,372   | 25         | 68,704   | 35              | 107,288  | 35         | 107,652  | 191,324      | 63       | 191,675    | 63       | 76              | 235,292  | 76            | 235,658  | 98              | 316,798  | 98            | 317,141  | 128             | 423,429  | 128        | 423,796  |
| 108                  | 127             | 238,972  | 139        | 257,089  | 181             | 342,905  | 194        | 363,725  | 214             | 409,079  | 227        | 431,006  | 521,305      | 278      | 542,547    | 290      | 314             | 589,090  | 326           | 610,700  | 366             | 693,031  | 378           | 713,844  | 447             | 853,655  | 460        | 874,770  |
| 109                  | 48              | 121,389  | 48         | 121,389  | 68              | 173,763  | 68         | 173,763  | 79              | 207,003  | 79         | 207,003  | 262,250      | 104      | 262,250    | 104      | 117             | 295,983  | 117           | 295,983  | 138             | 347,356  | 138           | 347,356  | 169             | 426,840  | 169        | 426,840  |
| 110                  | 49              | 90,132   | 49         | 90,132   | 75              | 136,540  | 75         | 136,540  | 89              | 166,857  | 89         | 166,857  | 220,170      | 121      | 220,170    | 121      | 137             | 251,812  | 137           | 251,812  | 165             | 301,893  | 165           | 301,893  | 203             | 376,801  | 203        | 376,801  |
| 111                  | 5               | 15,129   | 18         | 34,937   | 10              | 29,197   | 27         | 51,265   | 12              | 39,108   | 31         | 61,770   | 58,219       | 19       | 79,712     | 41       | 23              | 68,841   | 46            | 90,517   | 28              | 87,067   | 55            | 107,284  | 36              | 112,535  | 68         | 132,799  |
| 112                  | 16              | 42,813   | 42         | 82,520   | 26              | 67,751   | 59         | 117,686  | 34              | 86,324   | 71         | 140,715  | 129,840      | 53       | 182,394    | 94       | 63              | 152,775  | 106           | 206,912  | 78              | 193,609  | 126           | 245,643  | 100             | 249,428  | 155        | 303,918  |
| 113                  | 2               | 9,061    | 14         | 35,637   | 4               | 21,687   | 21         | 52,781   | 6               | 30,409   | 25         | 63,794   | 52,747       | 11       | 84,481     | 34       | 13              | 63,792   | 39            | 96,298   | 17              | 83,807   | 47            | 115,184  | 22              | 110,896  | 58         | 143,630  |
| 114                  | 1               | 2,139    | 16         | 30,263   | 3               | 8,548    | 24         | 44,019   | 4               | 14,059   | 28         | 53,184   | 32,757       | 10       | 70,737     | 38       | 12              | 41,424   | 43            | 80,773   | 16              | 58,719   | 53            | 97,059   | 22              | 80,534   | 66         | 121,036  |
| 115                  | 35              | 69,947   | 35         | 70,718   | 47              | 97,377   | 48         | 98,301   | 55              | 114,599  | 55         | 115,588  | 142,979      | 69       | 143,934    | 70       | 78              | 160,452  | 78            | 161,427  | 90              | 186,672  | 91            | 187,609  | 110             | 227,863  | 110        | 228,818  |

Table B-11 Peak Flow Summary Table - Tributary C

| Station | Design Point | Location                                          | Drainage Area |          | 100-Year                 | 2-Year   |        | 5-Year   |        | 10-Year  |        | 25-Year  |        | 50-Year  |        | 100-Year |        | 500-Year |        |
|---------|--------------|---------------------------------------------------|---------------|----------|--------------------------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|
|         |              |                                                   | Runoff Volume |          | Existing<br>FuLU (ac-ft) | Existing | Future | Existing | Future | Existing | Future | Existing | Future | Existing | Future | Existing | Future | Existing | Future |
|         |              |                                                   | (acres)       | (sq.mi.) |                          | (cfs)    | (cfs)  | (cfs)    | (cfs)  | (cfs)    | (cfs)  | (cfs)    | (cfs)  | (cfs)    | (cfs)  | (cfs)    | (cfs)  | (cfs)    | (cfs)  |
|         | 113          |                                                   | 14            | 0.021    | 2.6                      | 2        | 14     | 4        | 21     | 6        | 25     | 11       | 34     | 13       | 39     | 17       | 47     | 22       | 58     |
|         | 114          |                                                   | 12            | 0.018    | 2.2                      | 1        | 16     | 3        | 24     | 4        | 28     | 10       | 38     | 12       | 43     | 16       | 53     | 22       | 66     |
|         | 115          |                                                   | 19            | 0.030    | 4.3                      | 35       | 35     | 47       | 48     | 55       | 55     | 69       | 70     | 78       | 78     | 90       | 91     | 110      | 110    |
|         | 104          |                                                   | 38            | 0.059    | 6.5                      | 36       | 36     | 60       | 60     | 75       | 75     | 107      | 107    | 124      | 124    | 151      | 151    | 190      | 190    |
|         | 105          |                                                   | 48            | 0.075    | 8.8                      | 56       | 60     | 91       | 95     | 110      | 114    | 151      | 155    | 173      | 177    | 209      | 213    | 259      | 264    |
|         | 112          |                                                   | 28            | 0.044    | 5.6                      | 16       | 42     | 26       | 59     | 34       | 71     | 53       | 94     | 63       | 106    | 78       | 126    | 100      | 155    |
|         | 102          |                                                   | 24            | 0.038    | 4.5                      | 14       | 23     | 24       | 35     | 30       | 42     | 46       | 59     | 53       | 68     | 65       | 82     | 83       | 101    |
|         | 111          |                                                   | 12            | 0.019    | 2.5                      | 5        | 18     | 10       | 27     | 12       | 31     | 19       | 41     | 23       | 46     | 28       | 55     | 36       | 68     |
|         | 101          |                                                   | 26            | 0.040    | 4.3                      | 9        | 11     | 16       | 19     | 20       | 24     | 32       | 37     | 38       | 43     | 47       | 53     | 60       | 67     |
|         | 110          |                                                   | 37            | 0.058    | 6.9                      | 49       | 49     | 75       | 75     | 89       | 89     | 121      | 121    | 137      | 137    | 165      | 165    | 203      | 203    |
|         | 103          |                                                   | 72            | 0.113    | 14.7                     | 124      | 131    | 172      | 180    | 202      | 210    | 261      | 267    | 295      | 300    | 348      | 353    | 425      | 429    |
|         | 107          |                                                   | 54            | 0.084    | 7.3                      | 7        | 7      | 25       | 25     | 35       | 35     | 63       | 63     | 76       | 76     | 98       | 98     | 128      | 128    |
|         | 106          |                                                   | 97            | 0.152    | 14.3                     | 16       | 25     | 49       | 62     | 68       | 82     | 118      | 137    | 142      | 163    | 181      | 206    | 237      | 267    |
|         | 109          |                                                   | 37            | 0.058    | 8.0                      | 48       | 48     | 68       | 68     | 79       | 79     | 104      | 104    | 117      | 117    | 138      | 138    | 169      | 169    |
|         | 108          |                                                   | 76            | 0.119    | 16.4                     | 127      | 139    | 181      | 194    | 214      | 227    | 278      | 290    | 314      | 326    | 366      | 378    | 447      | 460    |
|         | 1130         |                                                   | 45            | 0.070    | 9.2                      | 34       | 61     | 51       | 87     | 60       | 102    | 84       | 136    | 96       | 154    | 116      | 183    | 144      | 225    |
|         | 1140         |                                                   | 31            | 0.048    | 6.5                      | 34       | 49     | 48       | 68     | 57       | 80     | 76       | 104    | 86       | 117    | 102      | 139    | 126      | 170    |
|         | 1150         |                                                   | 19            | 0.030    | 4.3                      | 35       | 35     | 47       | 48     | 55       | 55     | 69       | 70     | 78       | 78     | 90       | 91     | 110      | 110    |
|         | 1110         | North Outfall to East Plum Creek D/S Study Limits | 86            | 0.134    | 15.5                     | 9        | 22     | 14       | 31     | 17       | 36     | 29       | 59     | 40       | 78     | 72       | 115    | 113      | 239    |
|         | 1010         | South Outfall to East Plum Creek D/S Study Limits | 509           | 0.795    | 82.0                     | 173      | 189    | 250      | 269    | 293      | 310    | 426      | 467    | 563      | 614    | 793      | 860    | 1,135    | 1,209  |
|         | 1100         |                                                   | 37            | 0.058    | 5.5                      | 4        | 4      | 7        | 7      | 9        | 9      | 20       | 20     | 27       | 27     | 32       | 32     | 35       | 35     |
|         | 1060         | Brewer Court and Alexander Place                  | 151           | 0.236    | 21.5                     | 22       | 30     | 73       | 84     | 101      | 114    | 180      | 196    | 216      | 235    | 278      | 299    | 364      | 390    |
|         | 1086         |                                                   | 74            | 0.116    | 13.3                     | 48       | 48     | 68       | 68     | 79       | 79     | 104      | 104    | 117      | 117    | 139      | 139    | 182      | 182    |
|         | 1030         | Factory Shops Blvd                                | 309           | 0.483    | 49.1                     | 156      | 164    | 227      | 235    | 272      | 279    | 390      | 410    | 469      | 505    | 628      | 662    | 866      | 934    |
|         | 1070         |                                                   | 54            | 0.084    | 7.3                      | 7        | 7      | 25       | 25     | 35       | 35     | 63       | 63     | 76       | 76     | 98       | 98     | 128      | 128    |
|         | 1020         |                                                   | 333           | 0.520    | 51.3                     | 68       | 74     | 96       | 100    | 139      | 157    | 311      | 343    | 410      | 453    | 577      | 641    | 835      | 892    |
|         | 1012         |                                                   | 484           | 0.756    | 77.7                     | 171      | 185    | 240      | 256    | 281      | 298    | 402      | 439    | 534      | 582    | 753      | 817    | 1,084    | 1,154  |
|         | 1026         |                                                   | 333           | 0.520    | 53.6                     | 168      | 185    | 248      | 268    | 298      | 319    | 434      | 467    | 515      | 562    | 689      | 738    | 938      | 1,019  |
|         | 1084         |                                                   | 74            | 0.116    | 10.2                     | 2        | 2      | 15       | 15     | 22       | 22     | 26       | 26     | 28       | 28     | 30       | 30     | 32       | 32     |
|         | 1082         | Castleton Road                                    | 74            | 0.116    | 10.2                     | 2        | 2      | 15       | 15     | 22       | 22     | 26       | 26     | 28       | 28     | 30       | 30     | 32       | 32     |
|         | 1092         |                                                   | 37            | 0.058    | 5.4                      | 4        | 4      | 7        | 7      | 9        | 9      | 20       | 20     | 27       | 27     | 32       | 32     | 35       | 35     |
|         | 1052         |                                                   | 199           | 0.311    | 30.3                     | 63       | 76     | 141      | 156    | 183      | 201    | 296      | 317    | 351      | 374    | 442      | 470    | 570      | 603    |
|         | 1036         |                                                   | 237           | 0.370    | 34.7                     | 35       | 36     | 106      | 123    | 141      | 147    | 270      | 292    | 337      | 361    | 435      | 498    | 654      | 701    |
|         | 1102         |                                                   | 37            | 0.058    | 6.9                      | 49       | 49     | 75       | 75     | 89       | 89     | 121      | 121    | 137      | 137    | 165      | 165    | 203      | 203    |
|         | 1042         |                                                   | 199           | 0.311    | 28.0                     | 13       | 22     | 86       | 99     | 104      | 116    | 222      | 240    | 276      | 289    | 359      | 395    | 528      | 567    |
|         | 1124         |                                                   | -             | 0.000    | 2.3                      | 8        | 9      | 12       | 12     | 12       | 12     | 12       | 12     | 12       | 12     | 12       | 12     | 12       | 12     |
|         | 1112         |                                                   | 73            | 0.114    | 13.1                     | 7        | 9      | 9        | 22     | 12       | 30     | 27       | 53     | 35       | 70     | 62       | 102    | 95       | 216    |
|         | 1122         |                                                   | 73            | 0.114    | 17.1                     | 50       | 99     | 78       | 141    | 96       | 167    | 143      | 225    | 165      | 256    | 202      | 306    | 253      | 377    |
|         | 1014         | U/S of US 85 (South)                              | 484           | 0.756    | 77.7                     | 171      | 185    | 240      | 256    | 281      | 298    | 402      | 439    | 534      | 582    | 753      | 817    | 1,084    | 1,154  |
|         | 1022         | Lot 3 Detention                                   | 333           | 0.520    | 22.0                     | 76       | 83     | 108      | 112    | 112      | 112    | 112      | 112    | 112      | 112    | 112      | 112    | 112      | 143    |
|         | 1024         |                                                   | 333           | 0.520    | 53.6                     | 76       | 83     | 108      | 112    | 151      | 169    | 323      | 355    | 422      | 463    | 582      | 644    | 843      | 904    |
|         | 1120         | U/S of US 85 (North)                              | 73            | 0.114    | 13.1                     | 7        | 9      | 9        | 22     | 12       | 30     | 27       | 53     | 35       | 70     | 62       | 102    | 95       | 207    |
|         | 1080         | Meadows Pkwy and US 85                            | 151           | 0.235    | 26.5                     | 128      | 140    | 182      | 195    | 215      | 228    | 280      | 292    | 315      | 327    | 367      | 380    | 449      | 462    |
|         | 1040         | I-25                                              | 237           | 0.370    | 34.5                     | 36       | 36     | 106      | 123    | 141      | 147    | 270      | 292    | 337      | 361    | 435      | 477    | 655      | 701    |
|         | 1090         |                                                   | 74            | 0.116    | 13.4                     | 48       | 48     | 68       | 68     | 79       | 79     | 104      | 104    | 117      | 117    | 139      | 139    | 174      | 174    |
|         | 1050         | U/S of US 85                                      | 199           | 0.311    | 28.0                     | 13       | 22     | 86       | 99     | 104      | 116    | 222      | 240    | 276      | 289    | 360      | 397    | 529      | 567    |
|         | 1034         |                                                   | 237           | 0.370    | 34.4                     | 35       | 36     | 106      | 123    | 141      | 147    | 270      | 292    | 337      | 361    | 435      | 498    | 654      | 701    |
|         | 1032         |                                                   | 237           | 0.370    | 34.4                     | 35       | 36     | 106      | 123    | 141      | 147    | 270      | 292    | 337      | 361    | 435      | 496    | 654      | 701    |
|         | 1028         | South Lowe's Pond                                 | 333           | 0.520    | 53.6                     | 168      | 185    | 248      | 268    | 298      | 319    | 434      | 467    | 515      | 562    | 689      | 738    | 938      | 1,019  |
|         | 1108         | Pond H                                            | 37            | 0.058    | 6.9                      | 49       | 49     | 75       | 75     | 89       | 89     | 121      | 121    | 137      | 137    | 165      | 165    | 203      | 203    |
|         | 1058         | Home Depot Pond                                   | 199           | 0.311    | 30.3                     | 63       | 76     | 141      | 156    | 183      | 201    | 296      | 317    | 351      | 374    | 442      | 470    | 570      | 603    |
|         | 1088         | Douglas County Justice Center Filing No. 3 Pond   | 74            | 0.116    | 13.3                     | 48       | 48     | 68       | 68     | 79       | 79     | 104      | 104    | 117      | 117    | 139      | 139    | 182      | 182    |
|         | 1128         | North Lowe's Pond                                 | 73            | 0.114    | 17.1                     | 50       | 99     | 78       | 141    | 96       | 167    | 143      | 225    | 165      | 256    | 202      | 306    | 253      | 377    |



# Appendix C

## Hydraulic Calculations

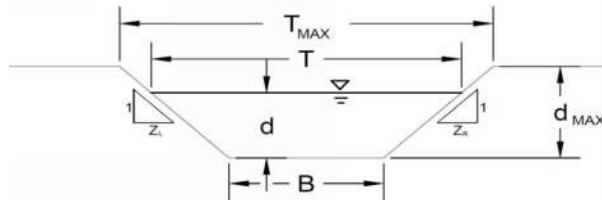
- Road and Inlet Calculations
- Pond 1 Calculations
- Pond 2 Calculations
- Hydraulic Calculations
- Tract Calculations



# AREA INLET IN A SWALE

Solena Subdivision

A2



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

## Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

| Soil Type:   | Max. Velocity ( $V_{MAX}$ ) | Max Froude No. ( $F_{MAX}$ ) |
|--------------|-----------------------------|------------------------------|
| Non-Cohesive | 5.0 fps                     | 0.60                         |
| Cohesive     | 7.0 fps                     | 0.80                         |
| Paved        | N/A                         | N/A                          |

A, B, C, D, or E =

|         |                   |
|---------|-------------------|
| E       |                   |
| n =     | see details below |
| $S_0$ = | 0.0400 ft/ft      |
| B =     | 2.00 ft           |
| Z1 =    | 4.00 ft/ft        |
| Z2 =    | 4.00 ft/ft        |

Choose One:

- ☒ Non-Cohesive  
☐ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

|             |             |             |    |
|-------------|-------------|-------------|----|
|             | Minor Storm | Major Storm |    |
| $T_{MAX}$ = | 10.00       | 10.00       | ft |
| $d_{MAX}$ = | 1.00        | 1.00        | ft |

## Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

|               |             |             |     |
|---------------|-------------|-------------|-----|
|               | Minor Storm | Major Storm |     |
| $Q_{allow}$ = | 47.9        | 47.9        | cfs |
| $d_{allow}$ = | 1.00        | 1.00        | ft  |

## Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

|         |      |      |     |
|---------|------|------|-----|
| $Q_o$ = | 0.5  | 7.9  | cfs |
| d =     | 0.17 | 0.49 | ft  |

