

Conceptual Drainage Report

***Compark Village South, Filing No. 1
Parker, Colorado***

P.N. CLCPKC3

Prepared for:
470 Compark, LLC
290 Fillmore St, Suite 1A
Denver, CO 80206

Prepared By:



8008 E Arapahoe Ct, Suite 110
Centennial, Colorado 80112
Contact: Rick Moore, P.E.
303-708-0500

Initially Submitted November 20, 2015
Revised April 11, 2016

This conceptual report for the Compark South was prepared by me or under my direct supervision in accordance with the provisions of the *Town of Parker Storm Drainage and Environmental Criteria Manual*. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

Prepared by:

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State of Colorado No. 49038

Reviewed by:

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State of Colorado No. 30877

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I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This drainage report is part of the Compark Village South development. The purpose of this report is to demonstrate the feasibility of the conceptual storm drainage system planned to control the overall Green Acres Tributary drainage basins associated with the project. Drainage criteria are in accordance with the *Town of Parker Storm Drainage and Environmental Criteria Manual*.

B. Location

Compark Village South lies within Section 6, Township 6 South, Range 66 West of the Sixth Principal Meridian, Town of Parker, Colorado. General project area boundaries include Highway E-470 to the north, Grand View Estates to the south, an undeveloped parcel to the west (Cordillera Corp property), and Compark 190, LLC property to the east (see vicinity map in Maps section at the end of this report). The project will include a new main access road, Belford Avenue, running east-west connecting South Peoria Street to South Chambers Road.

C. Description of Property

The Compark South Development Site consists of approximately 150 acres, and is mostly vacant with ground cover consisting of native grasses and shrubs. There are currently 2 residences on the south side of the property, which will be removed. Onsite soils consist mainly of Newlin gravelly sandy loams and Fondis clay loam. These dominant soils are classified as hydrologic group B and C soils, respectively. The site is approximately 77% Hydrologic Soil Group "B" and 23% HSG "C". Refer to Appendix B of this report for excerpts of the SCS soil survey summary.

D. Floodplain Information

Compark Village South is located within two major drainage basins. Happy Canyon Creek is a major drainage basin that has a regulatory 100-year floodplain. Firm Map No's 08035C0062F and 08035C0066F, Effective date: September 30, 2005 reflect a Zone AE and Zone X floodplain across the eastern edge of the site. Green Acres Tributary is a sub-basin tributary to Happy Canyon Creek. Firm Map No. 08035C0062F, Effective date: September 30, 2005 reflects a Zone A non-detailed study floodplain over a portion of the Green Acres Tributary. Refer to Appendix C for FIRMETTE copies of the FIRM Map. A Floodplain Development Permit will be required for any construction within the documented floodplains on the property.

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II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

Approximately 70 percent (+/- 105 ac) of this project lies within the Green Acres Tributary drainage basin. The remaining 30 percent (+/- 45 ac) of the site lies directly within the Happy Canyon Creek drainage basin, as studied as a part of the Happy Canyon Creek basin by the Urban Drainage and Flood Control District under the following studies:

- UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County, prepared by Kiowa Consultants, June 1993. Urban Drainage in conjunction with sponsor partners Town of Parker and Douglas County are planning on updating the Happy Canyon Creek OSP.
- Green Acres Tributary is a part of the Happy Canyon Creek watershed. The upstream area of the Green Acres Tributary contains several existing and proposed development projects that contain features for which drainage studies have been prepared. All current upstream drainage features are a part of the Meridian Office Park, Filings 4 & 5 (reference 5) master drainage analysis.
- Happy Canyon Creek Major Drainageway Plan, prepared by Muller Engineering Company, March 2014.

B. Basin Description

The overall drainage basin including the proposed site is divided into six sub-area basins, A, B, C, D, E, and F (See the Map Section at the end of this report). Basins A through E make up the Green Acres Tributary Basin and Basin F comprises the direct flow area tributary to Happy Canyon Creek. The drainage basin is divided into twelve sub-areas within the MDP. Sub-basins H100, H110, H115, H-120, H130, H140, H145, H150, H160, H170 and H180 drain to the Green Acres Tributary and sub-basin A370 drains directly to Happy Canyon Creek. Refer to the drainage maps included at the rear of this report for the spatial relationship of these drainage basins.

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Basin A (H100, H110, H115, H120 & H130)

Basin A is comprised of approximately 370 acres of the Meridian Development area and directs surface drainage within Green Acres Tributary to a regional pond on the Meridian site, adjacent to Peoria Street.

Basin B (H140, H145, H150 & Portion of H160)

Basin B consists of approximately 310 acres of undeveloped land between Peoria Street and the site's western boundary. Green Acres Tributary (natural drainage channel) bisects this basin and intercepts surface runoff. It is assumed that any development within this 310-acre basin will provide corresponding water quality measures and detention storage for the major and minor storm events. Construction of a regional detention pond immediately upstream of the site is recommended in the UDFCD 2014 Major Drainageway Plan for Happy Canyon Creek (Airport 320 Pond).

Basin C (Portions of H170 & H180)

Basin C includes approximately 88 acres of existing Grand View Estates – a large rural residential lot development, which is tributary to Green Acres Tributary. These large lots have an approximate impervious value of 15%. Natural drainage swales exist onsite that historically drain across the Compark Village South site to Green Acres Tributary. The existing surface runoff from Basin C will be intercepted by the proposed on-site storm drainage infrastructure and routed across Basin D to Green Acres Tributary.

Basin D (Portions of H160, H170 & H180)

Basin D includes approximately 100 acres of the site that drains directly into the Green Acres Tributary. Basin D comprises a majority of the proposed site development area. This basin will have an approximate improved site impervious value of 60%. Onsite flows will be combined with the discharge from Basins A, B, and C. A new regional pond is proposed on site for water quality and to attenuate stormwater peaks from basins C and D. This regional pond is referenced as the E-470 Pond in the UDFCD 2014 MDP.

Green Acres Tributary will intercept upstream flows from Basins A and B and will combine with future developed flows from Basins C and D. These combined flows will be routed through the proposed onsite regional detention pond and discharged through an existing drainage conveyance structure (12-ft by 10-ft RCBC) underneath C-470. Green Acres Tributary continues downstream through improved drainage channels and roadway crossing structures to converge with Happy Canyon Creek near Jordan

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Road within Arapahoe County. Note: The Arapahoe County portion of Green Acres Tributary is an unimproved channel segment.

A more detailed breakdown and analysis of these basins can be found on the Drainage Basin Map in Appendix H.

Basin E (Portion of H185)

Basin E is a small remnant basin within Green Acres Tributary basin that has been cutoff by the development of E-470 Tollway. Basin E is currently comprised of approximately 52 acres and includes a small portion of improved E-470 roadway and a larger portion of undeveloped property. E-470 construction provided a 48" diameter storm sewer system to collect and direct this basin area runoff under E-470. These basin flows merge back into Green Acres Tributary on the north side of E-470.

A small portion of the proposed site (+/- 10-acres) is impacted by existing topography and a natural drainage swale that directs offsite surface runoff across the very northwest corner of the site to the existing E-470 storm sewer entrance structure which is a multi-grate type D inlet.

Basin F (Portions of A360 & A370)

Basin F includes the remaining 45 acres of the site that drains directly into Happy Canyon Creek. The runoff from the developed portion of this basin will be planned to treat stormwater with a proposed local water quality/detention pond prior to discharging into Happy Canyon Creek. This basin will have a low density and an approximate composite impervious value of 34%.

III. DRAINAGE CHANNELS

A. Happy Canyon Creek

Happy Canyon Creek is a major basin that is tributary to Cherry Creek. The portion of Happy Canyon Creek thalweg that extends through the proposed site is a natural sandy bottom channel. The thalweg has an existing natural meander bend located near the southwest corner of the site. No apparent head cutting exists within this channel reach. The active channel is a dry stream bed that experiences active flows during wet seasonal conditions.

As discussed earlier, a Zone AE and Zone X floodplain exist along Happy Canyon Creek. It is anticipated that bank stabilization will be required along

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the outer edges of the existing meander bends. No major channel improvements are contemplated for Happy Canyon Creek, except the future construction of a roadway bridge crossing needed for Belford Avenue and possible installation of grade control structures. This bridge structure will likely span the existing floodplain. Floodplain mitigation is anticipated through the thalweg. FHU has been contracted to perform the proposed bridge design and floodplain mitigation. All proposed improvements to Happy Canyon Creek will be addressed in a separate drainage report.

UDFCD and the Town of Parker has sponsored an update to the existing Happy Canyon Creek Outfall Systems Plan (OSP) and the 2014 Happy Canyon Creek Major Drainageway Plan (MDP). Any recommendations to channel upgrades to this reach of Happy Canyon Creek need to meet the recommendations of the OSP and 2014 MDP. Channel design and the Happy Canyon Creek bridge design must be reviewed and approved by UDFCD prior to the approval of associated drawings.

Note: Note all channel improvement design and construction shall meet the minimum requirements of the UDFCD maintenance eligibility program.

B. Green Acres Tributary

Green Acres Tributary is a sizeable drainage basin (approximately 920 ac) within the Happy Canyon Creek drainage basin. The portion of Green Acres Tributary thalweg that extends through the site begins at an existing 12-ft. x 10-ft. RCBC structure at E-470 and extends southwest upstream through the site to the southwest corner. This channel receives intermittent seasonal flows and is normally a dry stream bed. A small pocket of wetlands exists within the channel near the upper reach of the channel. The on-site wetland areas were determined to be isolated and non-jurisdictional. A current wetland determination prepared by Smith Environmental and Engineers has been certified by the US Army Corps of Engineers and is valid until March 2, 2017. See Appendix C for a copy of the Approved Jurisdictional Determination.

As discussed earlier, a Zone A non-detailed floodplain exists over a portion of the lower reach of the Green Acres Tributary channel near the E-470 box culvert. Channel improvements will be needed to stabilize the existing channel bed and allow for on-stream detention/water quality storage. Several roadway crossing structures will be required to provide access to future developed sites and to provide a channel crossing for Belford Avenue. As currently planned, the Green Acres Tributary will be realigned throughout the site. Significant channel drop occurs across the site. Some of this drop will be provided through the roadway crossing structures and the

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remaining drop will likely require stable drop structures strategically placed to minimize the difference in elevation between the proposed channel and the adjacent parcels to be developed.

Floodplain mitigation will be required to map the final floodplain through the site and mitigate the existing Zone A floodplain. A LOMR will be required to complete this floodplain mitigation.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

The regulations, guidelines, and drainage design criteria to be used are those contained within the *Town of Parker Storm Drainage Design and Environmental Criteria* and the *Urban Storm Drainage Criteria Manual*. The general drainage concept is to construct a regional pond to provide detention for that portion of Green Acres Tributary basin downstream of the western limits of the proposed site and Grand View Estates. In addition, detention/water quality ponds will be required for all areas not treated by the proposed regional detention pond.

B. Hydrologic Criteria

The Rational Method will be used in the runoff calculations of the site's historic and developed flows. The initial storm will be based on a five-year storm frequency. The major storm discharge will be calculated for the 100-year storm frequency. The pond outfall storm sewer will be designed for the 100-year storm. The Town of Parker intensity-frequency-duration curves will be used to determine the flows for each of the basins (refer to Appendix A). The final required volumes of the sediment and detention ponds will be determined using the *Town of Parker Storm Drainage Design and Environmental Criteria*. Allowable release rates for the ponds will be based on release factors for soil types B and C as presented in the *Town of Parker Storm Drainage Design and Environmental Criteria*.

Future sizing of planned regional and sub-regional detention pond facilities shall follow the recommendations of UDFCD Outfall Systems Plan (OSP) and the 2014 Major Drainageway Plan for the Happy Canyon/Green Acres Tributary.

Based on the existing Grand View Estates Subdivision and the assumed imperviousness for the proposed site, preliminary sizing for the on-site regional detention was completed. The proposed regional pond planned

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within Basin D will be required to contain a combined storage for water quality and detention volume for the major storm event. The proposed pond will meet the recommendations of the recent UDFCD OSP and Major Drainageway Plan updates.

The proposed on-site regional water quality/detention pond will include a 5' deep permanent pool. An upstream water feature pond will also include a 5' permanent pool. The upstream pond is labeled as a water feature since its volume is not included in the calculations to meet the Town of Parker water quality/detention requirements. The proposed ponds will be online with the Green Acres Tributary. The proposed detention pond will discharge via an outlet structure to the existing 12'x10' RCBC beneath Highway E-470.

The water quality/detention pond(s) in Basin F will be required to contain the combined total storage for water quality and detention volume for the major storm event. Detention/Water Quality shall be designed to meet the minimum requirements of the UDFCD OSP and the Town of Parker requirements.

C. Variance from Criteria

Because the proposed regional detention pond is a wet pond, UDFCD has indicated it is not eligible for full maintenance eligibility. They indicated it is eligible for maintenance of the outlet structure, forebays and maintenance trail. They also indicated the proposed water feature pond is not eligible for maintenance.

The Town of Parker Storm Drainage and Environmental Criteria Manual, section 2.4.2.2 "requires all major drainage facilities located outside of street rights-of-way be eligible for UDFCD's maintenance program as a pre-condition of approval". A variance from this requirement will be requested.

V. ENVIRONMENTAL PROTECTION CRITERIA

A. General

Site drainage improvements are intended to minimize the impact to the environment.

B. Construction BMP Plan

Construction BMPs shall be placed during the appropriate construction phases to minimize soil erosion and the movement of sediment offsite. Construction BMPs shall be placed in two phases (Phase A and Phase B). The intent of the Phase A BMPs are to fulfill water quality objectives during

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the overlot and roadway rough grading phase of the project. Once Phase A rough grading and earthmoving is completed, Phase B BMP placement will commence. Phase B includes fine grading, utility construction, and street construction. Construction Plans will contain all appropriate Stormwater Management Details. In addition, a Stormwater Management Plan will be prepared to meet the town of Parker, State of Colorado, and Environmental Protection Agency criteria.

VI. CONCLUSION

This conceptual drainage report complies with all major standards of the Town of Parker and the Urban Drainage Flood Control District. This overall plan for the site's drainage design is effective and economical for controlling damage due to excess storm runoff and minimizing erosive discharges. This plan is intended to integrate into the future basin planning efforts by UDFCD, Douglas County and the Town of Parker when the Happy Canyon Creek Outfall System Planning study is updated.

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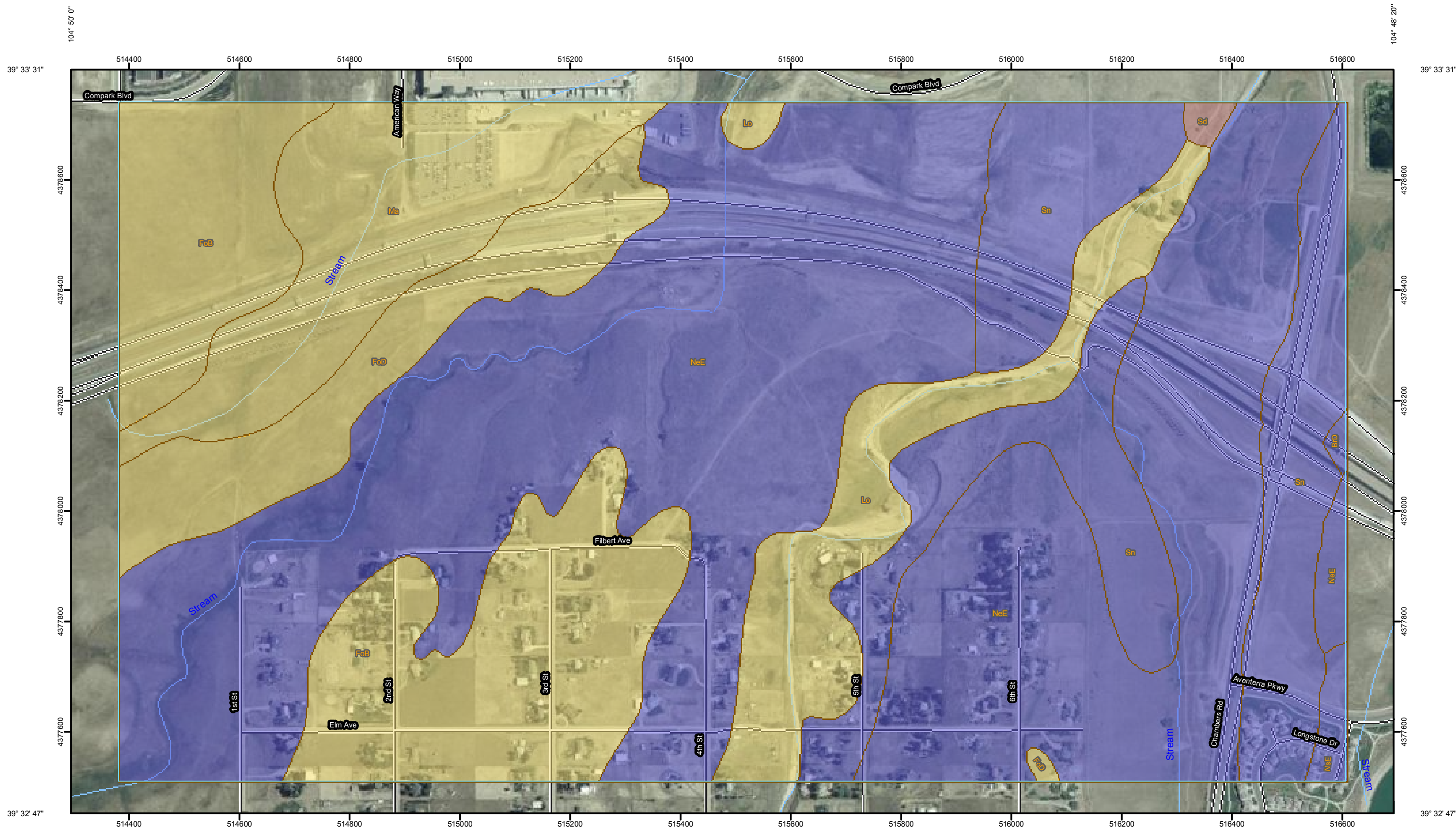
VII. REFERENCES

1. *Soil Survey of Castle Rock Area*, US Department of Agriculture Soil Conservation Service, September 23, 2014.
2. *Town of Parker Storm Drainage and Environmental Criteria Manual*, last revised February 2014.
3. *Urban Storm Drainage Criteria Manual*, Volumes 1–3, Urban Drainage and Flood Control District, 2010, with current revisions.
4. *UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County*, prepared by Kiowa Consultants, June 1993.
5. *Meridian Office Park Filings 4 & 5 2nd. Amended Master Drainage Study*, prepared by Martin and Martin, November 2010.
6. UDFCD – Happy Canyon Creek Master Drainage Plan, Muller Engineering March 2014.

APPENDIX A

USDA NRSC Soils Information Summary

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Map Scale: 1:6,630 if printed on B size (11" x 17") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Units

Soil Ratings

 A

 A/D

 B

 B/D

 C

 C/D

 D

 Not rated or not available

Political Features

 Cities

Water Features

 Streams and Canals


Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

MAP INFORMATION

Map Scale: 1:6,630 if printed on B size (11" × 17") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>

Coordinate System: UTM Zone 13N NAD83

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 6, May 4, 2009

Date(s) aerial images were photographed: 7/30/2005; 7/29/2005

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

Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BrD	Bresser sandy loam, 3 to 9 percent slopes	B	0.8	0.1%
FoB	Fondis clay loam, 1 to 3 percent slopes	C	100.7	14.9%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	38.8	5.7%
Lo	Loamy alluvial land	C	44.9	6.6%
Ma	Manzanola clay loam	C	55.6	8.2%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	334.2	49.4%
NsE	Newlin-Satanta complex, 5 to 20 percent slopes	B	3.2	0.5%
Sd	Sandy alluvial land	A	1.4	0.2%
Sn	Satanta loam	B	97.2	14.4%
Totals for Area of Interest			676.8	100.0%

Description

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

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

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

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

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

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

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

Rating Options

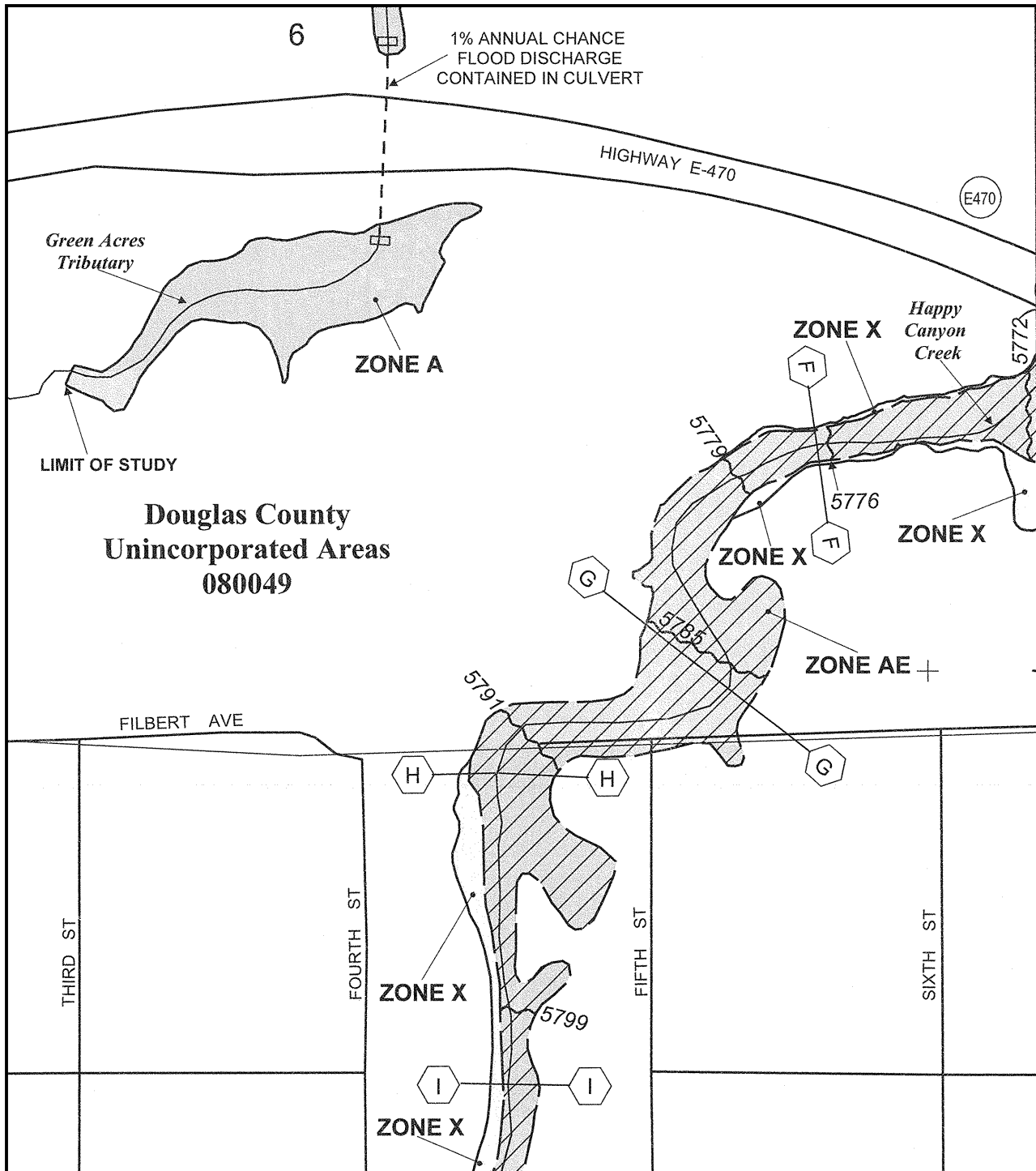
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

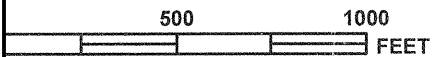
Tie-break Rule: Higher

APPENDIX B
FEMA FIRM Maps

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MAP SCALE 1" = 500'



PANEL 0062F

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

PANEL 62 OF 495
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0062	F
LONE TREE, CITY OF	080319	0062	F

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



MAP NUMBER
08035C0062F

EFFECTIVE DATE:
SEPTEMBER 30, 2005

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX C

USACOE Approved Jurisdictional Determination

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

March 2, 2012

Mr. Peter Smith
Smith Environmental and Engineers
1490 W. 121st. Avenue, Suite 101
Westminster, CO 80234

**RE: Compark Development Approved Jurisdictional Determination, Two Isolated Drainages
(Green Acres Tributary)
Corps File No. 199780436**

Dear Mr. Smith:

Reference is made to the above-mentioned project located at 39.554033; -104.824038, Douglas County, Colorado. These isolated drainages at this site were determined to be non-jurisdictional and are not regulated under Section 404 of the Clean Water Act.

This site has been reviewed in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material and certain excavation activities in waters of the United States. Waters of the U.S. includes ephemeral, intermittent and perennial streams, their surface connected wetlands and adjacent wetlands and certain lakes, ponds, drainage ditches and irrigation ditches that have a nexus to interstate commerce.

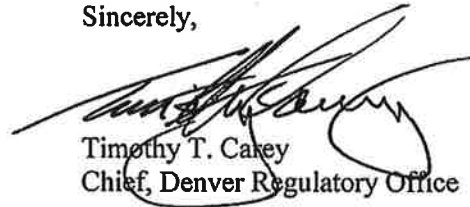
An approved jurisdictional determination (JD) has been completed for this project. The JD is attached to this letter. If you are not in agreement with the JD decision, you may request an administrative appeal under regulation 33 CFR 331, by using the attached Appeal Form and Administrative Appeal Process form. The request for appeal must be received within 60 days from the date of this letter. If you would like more information on the jurisdictional appeal process, contact this office. It is not necessary to submit a Request for Appeal if you do not object to the JD.

This JD is valid for a period of five years from the date of this letter, unless new information warrants revisions of the JDs before the expiration date, or unless the Corps has identified, after a possible public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.

The Omaha District, Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete our Customer Service Survey found on our website at <http://per2.nwvp.usace.army.mil/survey.html>. If you do not have Internet access, you may call and request a paper copy of the survey that you can complete and return to us by mail or fax. (Completing the survey is a voluntary action)

If there are any questions call Mr. Terry McKee of my office at 303-979-4120 and reference Corps File No. 199780436.

Sincerely,

A handwritten signature in black ink, appearing to read "Timothy T. Carey", is written over the typed name and title. The signature is fluid and cursive, with a large loop at the end.

Timothy T. Carey
Chief, Denver Regulatory Office

tm

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant:	File Number: 199780436	Date:
Attached is:	See Section below	
<input type="checkbox"/>	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
<input type="checkbox"/>	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
<input type="checkbox"/>	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
<input type="checkbox"/>	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at <http://usace.army.mil/inet/functions/cw/cecwo/reg> or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:

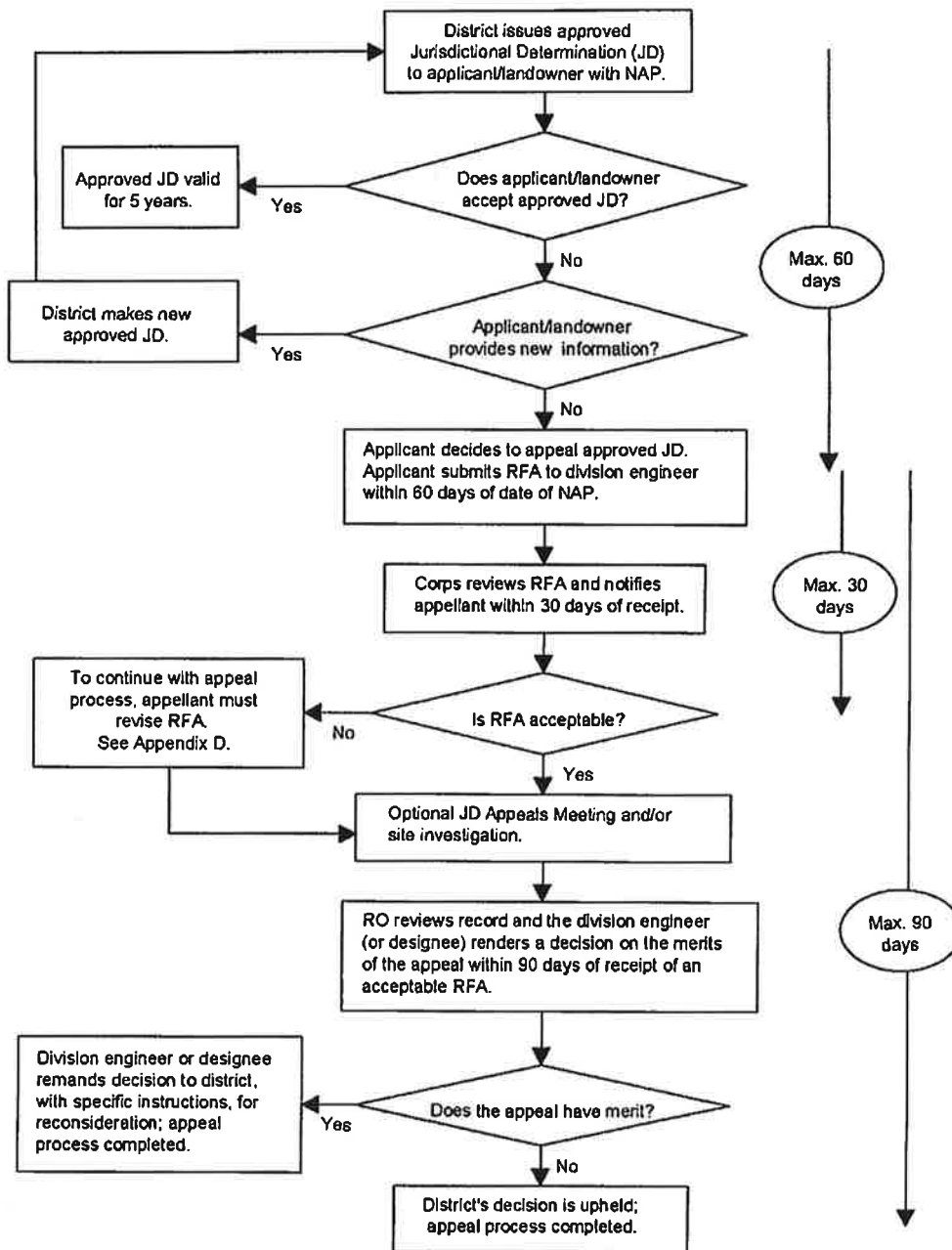
Timothy T. Carey
Chief, Denver Regulatory Office
9307 South Wadsworth Boulevard
Littleton, CO 80128
(303) 979-4120

If you only have questions regarding the appeal process you may also contact:

US Army Corps of Engineers, Northwestern Division
Attn: David Gesl, Appeal Review Officer
1125 NW Couch St.
Portland, OR 97209-4141
Telephone (503) 808-3825

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Administrative Appeal Process for Approved Jurisdictional Determinations



APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): March 1, 2012

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

Denver Regulatory Office
Compark Development
199780436

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: Co County/parish/borough: Douglas City: Parker
Center coordinates of site (lat/long in degree decimal format): Lat. 39.554033 N; Long. -104.824038 W
Name of nearest waterbody: Happy Canyon Creek
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: N/A
Name of watershed or Hydrologic Unit Code (HUC): 10190003

- Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
 Check if other sites (e.g., offsite mitigation sites, disposal sites, etc...) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

- Office (Desk) Determination. Date: February 16, 2012
 Field Determination. Date(s): December 15, 2011

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "navigable waters of the U.S." within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [Required]

- Waters subject to the ebb and flow of the tide.
 Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain:

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are no** "waters of the U.S." within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [Required]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply):¹

- TNWs, including territorial seas
 Wetlands adjacent to TNWs
 Relatively permanent waters² (RPWs) that flow directly or indirectly into TNWs
 Non-RPWs that flow directly or indirectly into TNWs
 Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
 Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
 Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
 Impoundments of jurisdictional waters
 Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:

Non-wetland waters: linear feet: width (ft) and/or acres.
Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: Pick List

Elevation of established OHWM (if known):

2. Non-regulated waters/wetlands (check if applicable):³

- Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain:** This wetland is at the upper end of a drainage approximately 8,600 feet up-gradient from Happy Canyon Creek. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. Sporadic wetlands exist down-gradient, associated with culverts and grade control structures. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

¹ Boxes checked below shall be supported by completing the appropriate sections in Section III below.

² For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).

³ Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are “relatively permanent waters” (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody⁴ is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:

Watershed size: 1815 square miles
Drainage area: 2 square miles
Average annual rainfall: 14 inches
Average annual snowfall: 40 inches

(ii) Physical Characteristics:

(a) Relationship with TNW:

- Tributary flows directly into TNW.
- Tributary flows through 0 tributaries before entering TNW.

Project waters are 5-10 river miles from TNW.
Project waters are 2-5 river miles from RPW.
Project waters are 5-10 aerial (straight) miles from TNW.
Project waters are 2-5 aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain:

Identify flow route to TNW⁵: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

Tributary stream order, if known:

(b) General Tributary Characteristics (check all that apply): This drainage swale displays no OHWM physical characteristics

Tributary is: Natural
 Artificial (man-made). Explain:
 Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):

Average width: feet
Average depth: 1 feet
Average side slopes: 3:1

⁴ Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

⁵ Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

Primary tributary substrate composition (check all that apply):

- | | | |
|--|--|-----------------------------------|
| <input type="checkbox"/> Silts | <input checked="" type="checkbox"/> Sands | <input type="checkbox"/> Concrete |
| <input type="checkbox"/> Cobbles | <input type="checkbox"/> Gravel | <input type="checkbox"/> Muck |
| <input type="checkbox"/> Bedrock | <input type="checkbox"/> Vegetation. Type/% cover: | |
| <input type="checkbox"/> Other. Explain: | | |

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: **stable**.

Presence of run/riffle/pool complexes. Explain:

Tributary geometry: **Meandering**

Tributary gradient (approximate average slope): **0.5 %**

(c) **Flow:**

Tributary provides for: **Ephemeral flow**

Estimate average number of flow events in review area/year: **Unknown**

Describe flow regime: **There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.**

Other information on duration and volume: **Flows from the project site would reach Happy Canyon Creek only during a 5 - 10 flow year event.**

Surface flow is: **Overland sheetflow.**

Characteristics: **The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek.**

Subsurface flow: **Unknown.** Explain findings:

- Dye (or other) test performed:

Tributary has (check all that apply): **This drainage/swale displays no OHWM physical characteristics**

- | | |
|---|---|
| <input type="checkbox"/> Bed and banks | |
| <input type="checkbox"/> OHWM ⁶ (check all indicators that apply): | |
| <input type="checkbox"/> clear, natural line impressed on the bank | <input type="checkbox"/> the presence of litter and debris |
| <input type="checkbox"/> changes in the character of soil | <input type="checkbox"/> destruction of terrestrial vegetation |
| <input type="checkbox"/> shelving | <input type="checkbox"/> the presence of wrack line |
| <input type="checkbox"/> vegetation matted down, bent, or absent | <input type="checkbox"/> sediment sorting |
| <input type="checkbox"/> leaf litter disturbed or washed away | <input type="checkbox"/> scour |
| <input type="checkbox"/> sediment deposition | <input type="checkbox"/> multiple observed or predicted flow events |
| <input type="checkbox"/> water staining | <input type="checkbox"/> abrupt change in plant community |
| <input checked="" type="checkbox"/> other (list): wetland only | |
| <input type="checkbox"/> Discontinuous OHWM. ⁷ Explain: | |

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

- | | |
|--|--|
| <input type="checkbox"/> High Tide Line indicated by: | <input type="checkbox"/> Mean High Water Mark indicated by: |
| <input type="checkbox"/> oil or scum line along shore objects | <input type="checkbox"/> survey to available datum; |
| <input type="checkbox"/> fine shell or debris deposits (foreshore) | <input type="checkbox"/> physical markings; |
| <input type="checkbox"/> physical markings/characteristics | <input type="checkbox"/> vegetation lines/changes in vegetation types. |
| <input type="checkbox"/> tidal gauges | |
| <input type="checkbox"/> other (list): | |

(iii) **Chemical Characteristics:**

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).

Explain: **There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.**

Identify specific pollutants, if known:

(iv) **Biological Characteristics. Channel supports (check all that apply):**

- Riparian corridor. Characteristics (type, average width): **upland grass and weeds.**
- Wetland fringe. Characteristics:

⁶A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.

⁷Ibid.

