Conceptual Drainage Report

Compark South
Parker, Colorado

P.N. CLCPKC3

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

Prepared By:

Manhard CONSULTING

8008 E Arapahoe Ct, Suite 110
Centennial, Colorado 80112
Contact: Russell L. Burrows, P.E.
303-708-0500

Initially Submitted November 20, 2015

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:

____

Amie S. Drucker, P.E.
Registered Professional Engineer
State of Colorado No. 49038

Reviewed by:

____

Russell L. Burrows, P.E.
Registered Professional Engineer
State of Colorado No. 14662

Initially Submitted November 20, 2015

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I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This drainage report is part of the Compark 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 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. 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 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.

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 study:

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 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. 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, H170and 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.

<u>Basin A (H100, H110, H115, H120 & H130)</u>

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 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 (10-ft by 12-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 Road within Arapahoe County. Note: The Arapahoe County portion of Green Acres Tributary is an unimproved channel segment.

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 exists along Happy Canyon Creek. It is anticipated that bank stabilization will be required along 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.

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 a 10-ft. x 12-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 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 likely be required to map the final floodplain through the site and mitigate the existing Zone A floodplain. A LOMR would 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 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 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

No variances from Town of Parker criteria are anticipated.

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 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.

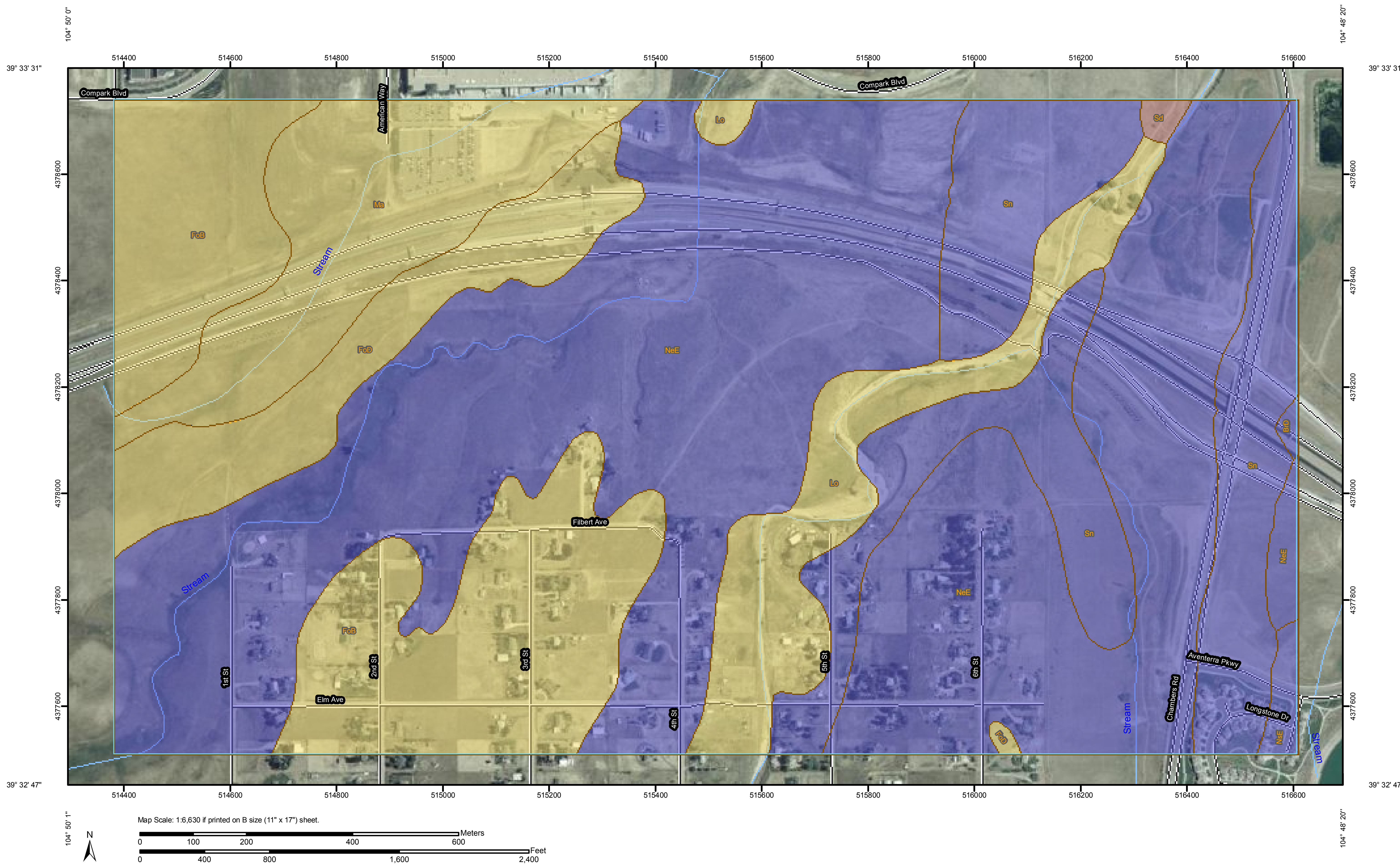
VII. REFERENCES

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

Initially Submitted November 20, 2015


104° 50' 0"
104° 48' 20"
39° 33' 31"
39° 32' 47"
104° 50' 1"
514400
514600
514800
515000
515200
515400
515600
515800
516000
516200
516400
516600
4378600
4378400
4378200
4378000
4377800
4377600
Compark Blvd
American Way
FoB
Ma
Stream
FoD
NeE
Lo
Sd
Sn
BrD
Filbert Ave
Elm Ave
1st St
2nd St
3rd St
4th St
5th St
6th St
Aventerra Pkwy
Chambers Rd
Longstone Dr
Map Scale: 1:6,630 if printed on B size (11" x 17") sheet.
N
Meters
0
100
200
400
600
Feet
0
400
800
1,600
2,400

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

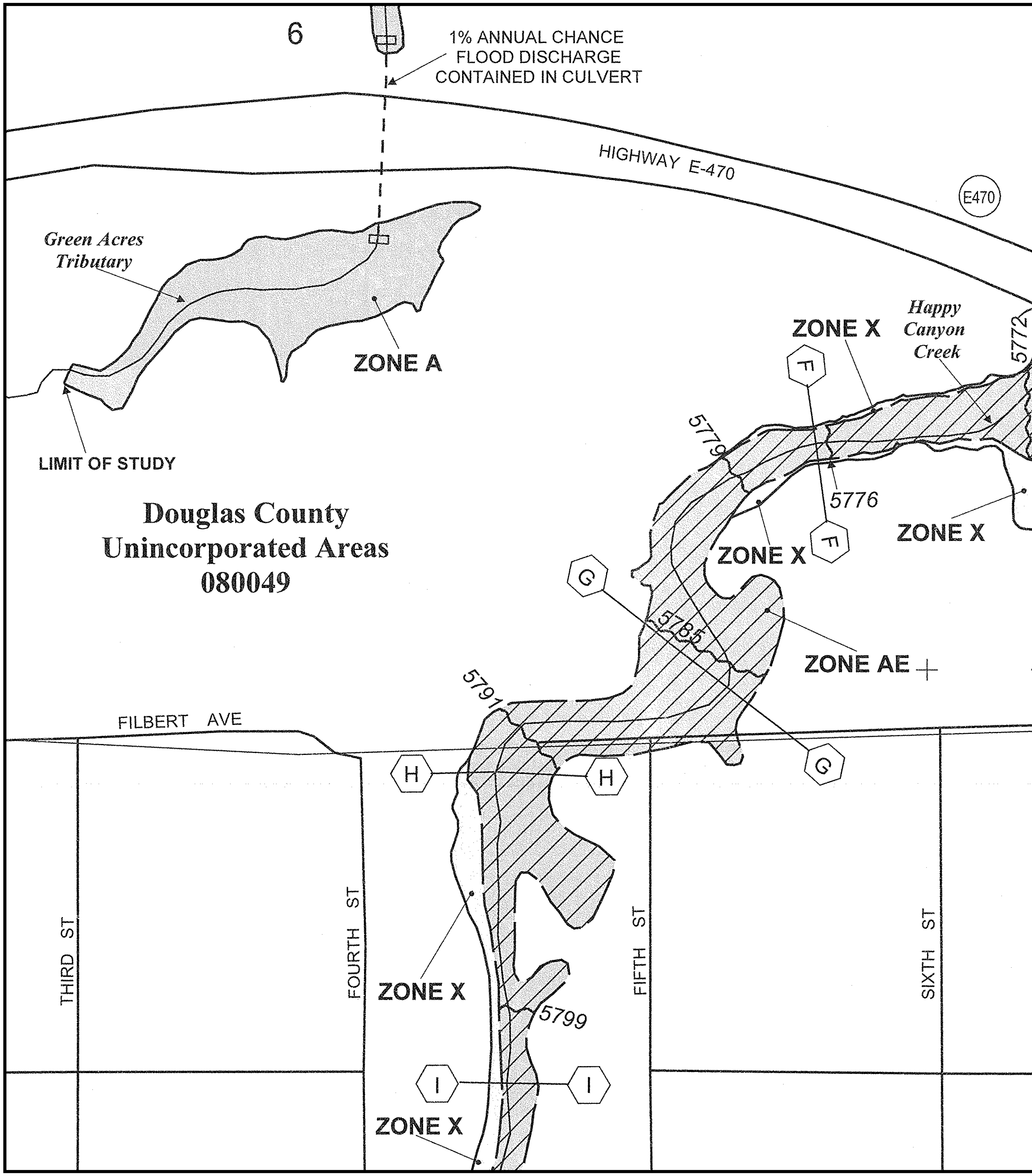
Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX B