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

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

# AREA INLET IN A SWALE

Solena Subdivision

A2

## Inlet Design Information (Input)

Type of Inlet

CDOT Type C (Depressed)

Inlet Type =

CDOT Type C (Depressed)

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

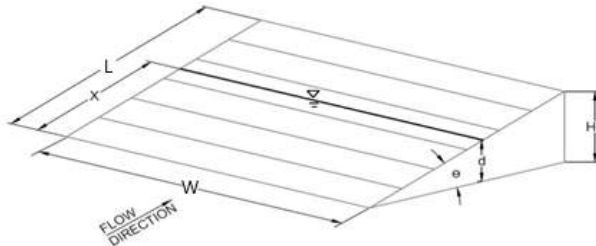
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient

 $\theta = 0.00$  degrees $W = 3.00$  ft $L = 3.00$  ft $A_{\text{RATIO}} = 0.70$  $H_b = 0.00$  ft $C_f = 0.50$  $C_d = 0.84$  $C_o = 0.56$  $C_w = 1.81$ 

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage =  $Q_a/Q_o$ 

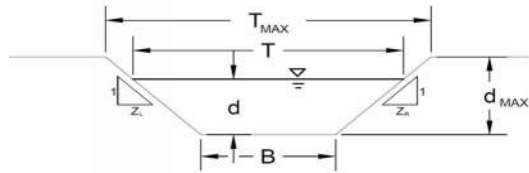
|         | MINOR | MAJOR |     |
|---------|-------|-------|-----|
| $d =$   | 1.17  | 1.49  |     |
| $Q_a =$ | 15.4  | 17.4  | cfs |
| $Q_b =$ | 0.0   | 0.0   | cfs |
| $C\% =$ | 100   | 100   | %   |

**Warning 04: Froude No. exceeds USDCM Volume I recommendation.**

# AREA INLET IN A SWALE

Solena Subdivision

A3



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

## Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

| Soil Type:   | Max. Velocity ( $V_{MAX}$ ) | Max Froude No. ( $F_{MAX}$ ) |
|--------------|-----------------------------|------------------------------|
| Non-Cohesive | 5.0 fps                     | 0.60                         |
| Cohesive     | 7.0 fps                     | 0.80                         |
| Paved        | N/A                         | N/A                          |

A, B, C, D, or E =

A

n = see details below

 $S_0$  = 0.0050 ft/ft

B = 6.00 ft

Z1 = 4.00 ft/ft

Z2 = 4.00 ft/ft

Choose One:

☐ Non-Cohesive☐ Cohesive☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

|             | Minor Storm | Major Storm |    |
|-------------|-------------|-------------|----|
| $T_{MAX}$ = | 20.00       | 28.00       | ft |
| $d_{MAX}$ = | 2.00        | 3.00        | ft |

## Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Top Width Criterion

MAJOR STORM Allowable Capacity is based on Top Width Criterion

|               | Minor Storm | Major Storm |     |
|---------------|-------------|-------------|-----|
| $Q_{allow}$ = | 7.1         | 20.2        | cfs |
| $d_{allow}$ = | 1.75        | 2.75        | ft  |

## Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

|         | Minor Storm | Major Storm |     |
|---------|-------------|-------------|-----|
| $Q_o$ = | 3.2         | 17.8        | cfs |
| $d$ =   | 1.12        | 2.63        | ft  |

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

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

# AREA INLET IN A SWALE

Solena Subdivision

A3

## Inlet Design Information (Input)

Type of Inlet

CDOT Type D (In Series &amp; Depressed)

Inlet Type =

CDOT Type D (In Series &amp; Depressed)

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

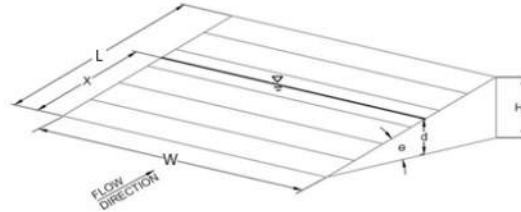
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient



θ = 0.00 degrees

W = 3.00 ft

L = 6.00 ft

A<sub>RATIO</sub> = 0.70H<sub>B</sub> = 0.00 ftC<sub>g</sub> = 0.38C<sub>g</sub> = 0.72C<sub>o</sub> = 0.48C<sub>w</sub> = 1.53

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage =  $Q_a/Q_o$ 

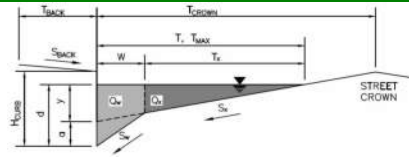
|                        | MINOR       | MAJOR       |            |
|------------------------|-------------|-------------|------------|
| d =                    | 2.12        | 3.63        |            |
| <b>Q<sub>a</sub> =</b> | <b>43.9</b> | <b>57.4</b> | <b>cfs</b> |
| <b>Q<sub>b</sub> =</b> | <b>0.0</b>  | <b>0.0</b>  | <b>cfs</b> |
| <b>C% =</b>            | <b>100</b>  | <b>100</b>  | <b>%</b>   |

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

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

Project: Solena Subdivision

Inlet ID: B2

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 15.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.010 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

|           | Minor Storm              | Major Storm                         |        |
|-----------|--------------------------|-------------------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                                | ft     |
| $d_{MAX}$ | 6.0                      | 6.9                                 | inches |
|           | <input type="checkbox"/> | <input checked="" type="checkbox"/> |        |

MINOR STORM Allowable Capacity is based on Spread Criterion

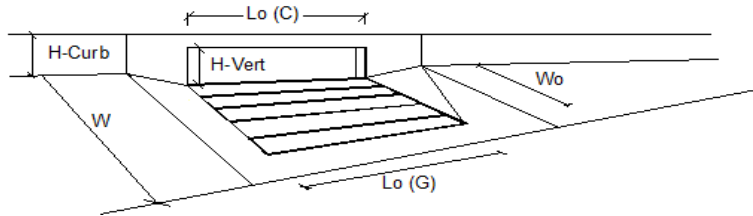
MAJOR STORM Allowable Capacity is based on Depth Criterion

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | 11.5        | 26.2        | cfs |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.60 cfs on sheet 'Inlet Management'****WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 29.10 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



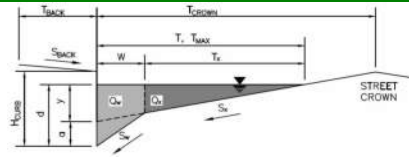
| Design Information (Input)                                                |                          | MINOR                |                          | MAJOR |        |
|---------------------------------------------------------------------------|--------------------------|----------------------|--------------------------|-------|--------|
| Type of Inlet                                                             | CDOT Type R Curb Opening | Type =               | CDOT Type R Curb Opening |       |        |
| Local Depression (additional to continuous gutter depression 'a')         |                          | a <sub>LOCAL</sub> = | 3.0                      | 3.0   | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening)                |                          | No =                 | 3                        | 3     |        |
| Length of a Single Unit Inlet (Grate or Curb Opening)                     |                          | L <sub>o</sub> =     | 5.00                     | 5.00  | ft     |
| Width of a Unit Grate (cannot be greater than W, Gutter Width)            |                          | W <sub>o</sub> =     | N/A                      | N/A   | ft     |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5)        |                          | C <sub>f</sub> (G) = | N/A                      | N/A   |        |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) |                          | C <sub>f</sub> (C) = | 0.10                     | 0.10  |        |
| <b>Street Hydraulics: WARNING: Q &gt; ALLOWABLE Q FOR MAJOR STORM</b>     |                          |                      |                          |       |        |
| Total Inlet Interception Capacity                                         |                          | Q =                  | 3.6                      | 15.7  | cfs    |
| Total Inlet Carry-Over Flow (flow bypassing inlet)                        |                          | Q <sub>s</sub> =     | 0.0                      | 13.4  | cfs    |
| Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>                       |                          | C% =                 | 100                      | 54    | %      |

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

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

Project: Solena Subdivision

Inlet ID: B3

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 12.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

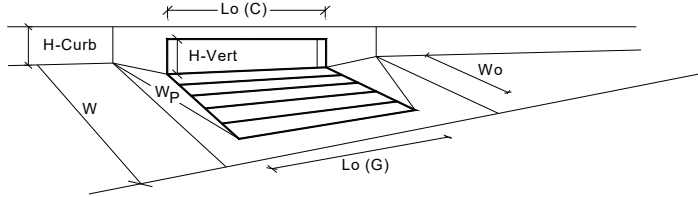
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



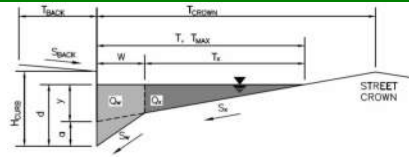
| Design Information (Input)                                                   |                          | MINOR                        |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|------------------------------|--------------------------|-------|-----------------------------------------------------|
| 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 <sub>local</sub> =         | 3.00                     | 3.00  | inches                                              |
| Number of Unit Inlets (Grate or Curb Opening)                                |                          | No =                         | 3                        | 3     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =              | 5.4                      | 6.0   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                              | MINOR                    | MAJOR | <input checked="" type="checkbox"/> Override Depths |
| Length of a Unit Grate                                                       |                          | L <sub>o</sub> (G) =         | N/A                      | N/A   | feet                                                |
| Width of a Unit Grate                                                        |                          | W <sub>o</sub> =             | N/A                      | N/A   | feet                                                |
| Open Area Ratio for a Grate (typical values 0.15-0.90)                       |                          | A <sub>ratio</sub> =         | N/A                      | N/A   |                                                     |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70)               |                          | C <sub>f</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Weir Coefficient (typical value 2.15 - 3.60)                           |                          | C <sub>w</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Orifice Coefficient (typical value 0.60 - 0.80)                        |                          | C <sub>o</sub> (G) =         | N/A                      | N/A   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                              | MINOR                    | MAJOR |                                                     |
| Length of a Unit Curb Opening                                                |                          | L <sub>o</sub> (C) =         | 5.00                     | 5.00  | feet                                                |
| Height of Vertical Curb Opening in Inches                                    |                          | H <sub>vert</sub> =          | 6.00                     | 6.00  | inches                                              |
| Height of Curb Orifice Throat in Inches                                      |                          | H <sub>throat</sub> =        | 6.00                     | 6.00  | inches                                              |
| Angle of Throat                                                              |                          | Theta =                      | 63.40                    | 63.40 | degrees                                             |
| Side Width for Depression Pan (typically the gutter width of 2 feet)         |                          | W <sub>p</sub> =             | 2.00                     | 2.00  | feet                                                |
| Clogging Factor for a Single Curb Opening (typical value 0.10)               |                          | C <sub>f</sub> (C) =         | 0.10                     | 0.10  |                                                     |
| Curb Opening Weir Coefficient (typical value 2.3-3.7)                        |                          | C <sub>w</sub> (C) =         | 3.60                     | 3.60  |                                                     |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)                 |                          | C <sub>o</sub> (C) =         | 0.67                     | 0.67  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                              | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | d <sub>Grate</sub> =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | d <sub>Curb</sub> =          | 0.28                     | 0.33  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Grate</sub> =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Curb</sub> =         | 0.74                     | 0.79  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | RF <sub>Combination</sub> =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                              | MINOR                    | MAJOR |                                                     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | Q <sub>s</sub> =             | 7.1                      | 9.7   | cfs                                                 |
|                                                                              |                          | Q <sub>PEAK REQUIRED</sub> = | 3.7                      | 36.4  | cfs                                                 |

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

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

Project: Solena Subdivision

Inlet ID: B4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

$$\begin{aligned} T_{\text{BACK}} &= 12.0 \text{ ft} \\ S_{\text{BACK}} &= 0.020 \text{ ft/ft} \\ n_{\text{BACK}} &= 0.020 \end{aligned}$$

$$\begin{aligned} H_{\text{CURB}} &= 6.00 \text{ inches} \\ T_{\text{CROWN}} &= 16.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_X &= 0.020 \text{ ft/ft} \\ S_W &= 0.083 \text{ ft/ft} \\ S_O &= 0.000 \text{ ft/ft} \\ n_{\text{STREET}} &= 0.013 \end{aligned}$$

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|                  | Minor Storm | Major Storm |        |
|------------------|-------------|-------------|--------|
| $T_{\text{MAX}}$ | 16.0        | 16.0        | ft     |
| $d_{\text{MAX}}$ | 6.0         | 6.0         | inches |

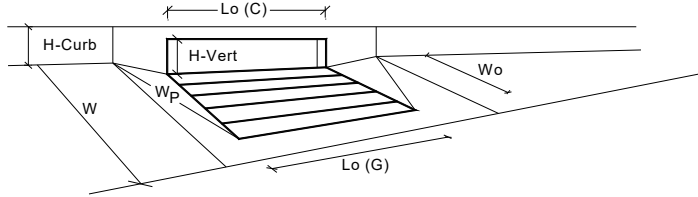
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$$Q_{\text{allow}} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ \text{SUMP} & \text{SUMP} \end{matrix} \text{ cfs}$$

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



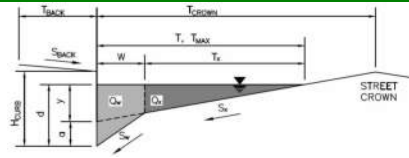
| Design Information (Input)                                                   |                          | MINOR                        |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|------------------------------|--------------------------|-------|-----------------------------------------------------|
| 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 <sub>local</sub> =         | 3.00                     | 3.00  | inches                                              |
| Number of Unit Inlets (Grate or Curb Opening)                                |                          | No =                         | 3                        | 3     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =              | 5.4                      | 6.0   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                              | MINOR                    | MAJOR | <input checked="" type="checkbox"/> Override Depths |
| Length of a Unit Grate                                                       |                          | L <sub>o</sub> (G) =         | N/A                      | N/A   | feet                                                |
| Width of a Unit Grate                                                        |                          | W <sub>o</sub> =             | N/A                      | N/A   | feet                                                |
| Open Area Ratio for a Grate (typical values 0.15-0.90)                       |                          | A <sub>ratio</sub> =         | N/A                      | N/A   |                                                     |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70)               |                          | C <sub>f</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Weir Coefficient (typical value 2.15 - 3.60)                           |                          | C <sub>w</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Orifice Coefficient (typical value 0.60 - 0.80)                        |                          | C <sub>o</sub> (G) =         | N/A                      | N/A   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                              | MINOR                    | MAJOR |                                                     |
| Length of a Unit Curb Opening                                                |                          | L <sub>o</sub> (C) =         | 5.00                     | 5.00  | feet                                                |
| Height of Vertical Curb Opening in Inches                                    |                          | H <sub>vert</sub> =          | 6.00                     | 6.00  | inches                                              |
| Height of Curb Orifice Throat in Inches                                      |                          | H <sub>throat</sub> =        | 6.00                     | 6.00  | inches                                              |
| Angle of Throat                                                              |                          | Theta =                      | 63.40                    | 63.40 | degrees                                             |
| Side Width for Depression Pan (typically the gutter width of 2 feet)         |                          | W <sub>p</sub> =             | 2.00                     | 2.00  | feet                                                |
| Clogging Factor for a Single Curb Opening (typical value 0.10)               |                          | C <sub>f</sub> (C) =         | 0.10                     | 0.10  |                                                     |
| Curb Opening Weir Coefficient (typical value 2.3-3.7)                        |                          | C <sub>w</sub> (C) =         | 3.60                     | 3.60  |                                                     |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)                 |                          | C <sub>o</sub> (C) =         | 0.67                     | 0.67  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                              | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | d <sub>Grate</sub> =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | d <sub>Curb</sub> =          | 0.28                     | 0.33  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Grate</sub> =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Curb</sub> =         | 0.74                     | 0.79  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | RF <sub>Combination</sub> =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                              | MINOR                    | MAJOR |                                                     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | Q <sub>s</sub> =             | 7.1                      | 9.7   | cfs                                                 |
|                                                                              |                          | Q <sub>PEAK REQUIRED</sub> = | 0.8                      | 17.3  | cfs                                                 |

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

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

Project: Solena Subdivision

Inlet ID: B5

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 12.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

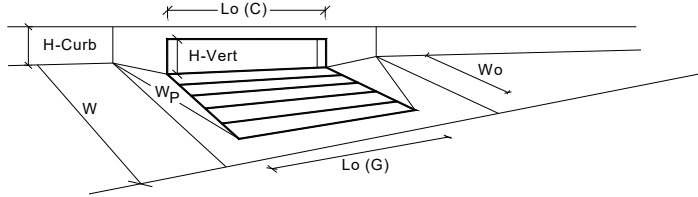
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



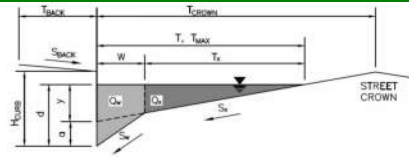
| Design Information (Input)                                                   |                          | MINOR                    |       | MAJOR |         |
|------------------------------------------------------------------------------|--------------------------|--------------------------|-------|-------|---------|
| Type of Inlet                                                                | CDOT Type R Curb Opening | 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 =                     | 3     | 3     |         |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =          | 5.4   | 6.0   | inches  |
| <b>Grate Information</b>                                                     |                          | MINOR                    |       | MAJOR |         |
| Length of a Unit Grate                                                       |                          | $L_o (G) =$              | N/A   | N/A   | feet    |
| Width of a Unit Grate                                                        |                          | $W_o =$                  | N/A   | N/A   | feet    |
| 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   |         |
| <b>Curb Opening Information</b>                                              |                          | 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  |         |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          | MINOR                    |       | MAJOR |         |
| Depth for Grate Midwidth                                                     |                          | $d_{Grate} =$            | N/A   | N/A   | ft      |
| Depth for Curb Opening Weir Equation                                         |                          | $d_{Curb} =$             | 0.28  | 0.33  | ft      |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | $RF_{Grate} =$           | N/A   | N/A   |         |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | $RF_{Curb} =$            | 0.74  | 0.79  |         |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | $RF_{Combination} =$     | N/A   | N/A   |         |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          | MINOR                    |       | MAJOR |         |
|                                                                              |                          | $Q_s =$                  | 7.1   | 9.7   | cfs     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | $Q_{PEAK REQUIRED} =$    | 5.5   | 29.8  | cfs     |