- Habitat for:
 - Federally Listed species. Explain findings:
 - Fish/spawn areas. Explain findings:
 - Other environmentally-sensitive species. Explain findings:
 - Aquatic/wildlife diversity. Explain findings: wetland habitat for wildlife adapted to life on the high plains. Corridor generally has upland vegetation throughout the upland swales, supporting natural high plains wildlife and birds.

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: 1.36 acres

Wetland type. Explain: PEM.

Wetland quality. Explain: Poor.

Project wetlands cross or serve as state boundaries. Explain:

(b) General Flow Relationship with Non-TNW:

Flow is: **No Flow**. Explain: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

Surface flow is: **Overland sheetflow**

Characteristics: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

Subsurface flow: **Unknown**. Explain findings:

Dye (or other) test performed:

(c) Wetland Adjacency Determination with Non-TNW: This wetland is at the upper end of a drainage approximately 8,600 feet up-gradient from Happy Canyon Creek. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. Sporadic wetlands exist down-gradient, associated with culverts and grade control structures. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek. These wetlands are not adjacent to any tributary.

Directly abutting

Not directly abutting

Discrete wetland hydrologic connection. Explain:

Ecological connection. Explain:

Separated by berm/barrier. Explain:

(d) Proximity (Relationship) to TNW

Project wetlands are **5-10** river miles from TNW.

Project waters are **5-10** aerial (straight) miles from TNW.

Flow is from: **No Flow**.

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain:

Identify specific pollutants, if known:

(iii) Biological Characteristics. Wetland supports (check all that apply):

Riparian buffer. Characteristics (type, average width):

Vegetation type/percent cover. Explain:

Habitat for:

Federally Listed species. Explain findings:

Fish/spawn areas. Explain findings:

Other environmentally-sensitive species. Explain findings:

Aquatic/wildlife diversity. Explain findings:

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **2**

Approximately (1.36) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

<u>Directly abuts? (Y/N)</u>	<u>Size (in acres)</u>	<u>Directly abuts? (Y/N)</u>	<u>Size (in acres)</u>
Wetland 1	1.10		
Wetland 2	0.26		

Summarize overall biological, chemical and physical functions being performed: The biological function provides habitat for micro and macro invertebrates including annelids, arthropods, arachnids and amphibians, which may be a food source for birds, rodents, small carnivorous mammals and reptiles. The vegetation may provide cover and a food source for rabbits and certain birds and other wildlife associated with the high plains. Chemical function is most likely insignificant given that flows from these wetlands would rarely, if ever, reach a downstream TNW.

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapans* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

Findings of absence of significant nexus.

Drainage (locally called Green Acres Tributary):

This wetland is at the upper end of a drainage approximately 8,600 feet up-gradient from Happy Canyon Creek. The soil along the reach of this drainage is sandy and porous, which allows most normal flows to dissipate into the ground before reaching Happy Canyon Creek. Sporadic wetlands exist down-gradient, associated with culverts and grade control structures at E-470, Compark Blvd, and South Chambers Road. No channel or tributary OHHM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

During a January 9, 2012 discussion with the Town of Parker's Engineering Manager, it was determined the flows from the project site would reach Happy Canyon Creek only during a 5 – 10 flow year event. He stated that he has driven over Jordan Road at the intersection of this drainage and Happy Canyon Creek for several years and has never seen water flowing from this drainage into Happy Canyon Creek.

Wetlands at the project site are approximately 8,600 feet up-gradient of Happy Canyon Creek. From this intersection, Happy Canyon Creek, and ephemeral non-RPW, flows for approximately 2,800 feet to its confluence with Cherry Creek, an RPW. From this confluence, Cherry Creek flows for approximately 5.45 miles to Cherry Creek Reservoir, a TNW.

The entire Cherry Creek drainage including East and West Cherry Creek is 400 square miles. The drainage comprises less than 0.001% of the total Cherry Creek watershed, which includes Cherry Creek Reservoir.

The composition of both the drainage basin and stream substrates is highly porous alluvial sand and gravel, and both rainfall and any accumulated flows quickly disappear into the ground. Only during less-frequent, high-precipitation storms would flows gather and negotiate through the broad upland swale to reach Happy Canyon Creek. Predominantly upland characteristics, along with the absence of normal aquatic resource characteristics at the lower end of the drainage help demonstrate that surficial flows to Happy Canyon Creek are rare. There are not even signs of high flows, such as drift deposits, reaching Happy Canyon Creek. Based on topography of the land and physical evidence it appears unlikely that water in this drainage flows to Happy Canyon Creek, the downstream tributary, on any routine basis.

The hydrologic nexus to the Cherry Creek Reservoir is so minimal as to be insubstantial. There is also no evidence of a significant biological or ecological nexus, such as ESA habitat or aquatic life movement.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
 - Prior to the Jan 2001 Supreme Court decision in "SWANCC," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: See Section C
- Other: (explain, if not covered above):

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- Non-wetland waters (i.e., rivers, streams):
- Lakes/ponds: acres.
- Other non-wetland waters: acres. List type of aquatic resource:
- Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

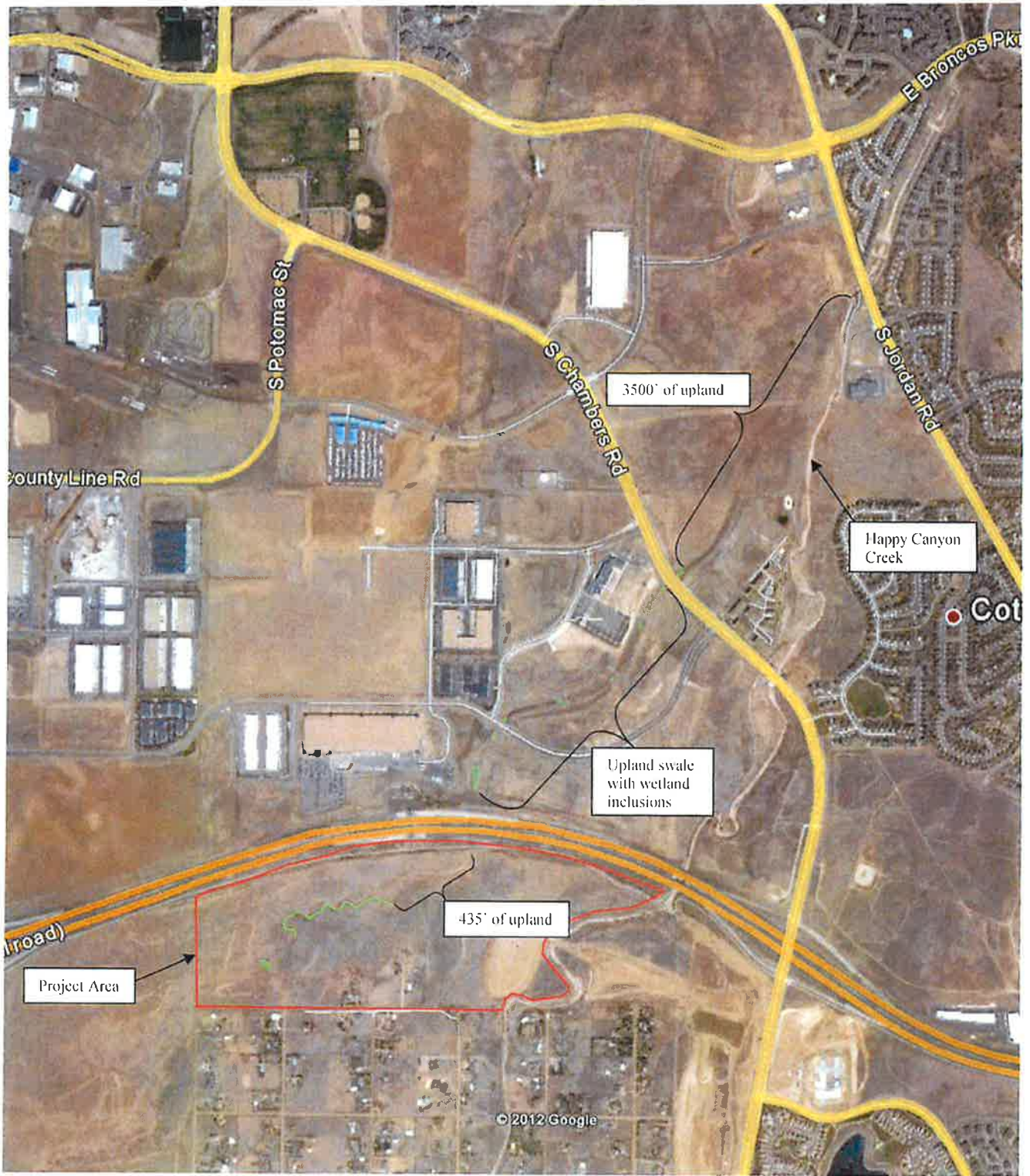
- Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- Lakes/ponds: acres.
- Other non-wetland waters: acres. List type of aquatic resource:
- Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: **Smith Environmental**
- Data sheets prepared/submitted by or on behalf of the applicant/consultant.
 - Office concurs with data sheets/delineation report.
 - Office does not concur with data sheets/delineation report.
- Data sheets prepared by the Corps:
- Corps navigable waters' study:
- U.S. Geological Survey Hydrologic Atlas:
 - USGS NIID data.
 - USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name: **1:24000, Parker**
- USDA Natural Resources Conservation Service Soil Survey. Citation:
- National wetlands inventory map(s). Cite name:
- State/Local wetland inventory map(s):
- FEMA/FIRM maps:
- 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
- Photographs: Aerial (Name & Date): or Other (Name & Date): **Project site**
- Previous determination(s). File no. and date of response letter:
- Applicable/supporting case law: **Rapanos and Carabell cases.**
- Applicable/supporting scientific literature:
- Other information (please specify):

Project area map

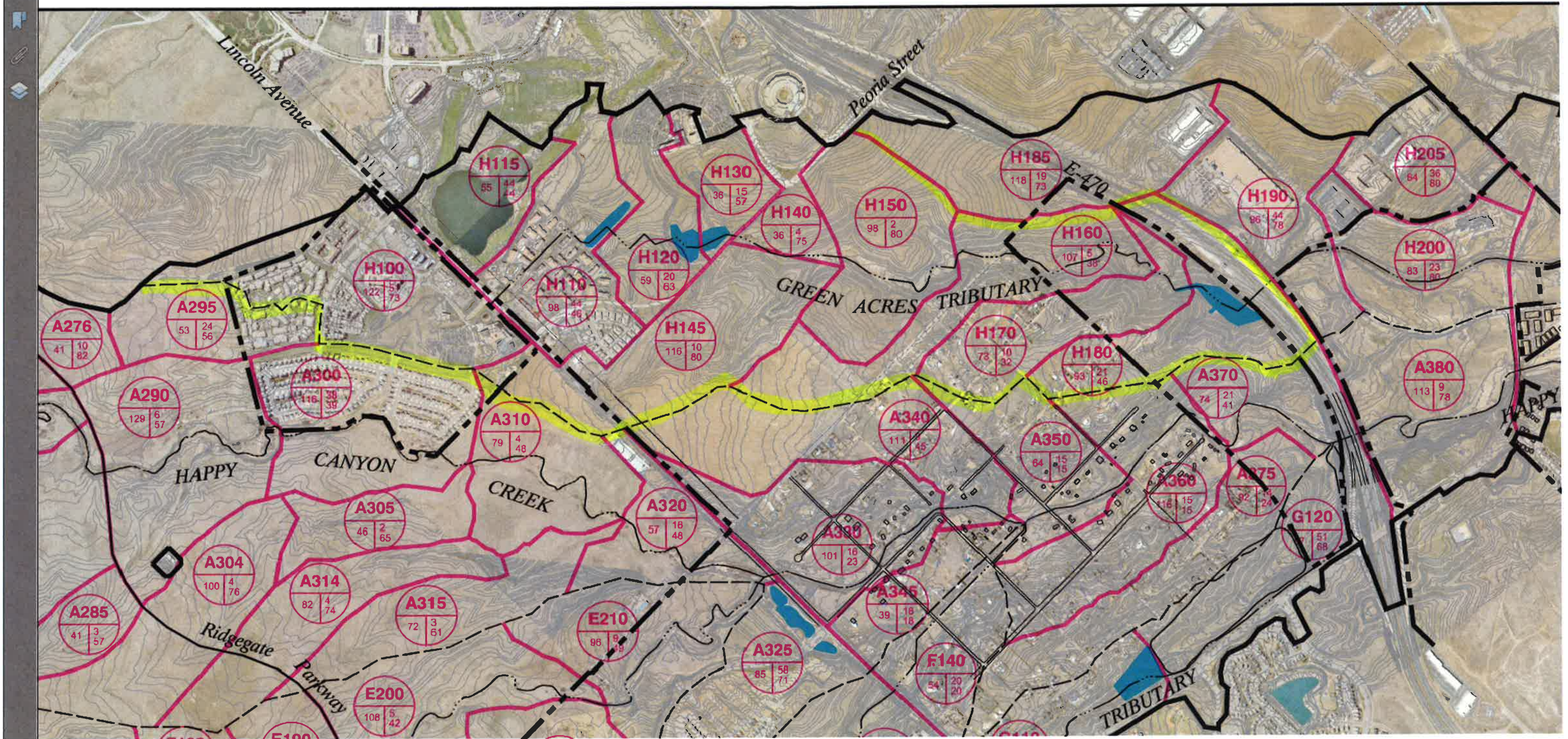


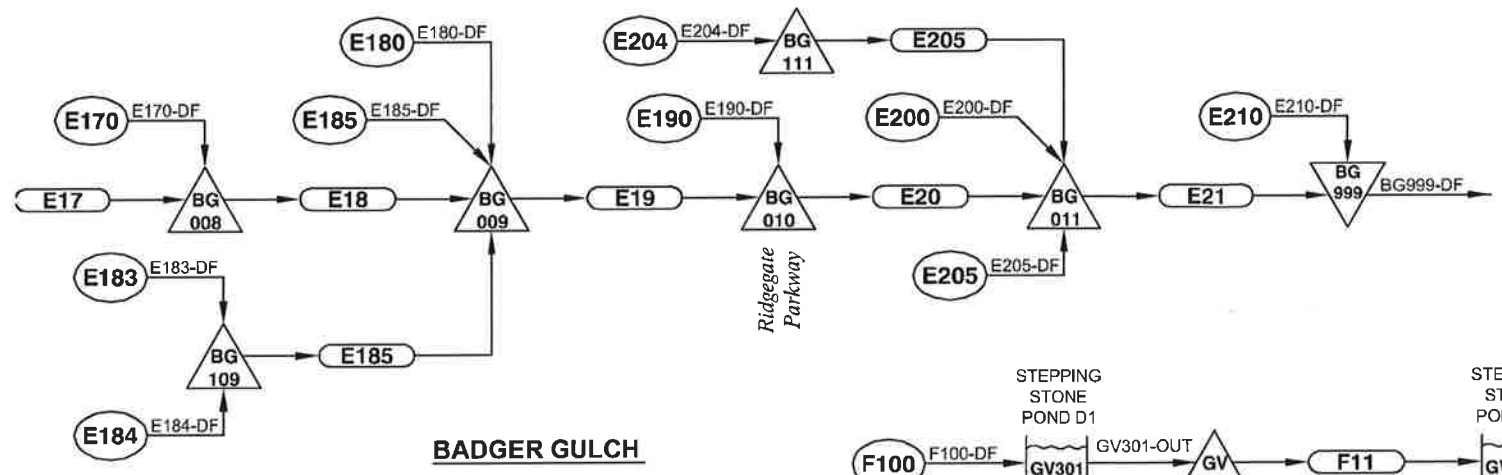
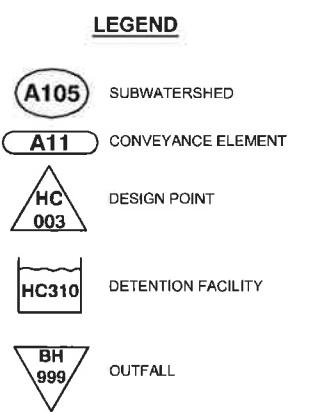
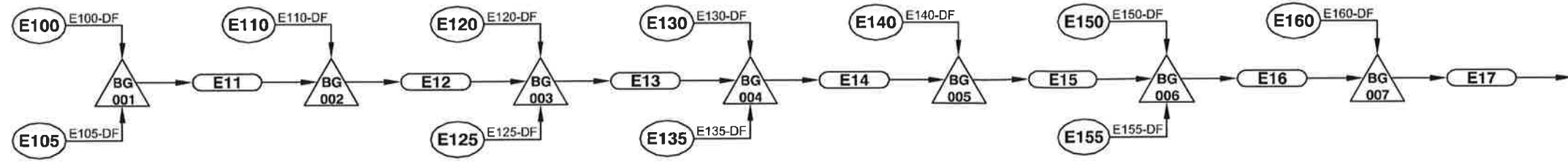


APPENDIX D

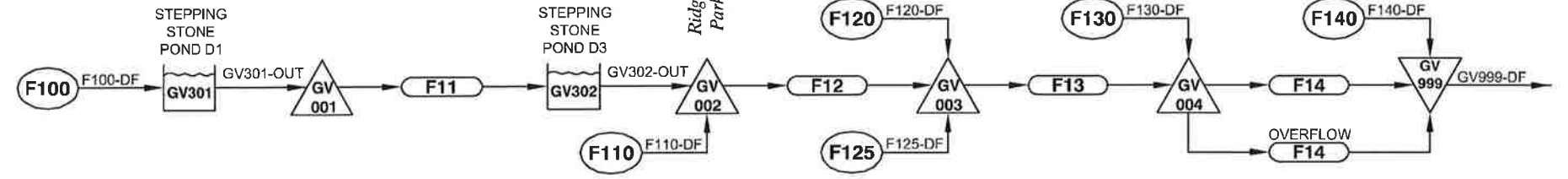
Excerpts from Happy Canyon Major Drainageways Plan

Initially Submitted November 20, 2015
Revised April 11, 2016

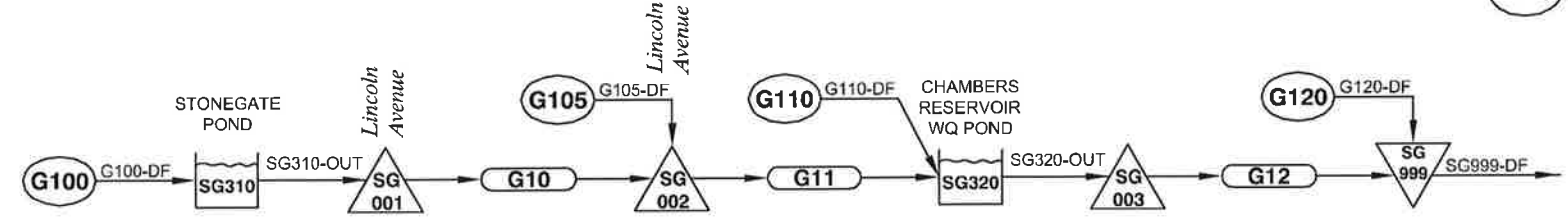




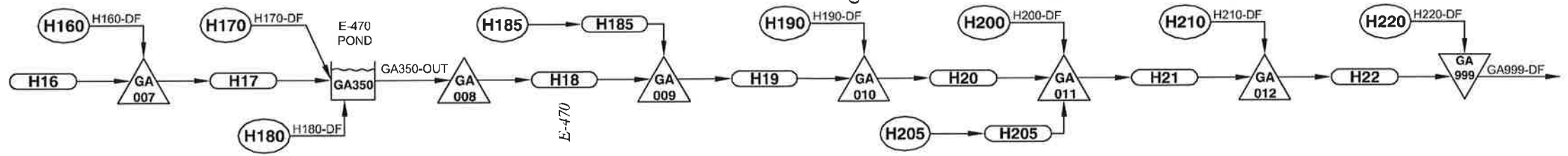
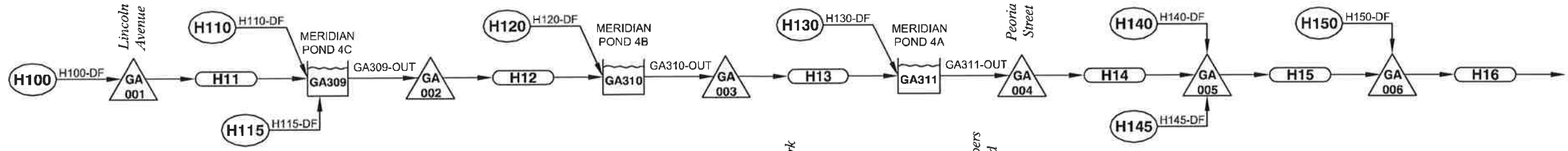
BADGER GULCH



GRANDVIEW TRIBUTARY



STONEGATE TRIBUTARY



GREEN ACRES TRIBUTARY

DATE: OCT 08 2013 TIME: 2:25 PM
 NAME: P:\1301301_Happy Canyon Creek_MDP & PHAD_UHF_CD_CAD\1301301-SWMM_Schematic.dwg

Subwatershed ID	Area		Dist to Centroid		Length		Length-Weighted Slope ft/ft	Weighted % Impervious		Depression Storage		Infiltration			Corresponding Basin IDs - 1993 OSP
	acres	sq mi	ft	mi	ft	mi		Existing %	Future %	Pervious watershed in	Impervious watershed in	Initial Rate in/hr	Decay Coeff. 1/second	Final Rate in/hr	
E204	42	0.06605	1067	0.202	2541	0.481	0.0294	2.0	71.6	0.5	0.1	3	0.0018	0.5	94
E205	100	0.15620	1948	0.369	4214	0.798	0.0320	35.2	52.8	0.5	0.1	3.15	0.0018	0.51	94
E210	96	0.14956	2674	0.507	5765	1.092	0.0159	9.2	49.3	0.5	0.1	3.825	0.0018	0.555	98
Grandview Tributary															
F100	93	0.14511	800	0.152	2700	0.511	0.0308	2.0	56.8	0.5	0.1	3	0.0018	0.5	100
F110	105	0.16378	880	0.167	2240	0.424	0.0234	6.5	52.5	0.5	0.1	3	0.0018	0.5	100,101,103
F120	124	0.19354	1990	0.377	3526	0.668	0.0282	38.3	55.6	0.5	0.1	3.075	0.0018	0.505	101,102,103
F125	70	0.10874	1339	0.254	3288	0.623	0.0252	2.0	50.0	0.5	0.1	3.675	0.0018	0.545	101,103,104
F130	107	0.16717	1518	0.287	3294	0.624	0.0217	4.7	51.4	0.5	0.1	3.675	0.0018	0.545	104
F140	54	0.08509	2009	0.380	4129	0.782	0.0215	19.6	19.6	0.5	0.1	4.05	0.0018	0.57	105
Stonegate Tributary															
G100	112	0.17554	3093	0.586	6705	1.270	0.0154	2.0	50.0	0.5	0.1	3.075	0.0018	0.505	107
G105	43	0.06657	1219	0.231	3081	0.584	0.0194	50.0	50.0	0.5	0.1	3.825	0.0018	0.555	107
G110	73	0.11451	1596	0.302	3413	0.646	0.0227	22.8	22.8	0.5	0.1	4.05	0.0018	0.57	108,111
G120	87	0.13633	2412	0.457	4933	0.934	0.0215	50.5	68.3	0.5	0.1	4.5	0.0018	0.6	111
Green Acres Tributary															
H100	122	0.19127	1349	0.255	5346	1.013	0.0122	51.2	72.6	0.5	0.1	3	0.0018	0.5	119,67,121
H110	98	0.15386	557	0.105	1981	0.375	0.0186	44.4	46.4	0.5	0.1	3	0.0018	0.5	120,124
H115	55	0.08578	691	0.131	1531	0.290	0.0131	44.4	44.4	0.5	0.1	3	0.0018	0.5	119,120
H120	59	0.09167	1533	0.290	2500	0.473	0.0165	19.5	63.0	0.5	0.1	3	0.0018	0.5	120,123
H130	36	0.05656	810	0.153	2112	0.400	0.0172	15.2	56.9	0.5	0.1	3	0.0018	0.5	123,124
H140	36	0.05631	1750	0.331	3054	0.578	0.0235	3.5	75.0	0.5	0.1	3.375	0.0018	0.525	123,124,125
H145	116	0.18173	2457	0.465	5742	1.088	0.0167	10.2	79.6	0.5	0.1	3.075	0.0018	0.505	68,124
H150	98	0.15282	637	0.121	2590	0.491	0.0323	2.0	80.0	0.5	0.1	3.6	0.0018	0.54	125
H160	107	0.16661	3461	0.655	6975	1.321	0.0172	5.2	37.7	0.5	0.1	3.675	0.0018	0.545	125,129
H170	73	0.11465	1902	0.360	4331	0.820	0.0214	10.0	32.3	0.5	0.1	3.75	0.0018	0.55	128
H180	93	0.14542	1094	0.207	3929	0.744	0.0191	21.1	45.7	0.5	0.1	3.75	0.0018	0.55	131
H185	118	0.18474	1850	0.350	5098	0.966	0.0219	19.0	73.3	0.5	0.1	3	0.0018	0.5	130,132
H190	96	0.15048	561	0.106	2865	0.543	0.0348	43.8	77.6	0.5	0.1	3.375	0.0018	0.525	132,133
H200	83	0.12951	1236	0.234	3650	0.691	0.0189	23.4	80.0	0.5	0.1	3.9	0.0018	0.56	132,133,114,134
H205	64	0.10061	820	0.155	1900	0.360	0.0349	35.8	80.0	0.5	0.1	3.75	0.0018	0.55	132,133,134
H210	120	0.18689	1520	0.288	3320	0.629	0.0222	4.9	78.6	0.5	0.1	3.8	0.00169	0.59	133,115,134,135
H220	50	0.07869	1530	0.290	2490	0.472	0.0269	4.4	64.0	0.5	0.1	3.55	0.00158	0.61	135,116

Storage Curve					Storage Curve					Storage Curve				
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)	Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)	Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Chambers Reservoir WQ Pond (SWMM element SG320)					Meridian Pond 4A (SWMM element GA311)					Stepping Stone Pond D1 (SWMM element GV301)				
5837.2	0	0	0.0	0	5888.5	0	11333	0.0	0.0	6007.5	0	10	0.0	0.0
5838	0.8	334	0.8	0.4	5889	0.5	15901	0.5	0.0	6008	0.5	2672	0.5	1.3
5840	2.8	47285	2.8	2.2	5890	1.5	34312	1.5	0.11	6009	1.5	13483	1.5	13.20
5840.3	3.1	51599	3.1	2.5	5891	2.5	52329	2.5	0.51	6010	2.5	27296	2.5	30.90
5842	4.8	88359	4.8	3.7	5892	3.5	64920	3.5	1.06	6011	3.5	44579	3.5	52.20
5844	6.8	110216	6.8	64.7	5893	4.5	70257	4.5	1.73	6012	4.5	66756	4.5	71.20
5846	8.8	124039	8.8	75.1	5894	5.5	75559	5.5	58.1	6013	5.5	76808	5.5	86.4
5848	10.8	137906	10.8	2671	5895	6.5	79701	6.5	219	6014	6.5	86899	6.5	99
5849	11.8	145138	11.8	4890	5896	7.5	83843	7.5	290	6015	7.5	96990	7.5	151
Stonegate Pond (SWMM element SG310)					Meridian Pond 4B (SWMM element GA310)					Stepping Stone Pond D3 (SWMM element GV302)				
5886.3	0	260	0.0	0.00	5891.5	0	0	0.0	0.0	5973.5	0	76487	0.0	0.0
5887	1	4340	0.7	0.13	5892	0.5	348	0.5	3.26	5974	0.5	114069	0.5	0.21
5888	2	9086	1.7	0.40	5893	1.5	5730	1.5	16.9	5975	1.5	122270	1.5	0.5
5889	3	24864	2.7	0.75	5894	2.5	24126	2.5	36.5	5976	2.5	131136	2.5	13.7
5890	4	52193	3.7	1.18	5895	3.5	53961	3.5	60.4	5977	3.5	138533	3.5	87.0
5891	5	77199	4.7	1.66	5896	4.5	92234	4.5	75.7	5978	4.5	147406	4.5	193.8
5892	5.7	94517	5.7	2.20	5897	5.5	126509	5.5	118	5979	5.5	157864	5.5	207
5893	6.7	105201	6.7	7.05	5898	6.5	146888	6.5	147	5980	6.5	167217	6.5	220
5894	7.7	112546	7.7	32.5	5899	7.5	153323	7.5	161	5981	7.5	176570	7.5	390
5895	8.7	120451	8.7	41.8	5900	8.5	159889	8.5	173	5982	8.5	185923	8.5	915
5896	9.7	127914	9.7	43.9	5901	9.5	166733	9.5	185	5983	9.5	195276	9.5	1677
5897	10.7	135421	10.7	45.8	5902	10.5	173678	10.5	197					
5898	11.7	147109	11.7	47.7	5903	11.5	180632	11.5	207					
5899	12.7	160614	12.7	49.5	5904	12.5	187664	12.5	217					
E-470 Pond (SWMM element GA350)					Meridian Pond 4C (SWMM element GA309)									
5782	0	200	0	103	5917	0	10	0	0.00					
5784	2	21000	2	291	5918	1	2120	1	9.22					
5786	4	58900	4	531	5919	2	15960	2	26.1					
5788	6	115100	6	813	5920	3	33760	3	55.3					
5790	8	192300	8	1134	5921	4	42906	4	94.6					
5792	10	269600	10	1467	5922	5	51523	5	160					
					5923	6	60321	6	258					
					5924	7	78033	7	268					
					5925	8	184401	8	278					
					5926	9	190000	9	437					
					5927	10	195600	10	711					

SWMM Node	Station (ft)	Channel Reach	Landmark	Design Storm	EXISTING DEVELOPMENT						FUTURE DEVELOPMENT							
					500-YR (cfs)	100-YR (cfs)	50-YR (cfs)	25-YR (cfs)	10-YR (cfs)	5-YR (cfs)	2-YR (cfs)	500-YR (cfs)	100-YR (cfs)	50-YR (cfs)	25-YR (cfs)	10-YR (cfs)	5-YR (cfs)	2-YR (cfs)
HC124				2-hr	75	52	38	28	13	7	0.8	154	119	101	85	59	50	31
HC123				2-hr	116	82	61	45	20	11	1.4	235	183	155	131	93	78	49
HC122				2-hr	54	38	29	21	9	5	0.5	99	76	63	52	35	28	16
HC119				2-hr	195	136	101	74	31	16	1.0	276	200	157	122	66	45	18
HC117				2-hr	294	205	155	114	49	25	1.5	328	231	177	133	62	36	6
HC116				2-hr	141	99	75	56	25	13	0.8	173	124	96	74	37	24	6
HC104				2-hr	417	304	244	193	115	82	36	417	304	244	193	115	82	36
HC103				2-hr	371	279	231	187	126	97	52	371	279	231	187	126	97	52
GREEN ACRES TRIBUTARY																		
GA999	70000		Confluence w/ Happy Canyon	2-hr	1249	882	667	507	253	165	69	1874	1446	1182	986	669	545	317
GA012	71400			2-hr	1193	844	640	488	257	169	70	1780	1377	1125	940	640	521	304
GA011	73700		Chambers Road	2-hr	1041	740	563	434	240	166	73	1543	1199	979	819	559	454	265
GA010	76300		Compark Boulevard	2-hr	819	580	431	332	191	158	64	1253	976	800	667	454	367	213
GA009	77200		E-470 (D/S)	2-hr	703	495	368	293	187	176	86	1106	861	710	589	396	320	200
GA008	77700		E-470 (U/S) / E-470 Pond Outflow	2-hr	594	420	332	269	171	141	70	891	688	567	470	319	249	144
GA350	77700		E-470 Pond Inflow	2-hr	600	422	332	270	171	115	47	961	725	586	479	319	250	144
GA007	79200			2-hr	481	355	287	240	159	110	46	680	522	430	357	287	229	118
GA006	82600		NW Corner of Grandview Estates (approx.)	2-hr	423	320	265	228	158	114	50	592	457	383	322	267	218	115
GA005	84600			2-hr	378	288	247	217	157	115	51	475	385	335	297	241	201	111
GA004	86000		Peoria Street / Meridian Pond 4A Outflow	2-hr	303	212	193	176	137	106	50	332	224	207	193	164	141	81
GA311	86000		Meridian Pond 4A Inflow	2-hr	326	213	194	178	139	111	65	383	226	208	194	166	143	87
GA003	86600		Meridian Pond 4B Outflow	2-hr	308	201	182	165	132	106	63	357	212	195	178	151	132	80
GA310	86600		Meridian Pond 4B Inflow	2-hr	580	420	324	303	203	155	79	617	477	366	335	256	204	112
GA002	87000		Mt Belford Avenue / Meridian Pond 4C Outflow	2-hr	519	361	276	264	182	141	74	559	394	301	271	212	169	92
GA309	87000		Meridian Pond 4C Inflow	2-hr	662	499	410	334	215	169	91	709	540	450	371	249	202	115
GA001	89600		Lincoln Avenue	2-hr	261	197	162	133	87	69	39	299	232	196	165	116	98	61
STONEGATE TRIBUTARY																		
SG999	90000		Confluence w/ Happy Canyon	2-hr	186	131	98	75	46	36	22	201	143	110	92	62	51	32
SG003	94500		Chambers Reservoir WQ Pond Outflow	2-hr	74	65	50	36	16	4	3	127	69	61	42	18	6	3
SG320	94500		Chambers Reservoir WQ Pond Inflow	2-hr	191	139	109	86	47	33	17	191	140	109	86	47	34	17
SG002	97500		Lincoln Avenue	2-hr	85	64	52	43	27	21	12	96	66	53	44	28	22	13
SG001	97300		Stonegate Pond Outflow	2-hr	35	21	9	4	2	1.0	0.2	45	41	35	26	11	5	2
SG310	97300		Stonegate Pond Inflow	2-hr	89	62	45	33	15	7	0.5	167	126	103	84	54	43	23
GRANDVIEW TRIBUTARY																		
GV999	110000		Confluence w/ Happy Canyon	2-hr	602	394	277	215	123	76	30	846	629	482	374	221	163	96
GV004	112900		Lincoln Avenue	2-hr	561	364	269	207	104	68	27	811	604	463	359	214	169	93
GV003	116500		Meridian Filing No. 7 / Sierra Ridge Boundary	2-hr	448	290	209	165	94	68	32	620	475	365	284	173	129	74
GV002	120100		Main Street / Stepping Stone Pond D3 Outflow	2-hr	194	133	90	58	9	0	0	219	198	169	136	85	60	13
GV302	120100		Stepping Stone Pond D3 Inflow	2-hr	286	210	165	127	61	35	5	431	337	287	241	166	136	80
GV001	121200		Stepping Stone Pond D1 Outflow	2-hr	97	78	64	51	25	14	1	200	119	94	84	65	57	36
GV301	121200		Stepping Stone Pond D1 Inflow	2-hr	182	128	98	73	33	18	1	327	249	208	172	119	96	55



NOTES:

- THIS DRAWING IS FOR MASTER PLANNING PURPOSES AND REPRESENTS PRELIMINARY CONCEPTUAL ENGINEERING. ALTERNATIVES TO THIS OUTLET SYSTEM AND FLOOD CONTROL DISTRICT PROVIDED BY THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PROVIDED THE ALTERNATIVE OFFERS AN EQUIVALENT INTENT OF THE PLAN, INCLUDING HYDRAULIC CAPACITY, WATER QUALITY, STREAM STABILITY AND NATURAL WATERWAY FEATURES. THE ALTERNATIVE MUST COMPLY WITH ALL APPLICABLE STATE AND FEDERAL REQUIREMENTS FOR URBAN DRAINAGE AND FLOOD CONTROL DISTRICTS. IN ADDITION, THERE MAY BE STATE AND FEDERAL REQUIREMENTS THAT WILL NEED TO BE CONSIDERED AND MET. THIS DRAWING DOES NOT PROVIDE A FINAL DESIGN AND SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.
- LOCAL CITIES, TOWNS, AND COUNTIES MANAGE AND REGULATE ALL LAND-USE CHANGE, DEVELOPMENT AND REDEVELOPMENT ACTIVITIES WITHIN AND ADJACENT TO THE 100-YEAR FLOODPLAINS IN ORDER TO PREVENT, TO A MAXIMUM EXTENT POSSIBLE, FUTURE FLOOD DAMAGES TO BUILDINGS AND STRUCTURES FROM THE 100-YEAR FLOOD AND TO MINIMIZE DAMAGES FROM LARGER FLOODS. THE REGULATION OF DEVELOPMENT AND LAND-USE CHANGE IS THE RESPONSIBILITY OF LOCAL CITIES, TOWNS AND COUNTIES IN CARRYING OUT THEIR FLOODPLAIN MANAGEMENT AND REGULATORY RESPONSIBILITIES AND OBLIGATIONS.
- MANY ACTIVITIES THAT OCCUR IN OR AFFECT DITCHES, DRAINAGES, AND FLOODPLAINS ARE SUBJECT TO FEDERAL AND STATE PERMIT AUTHORIZATION FROM THE US ARMY CORPS OF ENGINEERS. DURING PRELIMINARY DESIGN, AND PRIOR TO FINAL DESIGN OR STARTING WORK, CONTACT THE CORP'S DENVER REGULATORY OFFICE AT 303-979-4126 FOR APPROPRIATE PERMIT AUTHORITY TO AVOID COMPROMISING AND DELAYING THE COMPLETION OF THE PROJECT.