FEMA FIRM Maps



MAP SCALE 1" = 500'

500 1000 FEET

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

Initially Submitted November 20, 2015

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.nwp.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,

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
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
	PROFFERED PERMIT (Standard Permit or Letter of permission)		B
	PERMIT DENIAL		C
X	APPROVED JURISDICTIONAL DETERMINATION		D
	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

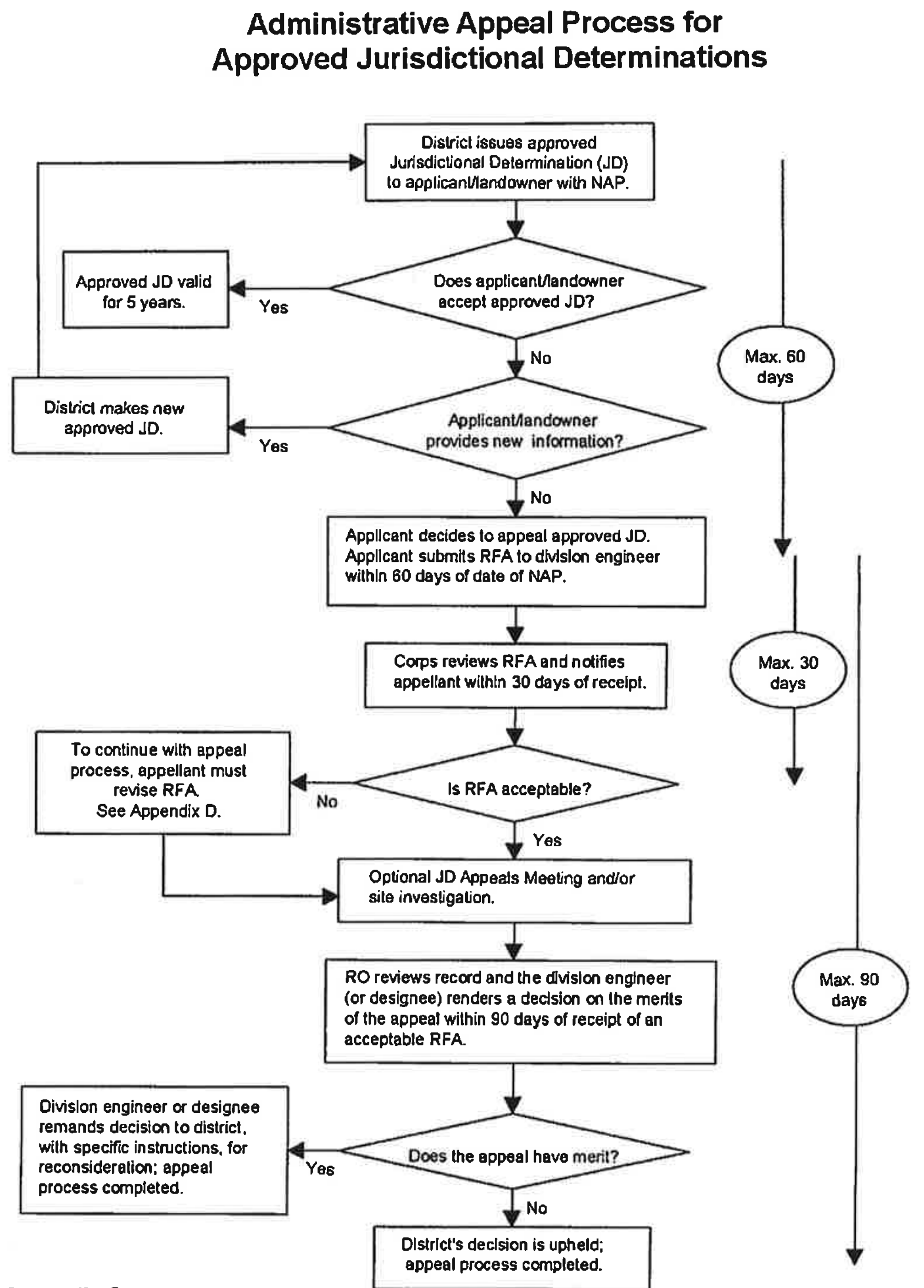
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