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

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

Project: Solena Subdivision

Inlet ID: B6

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

$$\begin{aligned} T_{BACK} &= 12.0 \text{ ft} \\ S_{BACK} &= 0.020 \text{ ft/ft} \\ n_{BACK} &= 0.020 \end{aligned}$$

$$\begin{aligned} H_{CURB} &= 6.00 \text{ inches} \\ T_{CROWN} &= 16.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_X &= 0.020 \text{ ft/ft} \\ S_W &= 0.083 \text{ ft/ft} \\ S_O &= 0.060 \text{ ft/ft} \\ n_{STREET} &= 0.013 \end{aligned}$$

Max. Allowable Spread for Minor &amp; Major Storm

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

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

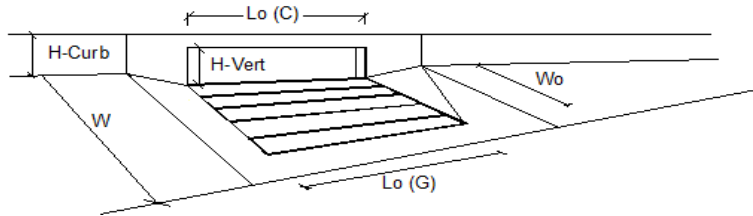
$$Q_{allow} = \begin{aligned} &\text{Minor Storm} & \text{Major Storm} \\ &17.7 & 17.7 \end{aligned} \text{ cfs}$$

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.20 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.30 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



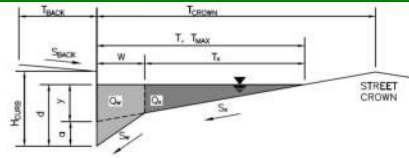
| Design Information (Input)                                                |                          | MINOR                |                          | MAJOR |        |
|---------------------------------------------------------------------------|--------------------------|----------------------|--------------------------|-------|--------|
| Type of Inlet                                                             | CDOT Type R Curb Opening | Type =               | CDOT Type R Curb Opening |       |        |
| Local Depression (additional to continuous gutter depression 'a')         |                          | a <sub>LOCAL</sub> = | 3.0                      | 3.0   | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening)                |                          | No =                 | 3                        | 3     |        |
| Length of a Single Unit Inlet (Grate or Curb Opening)                     |                          | L <sub>u</sub> =     | 5.00                     | 5.00  | ft     |
| Width of a Unit Grate (cannot be greater than W, Gutter Width)            |                          | W <sub>u</sub> =     | N/A                      | N/A   | ft     |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5)        |                          | C <sub>f</sub> (G) = | N/A                      | N/A   |        |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) |                          | C <sub>f</sub> (C) = | 0.10                     | 0.10  |        |
| Street Hydraulics: OK - Q < Allowable Street Capacity                     |                          |                      |                          |       |        |
| Total Inlet Interception Capacity                                         |                          | Q =                  | 2.2                      | 6.3   | cfs    |
| Total Inlet Carry-Over Flow (flow bypassing inlet)                        |                          | Q <sub>s</sub> =     | 0.0                      | 0.0   | cfs    |
| Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>                       |                          | C% =                 | 100                      | 100   | %      |

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

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

Project: Solena Subdivision

Inlet ID: B7

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

$$\begin{aligned} T_{BACK} &= 12.0 \text{ ft} \\ S_{BACK} &= 0.020 \text{ ft/ft} \\ n_{BACK} &= 0.020 \end{aligned}$$

$$\begin{aligned} H_{CURB} &= 6.00 \text{ inches} \\ T_{CROWN} &= 16.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_X &= 0.020 \text{ ft/ft} \\ S_W &= 0.083 \text{ ft/ft} \\ S_O &= 0.010 \text{ ft/ft} \\ n_{STREET} &= 0.013 \end{aligned}$$

Max. Allowable Spread for Minor &amp; Major Storm

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

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

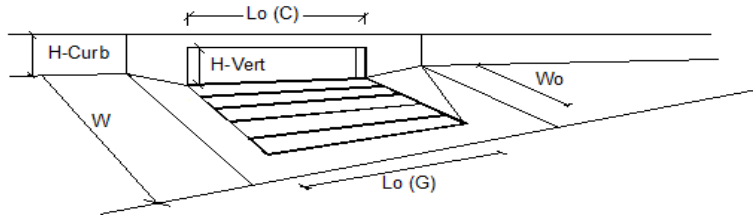
$$Q_{allow} = \begin{aligned} &\text{Minor Storm} & \text{Major Storm} \\ &11.5 & 11.5 \end{aligned} \text{ cfs}$$

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.20 cfs on sheet 'Inlet Management'

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

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



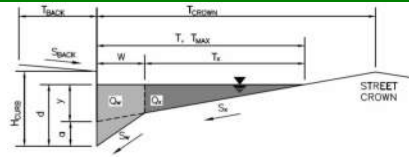
| Design Information (Input)                                                |                          | MINOR         |                          | MAJOR |        |
|---------------------------------------------------------------------------|--------------------------|---------------|--------------------------|-------|--------|
| 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)                |                          | $N_o$ =       | 4                        | 4     |        |
| 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 - $Q < \text{Allowable Street Capacity}$            |                          |               |                          |       |        |
| Total Inlet Interception Capacity                                         |                          | $Q$ =         | 2.2                      | 8.4   | cfs    |
| Total Inlet Carry-Over Flow (flow bypassing inlet)                        |                          | $Q_o$ =       | 0.0                      | 0.0   | cfs    |
| Capture Percentage = $Q_o/Q_o$                                            |                          | $C\%$ =       | 100                      | 100   | %      |

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

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

Project: Solena Subdivision

Inlet ID: B8

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 12.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.060 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

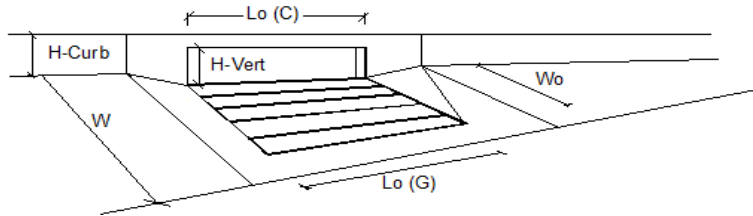
|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | 17.7        | 17.7        | cfs |

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.90 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



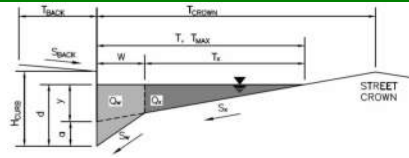
| Design Information (Input)                                                |                          | MINOR                |                          | MAJOR |        |
|---------------------------------------------------------------------------|--------------------------|----------------------|--------------------------|-------|--------|
| Type of Inlet                                                             | CDOT Type R Curb Opening | Type =               | CDOT Type R Curb Opening |       |        |
| Local Depression (additional to continuous gutter depression 'a')         |                          | a <sub>LOCAL</sub> = | 3.0                      | 3.0   | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening)                |                          | No =                 | 3                        | 3     |        |
| Length of a Single Unit Inlet (Grate or Curb Opening)                     |                          | L <sub>o</sub> =     | 5.00                     | 5.00  | ft     |
| Width of a Unit Grate (cannot be greater than W, Gutter Width)            |                          | W <sub>o</sub> =     | N/A                      | N/A   | ft     |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5)        |                          | C <sub>f</sub> (G) = | N/A                      | N/A   |        |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) |                          | C <sub>f</sub> (C) = | 0.10                     | 0.10  |        |
| Street Hydraulics: OK - Q < Allowable Street Capacity                     |                          |                      |                          |       |        |
| Total Inlet Interception Capacity                                         |                          | Q =                  | 2.8                      | 9.5   | cfs    |
| Total Inlet Carry-Over Flow (flow bypassing inlet)                        |                          | Q <sub>s</sub> =     | 0.0                      | 1.4   | cfs    |
| Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>                       |                          | C% =                 | 100                      | 87    | %      |

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

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

Project: Solena Subdivision

Inlet ID: B9

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

$$\begin{aligned} T_{BACK} &= 12.0 \text{ ft} \\ S_{BACK} &= 0.020 \text{ ft/ft} \\ n_{BACK} &= 0.020 \end{aligned}$$

$$\begin{aligned} H_{CURB} &= 6.00 \text{ inches} \\ T_{CROWN} &= 16.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_X &= 0.020 \text{ ft/ft} \\ S_W &= 0.083 \text{ ft/ft} \\ S_O &= 0.060 \text{ ft/ft} \\ n_{STREET} &= 0.013 \end{aligned}$$

Max. Allowable Spread for Minor &amp; Major Storm

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

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

MINOR STORM Allowable Capacity is based on Depth Criterion

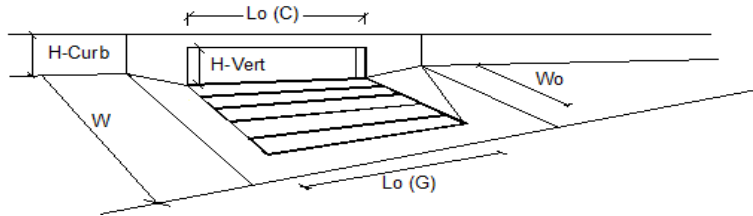
MAJOR STORM Allowable Capacity is based on Depth Criterion

$$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.7 & 17.7 \end{matrix} \text{ cfs}$$

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.80 cfs on sheet 'Inlet Management'****Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.51 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



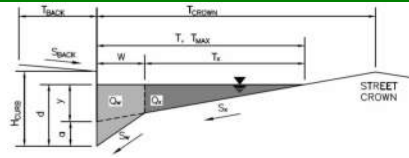
| Design Information (Input)                                                |                          | MINOR         |                          | MAJOR |        |
|---------------------------------------------------------------------------|--------------------------|---------------|--------------------------|-------|--------|
| 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)                |                          | $N_o$ =       | 3                        | 3     |        |
| 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 - $Q < \text{Allowable Street Capacity}$            |                          |               |                          |       |        |
| Total Inlet Interception Capacity                                         |                          | $Q$ =         | 0.8                      | 4.5   | cfs    |
| Total Inlet Carry-Over Flow (flow bypassing inlet)                        |                          | $Q_o$ =       | 0.0                      | 0.0   | cfs    |
| Capture Percentage = $Q_o/Q_o$                                            |                          | $C\%$ =       | 100                      | 100   | %      |

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

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

Project: Solena Subdivision

Inlet ID: C1

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

$$\begin{aligned} T_{\text{BACK}} &= 15.0 \text{ ft} \\ S_{\text{BACK}} &= 0.020 \text{ ft/ft} \\ n_{\text{BACK}} &= 0.012 \end{aligned}$$

$$\begin{aligned} H_{\text{CURB}} &= 6.00 \text{ inches} \\ T_{\text{CROWN}} &= 14.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_X &= 0.020 \text{ ft/ft} \\ S_W &= 0.083 \text{ ft/ft} \\ S_O &= 0.010 \text{ ft/ft} \\ n_{\text{STREET}} &= 0.013 \end{aligned}$$

Max. Allowable Spread for Minor &amp; Major Storm

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

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

|                  | Minor Storm              | Major Storm                         |        |
|------------------|--------------------------|-------------------------------------|--------|
| $T_{\text{MAX}}$ | 14.0                     | 14.0                                | ft     |
| $d_{\text{MAX}}$ | 6.0                      | 8.0                                 | inches |
|                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |        |

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

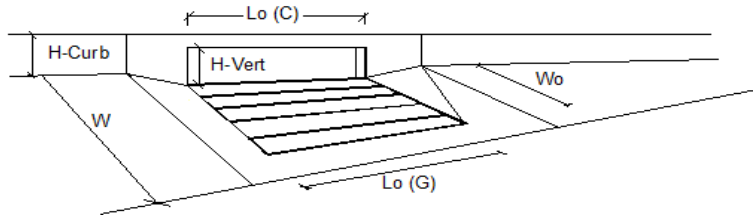
$$Q_{\text{allow}} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 8.3 & 39.4 \end{matrix} \text{ cfs}$$

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.20 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 27.10 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



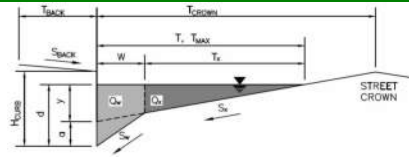
| Design Information (Input)                                                |                          | MINOR                |                          | MAJOR      |
|---------------------------------------------------------------------------|--------------------------|----------------------|--------------------------|------------|
| Type of Inlet                                                             | CDOT Type R Curb Opening | Type =               | CDOT Type R Curb Opening |            |
| Local Depression (additional to continuous gutter depression 'a')         |                          | a <sub>LOCAL</sub> = | 3.0                      | 3.0 inches |
| Total Number of Units in the Inlet (Grate or Curb Opening)                |                          | No =                 | 4                        | 4          |
| Length of a Single Unit Inlet (Grate or Curb Opening)                     |                          | L <sub>u</sub> =     | 5.00                     | 5.00 ft    |
| Width of a Unit Grate (cannot be greater than W, Gutter Width)            |                          | W <sub>u</sub> =     | N/A                      | N/A ft     |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5)        |                          | C <sub>f</sub> (G) = | N/A                      | N/A        |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) |                          | C <sub>f</sub> (C) = | 0.10                     | 0.10       |
| Street Hydraulics: OK - Q < Allowable Street Capacity                     |                          | MINOR                |                          | MAJOR      |
| Total Inlet Interception Capacity                                         |                          | Q =                  | 3.2                      | 19.1 cfs   |
| Total Inlet Carry-Over Flow (flow bypassing inlet)                        |                          | Q <sub>s</sub> =     | 0.0                      | 8.0 cfs    |
| Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>                       |                          | C% =                 | 100                      | 71 %       |

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

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

Project: Solena Subdivision

Inlet ID: C2

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 12.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 8.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

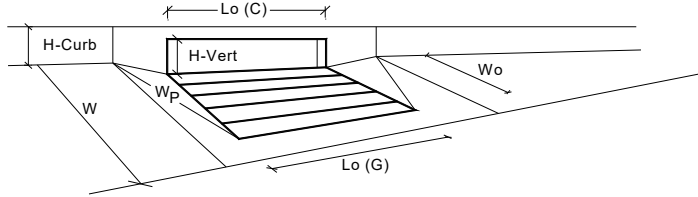
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



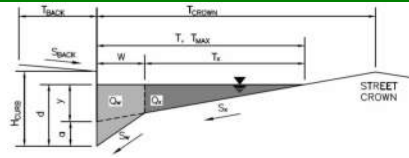
| Design Information (Input)                                                   |                          | MINOR                 |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|-----------------------|--------------------------|-------|-----------------------------------------------------|
| 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 =                  | 4                        | 4     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =       | 5.4                      | 6.0   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                       | MINOR                    | MAJOR | <input checked="" type="checkbox"/> 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   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                       | 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  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                       | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | $d_{Grate}$ =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | $d_{Curb}$ =          | 0.28                     | 0.33  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | $RF_{Grate}$ =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | $RF_{Curb}$ =         | 0.74                     | 0.79  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | $RF_{Combination}$ =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                       | MINOR                    | MAJOR |                                                     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | $Q_s$ =               | 9.1                      | 12.5  | cfs                                                 |
|                                                                              |                          | $Q_{PEAK REQUIRED}$ = | 3.7                      | 63.5  | cfs                                                 |

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

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

Project: Solena Subdivision

Inlet ID: C3

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 12.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

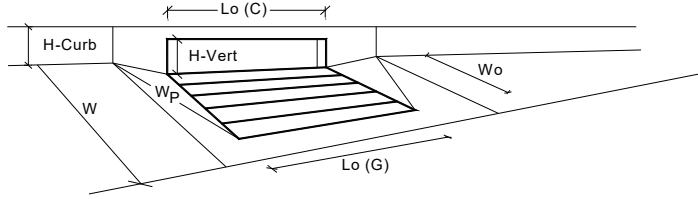
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



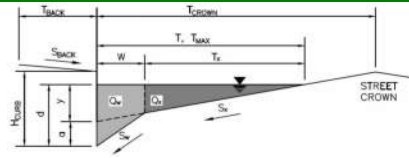
| Design Information (Input)                                                   |                          | MINOR                 |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|-----------------------|--------------------------|-------|-----------------------------------------------------|
| 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 =                  | 4                        | 4     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =       | 5.4                      | 6.0   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                       | MINOR                    | MAJOR | <input checked="" type="checkbox"/> 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   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                       | 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  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                       | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | $d_{Grate}$ =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | $d_{Curb}$ =          | 0.28                     | 0.33  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | $RF_{Grate}$ =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | $RF_{Curb}$ =         | 0.74                     | 0.79  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | $RF_{Combination}$ =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                       | MINOR                    | MAJOR |                                                     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | $Q_s$ =               | 9.1                      | 12.5  | cfs                                                 |
|                                                                              |                          | $Q_{PEAK REQUIRED}$ = | 2.0                      | 44.3  | cfs                                                 |

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

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

Project: Solena Subdivision

Inlet ID: C4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 17.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.013 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 14.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 14.0                     | 14.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 12.0                     | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

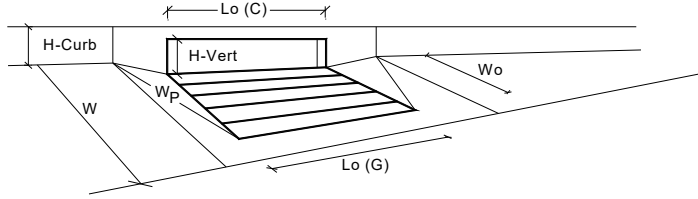
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