HYDRAULIC INFORMATION

EXTENDED DETENTION	100-YR
VOL. AF.	11
W.S. EL.	5789.5
RELEASE RATE CFS	503

DATE: MARCH 2014
 FIGURE NO.: G-4

CONCEPTUAL DESIGN
 E-470 POND PLAN

HAPPY CANYON CREEK
 MAJOR DRAINAGEWAY PLAN

MULLER ENGINEERING CO., INC.
 1715 SOUTH WALDEN STREET, SUITE 100
 DENVER, COLORADO 80202
 PHONE: 303.733.8888

MULLER

DESIGNED BY: JTW
 CHECKED BY: JTW

APPENDIX E

Basin Hydrology & SWMM Update

Initially Submitted November 20, 2015
Revised April 11, 2016

Basin Hydrology & SWMM Update

A copy of the CUHP and SWMM models associated with the latest Happy Canyon Creek Major Drainageway Plan was obtained from UDFCD. This model was run unedited as a calibration model. The results represented the values shown in the 2014 MDP.

The MDP model included a regional detention pond in the area of the existing natural low area just upstream of the existing 12'x10' RCBC that conveys the Green Acres Tributary under E-470. This model was edited to include the stage/storage pairs obtained from a current topographic survey of existing conditions in this area. Key nodes were compared with the original model. As can be seen from the attached comparison table, the differences between the models were not significant.

The model was then revised to include the sizing proposed in the Manhard Consulting design of the regional detention pond. Again, the differences between the inflows at the key nodes were not significant when compared with the original model utilized for the Happy Canyon Creek MDP.

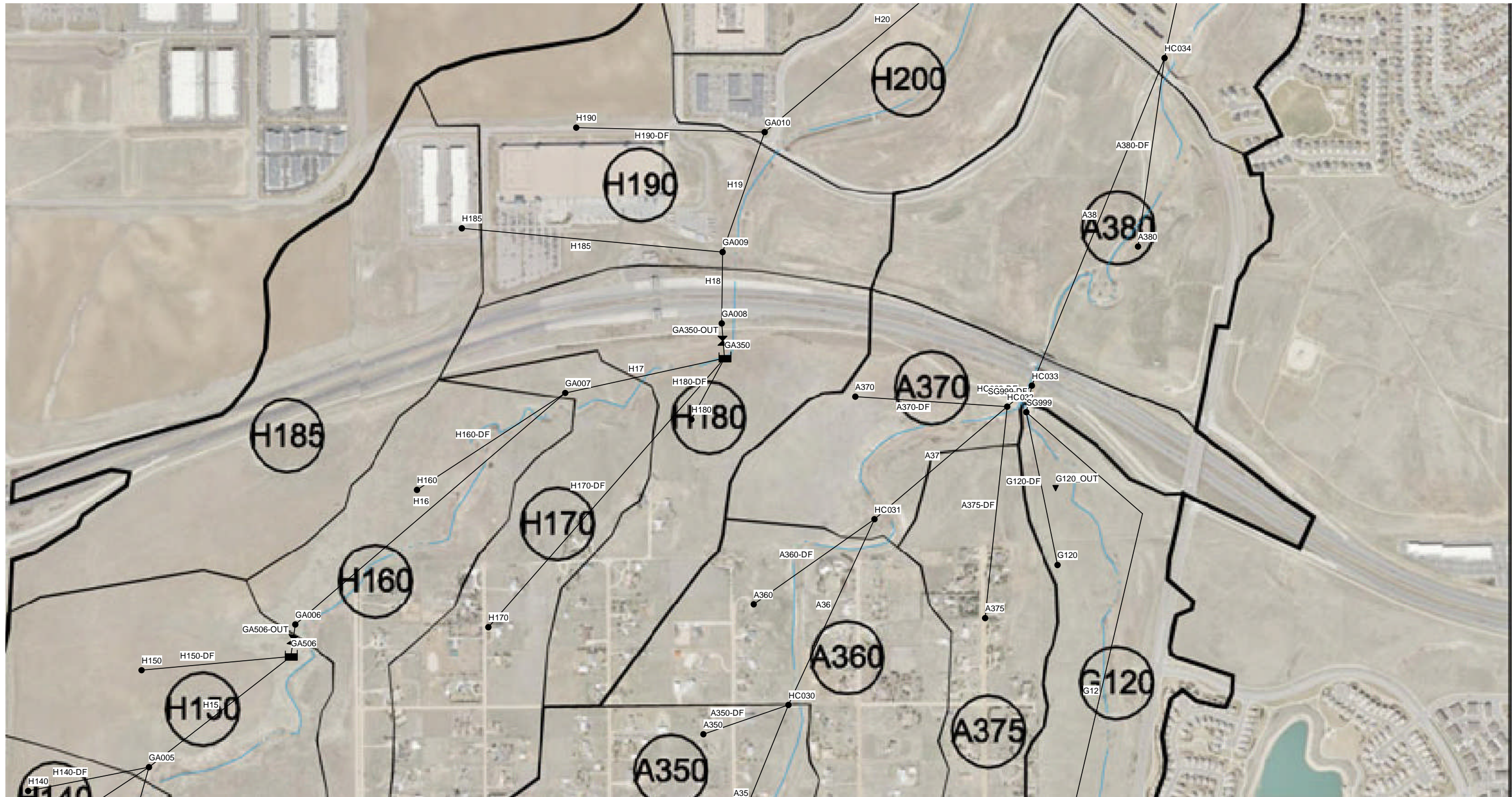
Given the details of the proposed development of Compark South, Manhard Consulting prepared a more detailed delineation of the sub-basin areas in this area. Some of the existing sub-basins included in the 2014 Happy Canyon MDP were also revised per more detailed information currently available. These revised drainage basins were input into the original MDP model as a calibration between the proposed Manhard model and the original MDP model. A comparison of the node inflows at key nodes within the model can be seen in the attached table.

As stated before, Manhard Consulting has re-delineated some of the drainage basins for Happy Canyon to better reflect the new development and more accurately evaluate the hydrology for the area. Basin H150 has been expanded to include a portion of basin H160 from the 2014 MDP model and a portion of basin A340. Basin H160 was reduced in size and split into two basins, creating a new basin (H161) to coincide with the residential development to the south of Belford Ave. H170 and 180 were split into two basins, creating two new basins (H171 and H181), also to coincide with the residential development to the south of Belford Ave. The northern portions of the original 2014 MDP basins H160, H170, and H180 were combined and now make up a new basin, H182, which includes the detention pond just south of E-470. An even further north portion of the original 2014 MDP basin H180, which includes a stretch of E-470, was combined with a small portion of the 2014 MDP basin A380 to form the new basin H183. Originally, most of this area was shown to be routed through the detention pond to the south of E-470, but we believe this area actually discharges, undetained, to Happy Canyon Creek, just to the north of the box culvert that runs under E-470. Original MDP basins H185 and H190 were each split into two basins, creating two new basins (H186 and H191, respectively).

Once the drainage area basins were revised and the model seemed to represent the original MDP model, the proposed Manhard regional detention pond design criteria and the proposed design of the Green Acres Tributary channel were entered into the model. Except for Node GA010 the inflows at the key nodes of the model are not significantly different from the 2014 Happy Canyon MDP. The difference between the Manhard model and the MDP model is that basin H183 runoff is routed straight to Node GA010. In the MDP model a large portion of the drainage basin was shown draining to the E-470 pond. However, the portion north of E-470 will not drain south under E-470 to the pond.

From the attached comparison of model results, it can be concluded that the proposed regional detention pond will meet the recommendations included in the 2014 Happy Canyon Major Drainageway Plan.

HAPPY CANYON CREEK MDP & FHAD



COMPARK VILLAGE SOUTH

01/01/2005 00:01:00



E-470 Natural Ex. Det Basin
Stage - Discharge

Elevation (ft)	H (ft)	L (ft)	Q _w (cfs)	HW (ft)	TW (ft)	Q _{cul} (cfs)	Q _{rel} (cfs)	Area (sf)	Vol. (AF)
5782.5	0	26	0.0	5782.5	5772.0	0.0	0.0	0	0.00
5783	0.5	26	34.0	5783	5774.1	185.5	34.0	936	0.00
5784	1.5	26	143.3	5784	5774.3	280.0	143.3	9,967	0.11
5785	2.5	28.4	336.8	5785	5774.6	384.4	336.8	24,707	0.50
5786	3.5	30.7	603.1	5786	5775.0	500.0	500.0	41,715	1.25
5787	4.5	32.9	942.2	5787	5775.3	626.3	626.3	68,834	2.51
5788	5.5	35.2	1362.1	5788	5775.6	760.0	760.0	99,020	4.42
5789	6.5	37.4	1859.4	5789	5775.9	902.9	902.9	132,636	7.07
5790	7.5	39.7	2446.3	5790	5776.3	1051.7	1051.7	166,976	10.50
5791	8.5	41.9	3115.0	5791	5776.6	1210.0	1210.0	206,888	14.76
5792	9.5	41.9	3680.6	5792	5776.8	1376.7	1376.7	243,993	19.93
5793	10.5	41.9	-	5793	5777.0	1508.0	1508.0	284,008	25.98
5794	11.5			5794	5777.1	1620.0	1620.0	315,488	32.86
5795	12.5			5795	5777.2	1730.0	1730.0	348,125	40.48
5796	13.5			5796	5777.4	1840.0	1840.0	381,674	48.85

**E-470 Proposed Regional FS Pond
Stage - Discharge**

Elevation (ft)	H (ft)	Q (cfs) WQ Plate	Q _w (cfs) 97' Weir @ 5792	Q _w (cfs) 50' Weir @ 5794	Q (cfs) 12'x10' EX RCBC	Q _{rel} (cfs)	Area (sf)	Vol. (AF)
5788	0	0			760.0	0.0	114,957	0.00
5789	1	0.53			902.9	0.5	127,960	2.79
5790	2	1.73			1051.7	1.4	134,911	5.80
5791	3	2.44			1210.0	2.4	142,080	8.98
5792	4	3.48	0.0		1376.7	3.5	149,170	12.33
5793	5	4.19	291.0		1508.0	295.2	156,002	15.83
5794	6	4.78	823.1	0	1620.0	827.9	162,642	19.49
5795	7	5.31	1512.1	150	1730.0	1667.4	170,252	23.31

Node ID	2014 MDP Basin Delineation			2015 MCL Basin Delineation			AFW Pond Alternate	Historical Design Flows	
	UDFCD Original MDP Model	UDFCD Original MDP Model with E-470 Natural Depression Per MCL Topo	UDFCD Original MDP Model with E-470 Pond Per MCL Design	UDFCD Original MDP Model with New Subdivided Basins Routed Based on Original MDP Model	MCL Model with New MCL Designed E-470 Pond, Channels, and Storm Sewer. New Subdivided Basins Routed Based on Original MDP Model	MCL Model with New MCL Designed E-470 Pond, Channels, and Storm Sewer. Basins Rerouted to Accurately Show Flow Paths ⁽³⁾	MCL Model with New MCL Designed E-470 Pond, AFW Pond, Channels, and Storm Sewer. Basins Rerouted to Accurately Show Flow Paths ⁽³⁾	LOMR By Others	Channel Design Plans
Q ₁₀₀ Inflow (cfs)									
GA005	385.3	385.3	385.3	385.3	385.3	385.3	385.3		
GA506 (Airport 320 Pond)	461.1	461.1	461.1	539.4 ⁽⁴⁾	539.4 ⁽⁴⁾	610.0 ⁽⁵⁾	610.0 ⁽⁵⁾		
GA006 (Pond Outflow)	408.0	408.0	408.0	448.0	448.0	472.8	472.8		
GA007	460.1	460.1	460.1	456.2	463.1	485.0	485.0		
GA350 (E-470 Pond)	543.2	543.2	543.2	512.5	577.0	587.9	587.9		
GA008 (Pond Outflow)	533.2	535.8	540.3	502.6	561.2	570.0	570.0		
GA009	602.0	607.6	614.5	532.6	561.1	569.9	569.9	724.0	1500.0
GA010	620.1	737.0 ⁽²⁾	638.1	617.6	676.9	872.6 ⁽¹⁾	734.6 ⁽¹⁾	1189.0	1720.0

Notes:

- 1.) Node GA010 observes a large increase in flow due to the fact that the E-470 portion of the original Basin H180 (+/- 34 Acres) is now being routed straight to Node GA010 as part of the new Basin H183. In the 2014 UDFCD MDP model, this area was shown to be detained and restricted by the E-470 Pond. We believe this to be inaccurate. In addition, Basin H183 now includes the area just North of E-470 and East of the channel. Our model assumes a developed condition for this area, which results in an increased impervious percentage, resulting in greater direct flow runoff to Green Acres Tributary.
- 2.) An increase in flow is seen due to the fact that the peaks of the two hydrographs that meet at this node line up at the same time. This is caused by the outflow pattern of the natural depression at E-470.
- 3.) Impervious percentages for the Grandview Estates basins were lowered from the Original MDP Model values to accurately depict the conditions of the current site design. Basin H150 now includes a portion of Basin A340 (+/- 56 Acres) from the Original MDP Model.
- 4.) An increase in flow is seen due to the addition of a portion of Basin H160 (+/- 48 Acres) to Basin H150.
- 5.) An increase in flow is seen due to the addition of a portion of Basin A340 (+/- 56 Acres) to Basin H150.

APPENDIX F

Channel & Arch Culvert Hydraulic Design

Initially Submitted November 20, 2015
Revised April 11, 2016

Channel & Arch Culvert Hydraulic Design

The peak runoffs utilized for design of Green Acres Tributary and the E-470 regional detention pond were taken from the Happy Canyon Major Drainageways Plan. The peak runoffs utilized considered future development of the drainage basin and no improvements to the existing infrastructure. The peak runoff during the minor 5 year design storm is 250 cfs and the peak runoff during the major 100 year design storm is 725 cfs

These peak runoffs were utilized to design the proposed channel sections for Green Acres Tributary. The peak runoff for the 5 year storm was utilized for the low flow section of the proposed channel and the peak 100 year storm was utilized for the overall capacity of the channel.

See following calculations

GAT Channel 10' Bottom 10 ft Shelf 5YR

Results

Top Width	52.30	ft
Normal Depth	2.99	ft
Critical Depth	2.04	ft
Critical Slope	0.01633	ft/ft
Velocity	3.44	ft/s
Velocity Head	0.18	ft
Specific Energy	3.17	ft
Froude Number	0.51	✓
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.99	ft
Critical Depth	2.04	ft
Channel Slope	0.00430	ft/ft
Critical Slope	0.01633	ft/ft

GAT Channel 10' Bottom, 10' Shelf 100 yr

Project Description

Friction Method Manning Formula
 Solve For Normal Depth

Input Data

Channel Slope 0.00430 ft/ft
 Discharge 725.00 ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	5.20
0+10	2.70
0+20	2.50
0+30	0.00
0+40	0.00
0+50	2.50
0+60	2.70
0+70	5.20

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5.20)	(0+70, 5.20)	0.035

Options

Current Roughness Weighted Method Pavlovskii's Method
 Open Channel Weighting Method Pavlovskii's Method
 Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 4.30 ft
 Elevation Range 0.00 to 5.20 ft
 Flow Area 148.40 ft²
 Wetted Perimeter 63.83 ft
 Hydraulic Radius 2.32 ft

GAT Channel 10' Bottom, 10' Shelf 100 yr

Results

Top Width	62.82	ft
Normal Depth	4.30	ft
Critical Depth	3.44	ft
Critical Slope	0.01514	ft/ft
Velocity	4.89	ft/s
Velocity Head	0.37	ft
Specific Energy	4.67	ft
Froude Number	0.56	20.5'
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.30	ft
Critical Depth	3.44	ft
Channel Slope	0.00430	ft/ft
Critical Slope	0.01514	ft/ft

GAT Section through Arch Culvert - 5 year

Results

Elevation Range	0.00 to 11.00 ft	
Flow Area	22.89	ft ²
Wetted Perimeter	14.57	ft
Hydraulic Radius	1.57	ft
Top Width	10.01	ft
Normal Depth	2.29	ft
Critical Depth	3.17	ft
Critical Slope	0.00285	ft/ft
Velocity	10.92	ft/s
Velocity Head	1.85	ft
Specific Energy	4.14	ft
Froude Number	1.27	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.29	ft
Critical Depth	3.17	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00285	ft/ft

GAT Section through Arch Culvert - 100 year

Results

Elevation Range	0.00 to 11.00 ft	
Flow Area	68.35	ft ²
Wetted Perimeter	36.78	ft
Hydraulic Radius	1.86	ft
Top Width	28.99	ft
Normal Depth	4.21	ft
Critical Depth	4.54	ft
Critical Slope	0.00330	ft/ft
Velocity	10.61	ft/s
Velocity Head	1.75	ft
Specific Energy	5.96	ft
Froude Number	1.22	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.21	ft
Critical Depth	4.54	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00330	ft/ft

APPENDIX G

Regional Detention/Water Quality Pond Design

Initially Submitted November 20, 2015
Revised April 11, 2016

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Compark South
Basin ID: H160, H170 & H180

* User input data shown in blue.

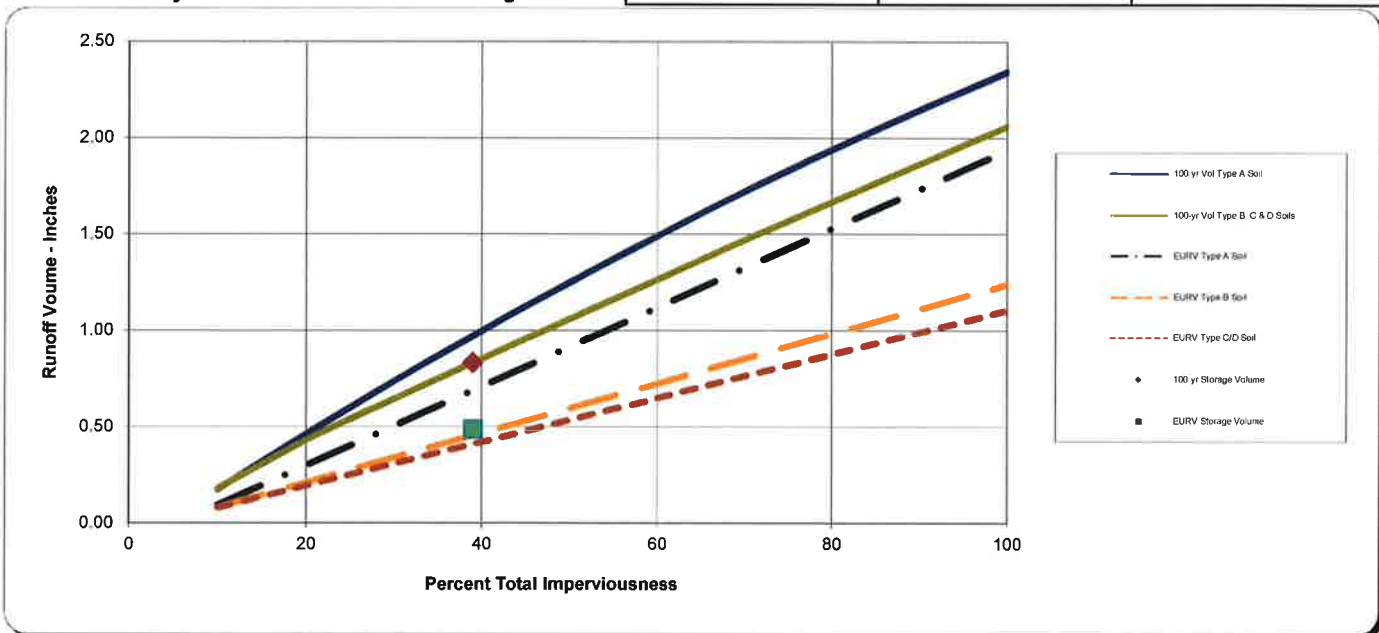
Area of Watershed (acres)	273.00	
Subwatershed Imperviousness	39.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0 ▼
Effective Imperviousness ¹	39.0%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0%	0.0
Type B	75.0%	204.8
Type C or D	25.0%	68.3

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
4.125	0.6	0.0018

Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.49	11.10	Design Outlet to Empty EURV in 72 Hours
0.83	18.93	242.29

Excess Urban Runoff Volume⁴

100-year Detention Volume Including WQCV⁵

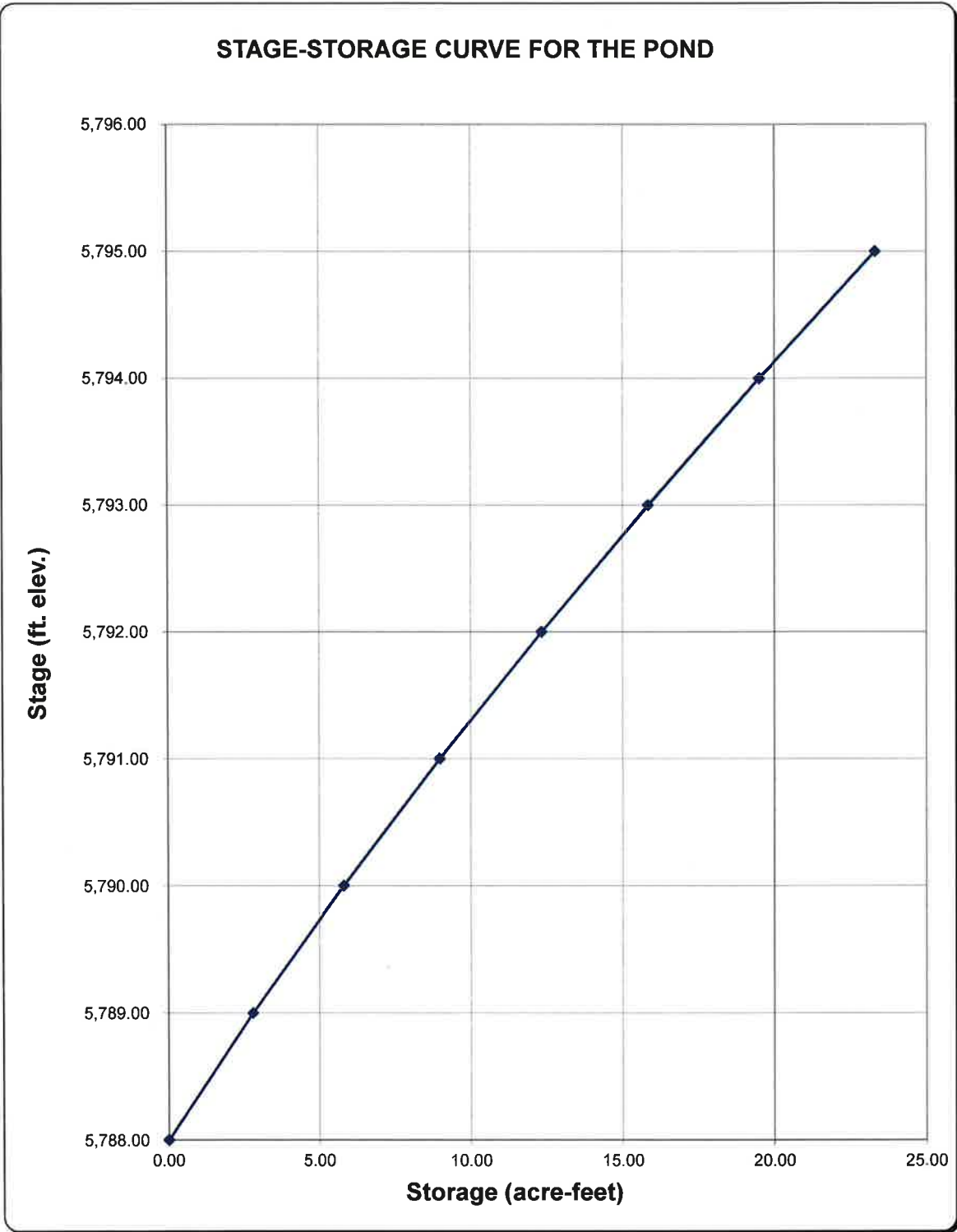


Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

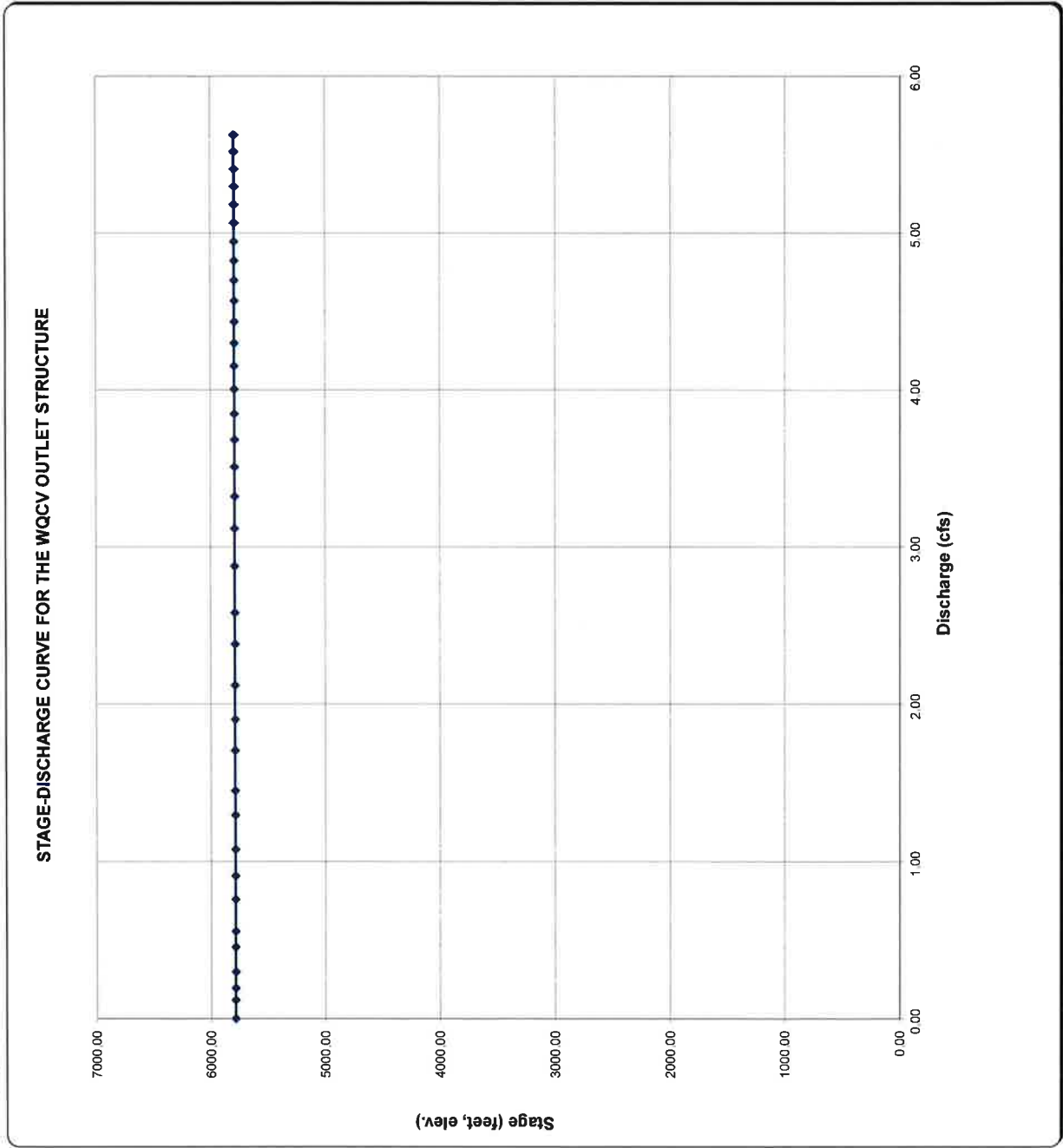
STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____
Basin ID: _____



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: Compark South
Basin ID: Regional Detention Pond



Compark South

Lower Pond (DETENTION AND WATER QUALITY) TOTAL DESIGN VOLUME CALCS
11/9/2015

Elevation	Element Depth	A1	A2	sqr (A1*A2)	Acre Ft Volume	Sum Volume	
5,788.00	-	-	114,957	-	-	-	
5,789.00	1.00	114,957	127,960	121,284	2.79	2.79	
5,790.00	1.00	127,960	134,911	131,390	3.02	5.80	
5,791.00	1.00	134,911	142,080	138,449	3.18	8.98	
5,792.00	1.00	142,080	149,170	145,582	3.34	12.33	EURV EI. 5791.6, 11 AC-ft
5,793.00	1.00	149,170	156,002	152,548	3.50	15.83	
5,794.00	1.00	156,002	162,642	159,287	3.66	19.49	100 yr EI 5793.6, 18 Ac-ft
5,795.00	1.00	162,642	170,252	166,404	3.82	23.31	

**E-470 Proposed Regional FS Pond
Stage - Discharge**

Elevation (ft)	H (ft)	Q (cfs) WQ Plate	Q _w (cfs) 97' Weir @ 5792	Q _w (cfs) 50' Weir @ 5794	Q (cfs) 12'x10' EX RCBC	Q _{rel} (cfs)	Area (sf)	Vol. (AF)
5788	0	0			760.0	0.0	114,957	0.00
5789	1	0.53			902.9	0.5	127,960	2.79
5790	2	1.73			1051.7	1.4	134,911	5.80
5791	3	2.44			1210.0	2.4	142,080	8.98
5792	4	3.48	0.0		1376.7	3.5	149,170	12.33
5793	5	4.19	291.0		1508.0	295.2	156,002	15.83
5794	6	4.78	823.1	0	1620.0	827.9	162,642	19.49
5795	7	5.31	1512.1	150	1730.0	1667.4	170,252	23.31

APPENDIX H

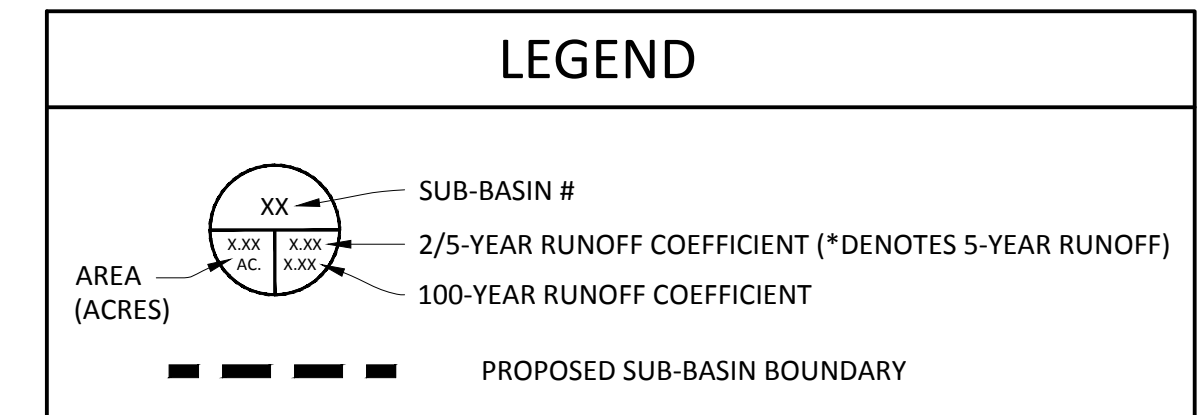
Storm Sewer Design

Initially Submitted November 20, 2015
Revised April 11, 2016

Project: 4/2/2016 10:04 AM, Draw Name: P:\Projects\CompSouth\05-Residential\05-StormWater\Reports\Preliminary\05-StormWater\Drainage\Exhibits\Drainage\Basin Map_RAK_2-5-16.dwg, Location: By: rskz



MATCH LINE - SEE SHEET 1



LEGEND

- XX - SUB-BASIN #
XXX - 2/5-YEAR RUNOFF COEFFICIENT (* DENOTES 5-YEAR RUNOFF)
XXX - 100-YEAR RUNOFF COEFFICIENT
--- PROPOSED SUB-BASIN BOUNDARY

Table with 4 columns: 2 YEAR STORM, 5 YEAR STORM, 100 YEAR STORM, and REMARKS. Each column contains detailed data for various basins including area, runoff coefficients, and flow rates.

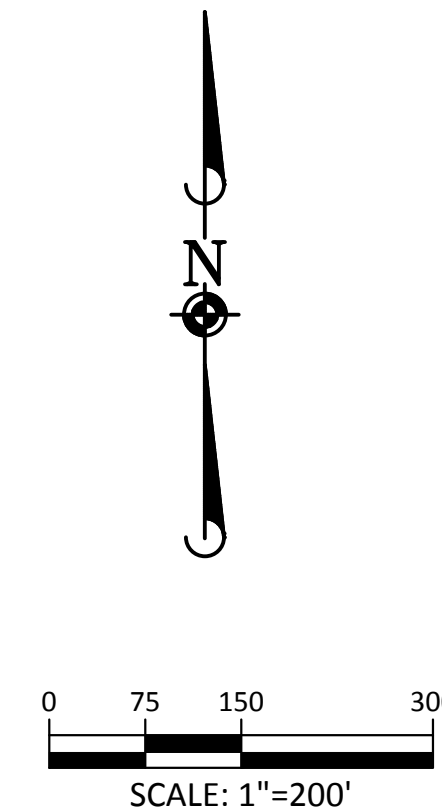


Table with columns: DATE, REVISIONS, and DRAWN BY.

Manhard CONSULTING LTD logo and contact information: 800 E. Arapahoe Court, Suite 110, Denver, CO 80218. Phone: 303.733.0000. Fax: 303.733.0000. Email: manhard.com

COMPARK SOUTH
TOWN OF PARKER, CO
PROPOSED DRAINAGE AREA MAP

Project details: PROJ. MGR.: RLB, PROJ. ASSOC.: ASD, DRAWN BY: RAK, DATE: 12-21-15, SHEET 2 OF 2, CLCPK3

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Compark South

TOWN OF PARKER, COLORADO PROPOSED IMPERVIOUSNESS CALCULATIONS 4/8/2016

CVS-1

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.18	1.18
Landscape	2%	2.67	0.05

Total Area: 3.85

Percentage Imperviousness: 32.0%
C₂ (Table 6-4, Type C Soil): 0.28
C₅ (Table 6-4, Type C Soil): 0.33
C₁₀₀ (Table 6-4, Type C Soil): 0.65

CVS-2

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.09	1.09
Landscape	2%	0.33	0.01

Total Area: 1.42

Percentage Imperviousness: 77.0%
C₂ (Table 6-4, Type C Soil): 0.69
C₅ (Table 6-4, Type C Soil): 0.72
C₁₀₀ (Table 6-4, Type C Soil): 0.85

CVS-3

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.57	0.57
Landscape	2%	0.37	0.01

Total Area: 0.94

Percentage Imperviousness: 62.0%
C₂ (Table 6-4, Type B Soil): 0.55
C₅ (Table 6-4, Type B Soil): 0.58
C₁₀₀ (Table 6-4, Type B Soil): 0.76

CVS-4

Percentage Imperviousness*: 50.0%
C₂ (Table 6-4, Type B Soil): 0.45
C₅ (Table 6-4, Type B Soil): 0.47
C₁₀₀ (Table 6-4, Type B Soil): 0.70

CVS-5

Percentage Imperviousness*: 45.0%
C₂ (Table 6-4, Type B Soil): 0.40
C₅ (Table 6-4, Type B Soil): 0.42
C₁₀₀ (Table 6-4, Type B Soil): 0.67

*Note: Impervious percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Criteria Manual.