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:	If you only have questions regarding the appeal process you may also contact:
Timothy T. Carey Chief, Denver Regulatory Office 9307 South Wadsworth Boulevard Littleton, CO 80128 (303) 979-4120	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
District issues approved Jurisdictional Determination (JD) to applicant/landowner with NAP.
Does applicant/landowner accept approved JD?
Yes
Approved JD valid for 5 years.
No
Applicant/landowner provides new information?
Yes
District makes new approved JD.
No
Applicant decides to appeal approved JD. Applicant submits RFA to division engineer within 60 days of date of NAP.
Corps reviews RFA and notifies appellant within 30 days of receipt.
Is RFA acceptable?
No
To continue with appeal process, appellant must revise RFA. See Appendix D.
Yes
Optional JD Appeals Meeting and/or site investigation.
RO reviews record and the division engineer (or designee) renders a decision on the merits of the appeal within 90 days of receipt of an acceptable RFA.
Does the appeal have merit?
Yes
Division engineer or designee remands decision to district, with specific instructions, for reconsideration; appeal process completed.
No
District's decision is upheld; appeal process completed.
Max. 60 days
Max. 30 days
Max. 90 days

Appendix C

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 waters[2] (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 porus, which allows most normal flows to dissapate 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.

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[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 waterbody[4] 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 TNW[5]: 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 porus, which allows most normal flows to dissapate 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):

- ☐ Silts
- ☒ Sands
- ☐ Concrete
- ☐ Cobbles
- ☐ Gravel
- ☐ Muck
- ☐ Bedrock
- ☐ Vegetation. Type/% cover:
- ☐ 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 porus, which allows most normal flows to dissapate 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 porus, which allows most normal flows to dissapate 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
- ☐ Bed and banks
- ☐ OHWM[6] (check all indicators that apply):
  - ☐ clear, natural line impressed on the bank
  - ☐ changes in the character of soil
  - ☐ shelving
  - ☐ vegetation matted down, bent, or absent
  - ☐ leaf litter disturbed or washed away
  - ☐ sediment deposition
  - ☐ water staining
  - ☒ other (list): wetland only
  - ☐ the presence of litter and debris
  - ☐ destruction of terrestrial vegetation
  - ☐ the presence of wrack line
  - ☐ sediment sorting
  - ☐ scour
  - ☐ multiple observed or predicted flow events
  - ☐ abrupt change in plant community
- ☐ Discontinuous OHWM.[7] Explain:.

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):
- ☐ High Tide Line indicated by:
  - ☐ oil or scum line along shore objects
  - ☐ fine shell or debris deposits (foreshore)
  - ☐ physical markings/characteristics
  - ☐ tidal gauges
  - ☐ other (list):
- ☐ Mean High Water Mark indicated by:
  - ☐ survey to available datum;
  - ☐ physical markings;
  - ☐ vegetation lines/changes in vegetation types.

(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 porus, which allows most normal flows to dissapate 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: .

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[6]A 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.
[7]Ibid.

☒ 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 porus, which allows most normal flows to dissapate 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 porus, which allows most normal flows to dissapate 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 porus, which allows most normal flows to dissapate 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:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)
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 *Rapanos* 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 porus, which allows most normal flows to dissapate 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 OHWM 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 Jordon 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 draiange 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 <u>solely</u> 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 <u>sole</u> 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.

<u>SECTION IV: DATA SOURCES.</u>

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 NHD 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 Geodectic 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): .