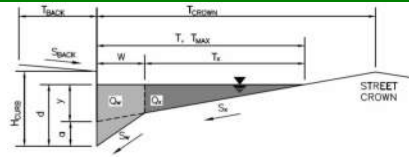
| Design Information (Input)                                                   |                          | MINOR                        |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|------------------------------|--------------------------|-------|-----------------------------------------------------|
| 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 <sub>local</sub> =         | 3.00                     | 3.00  | inches                                              |
| Number of Unit Inlets (Grate or Curb Opening)                                |                          | No =                         | 4                        | 4     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =              | 4.9                      | 6.0   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                              | MINOR                    | MAJOR | <input checked="" type="checkbox"/> Override Depths |
| Length of a Unit Grate                                                       |                          | L <sub>o</sub> (G) =         | N/A                      | N/A   | feet                                                |
| Width of a Unit Grate                                                        |                          | W <sub>o</sub> =             | N/A                      | N/A   | feet                                                |
| Open Area Ratio for a Grate (typical values 0.15-0.90)                       |                          | A <sub>ratio</sub> =         | N/A                      | N/A   |                                                     |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70)               |                          | C <sub>f</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Weir Coefficient (typical value 2.15 - 3.60)                           |                          | C <sub>w</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Orifice Coefficient (typical value 0.60 - 0.80)                        |                          | C <sub>o</sub> (G) =         | N/A                      | N/A   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                              | MINOR                    | MAJOR |                                                     |
| Length of a Unit Curb Opening                                                |                          | L <sub>o</sub> (C) =         | 5.00                     | 5.00  | feet                                                |
| Height of Vertical Curb Opening in Inches                                    |                          | H <sub>vert</sub> =          | 6.00                     | 6.00  | inches                                              |
| Height of Curb Orifice Throat in Inches                                      |                          | H <sub>throat</sub> =        | 6.00                     | 6.00  | inches                                              |
| Angle of Throat                                                              |                          | Theta =                      | 63.40                    | 63.40 | degrees                                             |
| Side Width for Depression Pan (typically the gutter width of 2 feet)         |                          | W <sub>p</sub> =             | 2.00                     | 2.00  | feet                                                |
| Clogging Factor for a Single Curb Opening (typical value 0.10)               |                          | C <sub>f</sub> (C) =         | 0.10                     | 0.10  |                                                     |
| Curb Opening Weir Coefficient (typical value 2.3-3.7)                        |                          | C <sub>w</sub> (C) =         | 3.60                     | 3.60  |                                                     |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)                 |                          | C <sub>o</sub> (C) =         | 0.67                     | 0.67  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                              | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | d <sub>Grate</sub> =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | d <sub>Curb</sub> =          | 0.24                     | 0.33  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Grate</sub> =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Curb</sub> =         | 0.71                     | 0.79  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | RF <sub>Combination</sub> =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                              | MINOR                    | MAJOR |                                                     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | Q <sub>s</sub> =             | 6.9                      | 12.5  | cfs                                                 |
|                                                                              |                          | Q <sub>PEAK REQUIRED</sub> = | 2.2                      | 34.0  | cfs                                                 |

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

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

Project: Solena Subdivision

Inlet ID: CS

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 17.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.013 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 14.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 14.0                     | 14.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

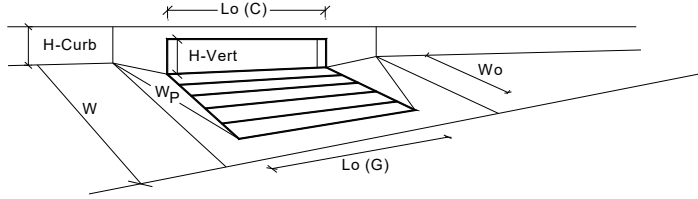
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



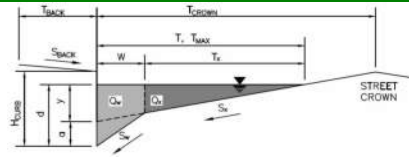
| Design Information (Input)                                                   |                          | MINOR                        |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|------------------------------|--------------------------|-------|-----------------------------------------------------|
| 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 <sub>local</sub> =         | 3.00                     | 3.00  | inches                                              |
| Number of Unit Inlets (Grate or Curb Opening)                                |                          | No =                         | 3                        | 3     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =              | 4.9                      | 6.0   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                              | MINOR                    | MAJOR | <input checked="" type="checkbox"/> Override Depths |
| Length of a Unit Grate                                                       |                          | L <sub>o</sub> (G) =         | N/A                      | N/A   | feet                                                |
| Width of a Unit Grate                                                        |                          | W <sub>o</sub> =             | N/A                      | N/A   | feet                                                |
| Open Area Ratio for a Grate (typical values 0.15-0.90)                       |                          | A <sub>ratio</sub> =         | N/A                      | N/A   |                                                     |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70)               |                          | C <sub>f</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Weir Coefficient (typical value 2.15 - 3.60)                           |                          | C <sub>w</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Orifice Coefficient (typical value 0.60 - 0.80)                        |                          | C <sub>o</sub> (G) =         | N/A                      | N/A   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                              | MINOR                    | MAJOR |                                                     |
| Length of a Unit Curb Opening                                                |                          | L <sub>o</sub> (C) =         | 5.00                     | 5.00  | feet                                                |
| Height of Vertical Curb Opening in Inches                                    |                          | H <sub>vert</sub> =          | 6.00                     | 6.00  | inches                                              |
| Height of Curb Orifice Throat in Inches                                      |                          | H <sub>throat</sub> =        | 6.00                     | 6.00  | inches                                              |
| Angle of Throat                                                              |                          | Theta =                      | 63.40                    | 63.40 | degrees                                             |
| Side Width for Depression Pan (typically the gutter width of 2 feet)         |                          | W <sub>p</sub> =             | 2.00                     | 2.00  | feet                                                |
| Clogging Factor for a Single Curb Opening (typical value 0.10)               |                          | C <sub>f</sub> (C) =         | 0.10                     | 0.10  |                                                     |
| Curb Opening Weir Coefficient (typical value 2.3-3.7)                        |                          | C <sub>w</sub> (C) =         | 3.60                     | 3.60  |                                                     |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)                 |                          | C <sub>o</sub> (C) =         | 0.67                     | 0.67  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                              | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | d <sub>Grate</sub> =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | d <sub>Curb</sub> =          | 0.24                     | 0.33  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Grate</sub> =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Curb</sub> =         | 0.71                     | 0.79  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | RF <sub>Combination</sub> =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                              | MINOR                    | MAJOR |                                                     |
| <b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>                   |                          | Q <sub>s</sub> =             | 5.3                      | 9.7   | cfs                                                 |
|                                                                              |                          | Q <sub>PEAK REQUIRED</sub> = | 4.8                      | 31.6  | cfs                                                 |

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

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

Project: Solena Subdivision

Inlet ID: C6

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

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

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

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

Street Longitudinal Slope - Enter 0 for sump condition

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

|            |   |       |       |
|------------|---|-------|-------|
| $T_{BACK}$ | = | 12.0  | ft    |
| $S_{BACK}$ | = | 0.020 | ft/ft |
| $n_{BACK}$ | = | 0.020 |       |

|              |   |       |        |
|--------------|---|-------|--------|
| $H_{CURB}$   | = | 6.00  | inches |
| $T_{CROWN}$  | = | 16.0  | ft     |
| $W$          | = | 2.00  | ft     |
| $S_X$        | = | 0.020 | ft/ft  |
| $S_W$        | = | 0.083 | ft/ft  |
| $S_O$        | = | 0.000 | ft/ft  |
| $n_{STREET}$ | = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

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

Check boxes are not applicable in SUMP conditions

|           | Minor Storm              | Major Storm              |        |
|-----------|--------------------------|--------------------------|--------|
| $T_{MAX}$ | 16.0                     | 16.0                     | ft     |
| $d_{MAX}$ | 6.0                      | 6.0                      | inches |
|           | <input type="checkbox"/> | <input type="checkbox"/> |        |

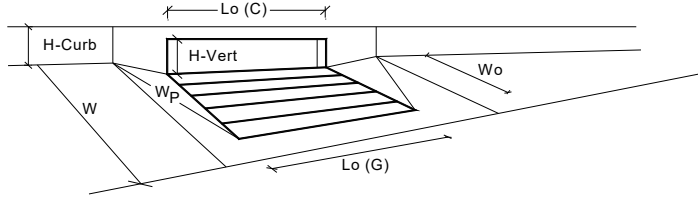
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|             | Minor Storm | Major Storm |     |
|-------------|-------------|-------------|-----|
| $Q_{allow}$ | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

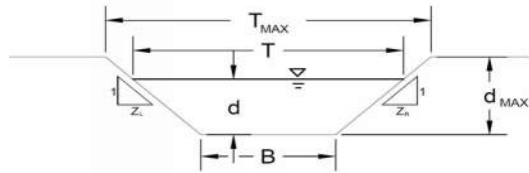


| Design Information (Input)                                                   |                          | MINOR                        |                          | MAJOR |                                                     |
|------------------------------------------------------------------------------|--------------------------|------------------------------|--------------------------|-------|-----------------------------------------------------|
| 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 <sub>local</sub> =         | 3.00                     | 3.00  | inches                                              |
| Number of Unit Inlets (Grate or Curb Opening)                                |                          | No =                         | 3                        | 3     |                                                     |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =              | 5.4                      | 5.6   | inches                                              |
| <b>Grate Information</b>                                                     |                          |                              | MINOR                    | MAJOR | <input checked="" type="checkbox"/> Override Depths |
| Length of a Unit Grate                                                       |                          | L <sub>o</sub> (G) =         | N/A                      | N/A   | feet                                                |
| Width of a Unit Grate                                                        |                          | W <sub>o</sub> =             | N/A                      | N/A   | feet                                                |
| Open Area Ratio for a Grate (typical values 0.15-0.90)                       |                          | A <sub>ratio</sub> =         | N/A                      | N/A   |                                                     |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70)               |                          | C <sub>f</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Weir Coefficient (typical value 2.15 - 3.60)                           |                          | C <sub>w</sub> (G) =         | N/A                      | N/A   |                                                     |
| Grate Orifice Coefficient (typical value 0.60 - 0.80)                        |                          | C <sub>o</sub> (G) =         | N/A                      | N/A   |                                                     |
| <b>Curb Opening Information</b>                                              |                          |                              | MINOR                    | MAJOR |                                                     |
| Length of a Unit Curb Opening                                                |                          | L <sub>o</sub> (C) =         | 5.00                     | 5.00  | feet                                                |
| Height of Vertical Curb Opening in Inches                                    |                          | H <sub>vert</sub> =          | 6.00                     | 6.00  | inches                                              |
| Height of Curb Orifice Throat in Inches                                      |                          | H <sub>throat</sub> =        | 6.00                     | 6.00  | inches                                              |
| Angle of Throat                                                              |                          | Theta =                      | 63.40                    | 63.40 | degrees                                             |
| Side Width for Depression Pan (typically the gutter width of 2 feet)         |                          | W <sub>p</sub> =             | 2.00                     | 2.00  | feet                                                |
| Clogging Factor for a Single Curb Opening (typical value 0.10)               |                          | C <sub>f</sub> (C) =         | 0.10                     | 0.10  |                                                     |
| Curb Opening Weir Coefficient (typical value 2.3-3.7)                        |                          | C <sub>w</sub> (C) =         | 3.60                     | 3.60  |                                                     |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)                 |                          | C <sub>o</sub> (C) =         | 0.67                     | 0.67  |                                                     |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                              | MINOR                    | MAJOR |                                                     |
| Depth for Grate Midwidth                                                     |                          | d <sub>Grate</sub> =         | N/A                      | N/A   | ft                                                  |
| Depth for Curb Opening Weir Equation                                         |                          | d <sub>Curb</sub> =          | 0.28                     | 0.30  | ft                                                  |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Grate</sub> =        | N/A                      | N/A   |                                                     |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | RF <sub>Curb</sub> =         | 0.74                     | 0.76  |                                                     |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | RF <sub>Combination</sub> =  | N/A                      | N/A   |                                                     |
| <b>Total Inlet Interception Capacity (assumes clogged condition)</b>         |                          |                              | MINOR                    | MAJOR |                                                     |
| <b>Inlet Capacity IS GOOD for Minor and Major Storms (&gt;Q Peak)</b>        |                          | Q <sub>s</sub> =             | 7.1                      | 8.0   | cfs                                                 |
|                                                                              |                          | Q <sub>PEAK REQUIRED</sub> = | 0.5                      | 7.7   | cfs                                                 |

# AREA INLET IN A SWALE

Solena Subdivision

C7



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

## Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

| Soil Type:   | Max. Velocity ( $V_{MAX}$ ) | Max Froude No. ( $F_{MAX}$ ) |
|--------------|-----------------------------|------------------------------|
| Non-Cohesive | 5.0 fps                     | 0.60                         |
| Cohesive     | 7.0 fps                     | 0.80                         |
| Paved        | N/A                         | N/A                          |

A, B, C, D, or E =

A

n = see details below

 $S_0 = 0.0100$  ft/ft

B = 4.00 ft

Z1 = 4.00 ft/ft

Z2 = 4.00 ft/ft

Choose One:

☐ Non-Cohesive☒ Cohesive☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

|             | Minor Storm | Major Storm |    |
|-------------|-------------|-------------|----|
| $T_{MAX} =$ | 12.00       | 20.00       | ft |
| $d_{MAX} =$ | 1.00        | 2.00        | ft |

## Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

|               | Minor Storm | Major Storm |     |
|---------------|-------------|-------------|-----|
| $Q_{allow} =$ | 2.7         | 11.0        | cfs |
| $d_{allow} =$ | 1.00        | 2.00        | ft  |

## Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

|         | Minor Storm | Major Storm |     |
|---------|-------------|-------------|-----|
| $Q_o =$ | 0.8         | 4.9         | cfs |
| $d =$   | 0.49        | 1.38        | ft  |

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

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

# AREA INLET IN A SWALE

Solena Subdivision

C7

## Inlet Design Information (Input)

Type of Inlet

CDOT Type C (Depressed)

Inlet Type =

CDOT Type C (Depressed)

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

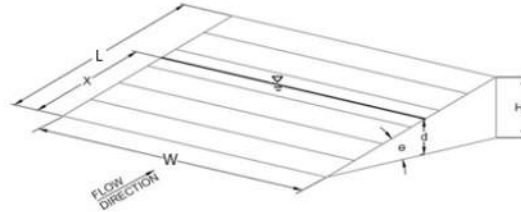
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient

 $\theta =$  0.00 degrees $W =$  3.00 ft $L =$  3.00 ft $A_{\text{RATIO}} =$  0.70 $H_b =$  0.00 ft $C_f =$  0.50 $C_d =$  0.84 $C_o =$  0.56 $C_w =$  1.81

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage =  $Q_a/Q_o$ 

|         | MINOR | MAJOR |     |
|---------|-------|-------|-----|
| $d =$   | 1.49  | 2.38  |     |
| $Q_a =$ | 17.4  | 21.9  | cfs |
| $Q_b =$ | 0.0   | 0.0   | cfs |
| $C\% =$ | 100   | 100   | %   |

*MHFD-Detention, Version 4.04 (February 2021)*

**Basin ID:** Basin A Pond 1



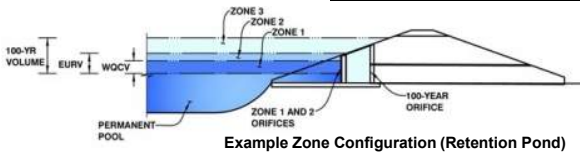
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# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Soleana Subdivision

Basin ID: Basin A Pond 1



Example Zone Configuration (Retention Pond)

|                      | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type          |
|----------------------|----------------------|--------------------------|----------------------|
| Zone 1 (WQCV)        | 1.66                 | 0.040                    | Orifice Plate        |
| Zone 2 (EURV)        | 1.94                 | 0.018                    | Orifice Plate        |
| Zone 3 (100+1/2WQCV) | 4.02                 | 0.253                    | Weir&Pipe (Restrict) |
| Total (all zones)    |                      | 0.311                    |                      |

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

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

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

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

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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

|                                | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|--------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Stage of Orifice Centroid (ft) | 0.00             | 1.45             | 2.91             |                  |                  |                  |                  |                  |
| Orifice Area (sq. inches)      | 0.33             | 0.33             | 0.33             |                  |                  |                  |                  |                  |

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Gate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Gate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Height of Gate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Gate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Gate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