CVS-6

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.28	0.28
Landscape	2%	0.37	0.01

Total Area: 0.65

Percentage Imperviousness: 45.0%
C₂ (Table 6-4, Type B Soil): 0.40
C₅ (Table 6-4, Type B Soil): 0.42
C₁₀₀ (Table 6-4, Type B Soil): 0.67

CVS-7

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.86	0.86
Landscape	2%	0.25	0.01

Total Area: 1.11

Percentage Imperviousness: 78.0%
C₂ (Table 6-4, Type B Soil): 0.69
C₅ (Table 6-4, Type B Soil): 0.73
C₁₀₀ (Table 6-4, Type B Soil): 0.84

CVS-8

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.83	0.83
Landscape	2%	0.68	0.01

Total Area: 1.51

Percentage Imperviousness: 56.0%
C₂ (Table 6-4, Type B Soil): 0.50
C₅ (Table 6-4, Type B Soil): 0.52
C₁₀₀ (Table 6-4, Type B Soil): 0.73

CVS-9

Percentage Imperviousness*: 55.0%
C₂ (Table 6-4, Type B Soil): 0.49
C₅ (Table 6-4, Type B Soil): 0.51
C₁₀₀ (Table 6-4, Type B Soil): 0.72

CVS-9A

Percentage Imperviousness*: 55.0%
C₂ (Table 6-4, Type B Soil): 0.49
C₅ (Table 6-4, Type B Soil): 0.51
C₁₀₀ (Table 6-4, Type B Soil): 0.72

CVS-10

Percentage Imperviousness*: 51.0%
C₂ (Table 6-4, Type B Soil): 0.45
C₅ (Table 6-4, Type B Soil): 0.47
C₁₀₀ (Table 6-4, Type B Soil): 0.70

*Note: Impervious percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Criteria Manual.

CVS-11

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.57	1.57
Landscape	2%	0.46	0.01

Total Area: 2.03

Percentage Imperviousness: 78.0%
C₂ (Table 6-4, Type B Soil): 0.69
C₅ (Table 6-4, Type B Soil): 0.73
C₁₀₀ (Table 6-4, Type B Soil): 0.84

CVS-12

Percentage Imperviousness*: 55.0%
C₂ (Table 6-4, Type B Soil): 0.49
C₅ (Table 6-4, Type B Soil): 0.51
C₁₀₀ (Table 6-4, Type B Soil): 0.72

CVS-13

Percentage Imperviousness*: 55.0%
C₂ (Table 6-4, Type B Soil): 0.49
C₅ (Table 6-4, Type B Soil): 0.51
C₁₀₀ (Table 6-4, Type B Soil): 0.72

CVS-13A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.41	0.41
Landscape	2%	0.28	0.01

Total Area: 0.69

Percentage Imperviousness: 61.0%
C₂ (Table 6-4, Type B Soil): 0.54
C₅ (Table 6-4, Type B Soil): 0.57
C₁₀₀ (Table 6-4, Type B Soil): 0.75

CVS-14

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	2.94	2.94
Landscape	2%	8.60	0.17

Total Area: 11.54

Percentage Imperviousness: 27.0%
C₂ (Table 6-4, Type B Soil): 0.24
C₅ (Table 6-4, Type B Soil): 0.25
C₁₀₀ (Table 6-4, Type B Soil): 0.59

CVS-15

Percentage Imperviousness*: 55.0%
C₂ (Table 6-4, Type B Soil): 0.49
C₅ (Table 6-4, Type B Soil): 0.51
C₁₀₀ (Table 6-4, Type B Soil): 0.72

*Note: Impervious percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Criteria Manual.

CVS-15A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.36	0.36
Landscape	2%	0.24	0.00
Total Area:		0.60	

Percentage Imperviousness:	60.0%
C₂ (Table 6-4, Type B Soil):	0.53
C₅ (Table 6-4, Type B Soil):	0.56
C₁₀₀ (Table 6-4, Type B Soil):	0.75

CVS-16

Percentage Imperviousness*:	50.0%
C₂ (Table 6-4, Type B Soil):	0.45
C₅ (Table 6-4, Type B Soil):	0.47
C₁₀₀ (Table 6-4, Type B Soil):	0.70

CVS-17

Percentage Imperviousness*:	51.0%
C₂ (Table 6-4, Type B Soil):	0.45
C₅ (Table 6-4, Type B Soil):	0.47
C₁₀₀ (Table 6-4, Type B Soil):	0.70

CVS-18

Percentage Imperviousness*:	50.0%
C₂ (Table 6-4, Type B Soil):	0.45
C₅ (Table 6-4, Type B Soil):	0.47
C₁₀₀ (Table 6-4, Type B Soil):	0.70

CVS-19

Percentage Imperviousness*:	73.0%
C₂ (Table 6-4, Type B Soil):	0.65
C₅ (Table 6-4, Type B Soil):	0.68
C₁₀₀ (Table 6-4, Type B Soil):	0.81

CVS-20

Percentage Imperviousness*:	50.0%
C₂ (Table 6-4, Type B Soil):	0.45
C₅ (Table 6-4, Type B Soil):	0.47
C₁₀₀ (Table 6-4, Type B Soil):	0.70

CVS-21

Percentage Imperviousness*:	50.0%
C₂ (Table 6-4, Type B Soil):	0.45
C₅ (Table 6-4, Type B Soil):	0.47
C₁₀₀ (Table 6-4, Type B Soil):	0.70

*Note: Impervious percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Criteria Manual.

BEL-1

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.23	1.23
Landscape	2%	1.65	0.03
Total Area:		2.88	

Percentage Imperviousness: 44.0%
C₂ (Table 6-4, Type B Soil): 0.39
C₅ (Table 6-4, Type B Soil): 0.41
C₁₀₀ (Table 6-4, Type B Soil): 0.67

BEL-2

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.68	0.68
Landscape	2%	0.70	0.01
Total Area:		1.38	

Percentage Imperviousness: 77.0%
C₂ (Table 6-4, Type B Soil): 0.69
C₅ (Table 6-4, Type B Soil): 0.72
C₁₀₀ (Table 6-4, Type B Soil): 0.83

BEL-3

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.34	1.34
Landscape	2%	2.60	0.05
Total Area:		3.94	

Percentage Imperviousness: 35.0%
C₂ (Table 6-4, Type B Soil): 0.31
C₅ (Table 6-4, Type B Soil): 0.33
C₁₀₀ (Table 6-4, Type B Soil): 0.63

BEL-4

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.36	1.36
Landscape	2%	0.39	0.01
Total Area:		1.75	

Percentage Imperviousness: 78.0%
C₂ (Table 6-4, Type B Soil): 0.69
C₅ (Table 6-4, Type B Soil): 0.73
C₁₀₀ (Table 6-4, Type B Soil): 0.84

*Note: Impervious percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Criteria Manual.

BEL-5

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	3.43	3.43
Landscape	2%	1.12	0.02

Total Area: 4.55

Percentage Imperviousness: 76.0%
C₂ (Table 6-4, Type B Soil): 0.68
C₅ (Table 6-4, Type B Soil): 0.71
C₁₀₀ (Table 6-4, Type B Soil): 0.83

BEL-6

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	2.77	2.77
Landscape	2%	1.18	0.02

Total Area: 3.95

Percentage Imperviousness: 71.0%
C₂ (Table 6-4, Type B Soil): 0.63
C₅ (Table 6-4, Type B Soil): 0.66
C₁₀₀ (Table 6-4, Type B Soil): 0.80

*Note: Impervious percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Criteria Manual.

**PROPOSED DRAINAGE BASINS
STANDARD FORM SF-2
TIME OF CONCENTRATION**

PROJECT: Compark Village South, Filing 1

NOTES:

JOB NO: CLCPKC3

CALCULATED BY: RAK DATE: April 8, 2016
REVISIED BY: DATE:

$T_1 = [0.395 \times (1.1 - C_s) \times L^{0.5}] / (S^{0.33})$
 $T_1 = L / (60 \times V)$ (Velocity from UDFCD Fig. RO-1)
 $T_c \text{ Check} = 10 + L/180$ (Urbanized Basins Only)

SUB-BASIN DATA			INITIAL/OVERLAND TIME (T ₁)			TRAVEL TIME (T _t) - (GRASS SWALE)				TRAVEL TIME (T _t) - (PAVEMENT/CURB & GUTTER)				T _c CHECK (urbanized basins)		FINAL T _c (min)	REMARKS
AREA DESIGNATION	RUNOFF COEFFICIENT, C/100	AREA, A (acres)	FLOW LENGTH (ft)	SLOPE (%)	INITIAL TIME T ₁ (min)	FLOW LENGTH (ft)	SLOPE (%)	VELOCITY (fps)	TRAVEL TIME T _t (min)	FLOW LENGTH (ft)	SLOPE (%)	VELOCITY (fps)	TRAVEL TIME T _t (min)	TOTAL LENGTH (ft)	MAXIMUM T _c = (L/180 + 10)		
CVS-1 (Inlet 1-3)	0.65	3.85	0	0.0%	0.0	0	0.0%	0.0	0.0	1172	2.0%	2.8	6.9	1172	16.5	6.9	
CVS-2 (Inlet 2-3)	0.85	1.42	0	0.0%	0.0	0	0.0%	0.0	0.0	1125	2.0%	2.8	6.6	1125	16.3	6.6	
CVS-3 (Inlet 1-4)	0.76	0.94	0	0.0%	0.0	0	0.0%	0.0	0.0	1055	2.0%	2.8	6.2	1055	15.9	6.2	
CVS-4 (Inlet 2-4)	0.70	3.58	100	1.0%	7.2	0	0.0%	0.0	0.0	404	1.5%	2.4	2.7	504	12.8	7.2	
CVS-5 (Inlet 4-4)	0.67	2.88	100	4.0%	4.9	130	5.5%	1.6	1.3	380	1.3%	2.3	2.8	610	13.4	9.0	
CVS-6 (Inlet 5-4)	0.67	0.69	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum
CVS-7 (Inlet 1-6)	0.84	1.11	0	0.0%	0.0	0	0.0%	0.0	0.0	904	0.6%	1.5	10.2	904	15.0	10.2	
CVS-8 (Inlet 2-6)	0.73	1.51	55	7.0%	2.6	0	0.0%	0.0	0.0	774	0.6%	1.5	8.7	829	14.6	11.3	
CVS-9 (Inlet 3-6)	0.72	2.44	60	1.5%	4.6	115	1.5%	0.9	2.2	624	1.1%	2.1	5.0	799	14.4	11.8	
CVS-9A (Inlet 3-4)	0.72	0.37	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum
CVS-10 (Inlet 4-6)	0.70	4.42	100	4.0%	4.5	113	4.0%	1.4	1.3	682	1.0%	2.0	5.7	895	15.0	11.6	
CVS-11 (Inlet 1-5)	0.84	2.03	0	0.0%	0.0	0	0.0%	0.0	0.0	1046	0.5%	1.4	12.3	1046	15.8	12.3	
CVS-12 (Inlet 2-5)	0.72	7.26	75	1.5%	5.1	137	1.5%	0.9	2.7	835	1.0%	2.0	7.0	1047	15.8	14.8	
CVS-13 (Inlet 3-5)	0.72	3.26	30	4.7%	2.2	0	0.0%	0.0	0.0	739	1.0%	2.0	6.2	769	14.3	8.4	
CVS-13A (Inlet 3-5A)	0.75	0.69	0	0.0%	0.0	0	0.0%	0.0	0.0	788	0.9%	1.9	6.9	788	14.4	6.9	
CVS-14 (Inlet 5-5)	0.59	11.54	100	2.0%	7.4	227	3.5%	1.3	2.9	867	1.0%	2.0	7.2	1194	16.6	16.6	
CVS-15 (Inlet 4-5)	0.72	2.40	100	5.7%	3.8	127	5.7%	1.7	1.3	723	1.4%	2.4	5.1	950	15.3	10.2	
CVS-15A (Inlet 4-5A)	0.75	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum
CVS-16	0.70	2.07	100	1.6%	6.2	44	1.6%	0.9	0.8	772	1.0%	2.0	6.4	916	15.1	13.5	
CVS-17	0.70	4.10	100	5.3%	4.1	129	5.3%	1.6	1.3	564	1.0%	2.0	4.7	793	14.4	10.2	
CVS-18	0.70	2.12	100	15.5%	2.9	115	3.0%	1.2	1.6	990	1.0%	2.0	8.3	1205	16.7	12.8	
CVS-19	0.81	1.61	100	3.5%	3.4	200	3.5%	1.3	2.5	0	0.0%	0.0	0.0	300	11.7	6.0	
CVS-20	0.70	1.80	100	2.0%	5.8	17	2.0%	1.0	0.3	570	1.0%	2.0	4.8	687	13.8	10.8	
CVS-21	0.70	3.88	100	0.0%	22.3	164	3.3%	1.3	2.1	833	1.1%	2.1	6.6	1097	16.1	16.1	
BEL-1 (Inlet 2-1)	0.67	2.88	100	1.5%	6.8	466	1.5%	0.9	9.1	462	0.8%	1.8	4.4	508	12.8	12.8	
BEL-2 (Inlet 1-1)	0.83	1.38	0	0.0%	0.0	0	0.0%	0.0	0.0	1123	1.5%	2.4	7.6	1123	16.2	7.6	
BEL-3 (Inlet 2-2)	0.63	3.94	100	1.5%	7.5	232	1.5%	0.9	4.5	462	0.8%	1.8	4.3	794	14.4	14.4	
BEL-4 (Inlet 1-2)	0.84	1.75	0	0.0%	0.0	0	0.0%	0.0	0.0	825	0.8%	1.7	7.9	825	14.6	7.9	
BEL-5	0.83	4.55	100	3.1%	3.4	0	0.0%	0.0	0.0	1602	3.1%	3.5	7.6	1702	19.5	11.0	
BEL-6	0.80	3.95	100	9.8%	2.5	0	0.0%	0.0	0.0	1009	3.0%	3.5	4.9	1109	16.2	7.4	

**PROPOSED DRAINAGE BASINS
STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)**

PROJECT: COMPARK VILLAGE SOUTH, FILING 1 CLCPKC3
 CALCULATED BY: RAK DATE: April 8, 2016 Manning's n-value = 0.013
 REVISED BY: _____ DATE: _____ 2-YEAR

Basin ID	Design Point	DIRECT RUNOFF							INLET		STORM SEWER			REMARKS
		Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.28	4.3	1.10	4.7	4.7	4.7	0.0	8.9	7.9%	24	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.69	4.3	0.97	4.2	4.2	4.2	0.0	4.2	9.6%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.55	4.4	0.52	2.3	2.3	2.3	0.0	24.0	0.7%	30	
CVS-4 (Inlet 2-4)	4	3.58	7.2	0.45	4.2	1.59	6.7	6.7	6.7	0.0	21.9	0.9%	30	
CVS-5 (Inlet 4-4)	5	2.88	9.0	0.40	3.9	1.15	4.5	4.5	4.5	0.0	14.3	2.7%	30	
CVS-6 (Inlet 5-4)	6	0.69	5.0	0.40	4.7	0.28	1.3	1.3	1.3	0.0	9.8	1.7%	30	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.69	3.7	0.77	2.9	2.9	2.9	0.0	17.0	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.51	11.3	0.50	3.6	0.75	2.7	2.7	2.7	0.0	14.1	1.4%	24	
CVS-9 (Inlet 3-6)	9	2.44	11.8	0.49	3.5	1.19	4.2	4.2	4.2	0.0	11.2	4.2%	24	
CVS-9A (Inlet 3-4)	9A	0.37	5.0	0.49	4.7	0.18	0.9	0.9	0.9	0.0	21.9	0.9%	30	
CVS-10 (Inlet 4-6)	10	4.42	11.6	0.45	3.5	2.01	7.1	7.1	7.1	0.0	7.1	1.1%	24	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.69	3.4	1.41	4.9	4.9	4.9	0.0	41.5	0.8%	36	
CVS-12 (Inlet 2-5)	12	7.26	14.8	0.49	3.2	3.55	11.3	11.3	11.3	0.0	36.7	0.8%	36	
CVS-13 (Inlet 3-5)	13	3.26	8.4	0.49	4.0	1.60	6.4	6.4	6.4	0.0	25.3	1.8%	36	
CVS-13A (Inlet 3-5A)	13A	0.69	6.9	0.54	4.3	0.37	1.6	1.6	1.6	0.0	15.5	4.4%	30	
CVS-14 (Inlet 5-5)	14	11.54	16.6	0.24	3.0	2.77	8.3	8.3	8.3	0.0	12.4	3.0%	30	
CVS-15 (Inlet 4-5)	15	2.40	10.2	0.49	3.7	1.17	4.4	4.4	4.4	0.0	25.3	1.8%	36	
CVS-15A (Inlet 4-5A)	15A	0.60	5.0	0.53	4.7	0.32	1.5	1.5	1.5	0.0	15.5	4.4%	30	
CVS-16	16	2.07	13.5	0.45	3.3	0.92	3.1	3.1	3.1	0.0	-	-	-	
CVS-17	17	4.10	10.2	0.45	3.7	1.86	7.0	7.0	7.0	0.0	-	-	-	
CVS-18	18	2.12	12.8	0.45	3.4	0.94	3.2	3.2	3.2	0.0	-	-	-	
CVS-19	19	1.61	6.0	0.65	4.5	1.05	4.7	4.7	4.7	0.0	-	-	-	
CVS-20	20	1.80	10.8	0.45	3.6	0.80	2.9	2.9	2.9	0.0	-	-	-	
CVS-21	21	3.88	16.1	0.45	3.1	1.73	5.3	5.3	5.3	0.0	-	-	-	
BEL-1 (Inlet 2-1)	B1	2.88	12.8	0.39	3.4	1.13	3.8	3.8	3.8	0.0	5.9	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.69	4.2	0.95	3.9	3.9	3.9	0.0	8.4	0.9%	36	
BEL-3 (Inlet 2-2)	B3	3.94	14.4	0.31	3.2	1.23	3.9	3.9	3.9	0.0	6.6	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.69	4.1	1.21	5.0	5.0	5.0	0.0	11.6	2.9%	36	
BEL-5	B5	4.55	11.0	0.68	3.6	3.08	11.1	11.1	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.63	4.2	2.50	10.5	10.5	-	-	-	-	-	

**PROPOSED DRAINAGE BASINS
STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)**

PROJECT: COMPARK VILLAGE SOUTH, FILING 1 CLCPKC3
 CALCULATED BY: RAK DATE: April 8, 2016 Manning's n-value = 0.013
 REVISED BY: _____ DATE: _____ 5-YEAR

Basin ID	Design Point	DIRECT RUNOFF							INLET		STORM SEWER			REMARKS
		Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.33	4.3	1.27	5.5	5.5	5.5	0.0		7.9%	24	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.72	4.3	1.03	4.5	4.5	4.5	0.0		9.6%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.58	4.4	0.54	2.4	2.4	2.4	0.0		0.7%	30	
CVS-4 (Inlet 2-4)	4	3.58	7.2	0.47	4.2	1.66	7.0	7.0	7.0	0.0		0.9%	30	
CVS-5 (Inlet 4-4)	5	2.88	9.0	0.42	3.9	1.21	4.7	4.7	4.7	0.0		2.7%	30	
CVS-6 (Inlet 5-4)	6	0.69	5.0	0.42	4.7	0.29	1.4	1.4	1.4	0.0		1.7%	30	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.73	3.7	0.81	3.0	3.0	3.0	0.0		3.0%	24	
CVS-8 (Inlet 2-6)	8	1.51	11.3	0.52	3.6	0.79	2.8	2.8	2.8	0.0		1.4%	24	
CVS-9 (Inlet 3-6)	9	2.44	11.8	0.51	3.5	1.25	4.4	4.4	4.4	0.0		4.2%	24	
CVS-9A (Inlet 3-4)	9A	0.37	5.0	0.51	4.7	0.19	0.9	0.9	0.9	0.0		0.9%	30	
CVS-10 (Inlet 4-6)	10	4.42	11.6	0.47	3.5	2.10	7.4	7.4	7.4	0.0		1.1%	24	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	5.1	5.1	5.1	0.0		0.8%	36	
CVS-12 (Inlet 2-5)	12	7.26	14.8	0.51	3.2	3.71	11.8	11.8	11.8	0.0		0.8%	36	
CVS-13 (Inlet 3-5)	13	3.26	8.4	0.51	4.0	1.67	6.7	6.7	6.7	0.0		1.8%	36	
CVS-13A (Inlet 3-5A)	13A	0.69	6.9	0.57	4.3	0.39	1.7	1.7	1.7	0.0		4.4%	30	
CVS-14 (Inlet 5-5)	14	11.54	16.6	0.25	3.0	2.90	8.7	8.7	8.7	0.0		3.0%	30	
CVS-15 (Inlet 4-5)	15	2.40	10.2	0.51	3.7	1.23	4.6	4.6	4.6	0.0		1.8%	36	
CVS-15A (Inlet 4-5A)	15A	0.60	5.0	0.56	4.7	0.33	1.6	1.6	1.6	0.0		4.4%	30	
CVS-16	16	2.07	13.5	0.47	3.3	0.96	3.2	3.2	-	-	-	-	-	
CVS-17	17	4.10	10.2	0.47	3.7	1.94	7.3	7.3	-	-	-	-	-	
CVS-18	18	2.12	12.8	0.47	3.4	0.99	3.3	3.3	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.68	4.5	1.09	4.9	4.9	-	-	-	-	-	
CVS-20	20	1.80	10.8	0.47	3.6	0.84	3.1	3.1	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.47	3.1	1.80	5.5	5.5	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	2.88	12.8	0.41	3.4	1.18	4.0	4.0	4.0	0.0	6.1	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.72	4.2	0.99	4.1	4.1	4.1	0.0	8.8	0.9%	36	
BEL-3 (Inlet 2-2)	B3	3.94	14.4	0.33	3.2	1.28	4.1	4.1	4.1	0.0	6.9	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.73	4.1	1.27	5.2	5.2	5.2	0.0	12.1	2.9%	36	
BEL-5	B5	4.55	11.0	0.71	3.6	3.22	11.6	11.6	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.66	4.2	2.61	10.9	10.9	-	-	-	-	-	

**PROPOSED DRAINAGE BASINS
STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)**

PROJECT: COMPARK VILLAGE SOUTH, FILING 1 CLCPKC3

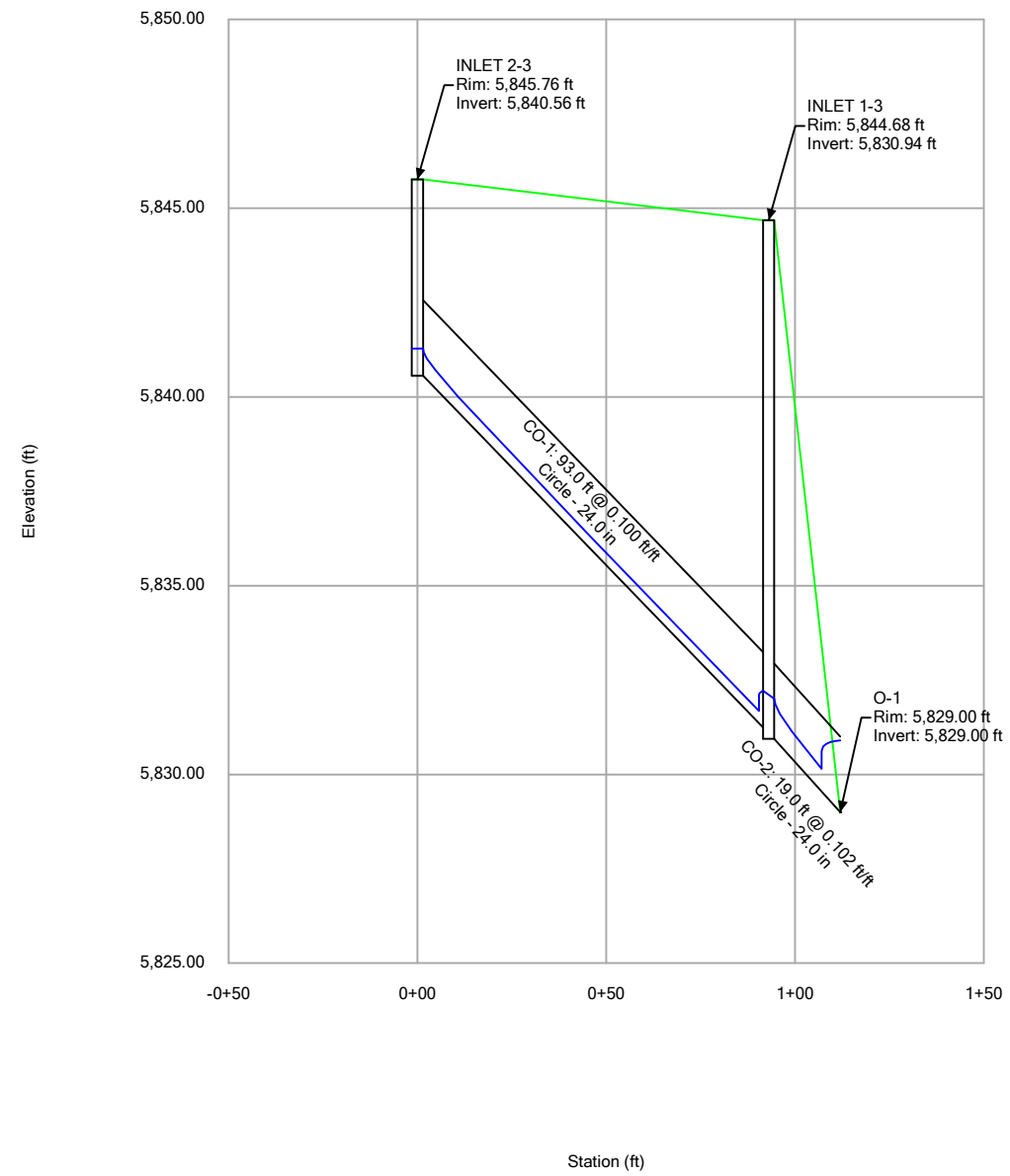
CALCULATED BY: RAK DATE: April 8, 2016 Manning's n-value = 0.013

REVISED BY: DATE: 100-YEAR

Basin ID	Design Point	DIRECT RUNOFF							INLET		STORM SEWER			REMARKS
		Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	Total Runoff with Bypass, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.65	8.0	2.51	20.2	20.2	13.5	6.7	19.8	7.9%	24	Bypass flow goes to CVS-3.
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.85	8.1	1.21	9.9	9.9	6.3	3.6	6.3	9.6%	24	Bypass flow goes to CVS-4.
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.76	8.3	0.71	5.9	12.6	7.7	4.9	88.3	0.7%	30	Takes bypass flow from CVS-1. Bypass goes to CVS-7.
CVS-4 (Inlet 2-4)	4	3.58	7.2	0.70	7.9	2.50	19.8	20.8	13.6	7.2	72.4	0.9%	30	Takes bypass flow from CVS-2 and CVS-5. Bypass goes to CVS-8.
CVS-5 (Inlet 4-4)	5	2.88	9.0	0.67	7.3	1.94	14.3	14.3	11.1	3.2	62.8	2.7%	30	Bypass flow goes to CVS-4.
CVS-6 (Inlet 5-4)	6	0.69	5.0	0.67	8.8	0.47	4.1	4.1	3.9	0.2	51.7	1.7%	30	Bypass flow goes to CVS-14.
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.84	7.0	0.93	6.5	11.4	7.1	4.3	43.2	3.0%	24	Takes bypass flow from CVS-3. Bypass goes to CVS-11.
CVS-8 (Inlet 2-6)	8	1.51	11.3	0.73	6.7	1.10	7.4	18.2	12.6	5.6	36.1	1.4%	24	Takes bypass flow from CVS-4. Bypass goes to CVS-12.
CVS-9 (Inlet 3-6)	9	2.44	11.8	0.72	6.6	1.77	11.6	11.6	9.9	1.7	23.5	4.2%	24	Bypass flow goes to CVS-12.
CVS-9A (Inlet 3-4)	9A	0.37	5.0	0.72	8.8	0.27	2.4	2.4	2.4	0.0	72.4	0.9%	30	No bypass flow.
CVS-10 (Inlet 4-6)	10	4.42	11.6	0.70	6.6	3.11	20.6	20.6	13.6	7.0	13.6	1.1%	24	Bypass flow goes to CVS-13.
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.84	6.5	1.70	11.0	15.1	15.1	0.0	159.2	0.8%	36	Takes bypass flow from CVS-7.
CVS-12 (Inlet 2-5)	12	7.26	14.8	0.72	5.9	5.25	31.2	56.0	56.0	0.0	56.0	0.8%	36	Takes bypass flow from CVS-8, CVS-9, CVS-13 and CVS-15.
CVS-13 (Inlet 3-5)	13	3.26	8.4	0.72	7.5	2.36	17.7	29.9	16.3	13.6	88.1	1.8%	36	Takes bypass flow from CVS-10 and CVS-13A. Bypass goes to CVS-12.
CVS-13A (Inlet 3-5A)	13A	0.69	6.9	0.75	8.0	0.52	4.2	17.8	12.6	5.2	59.4	4.4%	30	Bypass flow goes to CVS-13.
CVS-14 (Inlet 5-5)	14	11.54	16.6	0.59	5.6	6.77	38.0	38.2	11.1	27.1	34.3	3.0%	30	Takes bypass flow from CVS-6.
CVS-15 (Inlet 4-5)	15	2.40	10.2	0.72	7.0	1.74	12.1	17.2	12.4	4.8	88.1	1.8%	36	Takes bypass from CVS-15A. Bypass flow goes to CVS-12.
CVS-15A (Inlet 4-5A)	15A	0.60	5.0	0.75	8.8	0.45	4.0	17.6	12.5	5.1	59.4	4.4%	30	Bypass flow goes to CVS-15.
CVS-16	16	2.07	13.5	0.70	6.2	1.45	9.0	-	-	-	-	-	-	
CVS-17	17	4.10	10.2	0.70	7.0	2.89	20.2	-	-	-	-	-	-	
CVS-18	18	2.12	12.8	0.70	6.4	1.48	9.4	-	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.81	8.4	1.31	11.0	-	-	-	-	-	-	
CVS-20	20	1.80	10.8	0.70	6.8	1.26	8.6	-	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.70	5.7	2.71	15.5	-	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	2.88	12.8	0.67	6.3	1.93	12.2	12.2	7.6	4.6	63.6	3.3%	36	Bypass flow goes to BEL-3.
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.83	7.8	1.15	8.9	8.9	6.5	2.4	69.5	0.9%	36	Bypass flow goes to BEL-4.
BEL-3 (Inlet 2-2)	B3	3.94	14.4	0.63	6.0	2.46	14.8	19.4	19.4	0.0	95.6	3.2%	36	Takes bypass from BEL-1.
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	7.7	1.46	11.2	13.6	13.6	0.0	110.8	2.9%	36	Takes bypass from BEL-2.
BEL-5	B5	4.55	11.0	0.83	6.8	3.76	25.5	-	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.80	7.9	3.17	24.9	-	-	-	-	-	-	

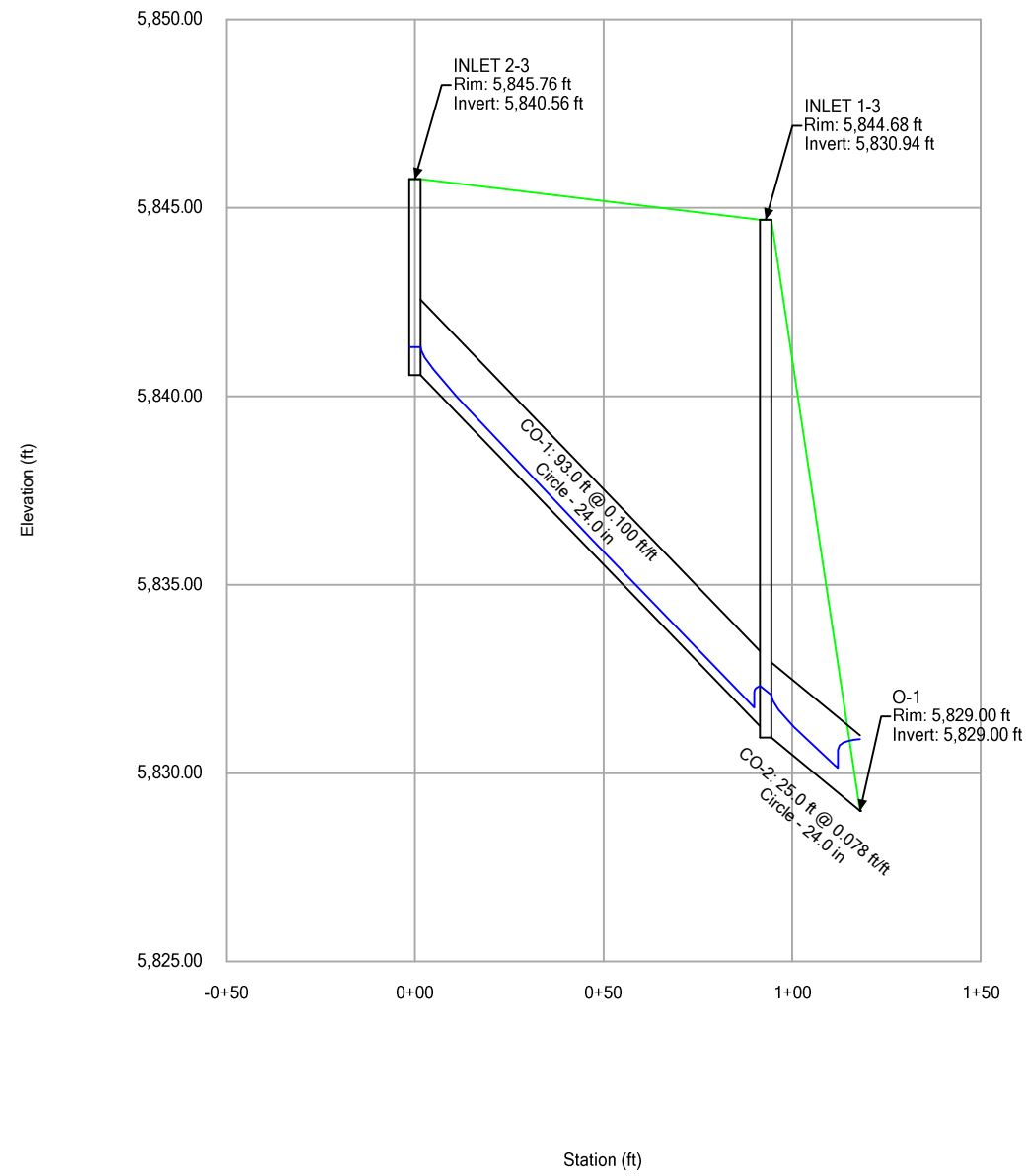
Profile Report

Engineering Profile - Profile - 1 (KB Homes StormCAD [2 year].stsw)