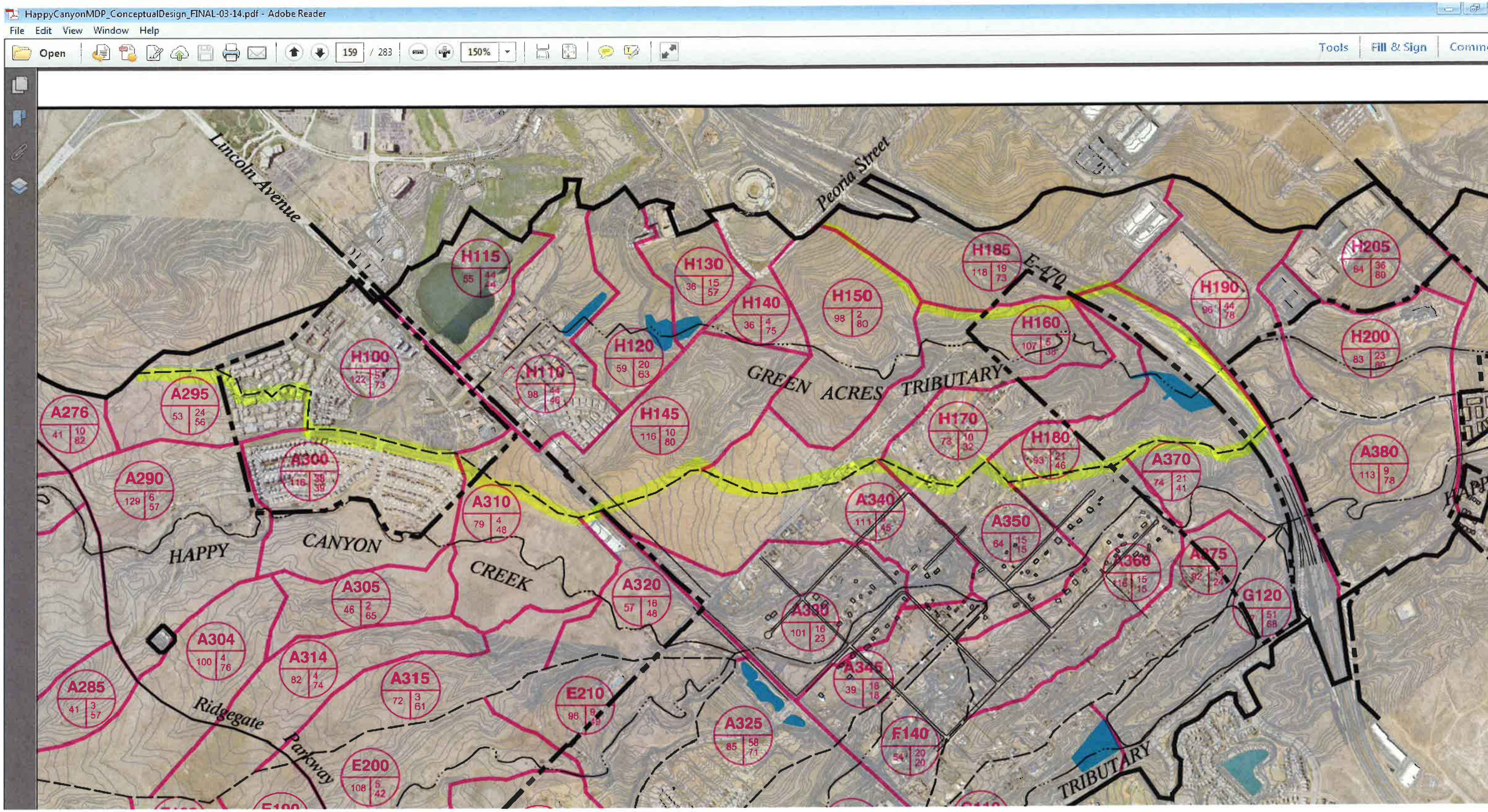
Project area map


E Broncos Pkwy
S Potomac St
S Chambers Rd
S Jordan Rd
County Line Rd
3500' of upland
Happy Canyon Creek
Upland swale with wetland inclusions
435' of upland
Project Area
©2012 Google


American Way
Exchange
E-470 (Toll road)
E-470 (Toll road)
E-470 (Toll road)
Cherokee Trail
Cherokee Trail
Cherokee Trail
Cherokee Trail