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

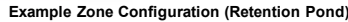
## Routed Hydrograph Results

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

|                                                 | WQCV  | EURV  | 2 Year | 5 Year | 10 Year         | 25 Year         | 50 Year         | 100 Year        | 500 Year       |
|-------------------------------------------------|-------|-------|--------|--------|-----------------|-----------------|-----------------|-----------------|----------------|
| Design Storm Return Period =                    | N/A   | N/A   | 1.06   | 1.43   | 1.66            | 1.69            | 2.26            | 2.60            | 3.14           |
| One-Hour Rainfall Depth (in) =                  | 0.040 | 0.058 | 0.094  | 0.280  | 0.419           | 0.490           | 0.867           | 1.149           | 1.525          |
| CUHP Runoff Volume (acre-ft) =                  | N/A   | N/A   | 0.094  | 0.280  | 0.419           | 0.490           | 0.867           | 1.149           | 1.525          |
| Inflow Hydrograph Volume (acre-ft) =            | N/A   | N/A   | 0.9    | 3.2    | 4.4             | 5.6             | 9.7             | 12.4            | 16.3           |
| CUHP Predevelopment Peak Q (cfs) =              | N/A   | N/A   | N/A    | N/A    | N/A             | N/A             | N/A             | N/A             | N/A            |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A   | N/A   | N/A    | N/A    | N/A             | N/A             | N/A             | N/A             | N/A            |
| Predevelopment Unit Peak Flow, q (cfs/acre) =   | N/A   | N/A   | 0.10   | 0.38   | 0.54            | 0.67            | 1.17            | 1.51            | 1.98           |
| Peak Inflow Q (cfs) =                           | N/A   | N/A   | 1.3    | 3.6    | 4.8             | 6.0             | 10.1            | 12.8            | 16.7           |
| Peak Outflow Q (cfs) =                          | 0.0   | 0.0   | 0.0    | 0.0    | 0.6             | 1.5             | 6.8             | 10.7            | 11.7           |
| Ratio Peak Outflow to Predevelopment Q =        | N/A   | N/A   | N/A    | 0.0    | 0.1             | 0.3             | 0.7             | 0.9             | 0.7            |
| Structure Controlling Flow =                    | Plate | Plate | Plate  | Plate  | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 |
| Max Velocity through Gate 1 (fps) =             | N/A   | N/A   | N/A    | N/A    | 0.0             | 0.0             | 0.2             | 0.3             | 0.3            |
| Max Velocity through Gate 2 (fps) =             | N/A   | N/A   | N/A    | N/A    | N/A             | N/A             | N/A             | N/A             | N/A            |
| Time to Drain 97% of Inflow Volume (hours) =    | 38    | 48    | 64     | 116    | >120            | >120            | >120            | 117             | 110            |
| Time to Drain 99% of Inflow Volume (hours) =    | 39    | 49    | 66     | >120   | >120            | >120            | >120            | >120            | >120           |
| Maximum Ponding Depth (ft) =                    | 1.65  | 1.95  | 2.35   | 3.79   | 4.41            | 4.46            | 4.64            | 4.74            | 5.09           |
| Area at Maximum Ponding Depth (acres) =         | 0.06  | 0.07  | 0.09   | 0.17   | 0.21            | 0.22            | 0.23            | 0.24            | 0.26           |
| Maximum Volume Stored (acre-ft) =               | 0.040 | 0.059 | 0.088  | 0.269  | 0.389           | 0.402           | 0.442           | 0.465           | 0.552          |

*MHFD-Detention, Version 4.04 (February 2021)*

**Basin ID: Pond 2 Sub Basins 106 and 107 Masterplan adjuisted for Developed Cooperhook and Martinez sites**



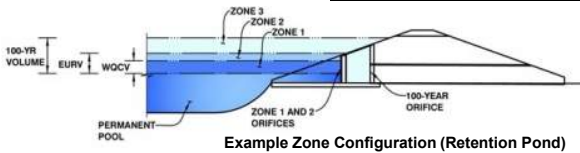
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# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Soleana Subdivision

Basin ID: Pond 2 Sub Basins 106 and 107 Masterplan adjusted for Developed Cooperhook and Martinez sites



Example Zone Configuration (Retention Pond)

|                   | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type          |
|-------------------|----------------------|--------------------------|----------------------|
| Zone 1 (WQCV)     | 2.99                 | 1.051                    | Orifice Plate        |
| Zone 2 (EURV)     | 3.86                 | 0.582                    | Orifice Plate        |
| Zone 3 (100-year) | 9.56                 | 5.082                    | Weir&Pipe (Restrict) |
| Total (all zones) |                      | 6.715                    |                      |

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = N/A ft<sup>2</sup>  
Underdrain Orifice Centroid = N/A feet

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

Calculated Parameters for Plate

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate = 3.20 ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing = 12.80 inches  
Orifice Plate: Orifice Area per Row = 4.43 sq. inches (use rectangular openings)

WQ Orifice Area per Row = 3.076E-02 ft<sup>2</sup>  
Elliptical Half-Width = N/A feet  
Elliptical Slot Centroid = N/A feet  
Elliptical Slot Area = N/A ft<sup>2</sup>

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

|                                | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|--------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Stage of Orifice Centroid (ft) | 0.00             | 1.07             | 2.13             |                  |                  |                  |                  |                  |
| Orifice Area (sq. inches)      | 4.43             | 4.43             | 4.43             |                  |                  |                  |                  |                  |

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

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

|                                               | Not Selected | Not Selected |                                               | Not Selected                | Not Selected        |
|-----------------------------------------------|--------------|--------------|-----------------------------------------------|-----------------------------|---------------------|
| Invert of Vertical Orifice =                  | N/A          | N/A          | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area =     | N/A ft <sup>2</sup> |
| Depth at top of Zone using Vertical Orifice = | N/A          | N/A          | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | N/A feet            |
| Vertical Orifice Diameter =                   | N/A          | N/A          | inches                                        |                             |                     |

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

Calculated Parameters for Overflow Weir

|                                                   | Zone 3 Weir  | Not Selected |                                               | Zone 3 Weir                                 | Not Selected           |
|---------------------------------------------------|--------------|--------------|-----------------------------------------------|---------------------------------------------|------------------------|
| Overflow Weir Front Edge Height, H <sub>o</sub> = | 3.40         | N/A          | ft (relative to basin bottom at Stage = 0 ft) | Height of Gate Upper Edge, H <sub>g</sub> = | 3.40 feet              |
| Overflow Weir Front Edge Length =                 | 45.00        | N/A          | feet                                          | Overflow Weir Slope Length =                | 4.00 feet              |
| Overflow Weir Gate Slope =                        | 0.00         | N/A          | H:V                                           | Grate Open Area / 100-yr Orifice Area =     | 7.32                   |
| Horiz. Length of Weir Sides =                     | 4.00         | N/A          | feet                                          | Overflow Grate Open Area w/o Debris =       | 125.28 ft <sup>2</sup> |
| Overflow Grate Type =                             | Type C Grate | N/A          |                                               | Overflow Grate Open Area w/ Debris =        | 62.64 ft <sup>2</sup>  |
| Debris Clogging % =                               | 50%          | N/A          | %                                             |                                             |                        |

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

|                                             | Zone 3 Restrictor | Not Selected |                                                  | Zone 3 Restrictor                                | Not Selected          |
|---------------------------------------------|-------------------|--------------|--------------------------------------------------|--------------------------------------------------|-----------------------|
| Depth to Invert of Outlet Pipe =            | 0.00              | N/A          | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area =                            | 17.12 ft <sup>2</sup> |
| Outlet Pipe Diameter =                      | 72.00             | N/A          | inches                                           | Outlet Orifice Centroid =                        | 1.99 feet             |
| Restrictor Plate Height Above Pipe Invert = | 42.00             |              | inches                                           | Half-Central Angle of Restrictor Plate on Pipe = | 1.74 radians          |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

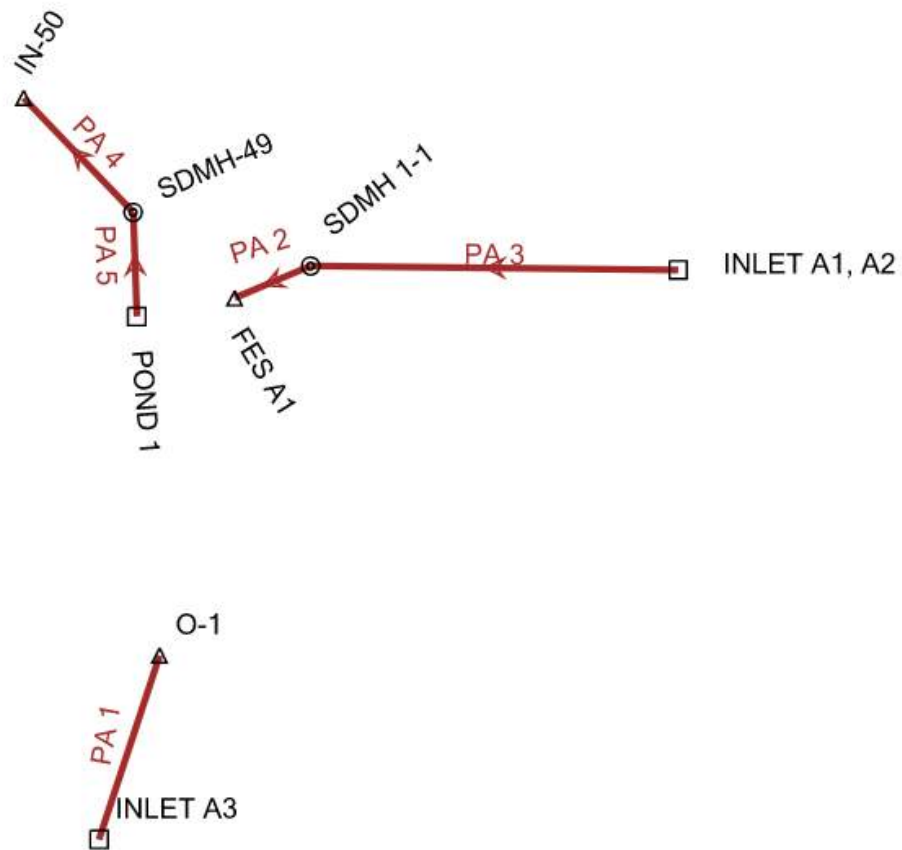
| Spillway Invert Stage =             | 10.00  | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth = 0.98 feet          |
|-------------------------------------|--------|-----------------------------------------------|-------------------------------------------------|
| Spillway Crest Length =             | 110.00 | feet                                          | Stage at Top of Freeboard = 11.98 feet          |
| Spillway End Slopes =               | 4.00   | H:V                                           | Basin Area at Top of Freeboard = 1.29 acres     |
| Freeboard above Max Water Surface = | 1.00   | feet                                          | Basin Volume at Top of Freeboard = 9.61 acre-ft |

## Routed Hydrograph Results

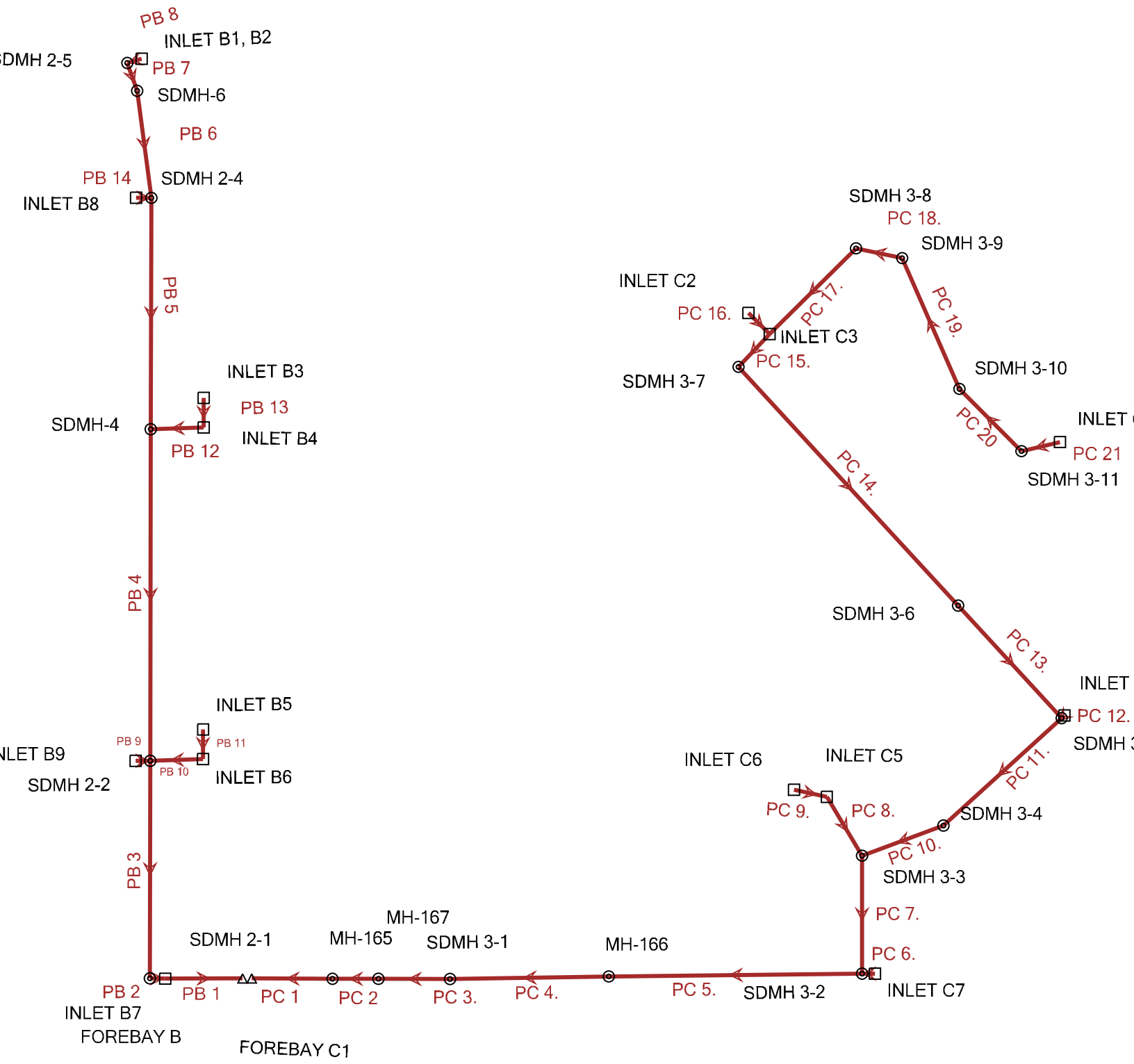
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

|                                                 | WQCV  | EURV            | 2 Year          | 5 Year          | 10 Year        | 25 Year        | 50 Year        | 100 Year       | 500 Year |
|-------------------------------------------------|-------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------|
| Design Storm Return Period =                    | N/A   | N/A             | 1.06            | 1.43            | 1.66           | 1.69           | 2.26           | 2.60           | 3.14     |
| One-Hour Rainfall Depth (in) =                  | 1.051 | 1.633           | 2.249           | 6.048           | 8.861          | 10.209         | 17.754         | 23.332         | 30.822   |
| CUHP Runoff Volume (acre-ft) =                  | N/A   | N/A             | 2.249           | 6.048           | 8.861          | 10.209         | 17.754         | 23.332         | 30.822   |
| Inflow Hydrograph Volume (acre-ft) =            | N/A   | N/A             | 22.2            | 80.6            | 113.5          | 139.3          | 243.6          | 311.5          | 409.3    |
| CUHP Predevelopment Peak Q (cfs) =              | N/A   | N/A             |                 |                 |                |                |                |                |          |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A   | N/A             |                 |                 |                |                |                |                |          |
| Predevelopment Unit Peak Flow, q (cfs/acre) =   | N/A   | N/A             | 0.14            | 0.50            | 0.70           | 0.86           | 1.50           | 1.91           | 2.52     |
| Peak Inflow Q (cfs) =                           | N/A   | N/A             | 36.7            | 97.6            | 130.2          | 157.0          | 261.7          | 330.4          | 428.9    |
| Peak Outflow Q (cfs) =                          | 0.6   | 28.4            | 16.5            | 84.9            | 121.4          | 134.0          | 185.5          | 219.8          | 364.2    |
| Ratio Peak Outflow to Predevelopment Q =        | N/A   | N/A             | N/A             | 1.1             | 1.1            | 1.0            | 0.8            | 0.7            | 0.9      |
| Structure Controlling Flow =                    | Plate | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Outlet Plate 1 | Outlet Plate 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) =            | N/A   | 0.39            | 0.13            | 0.7             | 1.0            | 1.1            | 1.5            | 1.7            | 1.9      |
| Max Velocity through Grate 2 (fps) =            | N/A   | N/A             | N/A             | N/A             | N/A            | N/A            | N/A            | N/A            | N/A      |
| Time to Drain 97% of Inflow Volume (hours) =    | 41    | 45              | 45              | 36              | 31             | 29             | 21             | 16             | 11       |
| Time to Drain 99% of Inflow Volume (hours) =    | 43    | 49              | 50              | 46              | 43             | 42             | 36             | 33             | 30       |
| Maximum Ponding Depth (ft) =                    | 2.99  | 3.86            | 3.62            | 4.06            | 4.24           | 4.64           | 7.06           | 9.10           | 10.51    |
| Area at Maximum Ponding Depth (acres) =         | 0.64  | 0.70            | 0.68            | 0.71            | 0.72           | 0.75           | 0.91           | 1.06           | 1.17     |
| Maximum Volume Stored (acre-ft) =               | 1.052 | 1.637           | 1.464           | 1.771           | 1.900          | 2.195          | 4.202          | 6.214          | 7.798    |