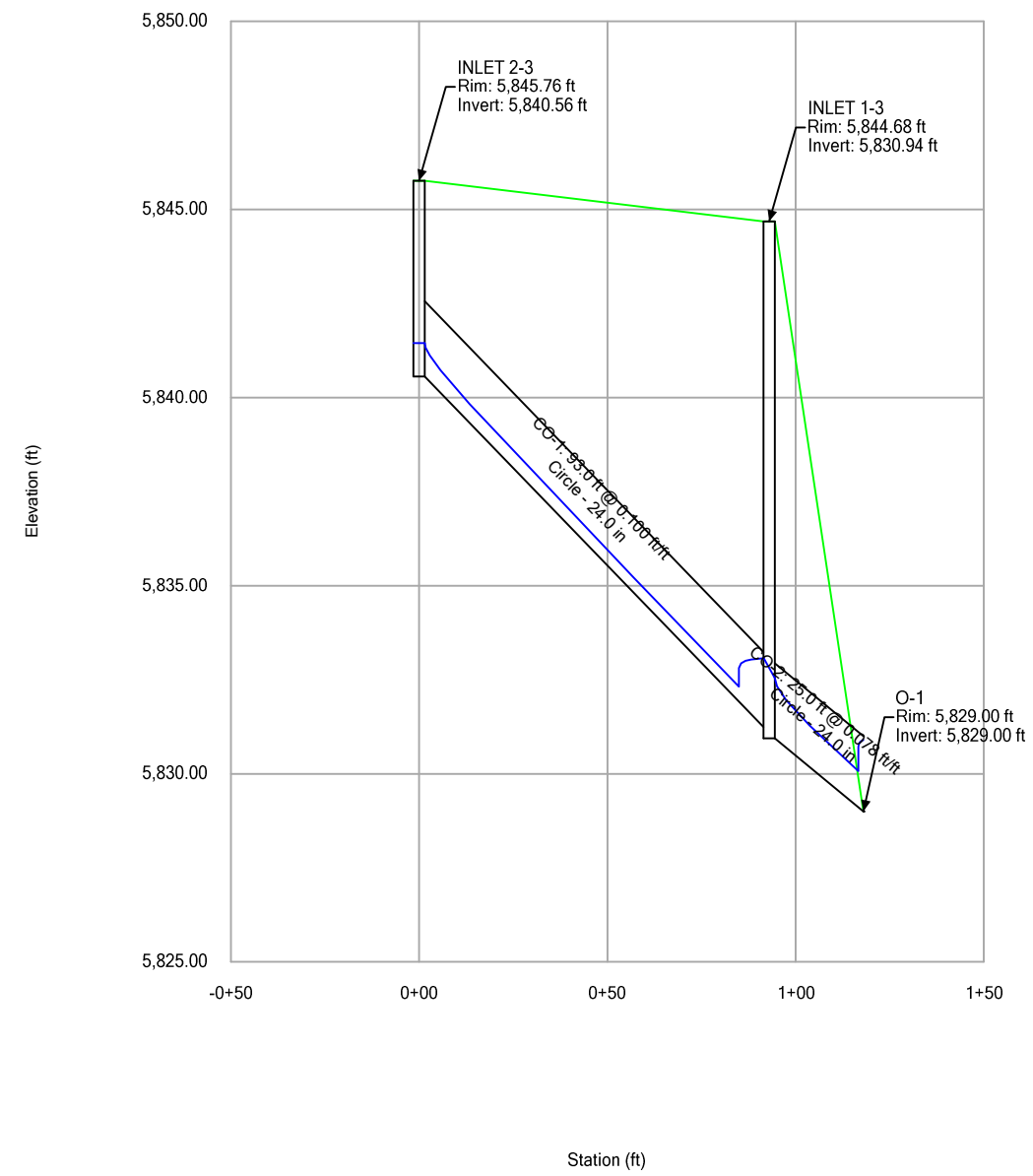
Profile Report

Engineering Profile - Profile - 1 (KB Homes StormCAD [5 year].stsw)



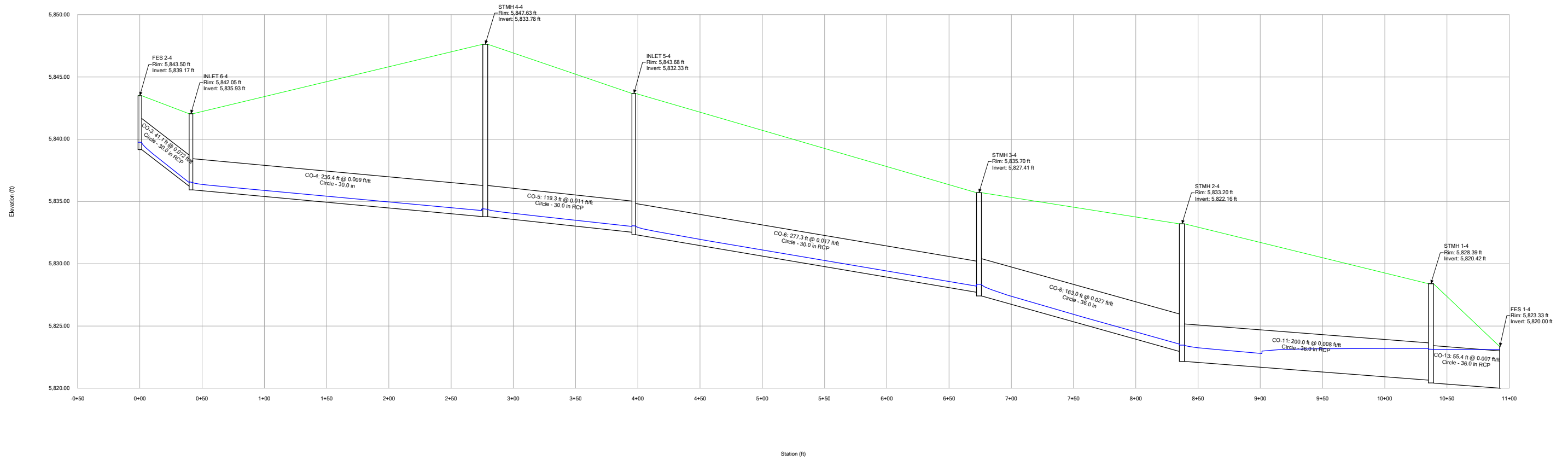
Profile Report

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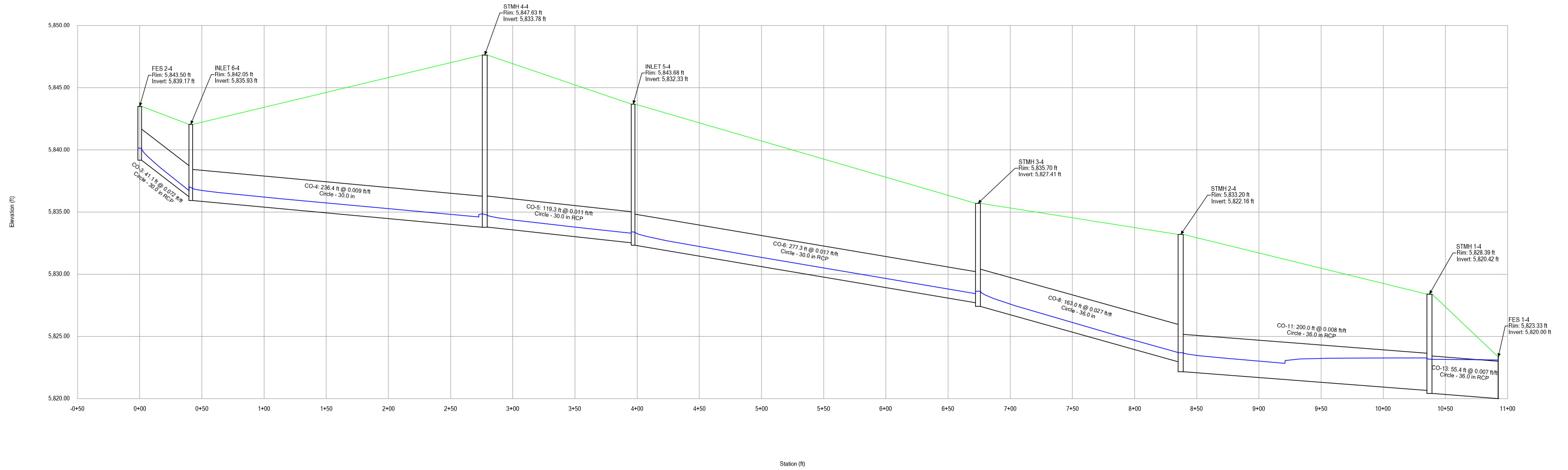
Profile Report

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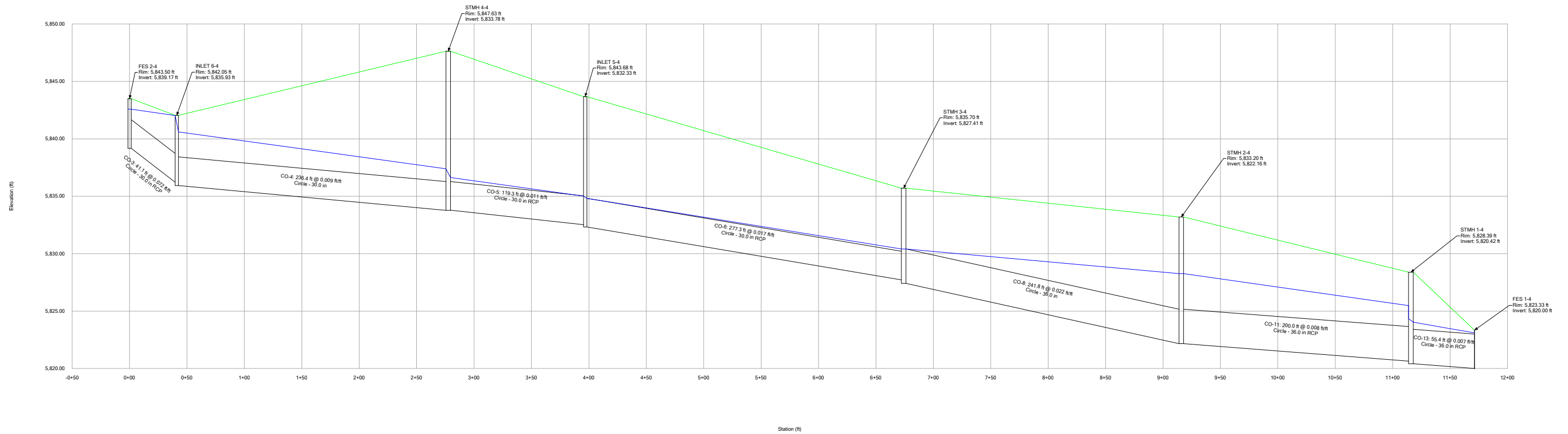
Profile Report

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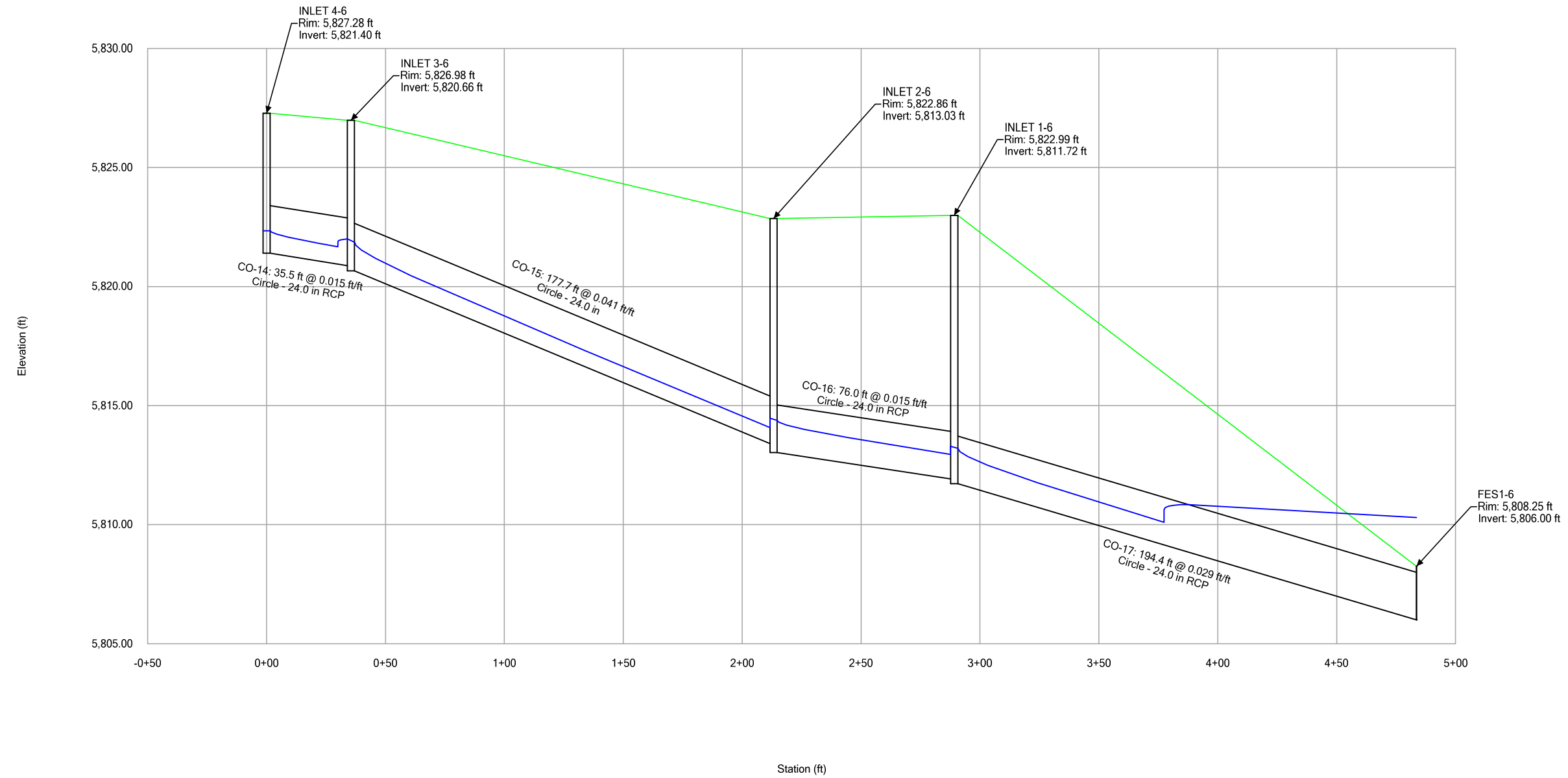
Profile Report

Engineering Profile - Profile - 2 (KB Homes StormCAD [100 year].stsw)



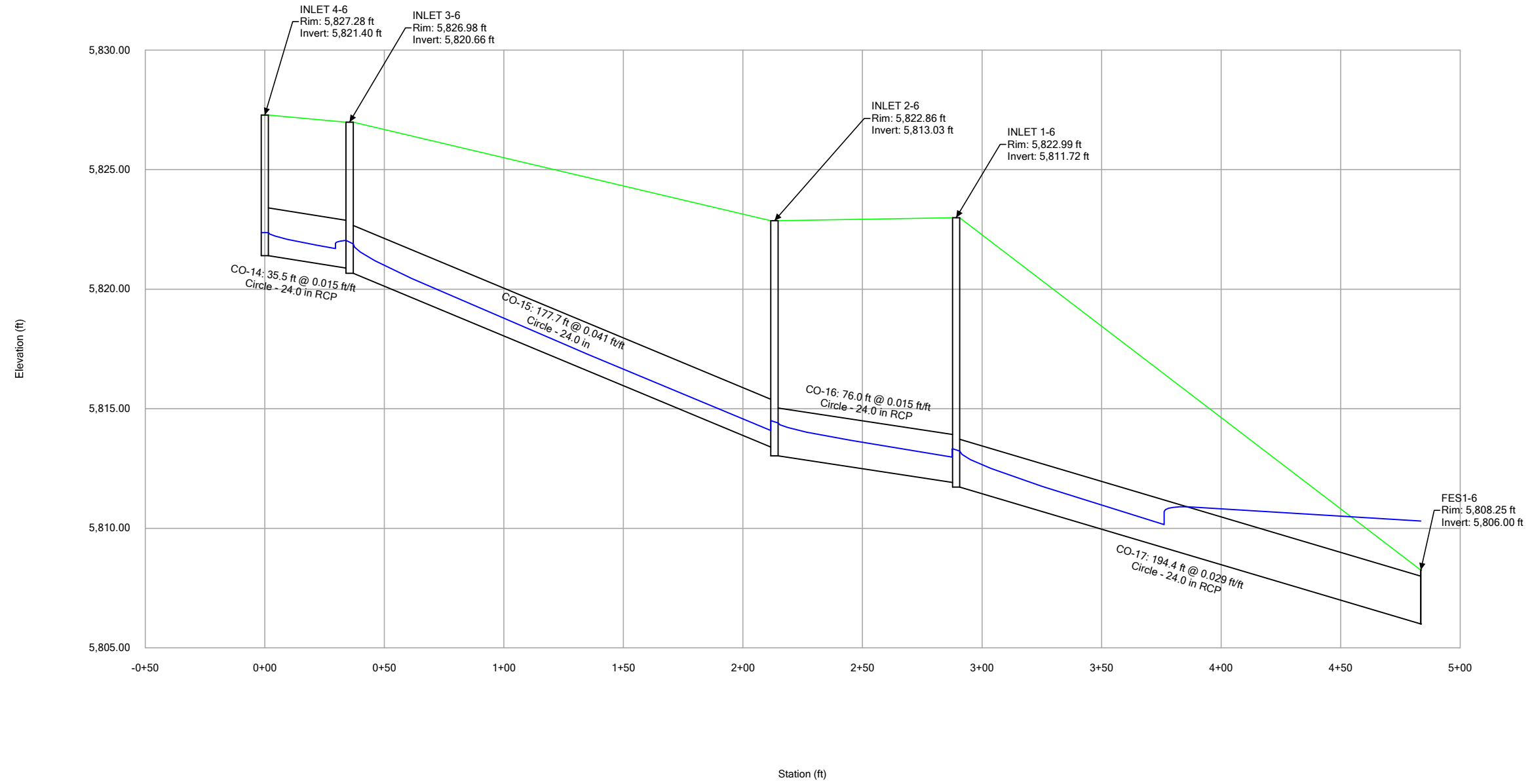
Profile Report

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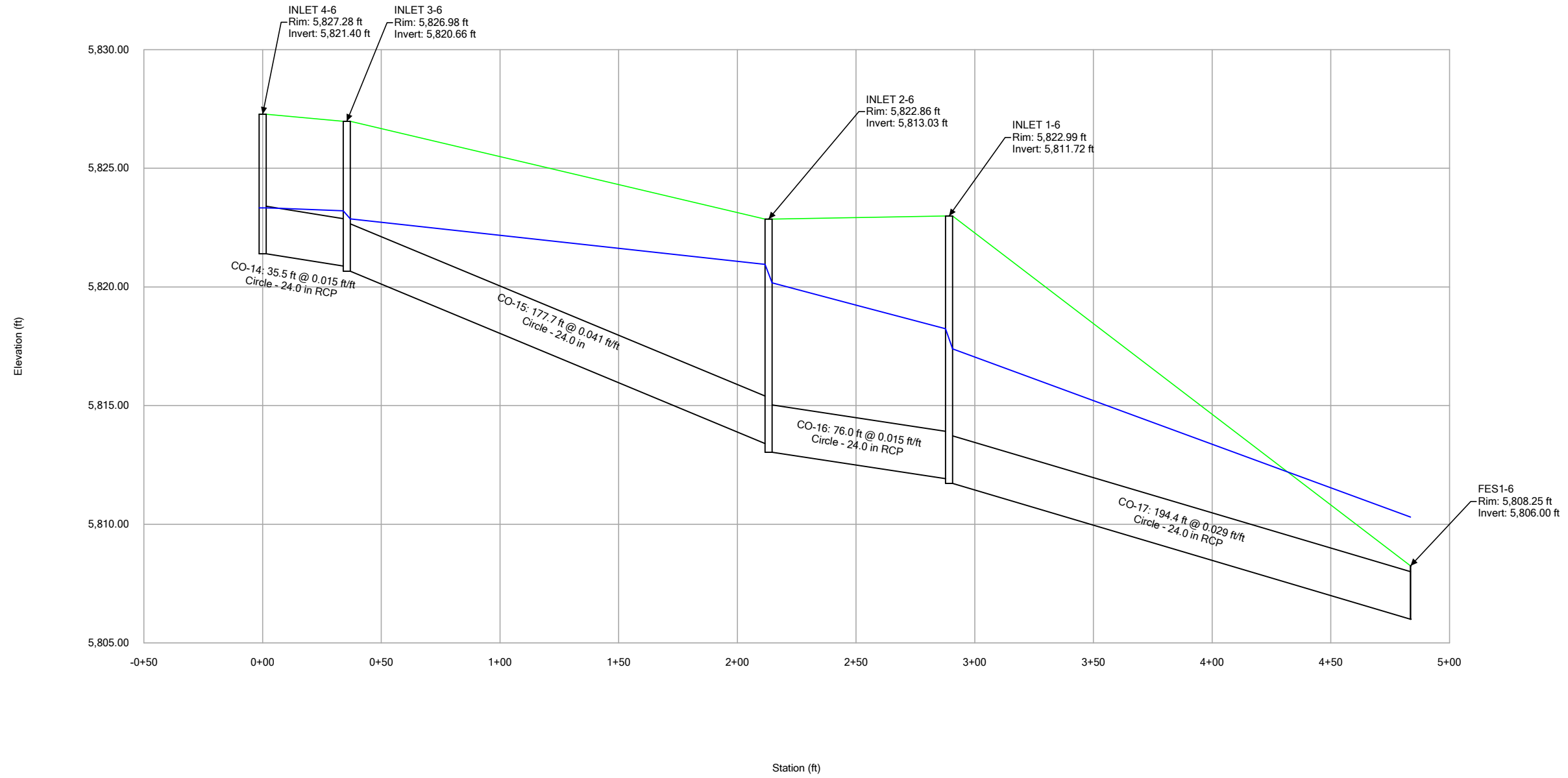
Profile Report

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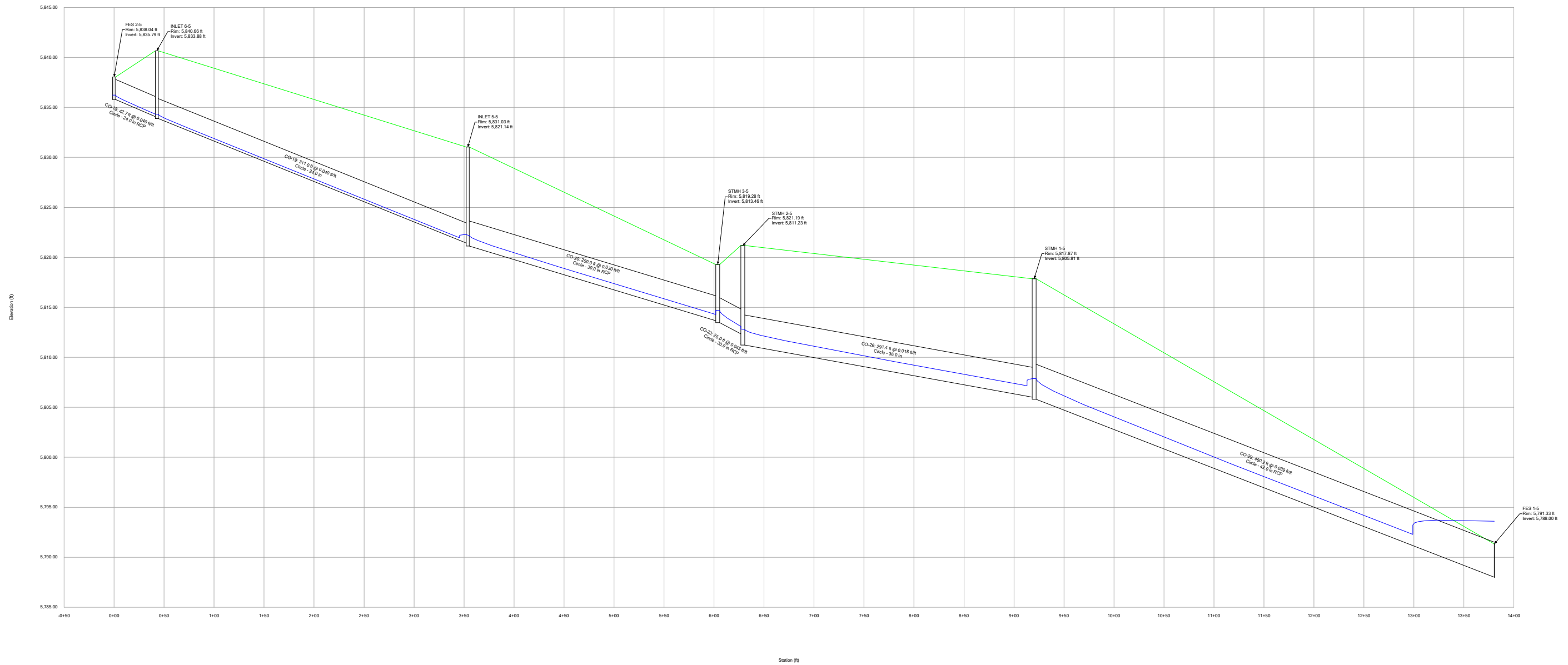
Profile Report

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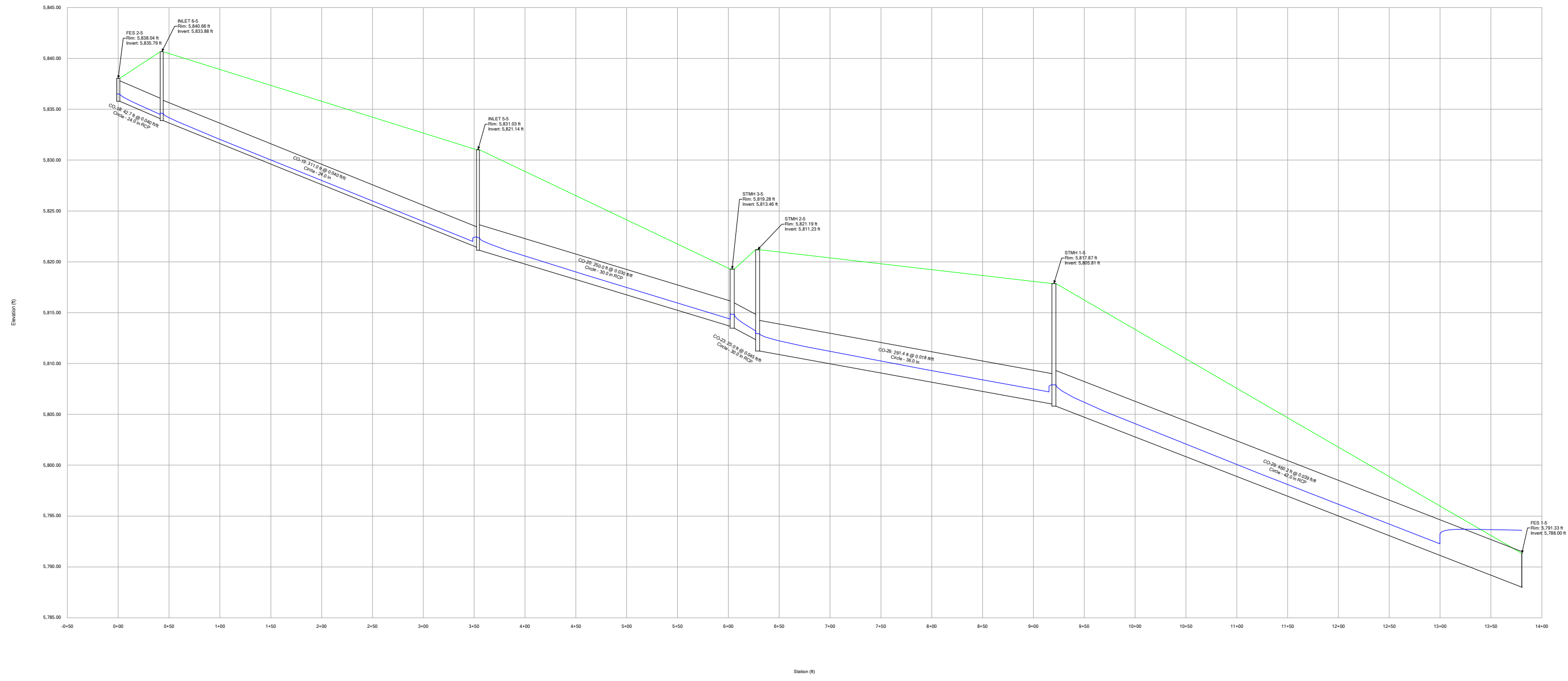
Profile Report

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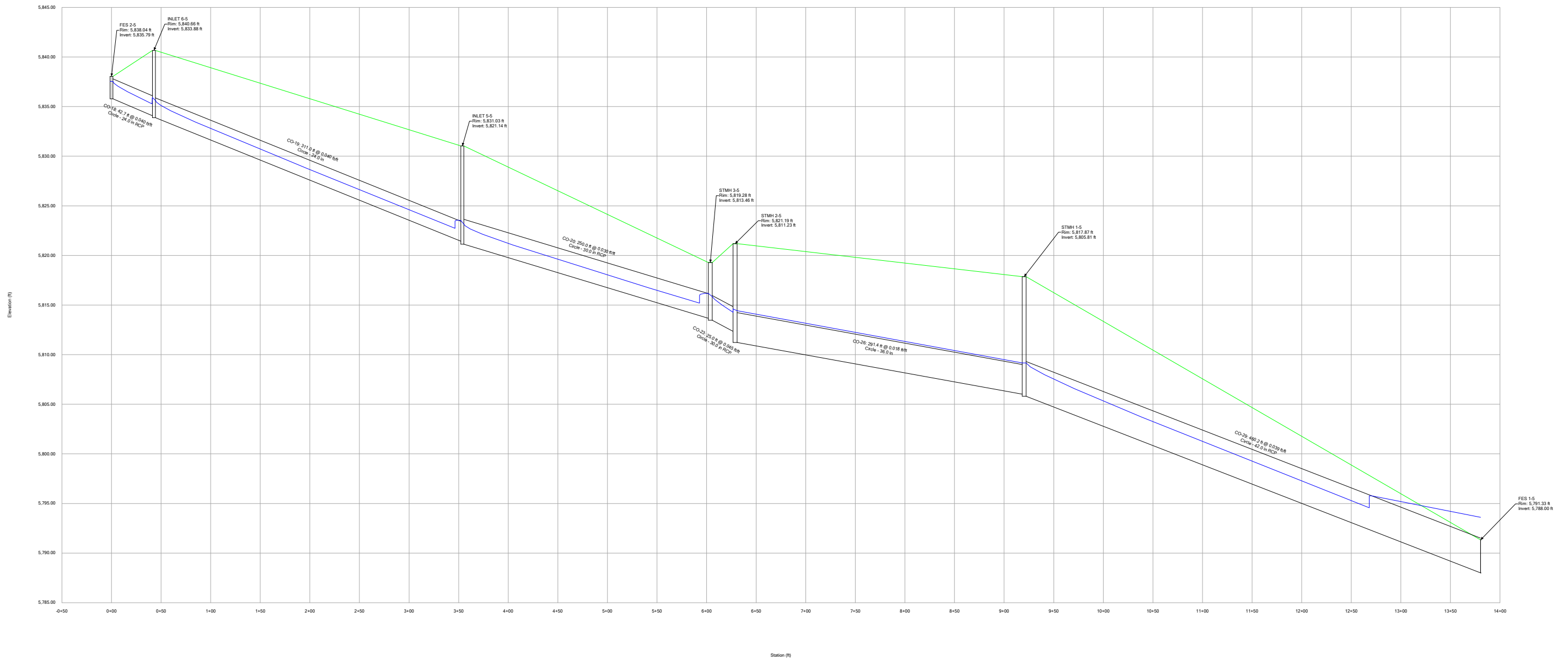
Profile Report

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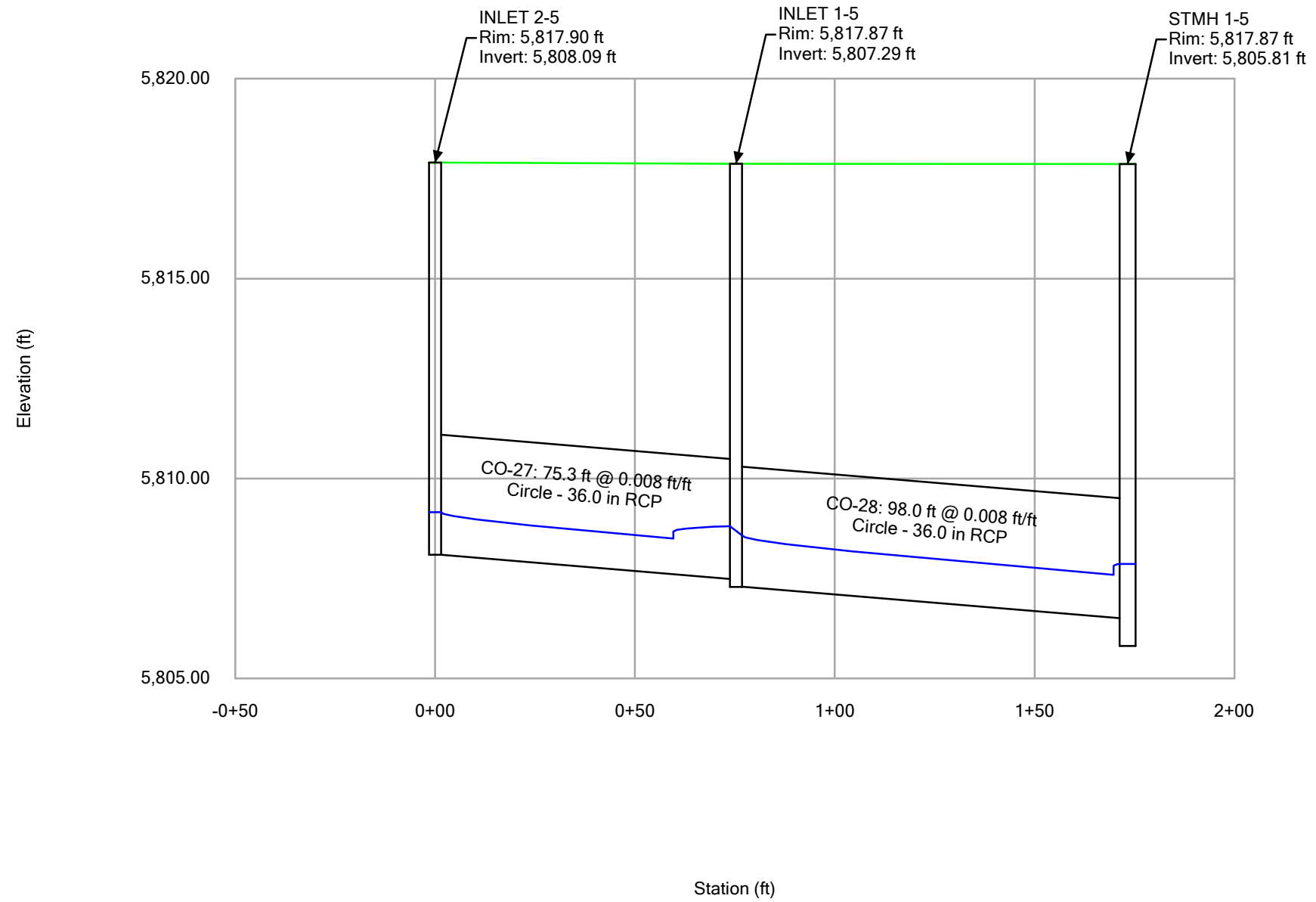


Profile Report

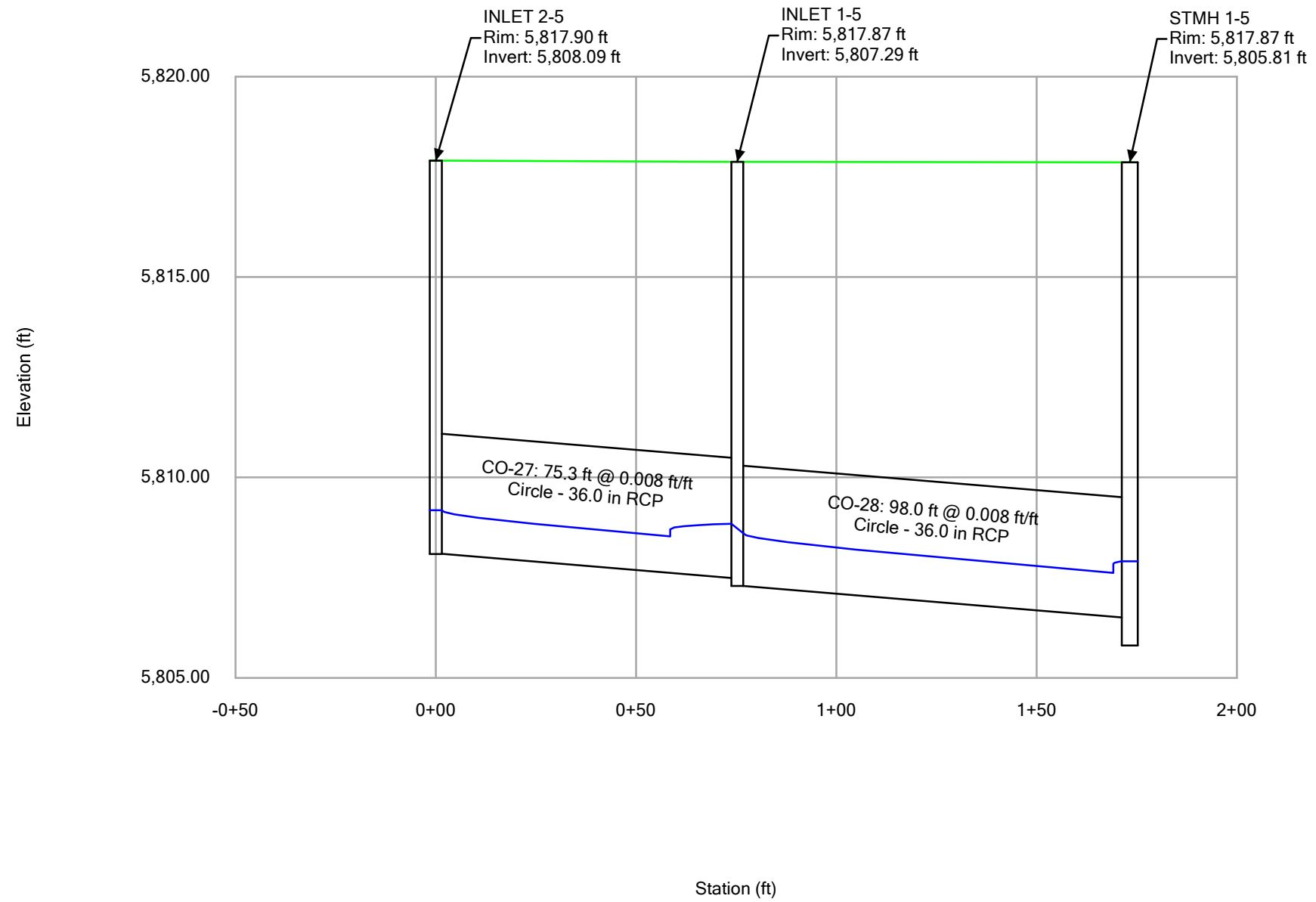
Engineering Profile - Profile - 4 (KB Homes StormCAD [100 year].stsw)