Soleana Phase II Drainage Report  
Storm Network Preview



Soleana Phase II Drainage Report  
Storm Network Preview



## Soleana Phase II Drainage Report

### Conduit FlexTable: PIPE REPORT

#### Active Scenario: 5 Years

| Label  | Diameter<br>(in) | Flow<br>(cfs) | Velocity<br>(ft/s) | Invert (Start)<br>(ft) | Invert (Stop)<br>(ft) | Hydraulic Grade<br>Line (In)<br>(ft) | Hydraulic Grade<br>Line (Out)<br>(ft) |
|--------|------------------|---------------|--------------------|------------------------|-----------------------|--------------------------------------|---------------------------------------|
| PA 1   | 15.0             | 0.00          | 0.00               | 6,274.00               | 6,267.44              | 6,274.00                             | 6,267.44                              |
| PA 2   | 30.0             | 0.50          | 6.09               | 6,270.59               | 6,263.78              | 6,270.82                             | 6,263.90                              |
| PA 3   | 18.0             | 0.50          | 6.99               | 6,302.80               | 6,271.59              | 6,303.06                             | 6,271.72                              |
| PA 4   | 30.0             | 2.20          | 7.24               | 6,253.45               | 6,248.10              | 6,253.93                             | 6,248.38                              |
| PA 5   | 30.0             | 2.20          | 6.33               | 6,256.03               | 6,253.65              | 6,256.51                             | 6,253.96                              |
| PB 1   | 36.0             | 21.80         | 12.72              | 6,222.85               | 6,219.64              | 6,224.35                             | 6,220.54                              |
| PB 2   | 36.0             | 19.40         | 13.15              | 6,223.71               | 6,222.95              | 6,225.12                             | 6,223.92                              |
| PB 3   | 30.0             | 19.40         | 14.52              | 6,237.60               | 6,223.91              | 6,239.09                             | 6,224.70                              |
| PB 4   | 24.0             | 10.90         | 12.93              | 6,263.00               | 6,240.50              | 6,264.18                             | 6,241.13                              |
| PB 5   | 18.0             | 6.40          | 11.78              | 6,282.23               | 6,265.00              | 6,283.21                             | 6,265.52                              |
| PB 6   | 18.0             | 3.60          | 8.83               | 6,287.87               | 6,282.23              | 6,288.59                             | 6,283.25                              |
| PB 7   | 18.0             | 3.60          | 5.97               | 6,288.39               | 6,287.87              | 6,289.11                             | 6,288.44                              |
| PB 8   | 18.0             | 3.60          | 5.59               | 6,291.19               | 6,290.88              | 6,291.91                             | 6,291.48                              |
| PB 9   | 18.0             | 0.80          | 5.97               | 6,240.49               | 6,239.60              | 6,240.82                             | 6,239.79                              |
| PB 10  | 24.0             | 7.70          | 11.44              | 6,241.21               | 6,239.10              | 6,242.20                             | 6,239.66                              |
| PB 11  | 18.0             | 5.50          | 10.21              | 6,242.04               | 6,241.21              | 6,242.94                             | 6,242.20                              |
| PB 12  | 24.0             | 4.50          | 3.06               | 6,267.58               | 6,267.50              | 6,268.47                             | 6,268.25                              |
| PB 13  | 18.0             | 3.70          | 6.93               | 6,267.92               | 6,267.58              | 6,268.65                             | 6,268.47                              |
| PB 14  | 18.0             | 2.80          | 10.05              | 6,286.20               | 6,284.86              | 6,286.83                             | 6,285.21                              |
| PC 1   | 30.0             | 19.00         | 9.49               | 6,223.60               | 6,222.00              | 6,225.08                             | 6,223.08                              |
| PC 2   | 30.0             | 19.00         | 15.55              | 6,229.27               | 6,225.71              | 6,230.75                             | 6,226.51                              |
| PC 3.  | 30.0             | 19.00         | 12.81              | 6,238.03               | 6,234.80              | 6,239.51                             | 6,235.68                              |
| PC 4.  | 30.0             | 19.00         | 10.62              | 6,244.81               | 6,240.53              | 6,246.29                             | 6,241.51                              |
| PC 5.  | 30.0             | 19.00         | 13.03              | 6,261.50               | 6,249.50              | 6,262.98                             | 6,250.34                              |
| PC 6.  | 18.0             | 0.80          | 6.24               | 6,268.22               | 6,267.34              | 6,268.55                             | 6,267.53                              |
| PC 7.  | 30.0             | 18.20         | 12.77              | 6,277.10               | 6,271.64              | 6,278.55                             | 6,272.47                              |
| PC 8.  | 18.0             | 5.30          | 8.50               | 6,283.20               | 6,280.80              | 6,284.09                             | 6,281.38                              |
| PC 9.  | 18.0             | 0.50          | 3.77               | 6,283.56               | 6,283.20              | 6,284.08                             | 6,284.09                              |
| PC 10. | 30.0             | 11.10         | 11.65              | 6,286.20               | 6,281.60              | 6,287.32                             | 6,282.22                              |

## Soleana Phase II Drainage Report

### Conduit FlexTable: PIPE REPORT

#### Active Scenario: 5 Years

| Label  | Diameter<br>(in) | Flow<br>(cfs) | Velocity<br>(ft/s) | Invert (Start)<br>(ft) | Invert (Stop)<br>(ft) | Hydraulic Grade<br>Line (In)<br>(ft) | Hydraulic Grade<br>Line (Out)<br>(ft) |
|--------|------------------|---------------|--------------------|------------------------|-----------------------|--------------------------------------|---------------------------------------|
| PC 11. | 30.0             | 11.10         | 11.61              | 6,295.10               | 6,286.70              | 6,296.22                             | 6,287.32                              |
| PC 12. | 18.0             | 2.20          | 6.22               | 6,296.11               | 6,296.00              | 6,296.67                             | 6,296.45                              |
| PC 13. | 30.0             | 8.90          | 9.20               | 6,300.90               | 6,295.90              | 6,301.89                             | 6,296.53                              |
| PC 14. | 30.0             | 8.90          | 11.53              | 6,322.00               | 6,302.00              | 6,322.99                             | 6,302.54                              |
| PC 15. | 30.0             | 8.90          | 10.21              | 6,323.98               | 6,322.00              | 6,324.97                             | 6,323.18                              |
| PC 16. | 18.0             | 3.70          | 7.60               | 6,324.99               | 6,323.98              | 6,325.73                             | 6,324.97                              |
| PC 17. | 24.0             | 3.20          | 9.23               | 6,323.98               | 6,332.66              | 6,333.29                             | 6,324.97                              |
| PC 18. | 24.0             | 3.20          | 9.15               | 6,335.95               | 6,332.66              | 6,336.58                             | 6,333.00                              |
| PC 19. | 24.0             | 3.20          | 6.54               | 6,339.79               | 6,335.95              | 6,340.42                             | 6,336.38                              |
| PC 20  | 24.0             | 3.20          | 4.19               | 6,340.47               | 6,339.79              | 6,341.10                             | 6,340.44                              |
| PC 21  | 24.0             | 3.20          | 4.74               | 6,341.10               | 6,340.67              | 6,341.73                             | 6,341.20                              |

## Soleana Phase II Drainage Report

### Conduit FlexTable: PIPE REPORT

#### Active Scenario: 100 Years

| Label  | Diameter<br>(in) | Flow<br>(cfs) | Velocity<br>(ft/s) | Invert (Start)<br>(ft) | Invert (Stop)<br>(ft) | Hydraulic Grade<br>Line (In)<br>(ft) | Hydraulic Grade<br>Line (Out)<br>(ft) |
|--------|------------------|---------------|--------------------|------------------------|-----------------------|--------------------------------------|---------------------------------------|
| PA 1   | 15.0             | 17.80         | 14.50              | 6,274.00               | 6,267.44              | 6,280.93                             | 6,268.68                              |
| PA 2   | 30.0             | 7.90          | 14.01              | 6,270.59               | 6,263.78              | 6,271.52                             | 6,264.21                              |
| PA 3   | 18.0             | 7.90          | 15.84              | 6,302.80               | 6,271.59              | 6,303.89                             | 6,272.08                              |
| PA 4   | 30.0             | 34.40         | 16.01              | 6,253.45               | 6,248.10              | 6,255.44                             | 6,249.26                              |
| PA 5   | 30.0             | 34.40         | 13.89              | 6,256.03               | 6,253.65              | 6,258.02                             | 6,254.98                              |
| PB 1   | 36.0             | 92.30         | 13.06              | 6,222.85               | 6,219.64              | 6,228.98                             | 6,227.00                              |
| PB 2   | 36.0             | 83.90         | 11.87              | 6,223.71               | 6,222.95              | 6,229.30                             | 6,228.98                              |
| PB 3   | 30.0             | 83.90         | 17.09              | 6,237.60               | 6,223.91              | 6,242.52                             | 6,230.39                              |
| PB 4   | 24.0             | 54.00         | 17.19              | 6,263.00               | 6,240.50              | 6,269.96                             | 6,244.79                              |
| PB 5   | 18.0             | 25.20         | 14.26              | 6,282.23               | 6,265.00              | 6,288.62                             | 6,270.88                              |
| PB 6   | 18.0             | 15.70         | 8.88               | 6,287.87               | 6,282.23              | 6,292.15                             | 6,288.93                              |
| PB 7   | 18.0             | 15.70         | 8.88               | 6,288.39               | 6,287.87              | 6,293.03                             | 6,292.15                              |
| PB 8   | 18.0             | 15.70         | 8.88               | 6,291.19               | 6,290.88              | 6,293.65                             | 6,293.03                              |
| PB 9   | 18.0             | 4.50          | 2.55               | 6,240.49               | 6,239.60              | 6,244.82                             | 6,244.79                              |
| PB 10  | 24.0             | 25.40         | 8.09               | 6,241.21               | 6,239.10              | 6,245.35                             | 6,244.79                              |
| PB 11  | 18.0             | 14.40         | 8.15               | 6,242.04               | 6,241.21              | 6,245.71                             | 6,245.35                              |
| PB 12  | 24.0             | 28.80         | 9.17               | 6,267.58               | 6,267.50              | 6,271.57                             | 6,270.88                              |
| PB 13  | 18.0             | 14.40         | 8.15               | 6,267.92               | 6,267.58              | 6,271.89                             | 6,271.57                              |
| PB 14  | 18.0             | 9.50          | 5.38               | 6,286.20               | 6,284.86              | 6,289.09                             | 6,288.93                              |
| PC 1   | 30.0             | 79.20         | 16.13              | 6,223.60               | 6,222.00              | 6,231.01                             | 6,227.00                              |
| PC 2   | 30.0             | 79.20         | 16.13              | 6,229.27               | 6,225.71              | 6,234.10                             | 6,231.82                              |
| PC 3.  | 30.0             | 79.20         | 17.42              | 6,238.03               | 6,234.80              | 6,240.49                             | 6,237.11                              |
| PC 4.  | 30.0             | 79.20         | 16.13              | 6,244.81               | 6,240.53              | 6,250.90                             | 6,242.99                              |
| PC 5.  | 30.0             | 79.20         | 17.94              | 6,261.50               | 6,249.50              | 6,263.96                             | 6,251.62                              |
| PC 6.  | 18.0             | 4.90          | 10.59              | 6,268.22               | 6,267.34              | 6,269.07                             | 6,267.87                              |
| PC 7.  | 30.0             | 74.30         | 17.75              | 6,277.10               | 6,271.64              | 6,279.55                             | 6,273.69                              |
| PC 8.  | 18.0             | 17.70         | 10.94              | 6,283.20               | 6,280.80              | 6,284.65                             | 6,282.11                              |
| PC 9.  | 18.0             | 8.00          | 8.26               | 6,283.56               | 6,283.20              | 6,284.66                             | 6,284.65                              |
| PC 10. | 30.0             | 56.60         | 17.99              | 6,286.20               | 6,281.60              | 6,288.57                             | 6,283.22                              |

## Soleana Phase II Drainage Report

### Conduit FlexTable: PIPE REPORT

#### Active Scenario: 100 Years

| Label  | Diameter<br>(in) | Flow<br>(cfs) | Velocity<br>(ft/s) | Invert (Start)<br>(ft) | Invert (Stop)<br>(ft) | Hydraulic Grade<br>Line (In)<br>(ft) | Hydraulic Grade<br>Line (Out)<br>(ft) |
|--------|------------------|---------------|--------------------|------------------------|-----------------------|--------------------------------------|---------------------------------------|
| PC 11. | 30.0             | 56.60         | 17.93              | 6,295.10               | 6,286.70              | 6,297.47                             | 6,288.25                              |
| PC 12. | 18.0             | 12.50         | 7.07               | 6,296.11               | 6,296.00              | 6,298.62                             | 6,298.54                              |
| PC 13. | 30.0             | 44.10         | 14.10              | 6,300.90               | 6,295.90              | 6,303.11                             | 6,298.54                              |
| PC 14. | 30.0             | 44.10         | 17.97              | 6,322.00               | 6,302.00              | 6,324.21                             | 6,303.25                              |
| PC 15. | 30.0             | 44.10         | 15.78              | 6,323.98               | 6,322.00              | 6,326.19                             | 6,324.93                              |
| PC 16. | 18.0             | 12.50         | 7.07               | 6,324.99               | 6,323.98              | 6,326.75                             | 6,326.19                              |
| PC 17. | 24.0             | 19.10         | 15.35              | 6,323.98               | 6,332.66              | 6,334.23                             | 6,326.19                              |
| PC 18. | 24.0             | 19.10         | 15.23              | 6,335.95               | 6,332.66              | 6,337.52                             | 6,333.56                              |
| PC 19. | 24.0             | 19.10         | 10.67              | 6,339.79               | 6,335.95              | 6,341.36                             | 6,337.06                              |
| PC 20  | 24.0             | 19.10         | 6.08               | 6,340.47               | 6,339.79              | 6,342.31                             | 6,341.44                              |
| PC 21  | 24.0             | 19.10         | 7.41               | 6,341.10               | 6,340.67              | 6,342.67                             | 6,342.31                              |

## Worksheet for Tract A Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning             |
|                       | Formula             |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.013               |
| Channel Slope         | 0.020 ft/ft         |
| Bottom Width          | 3.00 ft             |
| Discharge             | 5.30 cfs            |
| Results               |                     |
| Normal Depth          | 3.4 in              |
| Flow Area             | 0.9 ft <sup>2</sup> |
| Wetted Perimeter      | 3.6 ft              |
| Hydraulic Radius      | 2.9 in              |
| Top Width             | 3.00 ft             |
| Critical Depth        | 5.5 in              |
| Critical Slope        | 0.005 ft/ft         |
| Velocity              | 6.22 ft/s           |
| Velocity Head         | 0.60 ft             |
| Specific Energy       | 0.89 ft             |
| Froude Number         | 2.058               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 3.4 in              |
| Critical Depth        | 5.5 in              |
| Channel Slope         | 0.020 ft/ft         |
| Critical Slope        | 0.005 ft/ft         |

## Worksheet for Tract L Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning<br>Formula  |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 5.30 cfs            |
| Results               |                     |
| Normal Depth          | 2.9 in              |
| Flow Area             | 0.7 ft <sup>2</sup> |
| Wetted Perimeter      | 4.0 ft              |
| Hydraulic Radius      | 2.1 in              |
| Top Width             | 3.92 ft             |
| Critical Depth        | 5.4 in              |
| Critical Slope        | 0.009 ft/ft         |
| Velocity              | 7.45 ft/s           |
| Velocity Head         | 0.86 ft             |
| Specific Energy       | 1.10 ft             |
| Froude Number         | 3.086               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 2.9 in              |
| Critical Depth        | 5.4 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.009 ft/ft         |

## Worksheet for Tract M Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning             |
| Solve For             | Formula             |
|                       | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 17.00 cfs           |
| Results               |                     |
| Normal Depth          | 5.3 in              |
| Flow Area             | 1.6 ft <sup>2</sup> |
| Wetted Perimeter      | 5.6 ft              |
| Hydraulic Radius      | 3.5 in              |
| Top Width             | 5.50 ft             |
| Critical Depth        | 9.7 in              |
| Critical Slope        | 0.008 ft/ft         |
| Velocity              | 10.36 ft/s          |
| Velocity Head         | 1.67 ft             |
| Specific Energy       | 2.10 ft             |
| Froude Number         | 3.343               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 5.3 in              |
| Critical Depth        | 9.7 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.008 ft/ft         |

## Worksheet for Tract N Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning             |
| Solve For             | Formula             |
|                       | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 9.60 cfs            |
| Results               |                     |
| Normal Depth          | 3.9 in              |
| Flow Area             | 1.1 ft <sup>2</sup> |
| Wetted Perimeter      | 4.7 ft              |
| Hydraulic Radius      | 2.8 in              |
| Top Width             | 4.62 ft             |
| Critical Depth        | 7.3 in              |
| Critical Slope        | 0.008 ft/ft         |
| Velocity              | 8.84 ft/s           |
| Velocity Head         | 1.22 ft             |
| Specific Energy       | 1.54 ft             |
| Froude Number         | 3.217               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 3.9 in              |
| Critical Depth        | 7.3 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.008 ft/ft         |

## Worksheet for Tract O Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning             |
|                       | Formula             |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 5.00 cfs            |
| Results               |                     |
| Normal Depth          | 2.8 in              |
| Flow Area             | 0.7 ft <sup>2</sup> |
| Wetted Perimeter      | 3.9 ft              |
| Hydraulic Radius      | 2.1 in              |
| Top Width             | 3.86 ft             |
| Critical Depth        | 5.2 in              |
| Critical Slope        | 0.009 ft/ft         |
| Velocity              | 7.33 ft/s           |
| Velocity Head         | 0.83 ft             |
| Specific Energy       | 1.07 ft             |
| Froude Number         | 3.073               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 2.8 in              |
| Critical Depth        | 5.2 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.009 ft/ft         |

## Worksheet for Tract P Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning<br>Formula  |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 10.60 cfs           |
| Results               |                     |
| Normal Depth          | 4.1 in              |
| Flow Area             | 1.2 ft <sup>2</sup> |
| Wetted Perimeter      | 4.8 ft              |
| Hydraulic Radius      | 2.9 in              |
| Top Width             | 4.76 ft             |
| Critical Depth        | 7.7 in              |
| Critical Slope        | 0.008 ft/ft         |
| Velocity              | 9.09 ft/s           |
| Velocity Head         | 1.28 ft             |
| Specific Energy       | 1.63 ft             |
| Froude Number         | 3.236               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 4.1 in              |
| Critical Depth        | 7.7 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.008 ft/ft         |

## Worksheet for Tract Q Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning             |
|                       | Formula             |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 6.30 cfs            |
| Results               |                     |
| Normal Depth          | 3.2 in              |
| Flow Area             | 0.8 ft <sup>2</sup> |
| Wetted Perimeter      | 4.2 ft              |
| Hydraulic Radius      | 2.3 in              |
| Top Width             | 4.11 ft             |
| Critical Depth        | 5.9 in              |
| Critical Slope        | 0.009 ft/ft         |
| Velocity              | 7.84 ft/s           |
| Velocity Head         | 0.95 ft             |
| Specific Energy       | 1.22 ft             |
| Froude Number         | 3.123               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 3.2 in              |
| Critical Depth        | 5.9 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.009 ft/ft         |