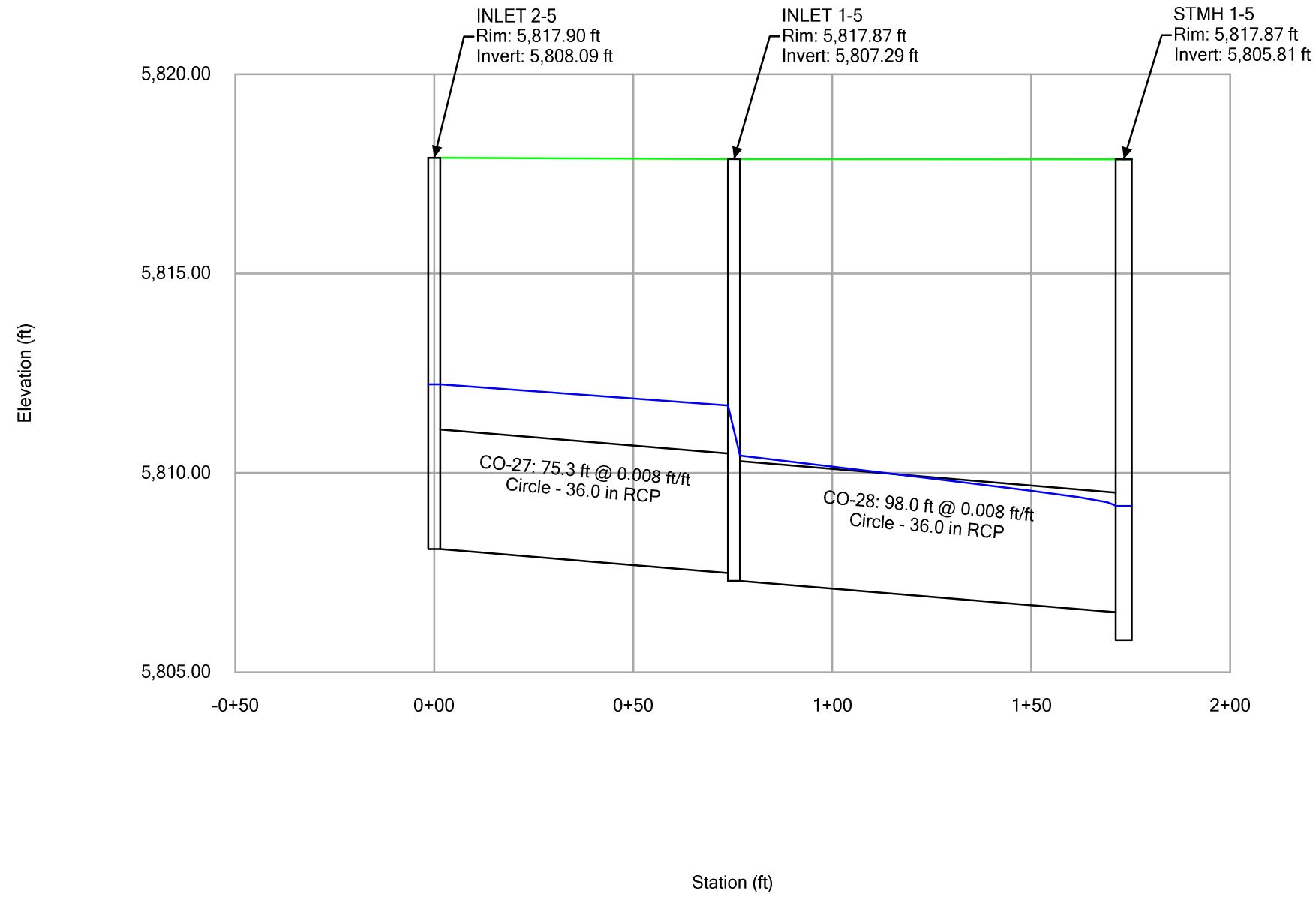
Profile Report
Engineering Profile - Profile - 5 (KB Homes StormCAD [2 year].stsw)



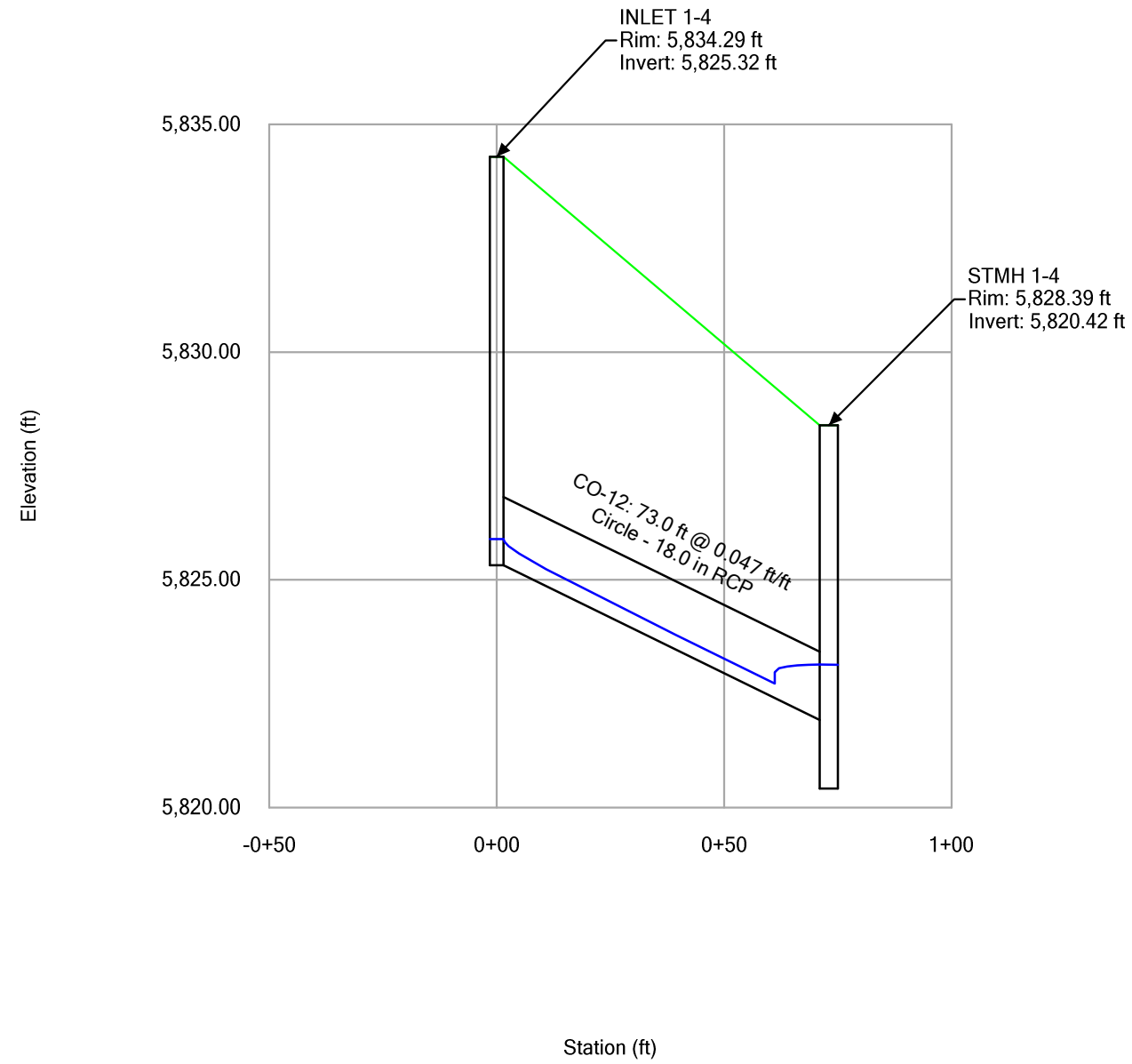
Profile Report
Engineering Profile - Profile - 5 (KB Homes StormCAD [5 year].stsw)



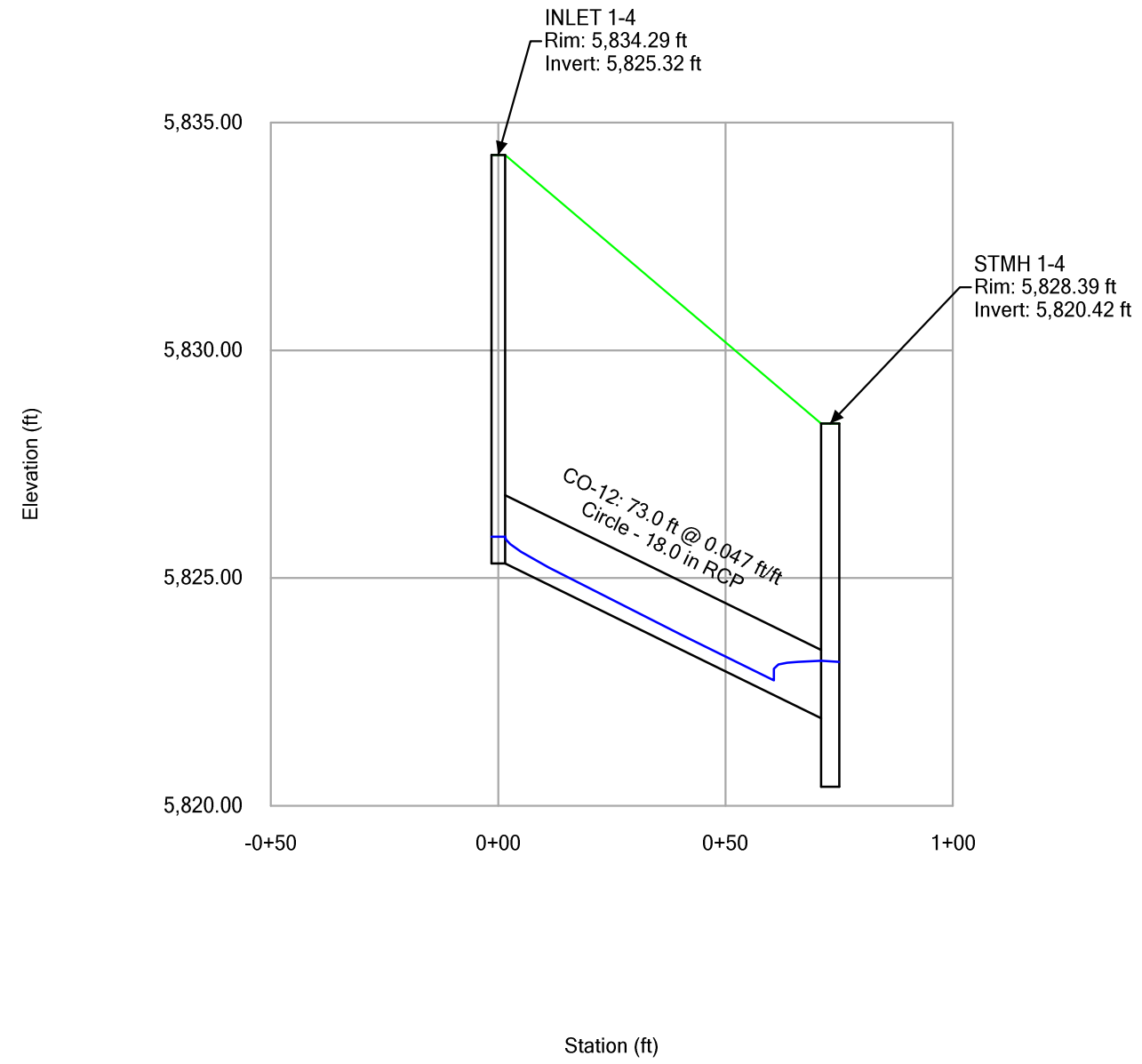
Profile Report
Engineering Profile - Profile - 5 (KB Homes StormCAD [100 year].stsw)



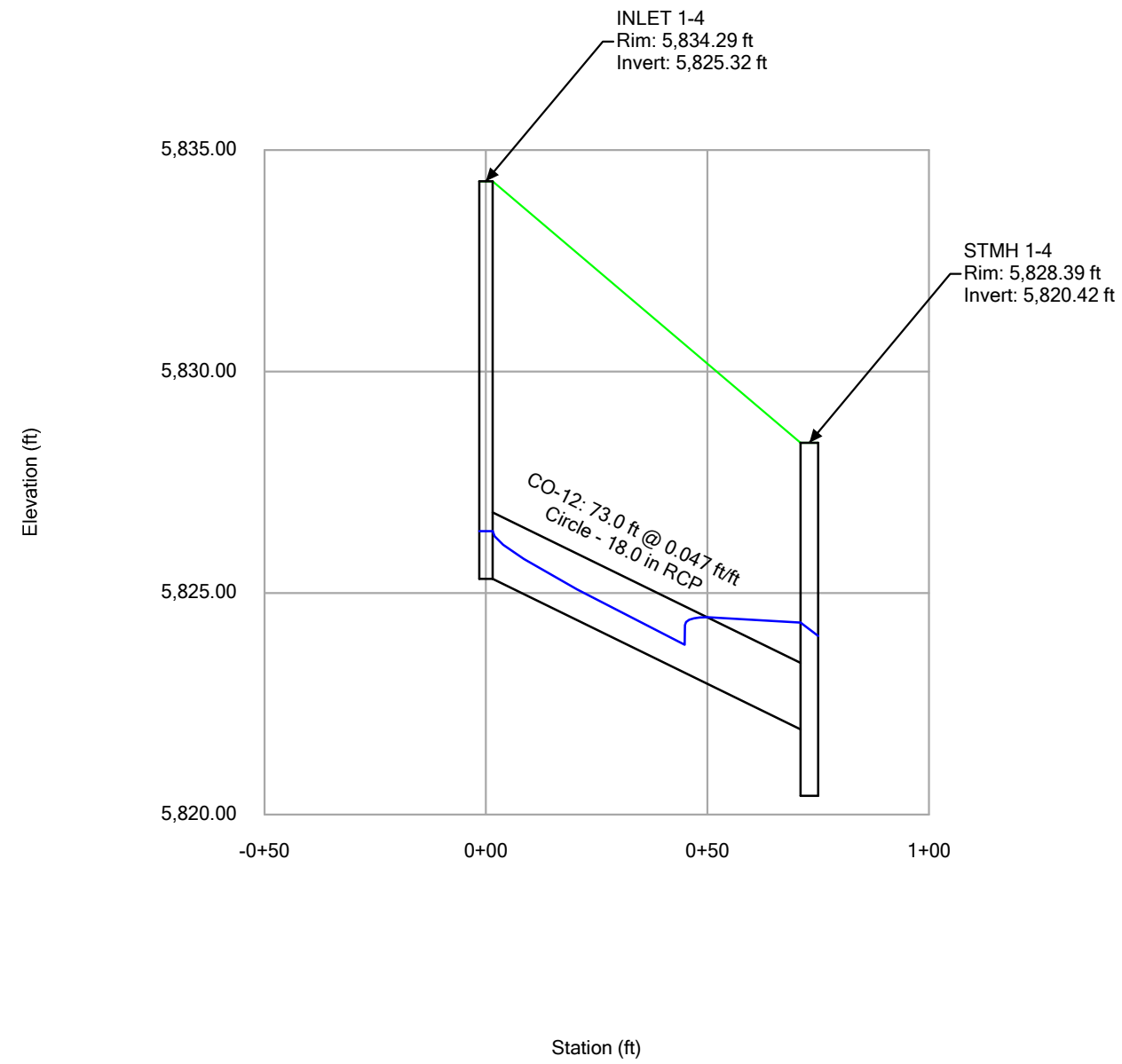
Profile Report
Engineering Profile - Profile - 6 (KB Homes StormCAD [2 year].stsw)



Profile Report
Engineering Profile - Profile - 6 (KB Homes StormCAD [5 year].stsw)



Profile Report
Engineering Profile - Profile - 6 (KB Homes StormCAD [100 year].stsw)

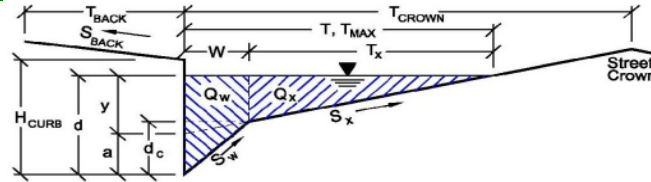


ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project:
Inlet ID:

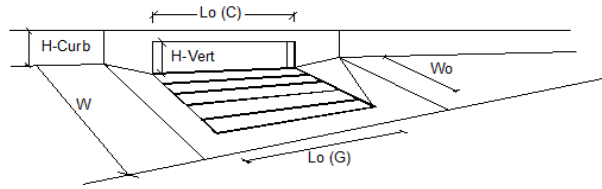
COMPARK SOUTH
INLET 1-1



Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 17.5$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 37.0$ ft				
Gutter Width	$W = 2.00$ ft				
Street Transverse Slope	$S_x = 0.020$ ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.019$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.013$				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> </tr> <tr> <td style="text-align: center;">$T_{MAX} = 21.0$</td> <td style="text-align: center;">37.0</td> </tr> </table> ft	Minor Storm	Major Storm	$T_{MAX} = 21.0$	37.0
Minor Storm	Major Storm				
$T_{MAX} = 21.0$	37.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> </tr> <tr> <td style="text-align: center;">$d_{MAX} = 6.0$</td> <td style="text-align: center;">12.0</td> </tr> </table> inches	Minor Storm	Major Storm	$d_{MAX} = 6.0$	12.0
Minor Storm	Major Storm				
$d_{MAX} = 6.0$	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="padding-left: 10px;">check = yes</td> </tr> </table>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = 23.4$ cfs				
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	207.0 cfs				

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 1-1



Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	Type = CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 2$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o = 5.00$	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o = N/A$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q = 3.98$	6.47	6.47	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.1$	2.4	2.4	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 97$	73	73	%

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

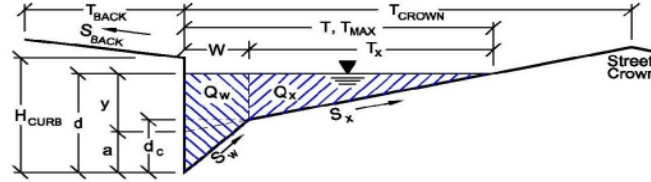
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

COMPARK SOUTH

Inlet ID:

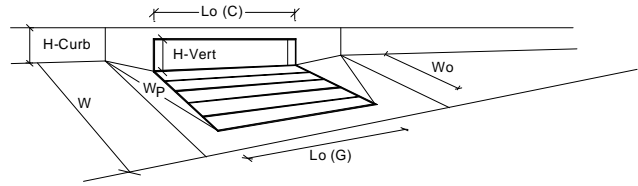
INLET 1-2



Gutter Geometry (Enter data in the blue cells)									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 17.5$ ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$								
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = 37.0$ ft								
Gutter Width	$W = 2.00$ ft								
Street Transverse Slope	$S_x = 0.020$ ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.013$								
Max. Allowable Spread for Minor & Major Storm	<table style="border: none;"> <tr> <td style="padding: 0 10px;"></td> <td style="text-align: center; padding: 0 10px;">Minor Storm</td> <td style="text-align: center; padding: 0 10px;">Major Storm</td> <td style="padding: 0 10px;"></td> </tr> <tr> <td style="padding: 0 10px;">$T_{MAX} =$</td> <td style="border: 1px solid black; text-align: center; padding: 2px;">21.0</td> <td style="border: 1px solid black; text-align: center; padding: 2px;">37.0</td> <td style="padding: 0 10px;">ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} =$	21.0	37.0	ft
	Minor Storm	Major Storm							
$T_{MAX} =$	21.0	37.0	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="border: none;"> <tr> <td style="padding: 0 10px;"></td> <td style="text-align: center; padding: 0 10px;">Minor Storm</td> <td style="text-align: center; padding: 0 10px;">Major Storm</td> <td style="padding: 0 10px;"></td> </tr> <tr> <td style="padding: 0 10px;">$d_{MAX} =$</td> <td style="border: 1px solid black; text-align: center; padding: 2px;">6.0</td> <td style="border: 1px solid black; text-align: center; padding: 2px;">12.0</td> <td style="padding: 0 10px;">inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} =$	6.0	12.0	inches
	Minor Storm	Major Storm							
$d_{MAX} =$	6.0	12.0	inches						
Allow Flow Depth at Street Crown (leave blank for no)	<table style="border: none;"> <tr> <td style="padding: 0 10px;"></td> <td style="text-align: center; padding: 0 10px;"><input type="checkbox"/></td> <td style="text-align: center; padding: 0 10px;"><input checked="" type="checkbox"/></td> <td style="padding: 0 10px;">check = yes</td> </tr> </table>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes				
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes						
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
$Q_{allow} =$	<table style="border: none;"> <tr> <td style="padding: 0 10px;"></td> <td style="text-align: center; padding: 0 10px;">Minor Storm</td> <td style="text-align: center; padding: 0 10px;">Major Storm</td> <td style="padding: 0 10px;"></td> </tr> <tr> <td style="padding: 0 10px;"></td> <td style="border: 1px solid black; text-align: center; padding: 2px;">SUMP</td> <td style="border: 1px solid black; text-align: center; padding: 2px;">SUMP</td> <td style="padding: 0 10px;">cfs</td> </tr> </table>		Minor Storm	Major Storm			SUMP	SUMP	cfs
	Minor Storm	Major Storm							
	SUMP	SUMP	cfs						

INLET IN A SUMP OR SAG LOCATION

Project = **COMPARK SOUTH**
 Inlet ID = **INLET 1-2**

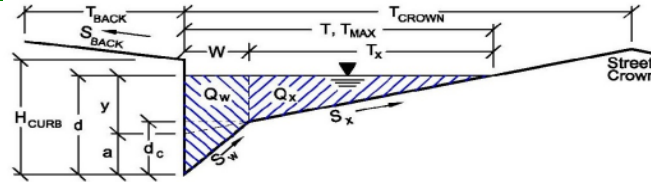


Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	N_o =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.4	inches
Grate Information	<input 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
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_r (G)$ =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G)$ =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G)$ =	N/A	N/A	
Curb Opening Information				
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 (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_r (C)$ =	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	
Total Inlet Interception Capacity (assumes clogged condition)				
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q_a =	10.5	23.8	cfs
	$Q_{PEAK REQUIRED}$ =	5.2	13.6	cfs

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

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

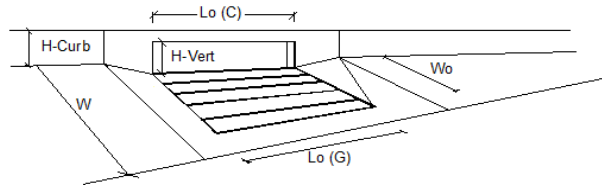
Project: **COMPARK SOUTH**
 Inlet ID: **INLET 1-3**



Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 17.5$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 37.0$ ft				
Gutter Width	$W = 2.00$ ft				
Street Transverse Slope	$S_x = 0.020$ ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.019$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.013$				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">$T_{MAX} = 21.0$</td> <td style="text-align: center; padding: 2px;">37.0</td> </tr> </table> ft	Minor Storm	Major Storm	$T_{MAX} = 21.0$	37.0
Minor Storm	Major Storm				
$T_{MAX} = 21.0$	37.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">$d_{MAX} = 6.0$</td> <td style="text-align: center; padding: 2px;">12.0</td> </tr> </table> inches	Minor Storm	Major Storm	$d_{MAX} = 6.0$	12.0
Minor Storm	Major Storm				
$d_{MAX} = 6.0$	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 2px;"><input type="checkbox"/></td> <td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td> <td style="padding-left: 10px;">check = yes</td> </tr> </table>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = 23.4$ cfs				
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	207.0 cfs				

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 1-3



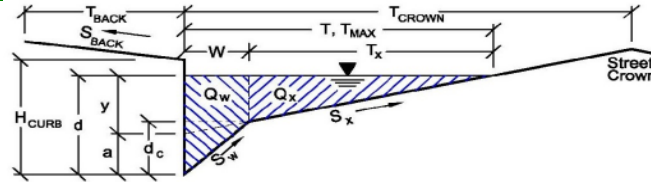
Design Information (Input)	MINOR		MAJOR		
	MINOR	MAJOR	MINOR	MAJOR	
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} = 3.0	3.0	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No = 3	3	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _G = 5.00	5.00	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _G = N/A	N/A	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _{r-G} = N/A	N/A	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _{r-C} = 0.10	0.10	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	Q = 5.50	13.47	5.50	13.47	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.0	6.7	0.0	6.7	cfs
Capture Percentage = Q _i /Q _o =	C% = 100	67	100	67	%

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

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

Project:
Inlet ID:

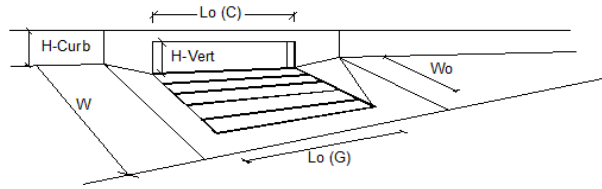
COMPARK SOUTH
INLET 1-4



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="17.5"/> ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>												
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="37.0"/> ft												
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft												
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.019"/> ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.013"/>												
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$T_{MAX} =$ <input style="width: 50px;" type="text" value="21.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="37.0"/></td> <td style="text-align: center;">ft</td> </tr> <tr> <td style="text-align: center;">$d_{MAX} =$ <input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: center;">inches</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;">check = yes</td> </tr> </tbody> </table>	Minor Storm	Major Storm		$T_{MAX} = $ <input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>	ft	$d_{MAX} = $ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes
Minor Storm	Major Storm												
$T_{MAX} = $ <input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>	ft											
$d_{MAX} = $ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches											
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes											
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)													
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = $ <input style="width: 50px;" type="text" value="23.4"/> <input style="width: 50px;" type="text" value="207.0"/> cfs												
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'													

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 1-4



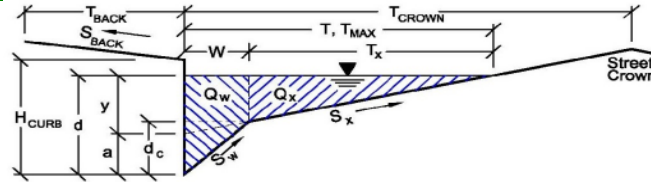
Design Information (Input)	MINOR		MAJOR		
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0		inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2		
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00		ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A		ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10		
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q =$	2.40	7.70		cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	4.9		cfs
Capture Percentage = $Q_i/Q_o =$	$C\% =$	100	61		%

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

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

Project:
Inlet ID:

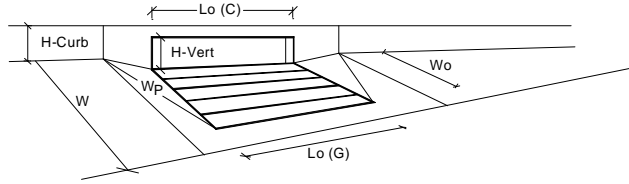
COMPARK SOUTH
INLET 1-5



Gutter Geometry (Enter data in the blue cells)						
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} =$	17.5 ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} =$	0.020 ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} =$	0.020				
Height of Curb at Gutter Flow Line	$H_{CURB} =$	6.00 inches				
Distance from Curb Face to Street Crown	$T_{CROWN} =$	37.0 ft				
Gutter Width	$W =$	2.00 ft				
Street Transverse Slope	$S_x =$	0.020 ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w =$	0.083 ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o =$	0.000 ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} =$	0.013				
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} =$	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Minor Storm</td> <td style="padding: 2px;">Major Storm</td> </tr> <tr> <td style="padding: 2px; text-align: center;">21.0</td> <td style="padding: 2px; text-align: center;">37.0</td> </tr> </table> ft	Minor Storm	Major Storm	21.0	37.0
Minor Storm	Major Storm					
21.0	37.0					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} =$	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Minor Storm</td> <td style="padding: 2px;">Major Storm</td> </tr> <tr> <td style="padding: 2px; text-align: center;">6.0</td> <td style="padding: 2px; text-align: center;">12.0</td> </tr> </table> inches	Minor Storm	Major Storm	6.0	12.0
Minor Storm	Major Storm					
6.0	12.0					
Allow Flow Depth at Street Crown (leave blank for no)		<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes				
MINOR STORM Allowable Capacity is based on Depth Criterion						
MAJOR STORM Allowable Capacity is based on Depth Criterion						
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} =$	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Minor Storm</td> <td style="padding: 2px;">Major Storm</td> </tr> <tr> <td style="padding: 2px; text-align: center;">SUMP</td> <td style="padding: 2px; text-align: center;">SUMP</td> </tr> </table> cfs	Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm					
SUMP	SUMP					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'						

INLET IN A SUMP OR SAG LOCATION

Project = **COMPARK SOUTH**
 Inlet ID = **INLET 1-5**



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	2	2	
Water Depth at Flowline (outside of local depression)	6.0	10.4	inches
Grate Information			
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information			
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)			
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	10.5	23.8	cfs
Q PEAK REQUIRED =	5.1	15.1	cfs

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

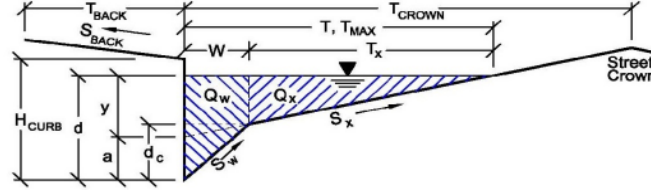
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

COMPARK SOUTH

Inlet ID:

Inlet 1-6



Gutter Geometry (Enter data in the blue cells)

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)

$T_{BACK} = 17.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$
 $H_{CURB} = 6.00$ inches
 $T_{CROWN} = 37.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_D = 0.010$ ft/ft
 $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	21.0	37.0	ft
d_{MAX}	6.0	12.0	inches
Allow Flow Depth at Street Crown	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

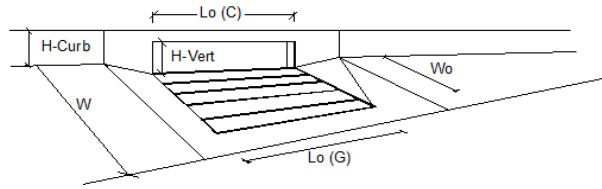
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow}	16.8	171.1	cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

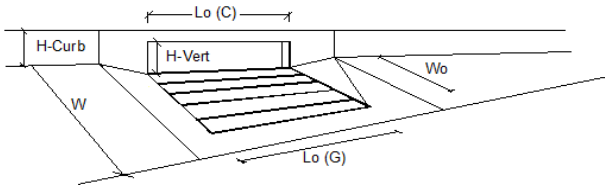
Project: COMPARK SOUTH
 Inlet ID: Inlet 1-6



Design Information (Input)	MINOR		MAJOR		
	MINOR	MAJOR	MINOR	MAJOR	
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	3.0			inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 2$	2			
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 from Q-Allow)	$W_o = N/A$	N/A			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10			
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q = 3.00$	7.28			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	4.1			cfs
Capture Percentage = $Q_c/Q_o =$	$C\% = 100$	64			%

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 2-1

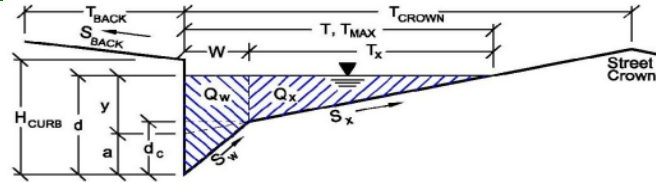


Design Information (Input)	MINOR		MAJOR		
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0		inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2		
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00		ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A		ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10		
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q =$	3.90	7.58		cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.1	4.6		cfs
Capture Percentage = $Q_c/Q_o =$	$C\% =$	98	62		%

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

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

Project: COMPARK SOUTH
 Inlet ID: INLET 2-2



Gutter Geometry (Enter data in the blue cells)

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)

$T_{BACK} = 17.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$
 $H_{CURB} = 6.00$ inches
 $T_{CROWN} = 37.0$ 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 & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	21.0	37.0	ft
d_{MAX}	6.0	12.0	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

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

$Q_{allow} =$

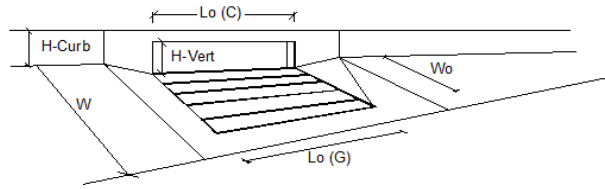
Minor Storm	Major Storm
SUMP	SUMP

 cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 2-2

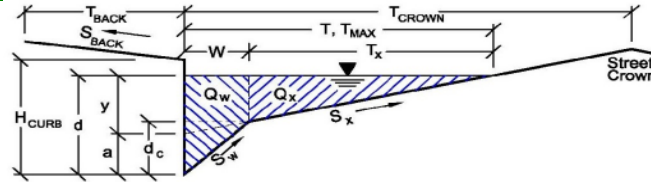


Design Information (Input)	MINOR		MAJOR		
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0		inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2		
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00		ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A		ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10		
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q =$	4.05	9.39		cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.1	10.0		cfs
Capture Percentage = $Q_i/Q_o =$	$C\% =$	96	48		%

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

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

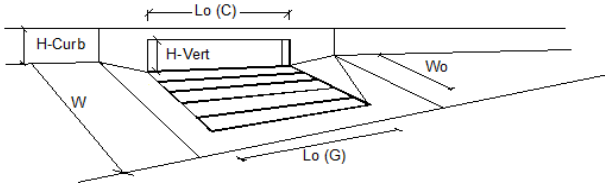
Project: **COMPARK SOUTH**
 Inlet ID: **INLET 2-3**



Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} =$ <input style="width: 50px;" type="text" value="17.5"/> ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} =$ <input style="width: 50px;" type="text" value="0.020"/> ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} =$ <input style="width: 50px;" type="text" value="0.013"/>				
Height of Curb at Gutter Flow Line	$H_{CURB} =$ <input style="width: 50px;" type="text" value="6.00"/> inches				
Distance from Curb Face to Street Crown	$T_{CROWN} =$ <input style="width: 50px;" type="text" value="37.0"/> ft				
Gutter Width	$W =$ <input style="width: 50px;" type="text" value="2.00"/> ft				
Street Transverse Slope	$S_x =$ <input style="width: 50px;" type="text" value="0.020"/> ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w =$ <input style="width: 50px;" type="text" value="0.083"/> ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o =$ <input style="width: 50px;" type="text" value="0.015"/> ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} =$ <input style="width: 50px;" type="text" value="0.013"/>				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> </tr> <tr> <td style="text-align: center;">$T_{MAX} =$ <input style="width: 50px;" type="text" value="21.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="37.0"/></td> </tr> </table> ft	Minor Storm	Major Storm	$T_{MAX} =$ <input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>
Minor Storm	Major Storm				
$T_{MAX} =$ <input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> </tr> <tr> <td style="text-align: center;">$d_{MAX} =$ <input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> </tr> </table> inches	Minor Storm	Major Storm	$d_{MAX} =$ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>
Minor Storm	Major Storm				
$d_{MAX} =$ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>				
Allow Flow Depth at Street Crown (leave blank for no)	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>check = yes</td> </tr> </table>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} =$ <input style="width: 50px;" type="text" value="20.8"/> cfs				
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	<input style="width: 50px;" type="text" value="225.6"/> cfs				