## Worksheet for Tract R Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning<br>Formula  |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.020               |
| Channel Slope         | 0.100 ft/ft         |
| Left Side Slope       | 4.000 H:V           |
| Right Side Slope      | 4.000 H:V           |
| Bottom Width          | 2.00 ft             |
| Discharge             | 3.50 cfs            |
| Results               |                     |
| Normal Depth          | 2.3 in              |
| Flow Area             | 0.5 ft <sup>2</sup> |
| Wetted Perimeter      | 3.6 ft              |
| Hydraulic Radius      | 1.8 in              |
| Top Width             | 3.54 ft             |
| Critical Depth        | 4.3 in              |
| Critical Slope        | 0.009 ft/ft         |
| Velocity              | 6.58 ft/s           |
| Velocity Head         | 0.67 ft             |
| Specific Energy       | 0.87 ft             |
| Froude Number         | 2.994               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 2.3 in              |
| Critical Depth        | 4.3 in              |
| Channel Slope         | 0.100 ft/ft         |
| Critical Slope        | 0.009 ft/ft         |

## Worksheet for Tract S Channel

|                       |                     |
|-----------------------|---------------------|
| Project Description   |                     |
| Friction Method       | Manning<br>Formula  |
| Solve For             | Normal Depth        |
| Input Data            |                     |
| Roughness Coefficient | 0.013               |
| Channel Slope         | 0.020 ft/ft         |
| Bottom Width          | 4.00 ft             |
| Discharge             | 11.30 cfs           |
| Results               |                     |
| Normal Depth          | 4.5 in              |
| Flow Area             | 1.5 ft <sup>2</sup> |
| Wetted Perimeter      | 4.8 ft              |
| Hydraulic Radius      | 3.8 in              |
| Top Width             | 4.00 ft             |
| Critical Depth        | 7.5 in              |
| Critical Slope        | 0.004 ft/ft         |
| Velocity              | 7.51 ft/s           |
| Velocity Head         | 0.88 ft             |
| Specific Energy       | 1.25 ft             |
| Froude Number         | 2.158               |
| Flow Type             | Supercritical       |
| GVF Input Data        |                     |
| Downstream Depth      | 0.0 in              |
| Length                | 0.0 ft              |
| Number Of Steps       | 0                   |
| GVF Output Data       |                     |
| Upstream Depth        | 0.0 in              |
| Profile Description   | N/A                 |
| Profile Headloss      | 0.00 ft             |
| Downstream Velocity   | Infinity ft/s       |
| Upstream Velocity     | Infinity ft/s       |
| Normal Depth          | 4.5 in              |
| Critical Depth        | 7.5 in              |
| Channel Slope         | 0.020 ft/ft         |
| Critical Slope        | 0.004 ft/ft         |

# Appendix D

## Exhibits

- USGS Stream Stats Comparison
- TCR Checklist
- Critical Habitat Exhibit
- Phase II Drainage Map
- Historic Basin Map





## Study Area Storm Event Runoff Summary for 6 Hour 100 Year Precipitation (Rational Method)

### General Disclaimers

Drainage area is greater than recommended maximum threshold of 200 acres.

### Parameters

|                                          |              |
|------------------------------------------|--------------|
| Precipitation Intensity (inches/hour):   | <b>0.597</b> |
| Drainage Area (square miles):            | <b>0.36</b>  |
| Soil Runoff Coefficient (dimensionless): | <b>0.33</b>  |

### Summary

|                                      |             |
|--------------------------------------|-------------|
| Peak runoff (cubic feet per second): | <b>45.3</b> |
|--------------------------------------|-------------|

### Citations

Kuichling, E., 1889, The relation between the rainfall and the discharge of sewers in populous districts: Transactions, American Society of Civil Engineers v. 20, 60 p.

**Dhakal N., 2012, Development of Guidance for Runoff Coefficient Selection and Modified Rational Unit Hydrograph Method for Hydrologic Design, 176 p., accessed October 5, 2016**

**([https://www.researchgate.net/publication/265233885Development\\_of\\_Guidance\\_for\\_Runoff](https://www.researchgate.net/publication/265233885Development_of_Guidance_for_Runoff))**

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Application Version: 4.19.4

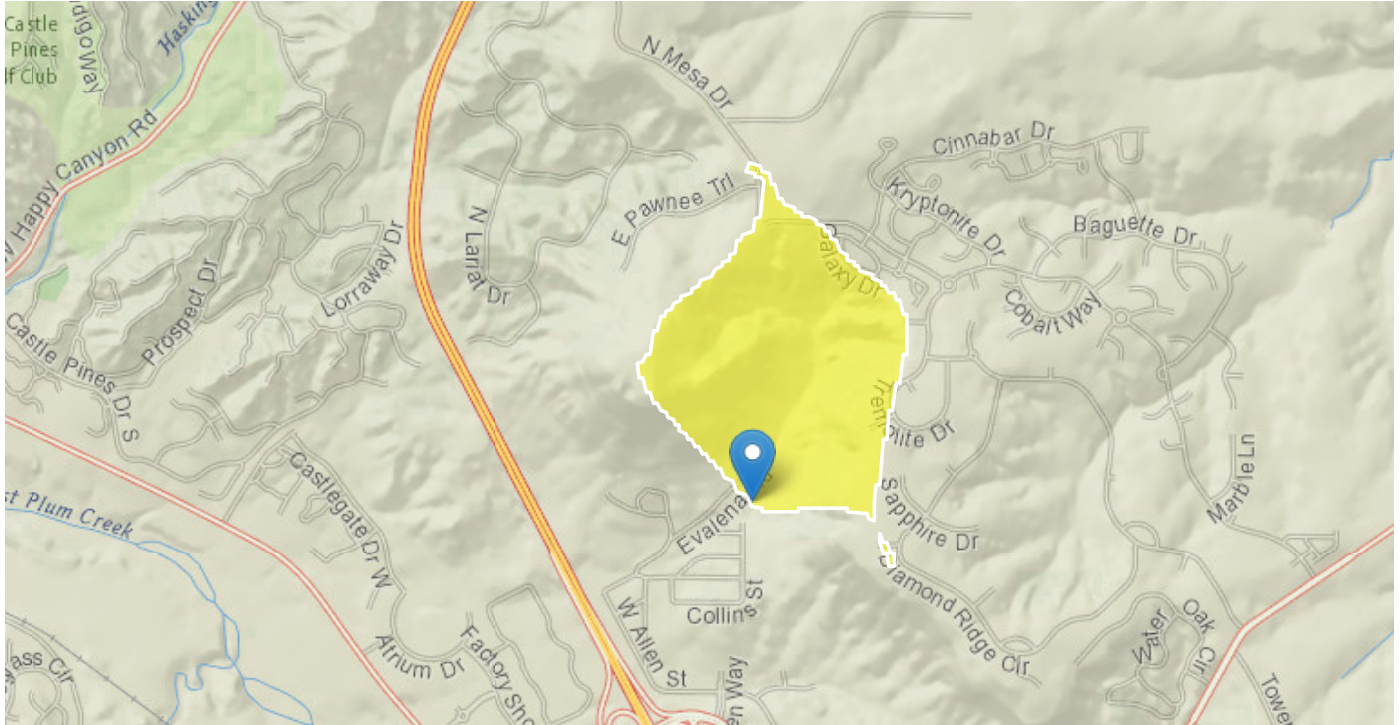
# StreamStats Report

**Region ID:** CO

**Workspace ID:** CO20240214163257188000

**Clicked Point (Latitude, Longitude):** 39.42103, -104.86336

**Time:** 2024-02-14 09:33:20 -0700



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Application Version: 4.19.4

StreamStats Services Version: 1.2.22

NSS Services Version: 2.2.1



## Phase II Drainage Report Checklist

The Phase II Drainage Report must be in conformance with the latest Town of Castle Rock Storm Drainage Design and Technical Criteria Manual available on the Town's website.

The Phase II Drainage Report must be signed and sealed by a Professional Engineer licensed in the State of Colorado. The purpose of the Phase II Drainage Report is to identify and refine conceptual storm-water management solutions to the challenges that may be present or occur on-site and off-site.

The preparer should contact and work with the Town Stormwater Engineering Staff regarding any design, master planning and existing system questions (720-733-6000). The following outline sets forth the **required minimum** content to be provided in the Phase II Drainage Report that shall be submitted with the Planned Development Plan or Straight Zoning documents. A copy of this checklist must be submitted with the Phase II Drainage Report.

Please see Chapter 4 of the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual for additional details and information. Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

| Included | N/A |                                                         |
|----------|-----|---------------------------------------------------------|
| X        |     | <b>I. COVER SHEET</b>                                   |
| X        |     | A. Name of Project, including legal name of development |
| X        |     | B. Address                                              |
| X        |     | C. Owner                                                |
|          | X   | D. Developer                                            |
| X        |     | E. Engineer                                             |
| X        |     | F. Submittal date and revision dates as applicable      |
|          |     | <b>II. GENERAL LOCATION AND DESCRIPTION</b>             |
| X        |     | A. Site Location                                        |
| X        |     | B. Description of Property and Land Use                 |
|          |     | <b>III. DRAINAGE BASIN AND SUB-BASINS</b>               |
| X        |     | A. Major Drainage Basins                                |
| X        |     | B. Minor Drainage Basins                                |
|          |     | <b>IV. DRAINAGE DESIGN CRITERIA</b>                     |
| X        |     | A. Regulations                                          |
| X        |     | B. Drainage Studies, Master Plans, Site Constraints     |
| X        |     | C. Hydrology                                            |
| X        |     | D. Hydraulics                                           |
| X        |     | E. Water Quality Enhancement                            |

## Phase II Drainage Report Checklist

| Included | N/A |                                                                |
|----------|-----|----------------------------------------------------------------|
|          |     | <b>V. STORMWATER MANAGEMENT FACILITY DESIGN</b>                |
| X        |     | A. Stormwater Conveyance Facilities                            |
| X        |     | B. Stormwater Storage Facilities                               |
| X        |     | C. Water Quality Enhancement Best Management Practices         |
| X        |     | D. Floodplain Modification                                     |
| X        |     | E. Additional Permitting Requirements                          |
| X        |     | F. General                                                     |
|          |     | <b>VI. CONCLUSIONS</b>                                         |
| X        |     | A. Compliance with Standards                                   |
| X        |     | B. Variances                                                   |
| X        |     | C. Drainage Concept                                            |
|          |     | <b>VII. REFERENCES</b>                                         |
|          |     | <b>VIII. APPENDICES</b>                                        |
| X        |     | A. Hydrologic Computations                                     |
| X        |     | B. Hydraulic Computations (If known at this time—not required) |
| X        |     | C. Water Quality Enhancement Best Management Practices         |
| X        |     | D. Referenced Information                                      |
| X        |     | <b>OVERALL DRAINAGE PLAN (IN POCKET)</b>                       |
|          | X   | <b>DETAILED DRAINAGE PLANS (IN POCKET)</b>                     |

### Notes/Comments:

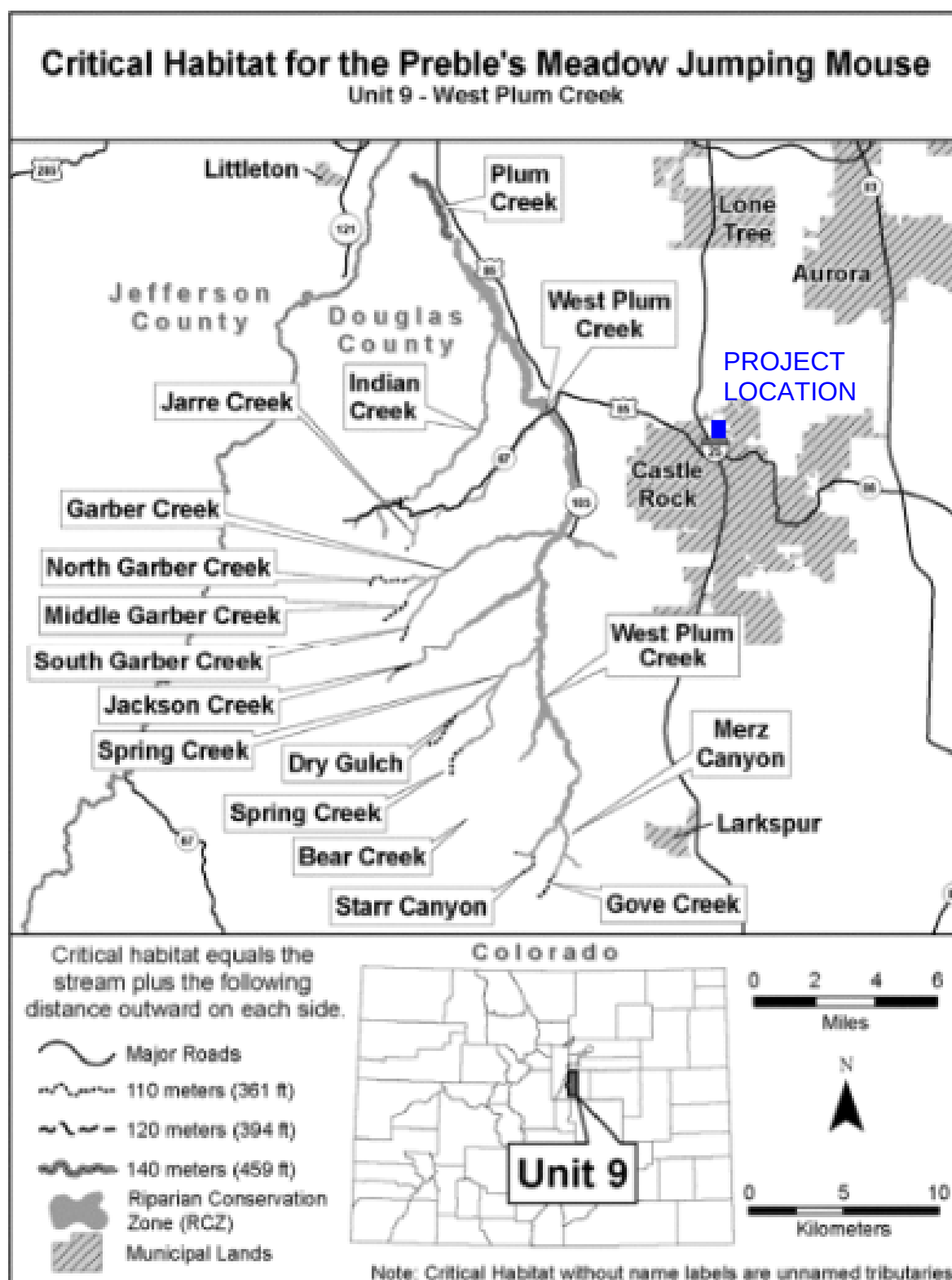
Drainage plans pending final coordination with metropolitan district inclusion areas.

**Permanent Water Quality Determination Worksheet (Taken from 2019 SDDTCM Sections 13.1.4 and 13.1.5)**

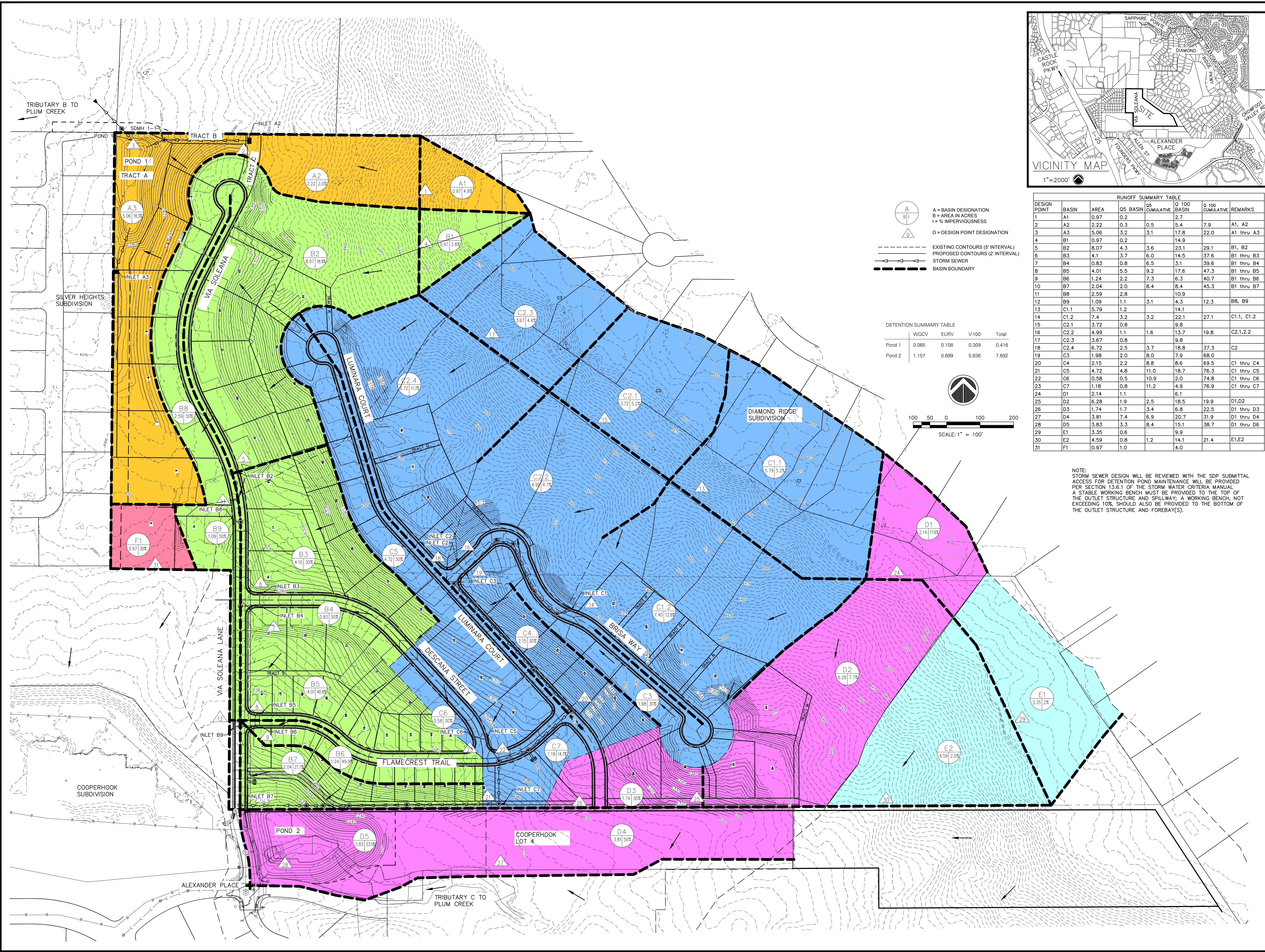
| Project:   |                                                                                                                                                                                                                                                                                                                                                                                                       | Project#      |                                                                 | Applicant:                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Section    | Questions                                                                                                                                                                                                                                                                                                                                                                                             | Response      | Check those that apply                                          | Instructions                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>1</b>   | <b>Non-applicable Sites</b>                                                                                                                                                                                                                                                                                                                                                                           |               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1.1        | Will the project result in a temporary disturbance of greater than one acre?                                                                                                                                                                                                                                                                                                                          | No<br>Yes     | <input type="checkbox"/><br><input checked="" type="checkbox"/> | Proceed to section 1.2.<br>Proceed to section 2.                                                                                                                                                                                                                                                                                                                                                                     |
| 1.2        | Is the project part of a larger common plan of development or sale where multiple separate and distinct construction activities may be taking place at different times on different schedules, but remain related and are within 1/4 mile of each other? (A common plan of development will generally be documented on a site development plan, master plan, or equivalent, for the property/project) | No<br><br>Yes | <input type="checkbox"/><br><br><input type="checkbox"/>        | Proceed to section 1.3.<br><br>Proceed to section 2.                                                                                                                                                                                                                                                                                                                                                                 |
| 1.3        | Is the project within the Cherry Creek Watershed?                                                                                                                                                                                                                                                                                                                                                     | Yes<br>No     | <input type="checkbox"/><br><input type="checkbox"/>            | Permanent water quality control measures may be required. Refer to Water Quality Control Regulation 72.7 for details and allowable exclusions.<br>Permanent water quality control measures are not required.                                                                                                                                                                                                         |
| <b>2</b>   | <b>Applicable Site Types and Exclusions by Variance</b>                                                                                                                                                                                                                                                                                                                                               |               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2.1        | Does the project have more than 35% impervious area on the existing site?                                                                                                                                                                                                                                                                                                                             | No<br>Yes     | <input checked="" type="checkbox"/><br><input type="checkbox"/> | Project is an applicable Development Site. Proceed to section 3.<br>Proceed to 2.2.                                                                                                                                                                                                                                                                                                                                  |
| 2.2        | Does the project have greater than 75% impervious area on the existing site?                                                                                                                                                                                                                                                                                                                          | No<br>Yes     | <input type="checkbox"/><br><input type="checkbox"/>            | Project is an applicable Redevelopment Site. Proceed to section 3.<br>Project is an applicable Constrained Redevelopment Site. Proceed to 2.3.                                                                                                                                                                                                                                                                       |
| 2.3        | Will 100% of the runoff from the existing and proposed site be captured and treated using one or more of the allowable design standards for permanent water quality?                                                                                                                                                                                                                                  | Yes<br>No     | <input type="checkbox"/><br><input type="checkbox"/>            | No further action required.<br>Proceed to 2.4.                                                                                                                                                                                                                                                                                                                                                                       |
| 2.4        | Do any other water quality exclusions apply to the site?                                                                                                                                                                                                                                                                                                                                              | No<br>Yes     | <input type="checkbox"/><br><input type="checkbox"/>            | Portions of the project are excluded. Proceed with design in accordance with Constrained Redevelopment standards and apply for <b>variance</b> for <u>Constrained Redevelopment Sites</u> .<br>Proceed to section 3. Following approval of other exclusions, design remaining site in accordance with Constrained Redevelopment standards and apply for <b>variance</b> for <u>Constrained Redevelopment Sites</u> . |
| <b>3</b>   | <b>Applicable Sites with Other Exclusions by Variance</b>                                                                                                                                                                                                                                                                                                                                             |               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>3.1</b> | <b>Category 1: Roadways, bridges and trails only</b>                                                                                                                                                                                                                                                                                                                                                  |               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3.1.1      | Is the project a bike or pedestrian trail?                                                                                                                                                                                                                                                                                                                                                            | Yes<br>No     | <input type="checkbox"/><br><input checked="" type="checkbox"/> | Proceed to next line.<br>Proceed to 3.1.2.                                                                                                                                                                                                                                                                                                                                                                           |
|            | Is the trail for a roadway?                                                                                                                                                                                                                                                                                                                                                                           | Yes<br>No     | <input type="checkbox"/><br><input type="checkbox"/>            | Proceed to 3.1.2.<br>Project is excluded. Submit <b>variance</b> for <u>Trails Excluded from Permanent Water Quality Requirements</u> .                                                                                                                                                                                                                                                                              |
| 3.1.2      | Is the project primarily used for parking or access to parking?                                                                                                                                                                                                                                                                                                                                       | Yes<br>No     | <input type="checkbox"/><br><input checked="" type="checkbox"/> | This exclusion does not apply. Permanent water quality is required.<br>Proceed to 3.1.3.                                                                                                                                                                                                                                                                                                                             |
| 3.1.3      | Does the project add impervious area?                                                                                                                                                                                                                                                                                                                                                                 | No<br>Yes     | <input type="checkbox"/><br><input checked="" type="checkbox"/> | Project is excluded. Submit <b>variance</b> for <u>Pavement Management Sites Excluded from Permanent Water Quality Requirements</u> .<br>Proceed to 3.1.4.                                                                                                                                                                                                                                                           |

| Section    | Questions                                                                                                                                                                                                                                                                                                                                                                                        | Response | Check those that apply              | Instructions                                                                                                                                                                                   |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.1.4      | Does the project add more than 8.25 feet of paved width at any location to the existing roadway?                                                                                                                                                                                                                                                                                                 | No       | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.                                  |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | Yes      | <input checked="" type="checkbox"/> |                                                                                                                                                                                                |
|            | Does the project add more than one acre of paved area per mile to an existing roadway?                                                                                                                                                                                                                                                                                                           | No       | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.                                  |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | Yes      | <input checked="" type="checkbox"/> |                                                                                                                                                                                                |
|            | Does the project increase the width by two times or more, on average, of the original roadway area?                                                                                                                                                                                                                                                                                              | No       | <input type="checkbox"/>            | Existing areas of site are excluded only. Submit <b>variance</b> for <u>Existing Roadway Surfaces Only Excluded from Permanent Water Quality Requirements</u> .                                |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | Yes      | <input checked="" type="checkbox"/> | This exclusion does not apply. Permanent water quality is required.                                                                                                                            |
| <b>3.2</b> | <b>Category 2: Non-residential and non-commercial projects only</b>                                                                                                                                                                                                                                                                                                                              |          |                                     |                                                                                                                                                                                                |
| 3.2.1      | Is the project associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities, including activities necessary to prepare a site for drilling and the movement and placement of drilling equipment?                                                                                                                                          | Yes      | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Oil and Gas Exploration Sites Excluded from Permanent Water Quality Requirements</u> .                                                      |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | No       | <input type="checkbox"/>            | Proceed to 3.2.2.                                                                                                                                                                              |
| 3.2.2      | Is the project for stream stabilization?                                                                                                                                                                                                                                                                                                                                                         | Yes      | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Stream Stabilization Sites Excluded from Permanent Water Quality Requirements</u> .                                                         |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | No       | <input type="checkbox"/>            | Proceed to 3.2.3.                                                                                                                                                                              |
| 3.2.3      | Is the project for installation or maintenance of aboveground or underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity including activities to install, replace or maintain utilities under roadways or other paved areas that return the surface to the same condition? | Yes      | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Aboveground and Underground Utilities Excluded from Permanent Water Quality Requirements</u> .                                              |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | No       | <input type="checkbox"/>            | Proceed to 3.2.4.                                                                                                                                                                              |
| 3.2.4      | Is the project on undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the project?                                                                                                                                                                                                                                            | Yes      | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Sites with Land Disturbances to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements</u> .      |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | No       | <input type="checkbox"/>            | Proceed to 3.2.5.                                                                                                                                                                              |
| 3.2.5      | Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?                                                                                                                                                                                                                                                                                 | No       | <input type="checkbox"/>            | Project is excluded. Submit <b>study</b> along with <b>variance</b> for <u>Non-residential and Non-commercial Infiltration Conditions Excluded from Permanent Water Quality Requirements</u> . |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | Yes      | <input type="checkbox"/>            | This exclusion does not apply. Permanent water quality is required.                                                                                                                            |
| <b>3.3</b> | <b>Category 3: Residential, Agricultural and Commercial projects</b>                                                                                                                                                                                                                                                                                                                             |          |                                     |                                                                                                                                                                                                |
| 3.3.1      | Is the project a single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling unit?                                                                                                                                                                                                                                                       | Yes      | <input type="checkbox"/>            | Proceed to next line.                                                                                                                                                                          |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | No       | <input checked="" type="checkbox"/> | Proceed to 3.3.2.                                                                                                                                                                              |
|            | Is the project site greater than 10% impervious?                                                                                                                                                                                                                                                                                                                                                 | No       | <input type="checkbox"/>            | Project is excluded. Submit <b>variance</b> for <u>Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements</u> .                                                      |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | Yes      | <input type="checkbox"/>            | Proceed to next line.                                                                                                                                                                          |
|            | Is the project site greater than 20% impervious?                                                                                                                                                                                                                                                                                                                                                 | Yes      | <input type="checkbox"/>            | This exclusion does not apply. Permanent water quality is required.                                                                                                                            |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | No       | <input type="checkbox"/>            | Proceed to next line.                                                                                                                                                                          |
|            | Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?                                                                                                                                                                                                                                                                                 | No       | <input type="checkbox"/>            | Project is excluded. Submit <b>study</b> along with <b>variance</b> for <u>Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements</u> .                              |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  | Yes      | <input type="checkbox"/>            | This exclusion does not apply. Permanent water quality is required.                                                                                                                            |
|            |                                                                                                                                                                                                                                                                                                                                                                                                  |          |                                     |                                                                                                                                                                                                |

| Section | Questions                                                                                               | Response  | Check those that apply                                          | Instructions                                                                                                                                                                                                                                                |
|---------|---------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.3.2   | Will 100% of the runoff from the residential or commercial site be captured?                            | Yes<br>No | <input type="checkbox"/><br><input checked="" type="checkbox"/> | This exclusion does not apply. Permanent water quality is required.<br>Proceed to next line.                                                                                                                                                                |
|         | Is all or a portion of the site undeveloped or will it remain undeveloped after construction?           | Yes<br>No | <input checked="" type="checkbox"/><br><input type="checkbox"/> | This portion of the project is excluded. Submit <b>variance</b> for <u>Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.<br>Proceed to next line. |
|         | Is the remaining untreated impervious area greater than 20% of the site?                                | Yes<br>No | <input type="checkbox"/><br><input checked="" type="checkbox"/> | This exclusion does not apply. Permanent water quality is required.<br>Proceed to next line.                                                                                                                                                                |
|         | Is the remaining untreated impervious area greater than one acre?                                       | Yes<br>No | <input type="checkbox"/><br><input checked="" type="checkbox"/> | This exclusion does not apply. Permanent water quality is required.<br>Proceed to next line.                                                                                                                                                                |
|         | Is it practicable to capture runoff from portions of the site that will not drain to a control measure? | No<br>Yes | <input checked="" type="checkbox"/><br><input type="checkbox"/> | Document justification demonstrating that it is not practicable to capture runoff from this portion of the site in the <b>drainage report</b> . No further action is needed.<br>This exclusion does not apply. Permanent water quality is required.         |



Wednesday, March 5, 2025, 5:01:51 PM  
C:\2025\2002764-00\DESIGN\PHASE II\CD\EXHIBIT\CONCEPT\2002764-00 PHASE II DRAINAGE EXHIBIT.DWG



**LEGEND**

- A = BASIN DESIGNATION
- B = AREA IN ACRES
- I = % IMPERVIOUSNESS
- D = DESIGN POINT DESIGNATION
- EXISTING CONTOURS (5' INTERVAL)
- - - PROPOSED CONTOURS (2' INTERVAL)
- STORM SEWER
- BASIN BOUNDARY

**DETENTION SUMMARY TABLE**

|        | WQCV  | EURV  | V-100 | Total |
|--------|-------|-------|-------|-------|
| Pond 1 | 0.065 | 0.108 | 0.309 | 0.416 |
| Pond 2 | 1.157 | 0.699 | 5.836 | 7.692 |

**SCALE: 1" = 100'**

**RUNOFF SUMMARY TABLE**

| DESIGN POINT | BASIN | AREA | Q5 BASIN | Q5 CUMULATIVE | Q 100 BASIN | Q 100 CUMULATIVE | REMARKS    |
|--------------|-------|------|----------|---------------|-------------|------------------|------------|
| 1            | A1    | 0.97 | 0.2      |               | 2.7         |                  |            |
| 2            | A2    | 2.22 | 0.3      | 0.5           | 5.4         | 7.9              | A1, A2     |
| 3            | A3    | 5.06 | 3.2      | 3.1           | 17.8        | 22.0             | A1 thru A3 |
| 4            | B1    | 0.97 | 0.2      |               | 14.9        |                  |            |
| 5            | B2    | 8.07 | 4.3      | 3.6           | 23.1        | 29.1             | B1, B2     |
| 6            | B3    | 4.1  | 3.7      | 6.0           | 14.5        | 37.6             | B1 thru B3 |
| 7            | B4    | 0.83 | 0.8      | 6.5           | 3.1         | 39.6             | B1 thru B4 |
| 8            | B5    | 4.01 | 5.5      | 9.2           | 17.6        | 47.3             | B1 thru B5 |
| 9            | B6    | 1.24 | 2.2      | 7.3           | 6.3         | 40.7             | B1 thru B6 |
| 10           | B7    | 2.04 | 2.0      | 8.4           | 8.4         | 45.3             | B1 thru B7 |
| 11           | B8    | 2.59 | 2.8      |               | 10.9        |                  |            |
| 12           | B9    | 1.09 | 1.1      | 3.1           | 4.3         | 12.3             | B8, B9     |
| 13           | C1.1  | 5.79 | 1.2      |               | 14.1        |                  |            |
| 14           | C1.2  | 7.4  | 3.2      | 3.2           | 22.1        | 27.1             | C1.1, C1.2 |
| 15           | C2.1  | 3.72 | 0.8      |               | 9.8         |                  |            |
| 16           | C2.2  | 4.99 | 1.1      | 1.6           | 13.7        | 19.8             | C2.1,2.2   |
| 17           | C2.3  | 3.67 | 0.8      |               | 9.8         |                  |            |
| 18           | C2.4  | 6.72 | 2.5      | 3.7           | 18.8        | 37.3             | C2         |
| 19           | C3    | 1.98 | 2.0      | 8.0           | 7.9         | 68.0             |            |
| 20           | C4    | 2.15 | 2.2      | 8.8           | 8.6         | 69.5             | C1 thru C4 |
| 21           | C5    | 4.72 | 4.8      | 11.0          | 18.7        | 76.3             | C1 thru C5 |
| 22           | C6    | 0.58 | 0.5      | 10.9          | 2.0         | 74.8             | C1 thru C6 |
| 23           | C7    | 1.18 | 0.8      | 11.2          | 4.9         | 76.9             | C1 thru C7 |
| 24           | D1    | 2.14 | 1.1      |               | 6.1         |                  |            |
| 25           | D2    | 6.28 | 1.9      | 2.5           | 18.5        | 19.9             | D1,D2      |
| 26           | D3    | 1.74 | 1.7      | 3.4           | 6.8         | 22.5             | D1 thru D3 |
| 27           | D4    | 3.81 | 7.4      | 6.9           | 20.7        | 31.9             | D1 thru D4 |
| 28           | D5    | 3.83 | 3.3      | 8.4           | 15.1        | 38.7             | D1 thru D6 |
| 29           | E1    | 3.35 | 0.6      |               | 9.9         |                  |            |
| 30           | E2    | 4.59 | 0.8      | 1.2           | 14.1        | 21.4             | E1,E2      |
| 31           | F1    | 0.97 | 1.0      |               | 4.0         |                  |            |

NOTE:  
STORM SEWER DESIGN WILL BE REVIEWED WITH THE SDP SUBMITTAL  
ACCESS FOR DETENTION POND MAINTENANCE WILL BE PROVIDED  
PER SECTION 13.6.1 OF THE STORM WATER CRITERIA MANUAL  
A STABLE WORKING BENCH MUST BE PROVIDED TO THE TOP OF  
THE OUTLET STRUCTURE AND SPILLWAY; A WORKING BENCH, NOT  
EXCEEDING 10%, SHOULD ALSO BE PROVIDED TO THE BOTTOM OF  
THE OUTLET STRUCTURE AND FOREBAY(S).

REVISIONS

| NO. | DESCRIPTION | DATE |
|-----|-------------|------|
|-----|-------------|------|

SOLEANA

CASTLE ROCK, CO

PHASE II DRAINAGE MAP

IMEG Project No:  
2002764.00

File Name:  
2002764.00 Phase II Drainage

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Field Book No:

Drawn By: RAR

Checked By: TCG

Date: 8/12/2022

1

Sheet 1 of 1