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 2-3



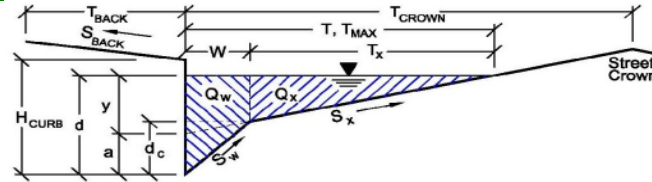
Design Information (Input)	MINOR		MAJOR		
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0		inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	3	3		
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00		ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A		ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10		
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q =$	4.50	8.95		cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	1.0		cfs
Capture Percentage = $Q_c/Q_o =$	$C\% =$	100	90		%

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

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

Project:
Inlet ID:

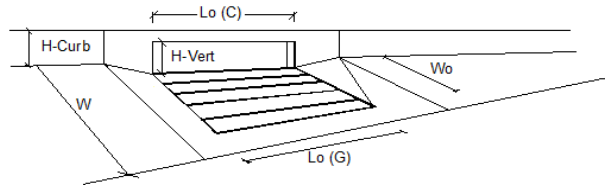
COMPARK SOUTH
INLET 2-4



Gutter Geometry (Enter data in the blue cells)									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="5.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.013"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="37.0"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.015"/> ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.013"/>								
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td>$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="21.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="37.0"/></td> <td style="text-align: right;">ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>	ft
	Minor Storm	Major Storm							
$T_{MAX} = $	<input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td>$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: right;">inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches
	Minor Storm	Major Storm							
$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches						
Allow Flow Depth at Street Crown (leave blank for no)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: right;">check = yes</td> </tr> </table>		Minor Storm	Major Storm			<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes
	Minor Storm	Major Storm							
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes						
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
$Q_{allow} = $	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="20.8"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="204.4"/></td> <td style="text-align: right;">cfs</td> </tr> </table>		Minor Storm	Major Storm			<input style="width: 50px;" type="text" value="20.8"/>	<input style="width: 50px;" type="text" value="204.4"/>	cfs
	Minor Storm	Major Storm							
	<input style="width: 50px;" type="text" value="20.8"/>	<input style="width: 50px;" type="text" value="204.4"/>	cfs						

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 2-4

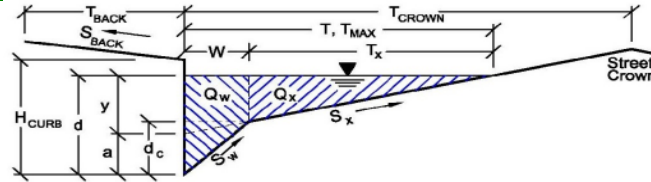


Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	Type = CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	3.0	inches	
Total Number of Units in the Inlet (Grate or Curb Opening)	$No = 3$	3		
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_G = 5.00$	5.00	ft	
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_G = N/A$	N/A	ft	
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10		
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q = 6.92$	14.64	cfs	
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.1$	9.4	cfs	
Capture Percentage = $Q_g/Q_o =$	$C\% = 99$	61	%	

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

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

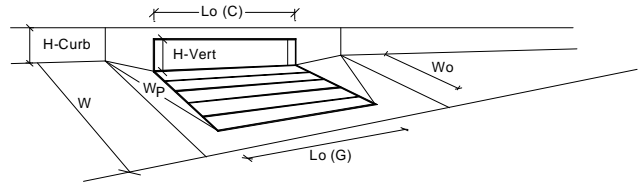
Project: **COMPARK SOUTH**
 Inlet ID: **INLET 2-5**



Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="0.0"/> ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.013"/>						
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="37.0"/> ft						
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft						
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft						
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft						
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.013"/>						
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$T_{MAX} =$ <input style="width: 50px;" type="text" value="21.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="37.0"/></td> <td style="text-align: center;">ft</td> </tr> </tbody> </table>	Minor Storm	Major Storm		$T_{MAX} = $ <input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>	ft
Minor Storm	Major Storm						
$T_{MAX} = $ <input style="width: 50px;" type="text" value="21.0"/>	<input style="width: 50px;" type="text" value="37.0"/>	ft					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$d_{MAX} =$ <input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="10.2"/></td> <td style="text-align: center;">inches</td> </tr> </tbody> </table>	Minor Storm	Major Storm		$d_{MAX} = $ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="10.2"/>	inches
Minor Storm	Major Storm						
$d_{MAX} = $ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="10.2"/>	inches					
Allow Flow Depth at Street Crown (leave blank for no)	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="padding-left: 10px;">check = yes</td> </tr> </table>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes					
MINOR STORM Allowable Capacity is based on Depth Criterion							
MAJOR STORM Allowable Capacity is based on Depth Criterion							
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							
$Q_{allow} = $	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;">cfs</td> </tr> </tbody> </table>	Minor Storm	Major Storm		<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs
Minor Storm	Major Storm						
<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs					

INLET IN A SUMP OR SAG LOCATION

Project = **COMPARK SOUTH**
 Inlet ID = **INLET 2-5**



Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} = 3.00	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	N_o = 5	5	5	
Water Depth at Flowline (outside of local depression)	Ponding Depth = 6.0	10.2	inches	<input type="checkbox"/> Override Depths
Grate Information	MINOR		MAJOR	
Length of a Unit Grate	$L_o (G)$ = N/A	N/A	N/A	feet
Width of a Unit Grate	W_o = N/A	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} = N/A	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_r (G)$ = N/A	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G)$ = N/A	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G)$ = N/A	N/A	N/A	
Curb Opening Information	MINOR		MAJOR	
Length of a Unit Curb Opening	$L_o (C)$ = 5.00	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} = 6.00	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} = 6.00	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta = 63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p = 2.00	2.00	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_r (C)$ = 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		
Total Inlet Interception Capacity (assumes clogged condition)	MINOR		MAJOR	
	Q_a = 22.9	61.2	cfs	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK REQUIRED}$ = 11.8	56.0	cfs	

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

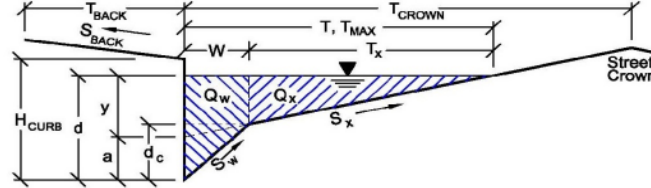
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

COMPARK SOUTH

Inlet ID:

Inlet 2-6



Gutter Geometry (Enter data in the blue cells)

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)

$T_{BACK} = 5.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.013$
 $H_{CURB} = 6.00$ inches
 $T_{CROWN} = 37.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_D = 0.005$ ft/ft
 $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	21.0	37.0	ft
d_{MAX}	6.0	12.0	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

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

$Q_{allow} =$

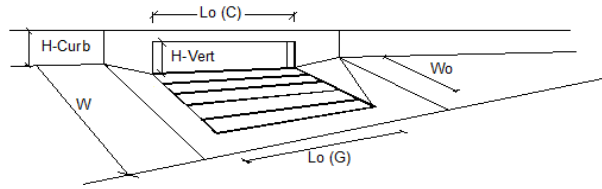
12.0	118.0
------	-------

 cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: Inlet 2-6



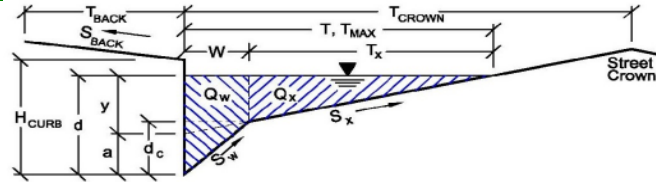
Design Information (Input)	MINOR		MAJOR		
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0		inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	3	3		
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00		ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A		ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10		
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q =$	2.80	12.08		cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	4.7		cfs
Capture Percentage = $Q_i/Q_o =$	$C\% =$	100	72		%

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

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

Project:
Inlet ID:

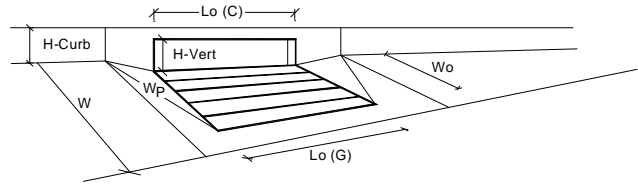
COMPARK SOUTH
INLET 3-4



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 0.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.012$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>8.0</td> <td>17.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>6.0</td> <td>12.0</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	8.0	17.0	ft	$d_{MAX} =$	6.0	12.0	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	8.0	17.0	ft										
$d_{MAX} =$	6.0	12.0	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> Minor Storm <input checked="" type="checkbox"/> Major Storm check = yes												
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} =$ <table border="1"><tr><td>SUMP</td><td>SUMP</td></tr></table> cfs	SUMP	SUMP										
SUMP	SUMP												
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'													

INLET IN A SUMP OR SAG LOCATION

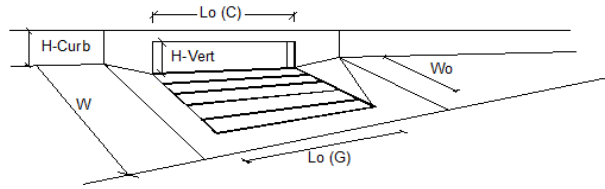
Project = **COMPARK SOUTH**
 Inlet ID = **INLET 3-4**



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.4	5.6	inches	<input type="checkbox"/> Override Depths
Grate Information		MINOR		MAJOR	
Length of a Unit Grate	$L_o (G)$ =	N/A	N/A	feet	
Width of a Unit Grate	W_o =	N/A	N/A	feet	
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_r (G)$ =	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G)$ =	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G)$ =	N/A	N/A		
Curb Opening Information		MINOR		MAJOR	
Length of a Unit Curb Opening	$L_o (C)$ =	5.00	5.00	feet	
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches	
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_r (C)$ =	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		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
	Q_a =	1.1	4.6	cfs	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK REQUIRED}$ =	0.9	2.4	cfs	

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 3-5

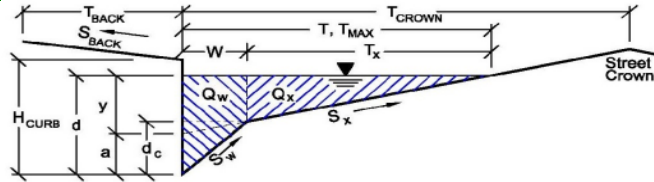


Design Information (Input)	MINOR		MAJOR		
	MINOR	MAJOR	MINOR	MAJOR	
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	3.0			inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 3$	3			
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 from Q-Allow)	$W_o = N/A$	N/A			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10			
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM!					
Total Inlet Interception Capacity	$Q = 6.48$	16.30			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	13.6			cfs
Capture Percentage = $Q_c/Q_o =$	$C\% = 100$	55			%

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

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

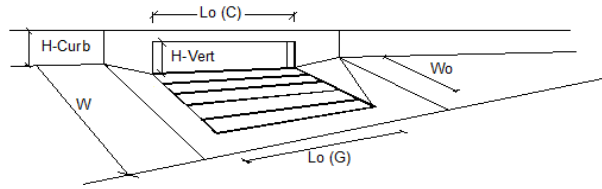
Project: **COMPARK SOUTH**
 Inlet ID: **INLET 3-5A**



Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 0.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft
Gutter Width	$W = 2.00$ ft
Street Transverse Slope	$S_x = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.015$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.013$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 7.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 6.0 & 12.0 \end{matrix}$ inches
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes
MINOR STORM Allowable Capacity is based on Spread Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
$Q_{allow} =$	$\begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 2.3 & 137.5 \end{matrix}$ cfs

INLET ON A CONTINUOUS GRADE

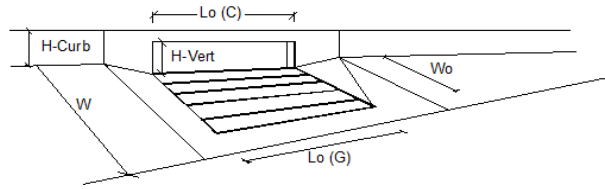
Project: COMPARK SOUTH
 Inlet ID: INLET 3-5A



Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	Type = CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 3$	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o = 5.00$	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o = N/A$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allow}$ maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q = 1.60$	12.60	12.60	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	5.2	5.2	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	71	71	%

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 3-6



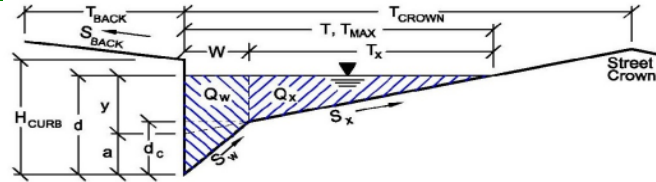
Design Information (Input)	MINOR		MAJOR		
	MINOR	MAJOR	MINOR	MAJOR	
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	3.0			inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 3$	3			
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 from Q-Allow)	$W_o = N/A$	N/A			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10			
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM!					
Total Inlet Interception Capacity	$Q = 4.20$	9.90			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	1.7			cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	85			%

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

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

Project: COMPARK SOUTH

Inlet ID: INLET 4-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 0.0$ ft

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

$S_{BACK} = 0.020$ ft/ft

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

$n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line

$H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ ft

Gutter Width

$W = 2.00$ ft

Street Transverse Slope

$S_x = 0.020$ ft/ft

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

$S_w = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

$S_o = 0.015$ ft/ft

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

$n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	7.0	17.0	ft

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

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

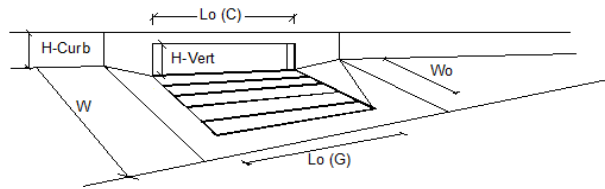
	Minor Storm	Major Storm	
$Q_{allow} =$	2.3	137.5	cfs

WARNING: MINOR STORM max. allowable capacity is less than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 4-4

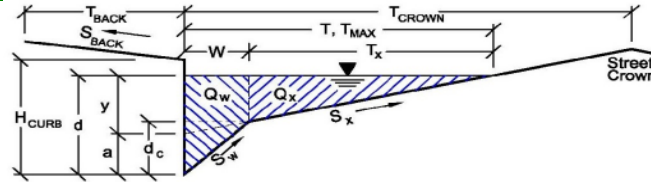


Design Information (Input)	MINOR		MAJOR		
	MINOR	MAJOR	MINOR	MAJOR	
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} = 3.0	3.0			inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No = 3	3			
Length of a Single Unit Inlet (Grate or Curb Opening)	L _G = 5.00	5.00			ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _G = N/A	N/A			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _{r-G} = N/A	N/A			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _{r-C} = 0.10	0.10			
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM!					
Total Inlet Interception Capacity	Q = 4.70	11.27			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.0	3.2			cfs
Capture Percentage = Q _i /Q _o =	C% = 100	78			%

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

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

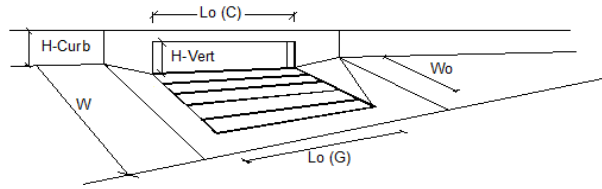
Project: **COMPARK SOUTH**
 Inlet ID: **INLET 4-5**



Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 0.0$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft				
Gutter Width	$W = 2.00$ ft				
Street Transverse Slope	$S_x = 0.020$ ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.015$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.013$				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">$T_{MAX} = 7.0$</td> <td style="text-align: center; padding: 2px;">$T_{MAX} = 17.0$</td> </tr> </table> ft	Minor Storm	Major Storm	$T_{MAX} = 7.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 7.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">$d_{MAX} = 6.0$</td> <td style="text-align: center; padding: 2px;">$d_{MAX} = 12.0$</td> </tr> </table> inches	Minor Storm	Major Storm	$d_{MAX} = 6.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 6.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 2px;"><input type="checkbox"/></td> <td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td> <td style="padding: 2px;">check = yes</td> </tr> </table>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes			
MINOR STORM Allowable Capacity is based on Spread Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">$Q_{allow} = 2.3$</td> <td style="text-align: center; padding: 2px;">$Q_{allow} = 137.5$</td> </tr> </table> cfs	Minor Storm	Major Storm	$Q_{allow} = 2.3$	$Q_{allow} = 137.5$
Minor Storm	Major Storm				
$Q_{allow} = 2.3$	$Q_{allow} = 137.5$				
WARNING: MINOR STORM max. allowable capacity is less than flow given on sheet 'Q-Peak' Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

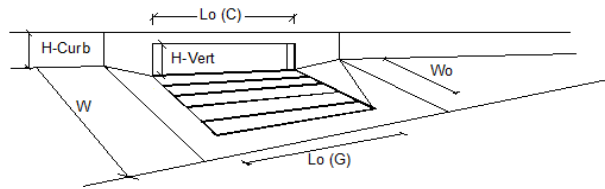
Project: COMPARK SOUTH
 Inlet ID: INLET 4-5



Design Information (Input)	MINOR		MAJOR		
	Type = CDOT Type R Curb Opening				
Type of Inlet	CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} = 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 _G = 5.00	5.00			ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _G = N/A	N/A			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _{r-G} = N/A	N/A			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _{r-C} = 0.10	0.10			
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM!					
Total Inlet Interception Capacity	Q = 4.40	12.37			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.0	4.8			cfs
Capture Percentage = Q _i /Q _o =	C% = 100	72			%

INLET ON A CONTINUOUS GRADE

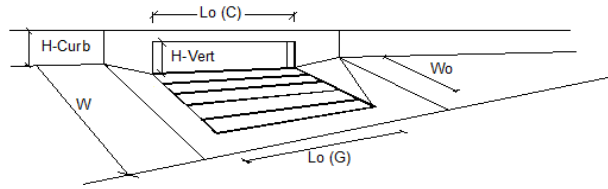
Project: COMPARK SOUTH
 Inlet ID: INLET 4-5A



Design Information (Input)	MINOR		MAJOR		
	MINOR	MAJOR	MINOR	MAJOR	
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} = 3.0$	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)	$L_G = 5.00$	5.00			ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_G = N/A$	N/A			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{r-G} = N/A$	N/A			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{r-C} = 0.10$	0.10			
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'					
Total Inlet Interception Capacity	$Q = 1.50$	12.52			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	5.1			cfs
Capture Percentage = $Q_g/Q_o =$	$C\% = 100$	71			%

INLET ON A CONTINUOUS GRADE

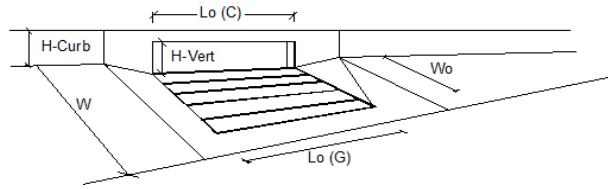
Project: COMPARK SOUTH
 Inlet ID: INLET 4-6



Design Information (Input)	MINOR		MAJOR		
Type of Inlet	Type = CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	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 from Q-Allow)	$W_o =$	N/A	N/A		ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10		
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM!					
Total Inlet Interception Capacity	$Q =$	7.00	13.58		cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.1	7.0		cfs
Capture Percentage = $Q_c/Q_o =$	$C\% =$	99	66		%

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
 Inlet ID: INLET 5-4

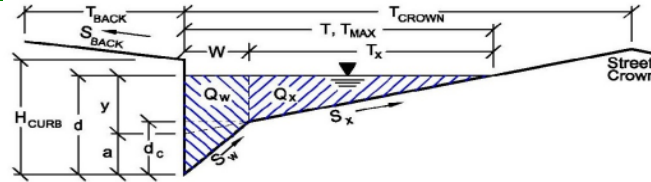


Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	Type = CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10	
Street Hydraulics: OK - $Q <$ maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q =$	1.30	3.95	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	0.2	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% =$	100	96	%

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

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

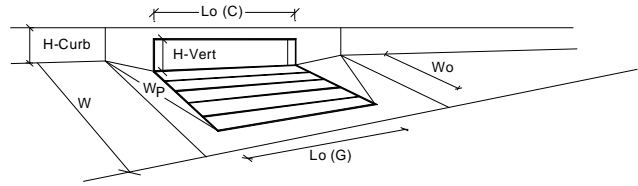
Project: **COMPARK SOUTH**
 Inlet ID: **INLET 5-5**



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="0.0"/> ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>												
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.0"/> ft												
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft												
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.013"/>												
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$T_{MAX} =$ <input style="width: 40px;" type="text" value="17.0"/></td> <td style="text-align: center;"><input style="width: 40px;" type="text" value="17.0"/></td> <td style="text-align: center;">ft</td> </tr> <tr> <td style="text-align: center;">$d_{MAX} =$ <input style="width: 40px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 40px;" type="text" value="12.0"/></td> <td style="text-align: center;">inches</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;">check = yes</td> </tr> </tbody> </table>	Minor Storm	Major Storm		$T_{MAX} = $ <input style="width: 40px;" type="text" value="17.0"/>	<input style="width: 40px;" type="text" value="17.0"/>	ft	$d_{MAX} = $ <input style="width: 40px;" type="text" value="6.0"/>	<input style="width: 40px;" type="text" value="12.0"/>	inches	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes
Minor Storm	Major Storm												
$T_{MAX} = $ <input style="width: 40px;" type="text" value="17.0"/>	<input style="width: 40px;" type="text" value="17.0"/>	ft											
$d_{MAX} = $ <input style="width: 40px;" type="text" value="6.0"/>	<input style="width: 40px;" type="text" value="12.0"/>	inches											
<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes											
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)													
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$Q_{allow} =$ <input style="width: 40px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 40px;" type="text" value="SUMP"/></td> <td style="text-align: center;">cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$Q_{allow} = $ <input style="width: 40px;" type="text" value="SUMP"/>	<input style="width: 40px;" type="text" value="SUMP"/>	cfs						
Minor Storm	Major Storm												
$Q_{allow} = $ <input style="width: 40px;" type="text" value="SUMP"/>	<input style="width: 40px;" type="text" value="SUMP"/>	cfs											
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak' Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'													

INLET IN A SUMP OR SAG LOCATION

Project = **COMPARK SOUTH**
 Inlet ID = **INLET 5-5**



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	N_o =	3	3		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	5.6	inches	<input type="checkbox"/> Override Depths
Grate Information		MINOR		MAJOR	
Length of a Unit Grate	$L_o (G)$ =	N/A	N/A	feet	
Width of a Unit Grate	W_o =	N/A	N/A	feet	
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_r (G)$ =	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G)$ =	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G)$ =	N/A	N/A		
Curb Opening Information		MINOR		MAJOR	
Length of a Unit Curb Opening	$L_o (C)$ =	5.00	5.00	feet	
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches	
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_r (C)$ =	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		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
	Q_a =	11.1	11.1	cfs	
	$Q_{PEAK REQUIRED}$ =	8.3	38.2	cfs	

WARNING: Inlet Capacity less than Q Peak for MAJOR Storm

APPENDIX I

Miscellaneous Drainage Improvement Design

Initially Submitted November 20, 2015
Revised April 11, 2016

Belford Avenue Water Quality Basin Design

Two full spectrum water quality/detention basins were designed to treat the runoff from the portions of Belford Avenue that will not be directed to the proposed regional detention/water quality pond proposed adjacent to E-470. The ponds are located at low points of the proposed Belford Avenue that correspond to existing low areas. The ponds were designed to treat the runoff from the entire drainage area intercepted by the ponds including the undeveloped land which historically drains to these low areas.

Sizing calculations are attached.

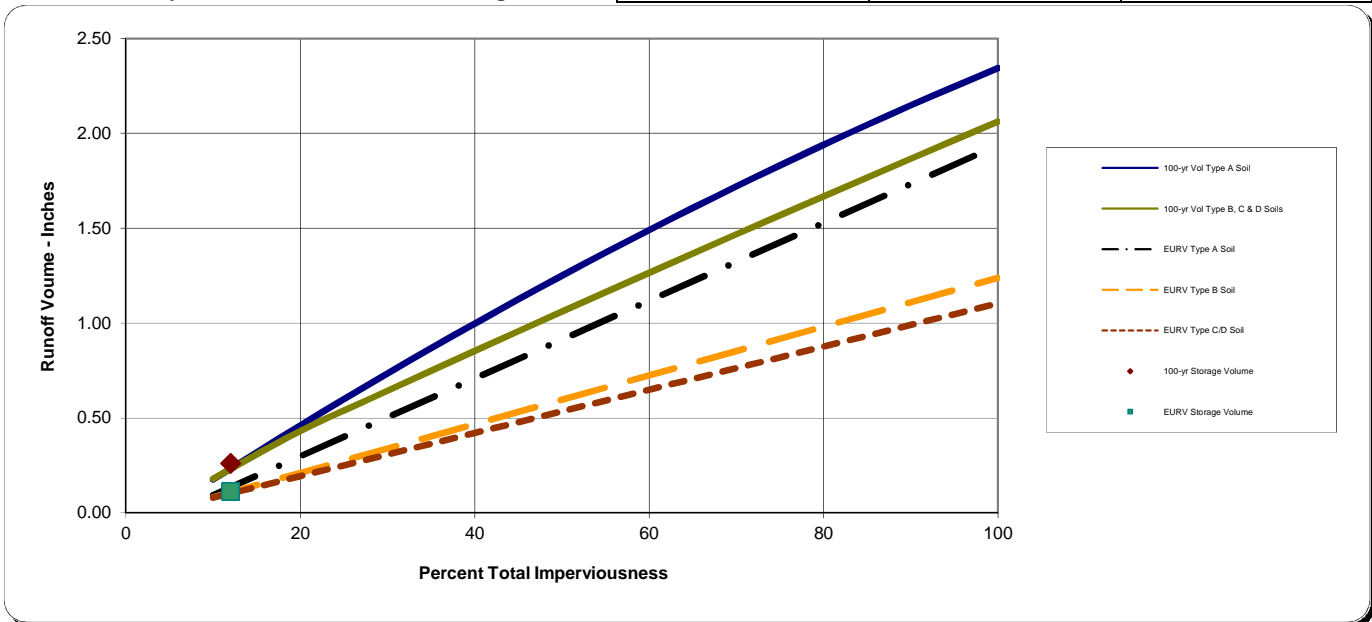
DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Compark South
Basin ID: Belford Ave Water Quality Pond - West

* User input data shown in blue.

Area of Watershed (acres)	17.50	
Subwatershed Imperviousness	12.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0 ▼
Effective Imperviousness ¹	12.0%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0	0.0
Type B	0.0	0.0
Type C or D	100.0%	17.5

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
3	0.5	0.0018
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.11	0.16	
Excess Urban Runoff Volume⁴		Design Outlet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV⁵		17.50

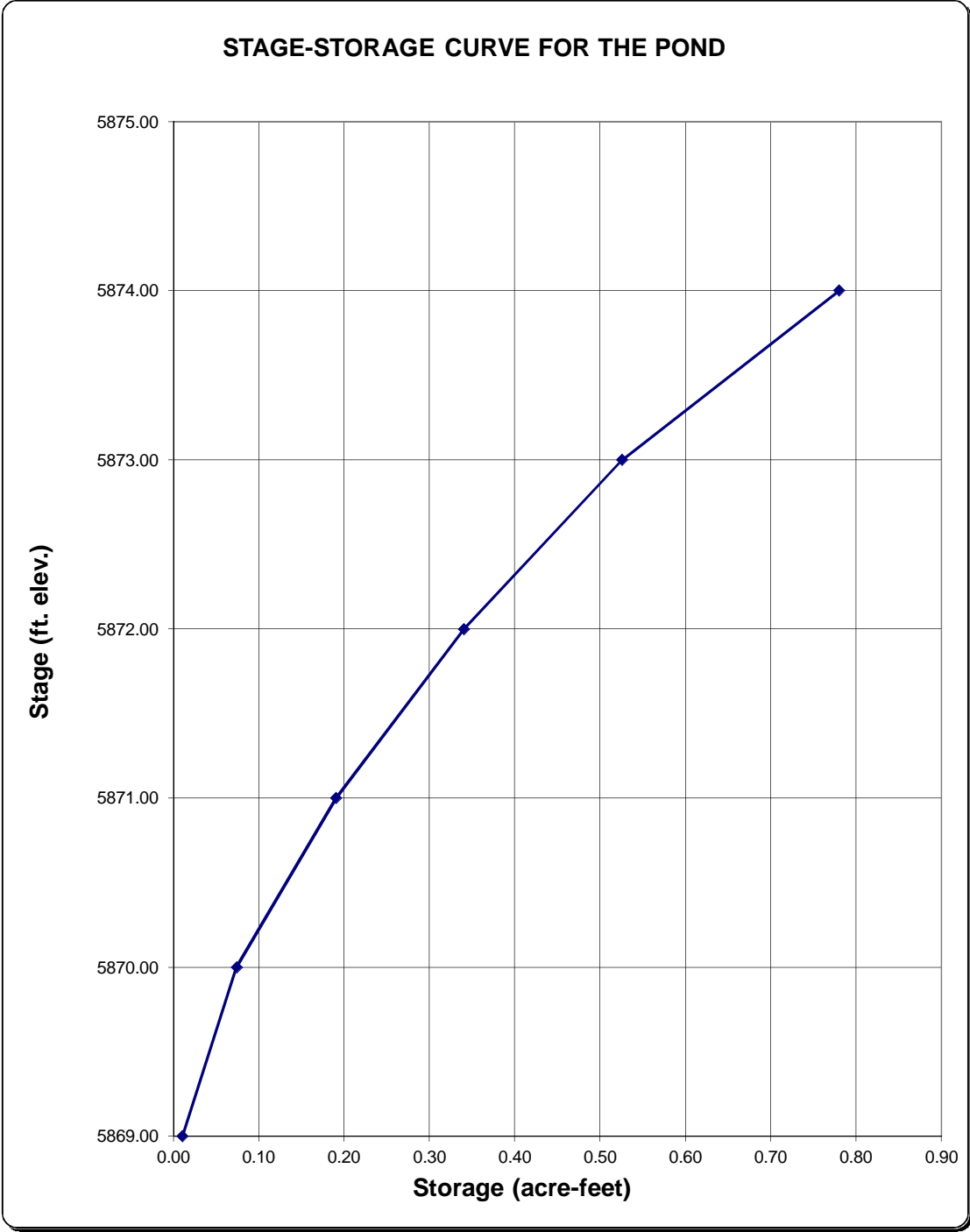


Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____
Basin ID: _____



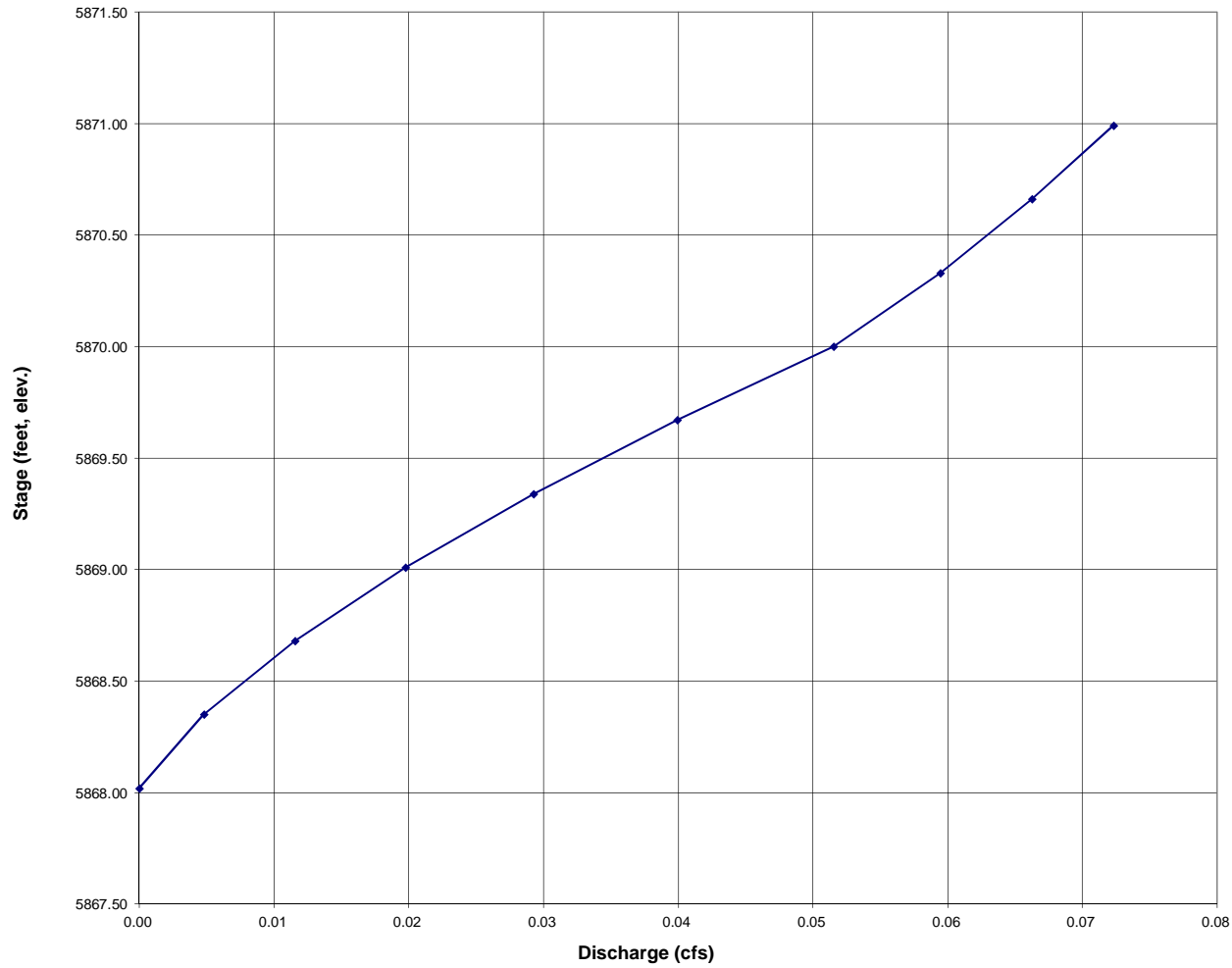
STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: **Compark South**

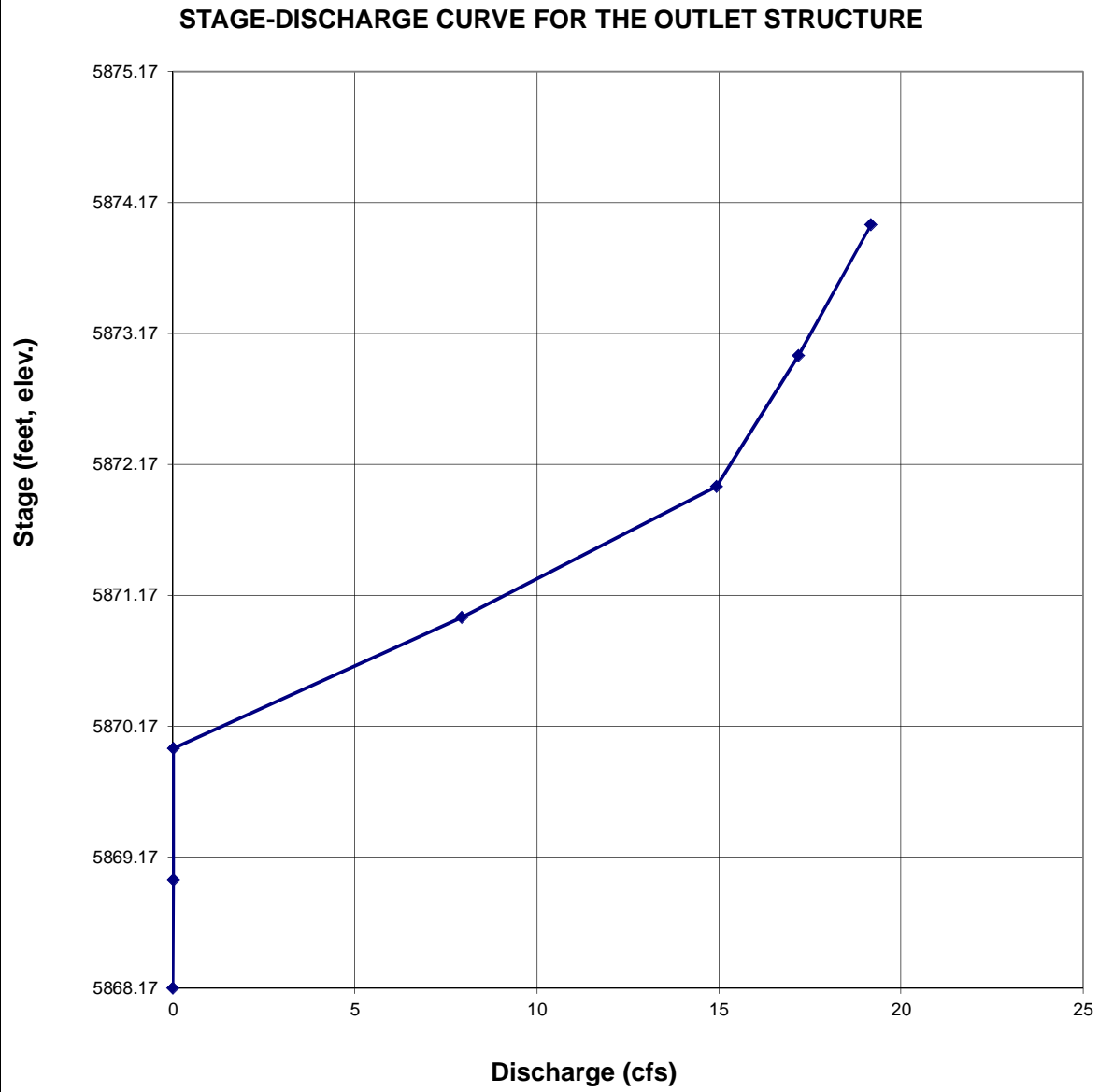
Basin ID: **Belford Ave Water Quality Pond - West**

STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE



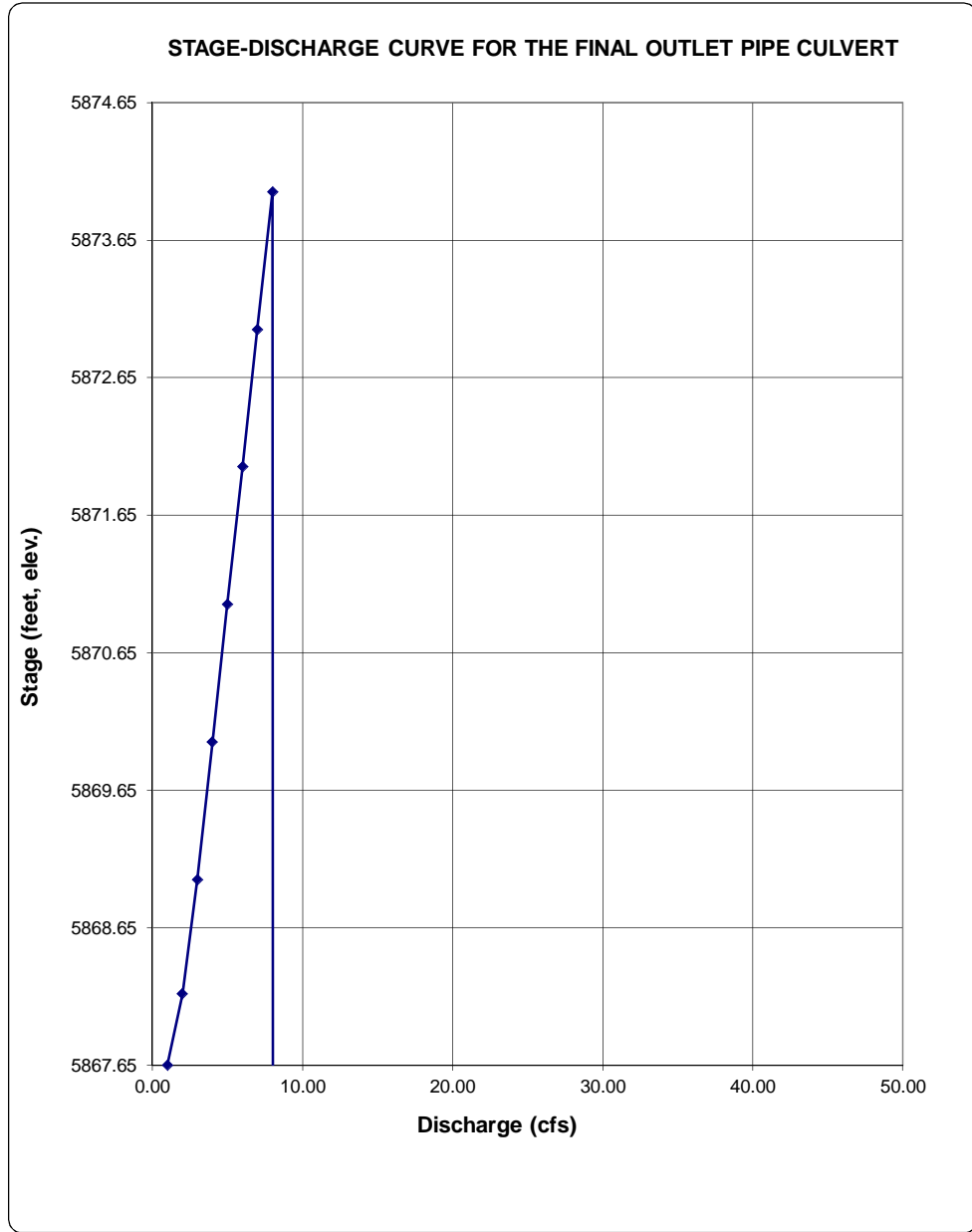
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Compark South
Basin ID: Belford Ave Water Quality Pond - West



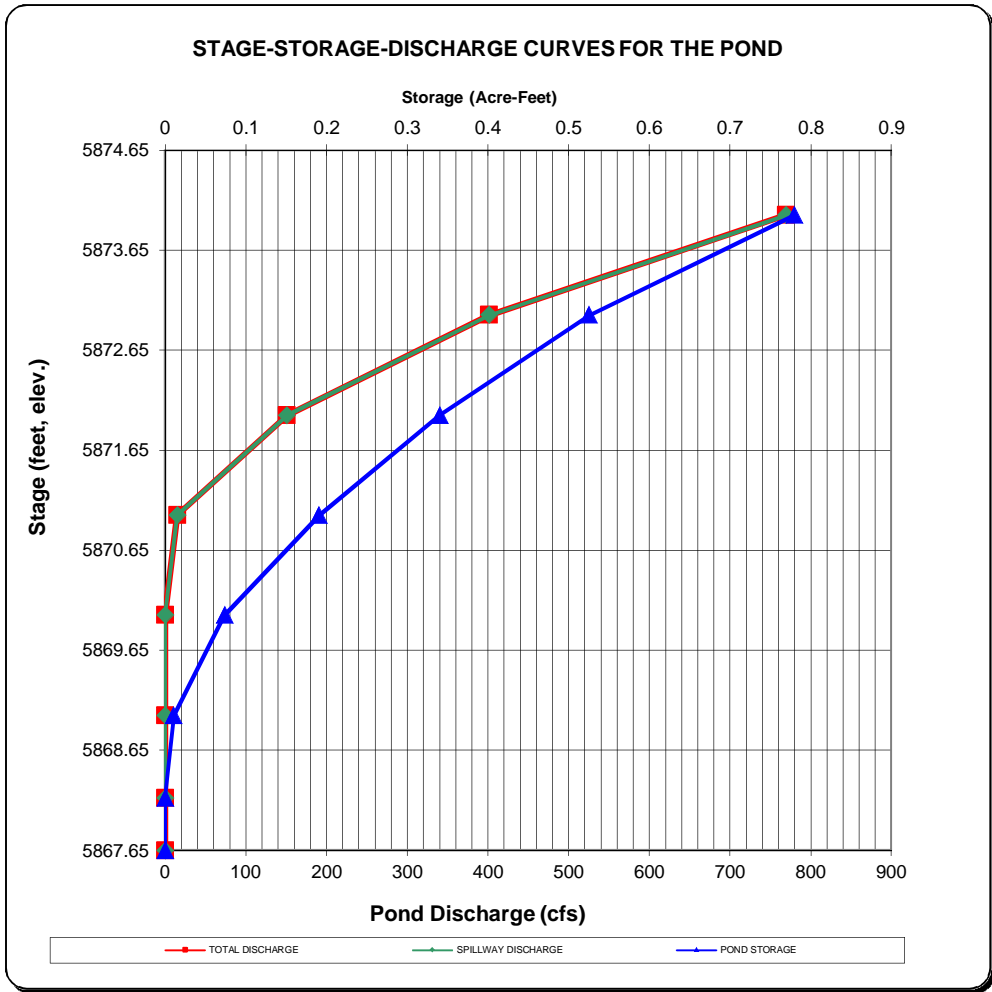
STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Compark South
Basin ID: Belford Ave Water Quality Pond - West



STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: **Compark South**
 Basin ID: **Belford Ave Water Quality Pond - West**



DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Compark South
Basin ID: Belford Ave Water Quality Pond - East

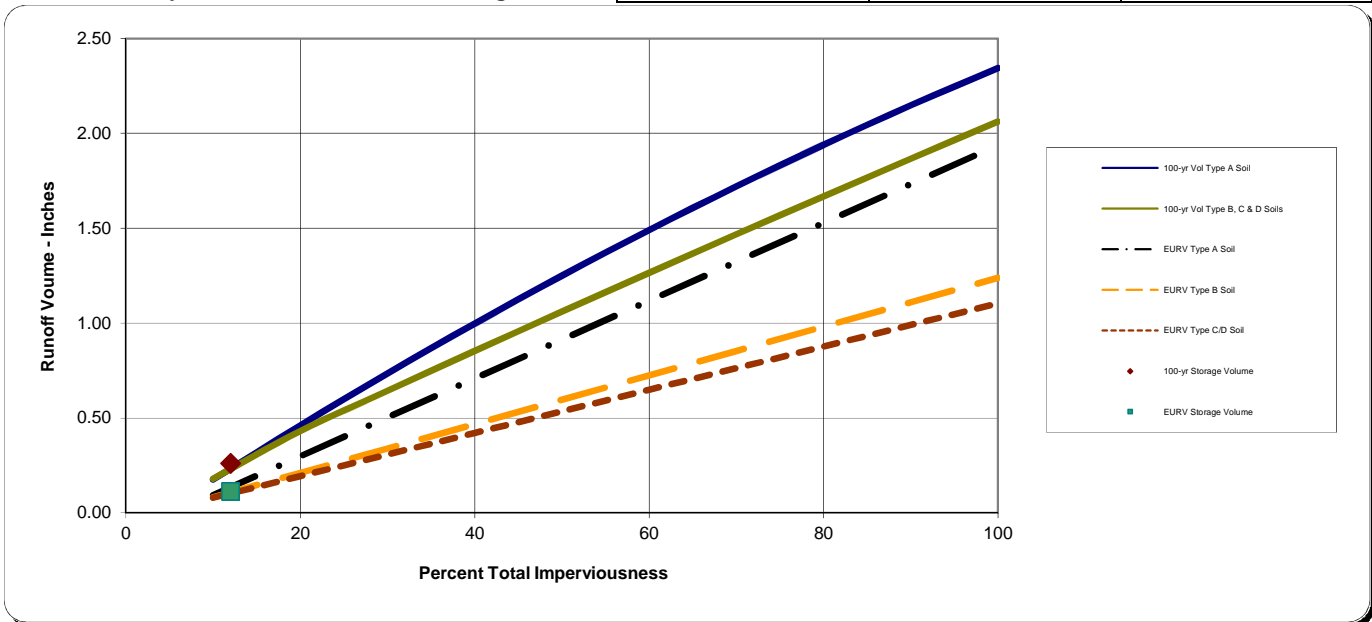
* User input data shown in blue.

Area of Watershed (acres)	24.00	
Subwatershed Imperviousness	12.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0 ▼
Effective Imperviousness ¹	12.0%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B		0.0
Type C or D	100.0%	24.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
3	0.5	0.0018
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.11	0.23	Design Outlet to Empty EURV in 72 Hours
0.26	0.52	24.00

Excess Urban Runoff Volume⁴

100-year Detention Volume Including WQCV⁵

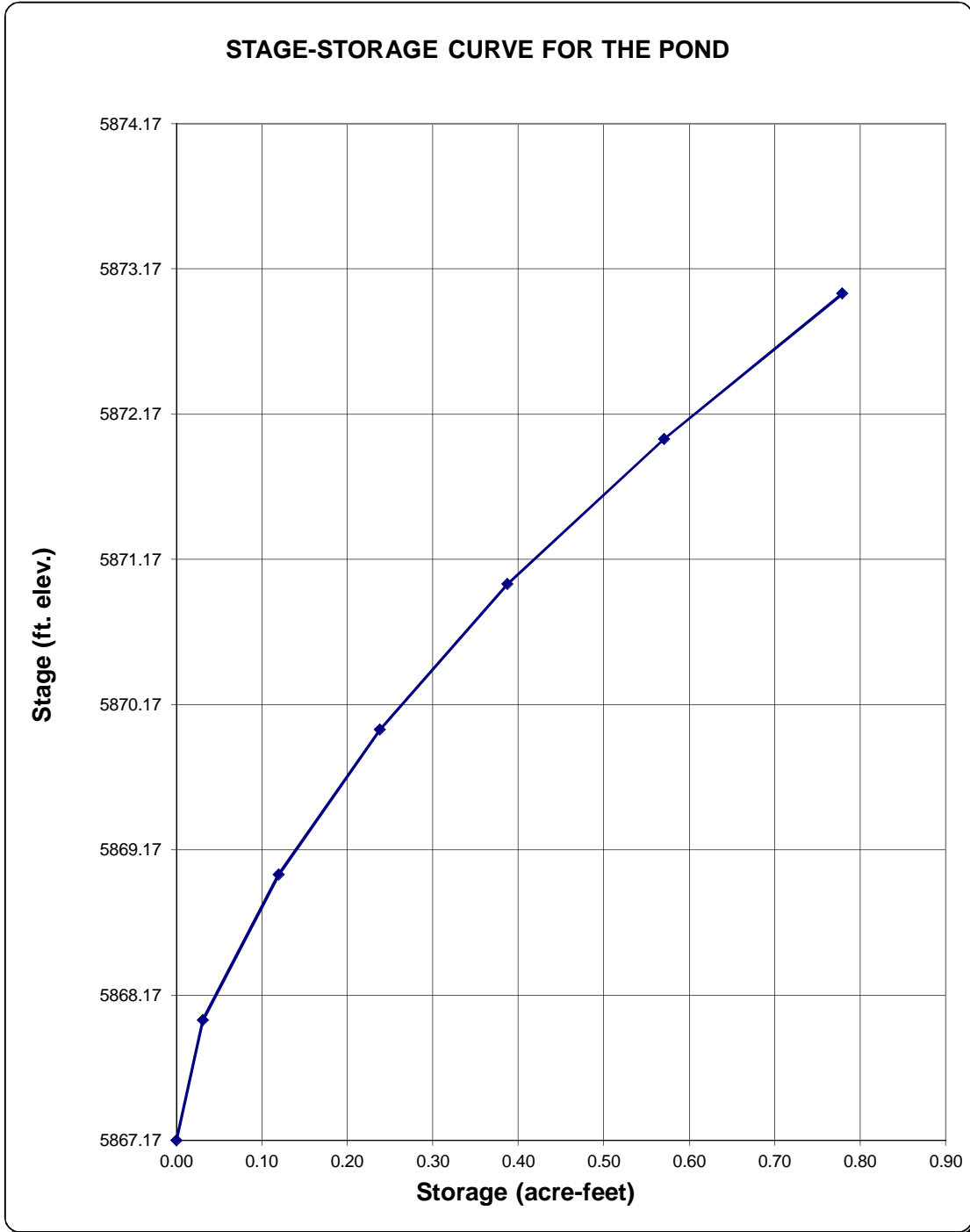


Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
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- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____
Basin ID: _____



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: **Compark South**
 Basin ID: **Belford Ave Water Quality Pond - East**

WQCV Design Volume (Input):

Catchment Imperviousness, I_p = 24.0 percent
 Catchment Area, A = 12.00 acres
 Depth at WQCV outlet above lowest perforation, H = 1 feet
 Vertical distance between rows, h = 4.00 inches
 Number of rows, NL = 3.00
 Orifice discharge coefficient, C_d = 0.60
 Slope of Basin Trickle Channel, S = 0.005 ft / ft
 Time to Drain the Pond = 72 hours

Diameter of holes, D = 0.781 inches
 Number of holes per row, N = 1
 OR

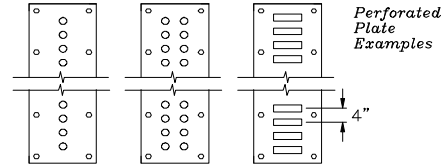
Height of slot, H = inches
 Width of slot, W = inches

Watershed Design Information (Input):

Percent Soil Type A = %
 Percent Soil Type B = %
 Percent Soil Type C/D = 100 %

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') = 0.113 watershed inches
 = N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') = **0.226** acre-feet
 Outlet area per row, A_o = 0.48 square inches
 Total opening area at each row based on user-input above, A_o = 0.48 square inches
 Total opening area at each row based on user-input above, A_o = 0.003 square feet



3

Central Elevations of Rows of Holes in feet																							Σ Flow		
Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23			
5868.00	5868.33	5868.67																							
Collection Capacity for Each Row of Holes in cfs																									
5868.00	0.0000	0.0000	0.0000																					0.00	
5869.00	0.0160	0.0131	0.0092																						0.04
5870.00	0.0227	0.0207	0.0185																						0.06
5871.00	0.0277	0.0262	0.0245																						0.08
5872.00	0.0320	0.0307	0.0292																						0.09
5873.00	0.0358	0.0346	0.0333																						0.10
5874.00	0.0392	0.0381	0.0370																						0.11
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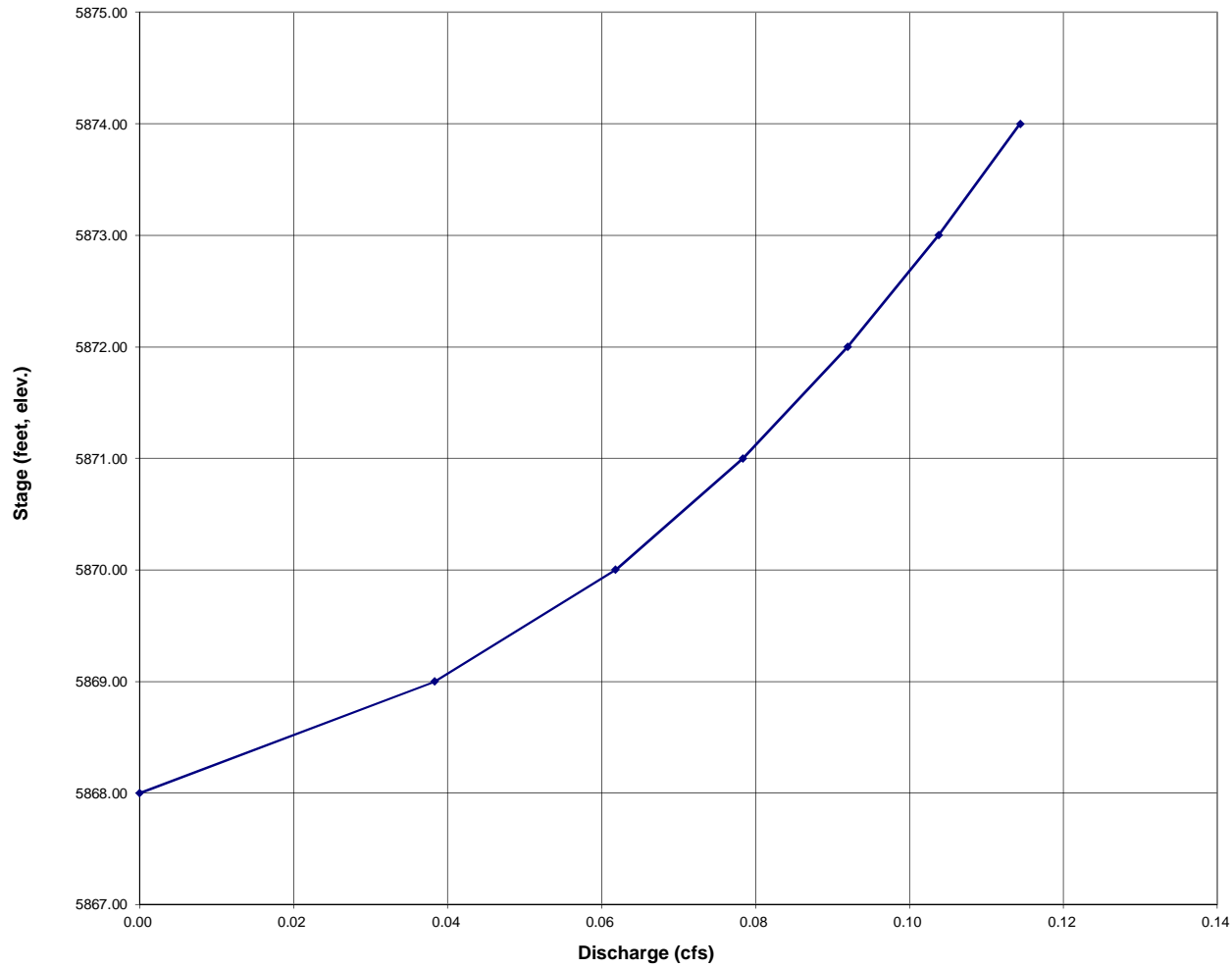
STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: **Compark South**

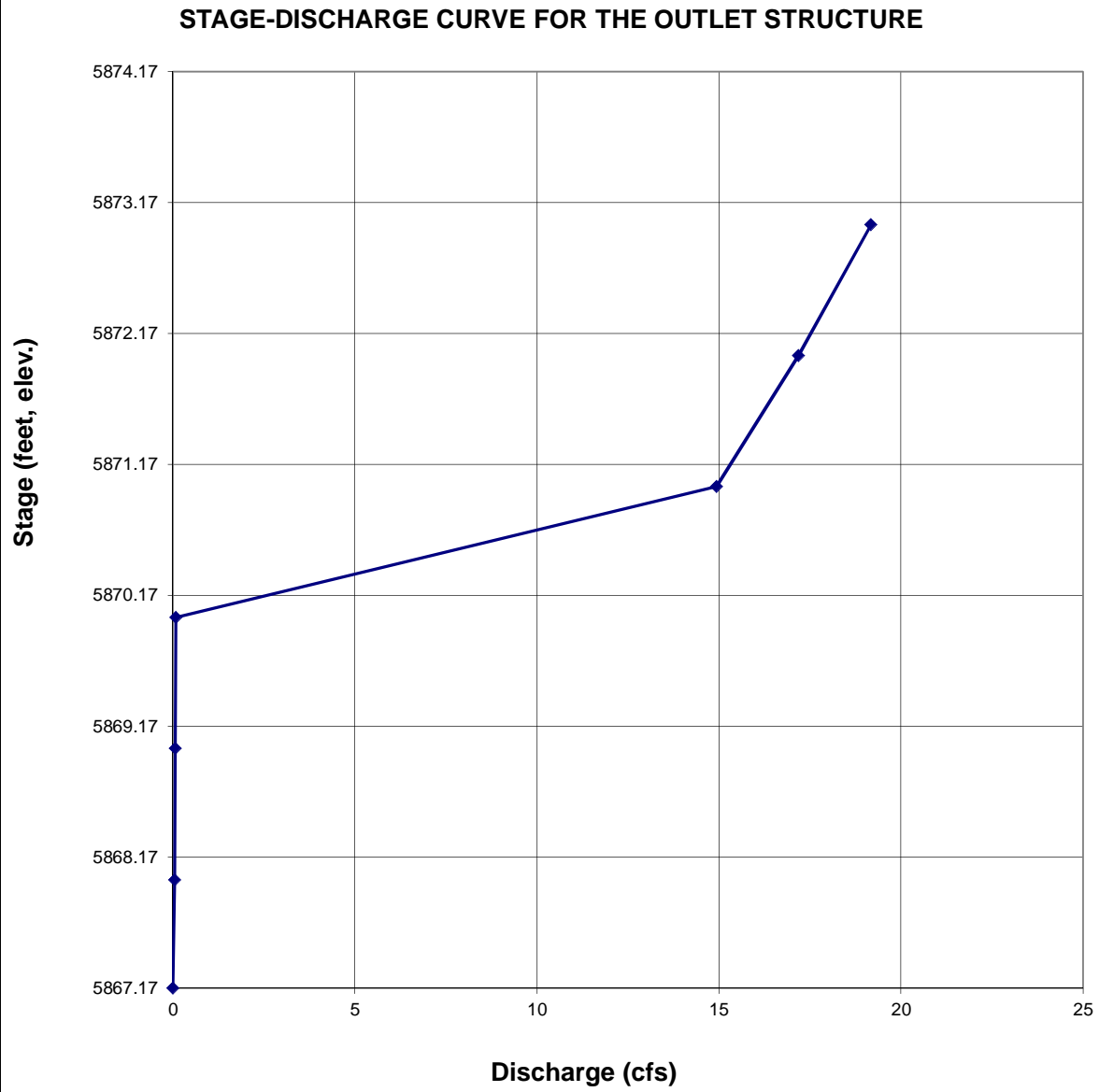
Basin ID: **Belford Ave Water Quality Pond - East**

STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE



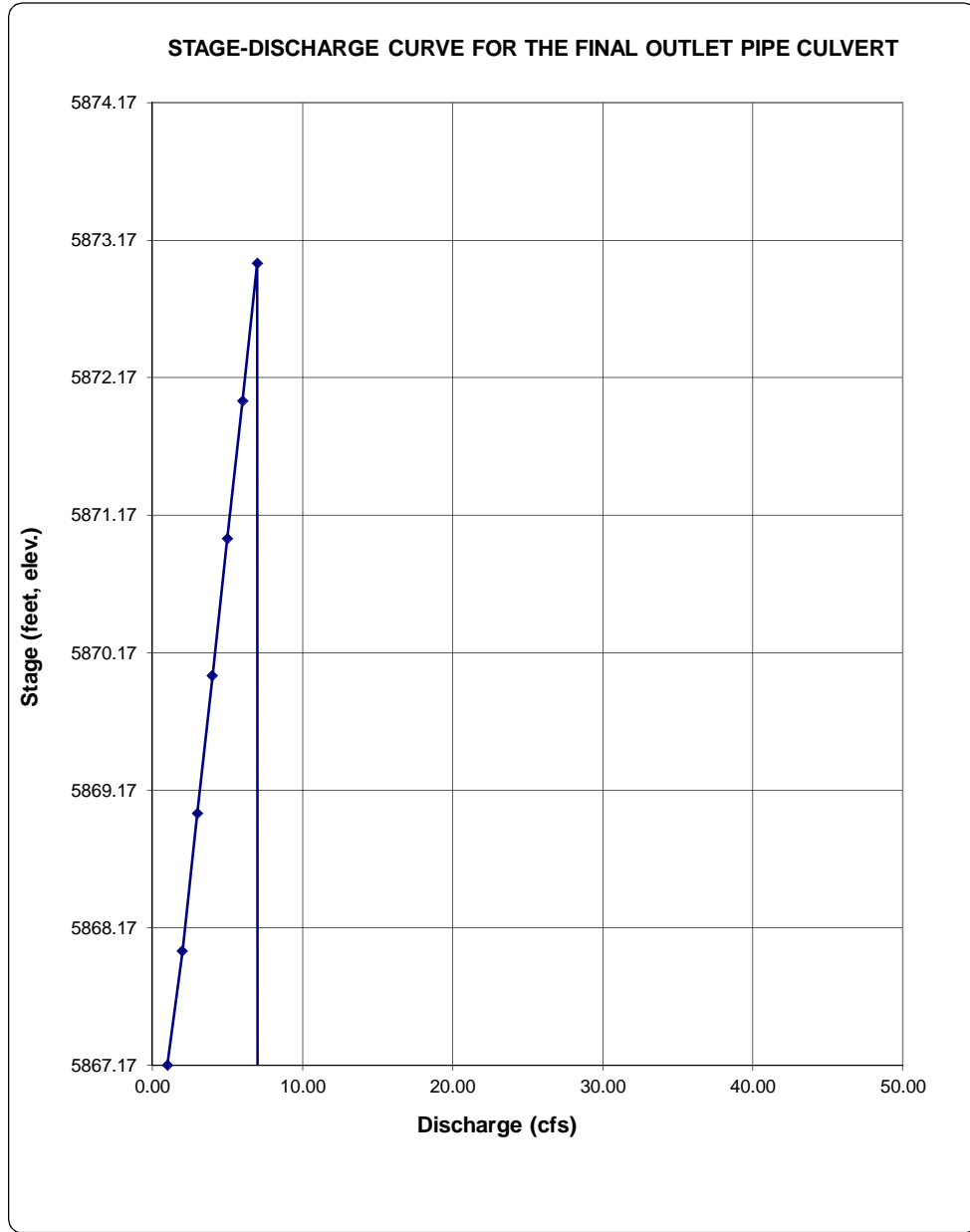
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Compark South
Basin ID: Belford Ave Water Quality Pond - East



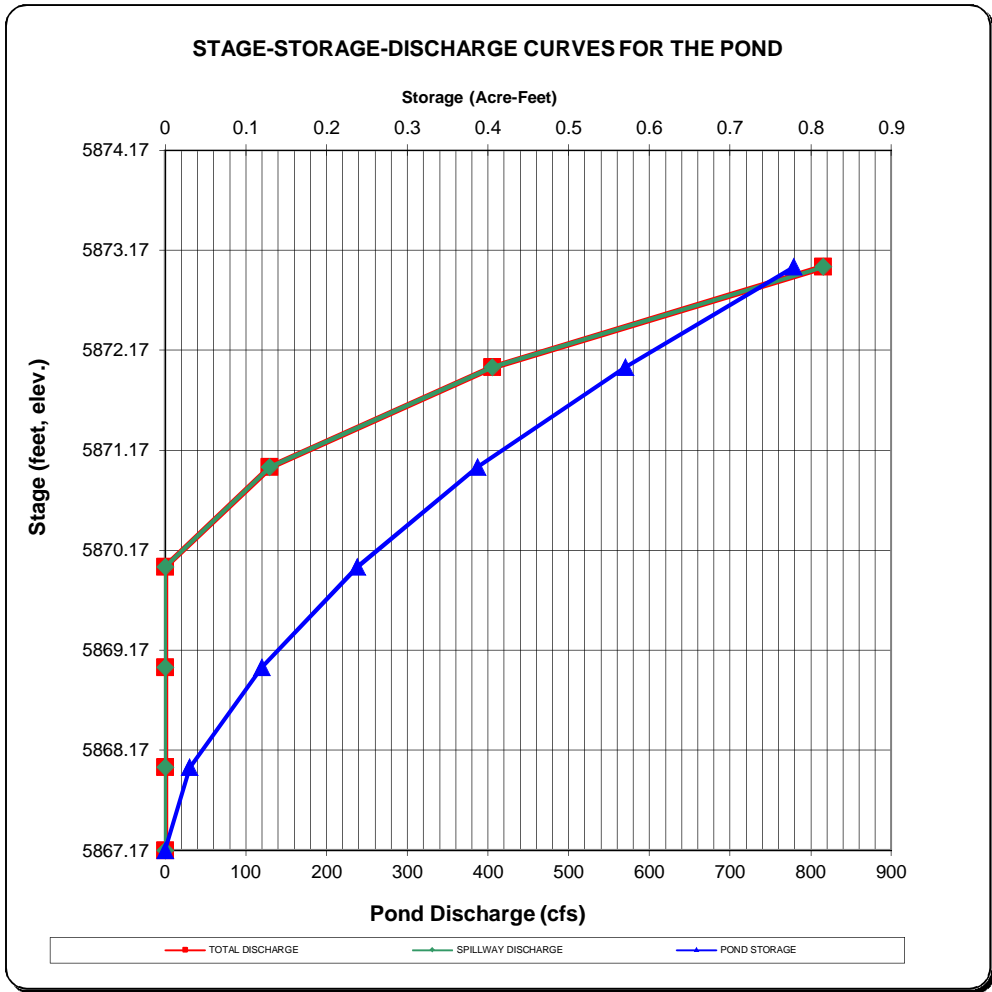
STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Compark South
Basin ID: Belford Ave Water Quality Pond - East



STAGE-DISCHARGE SIZING OF THE SPILLWAY

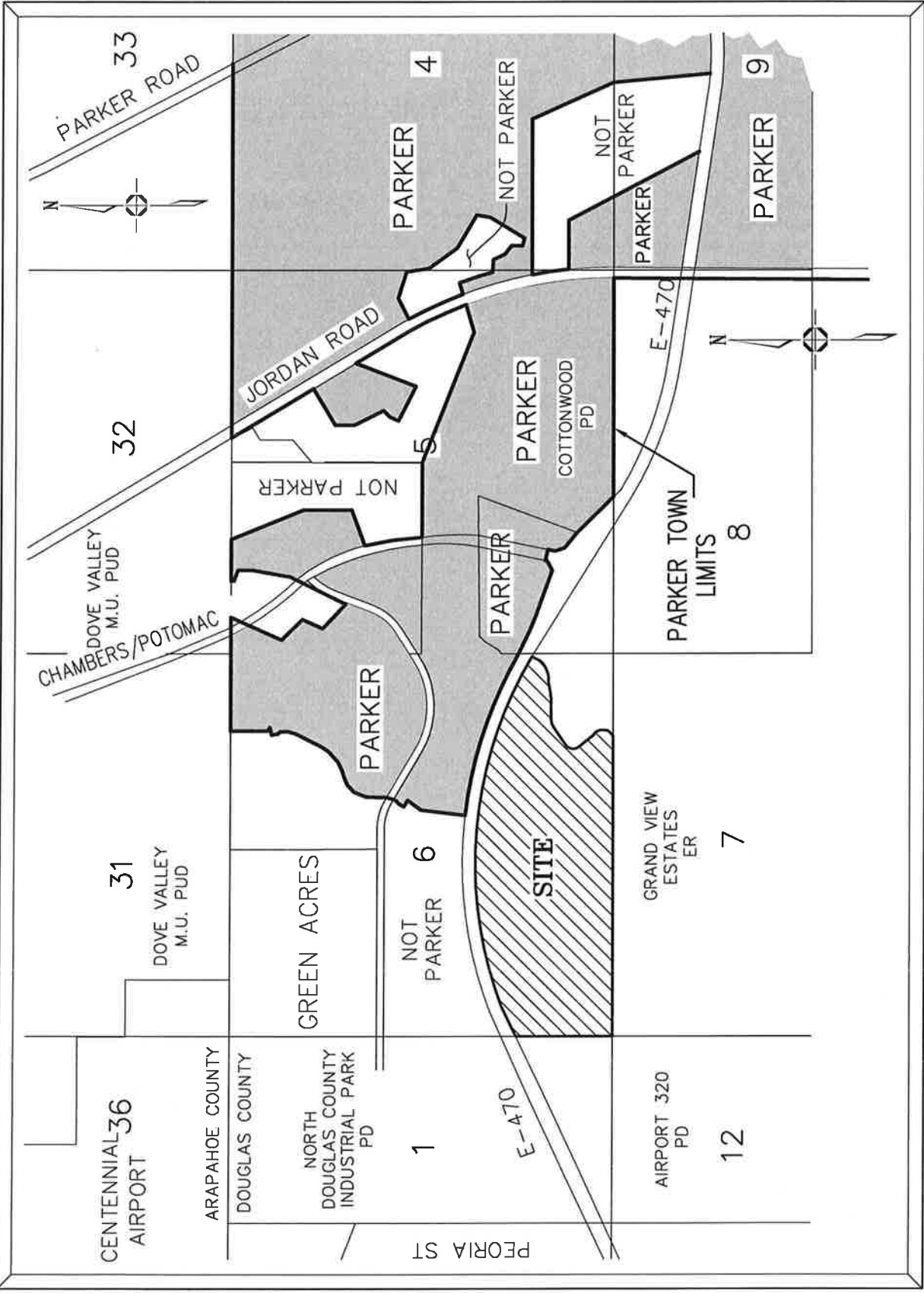
Project: **Compark South**
 Basin ID: **Belford Ave Water Quality Pond - East**



MAPS

**Vicinity Map
Overall Basin Drainage Plan**

Initially Submitted November 20, 2015
Revised April 11, 2016



VICINITY MAP

N.T.S.