APPENDIX D

Excerpts from Happy Canyon Major Drainageways Plan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File Edit View Window Help
Open
159 / 283
150%
Tools
Fill & Sign
Commen
Lincoln Avenue
Peoria Street
E-470
GREEN ACRES TRIBUTARY
HAPPY
CANYON
CREEK
Ridgegate
Parkway
TRIBUTARY
H115
H130
H140
H150
H185
H190
H205
H160
H200
H120
H100
H110
H145
H170
H180
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A295
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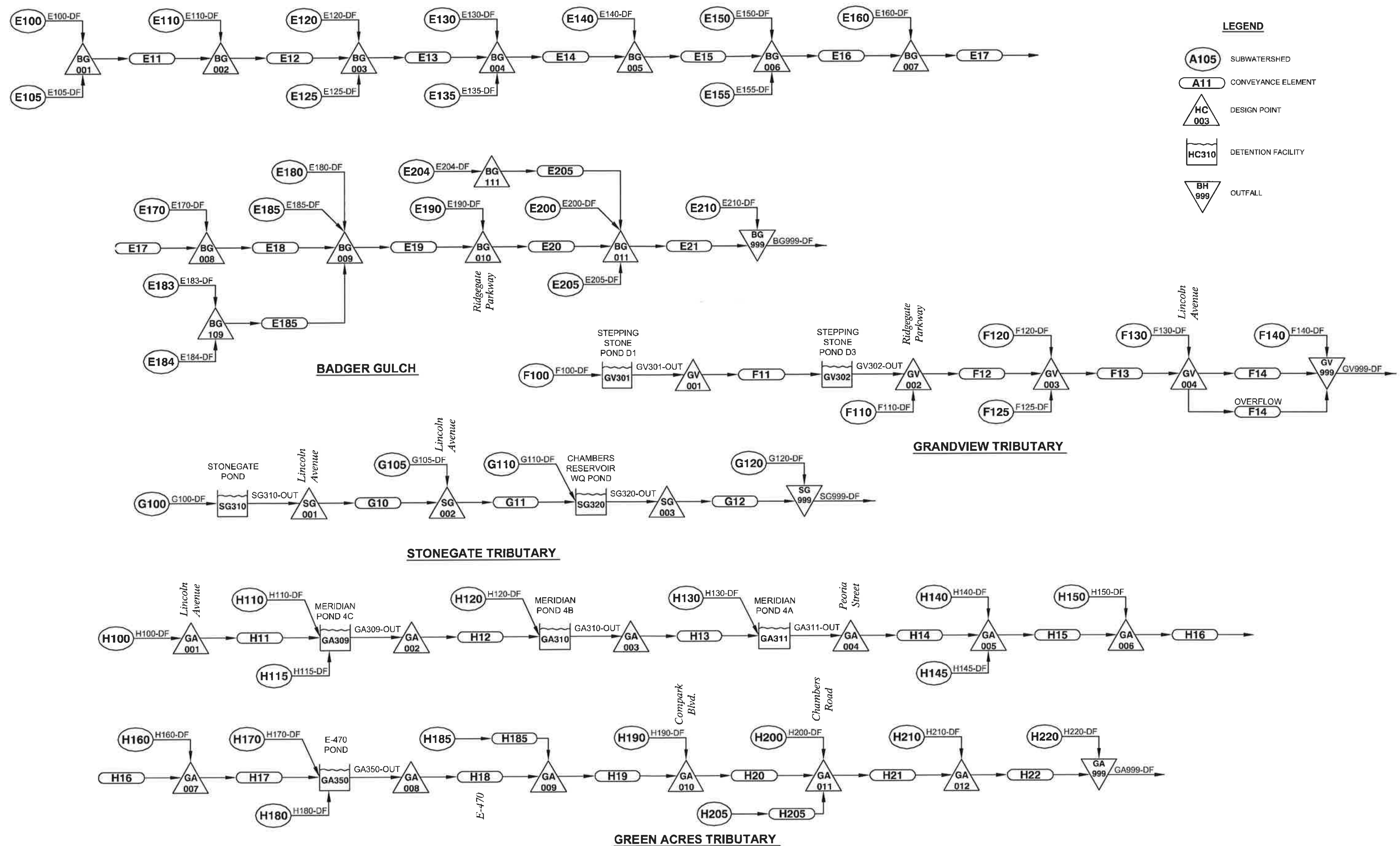


No.	DATE	REVISIONS	APPR.

MULLER

MULLER ENGINEERING CO., INC.
CONSULTING ENGINEERS
777 SOUTH WADSWORTH BLVD. 4-100
LAKEWOOD, COLORADO
80226 (303) 988-4939
PROJECT NO. 12-010.01

DESIGN MDC
DRAWN JHK
CHECK JTW

Parker COLORADO

Southeast Metro Stormwater Authority

HAPPY CANYON CREEK MAJOR DRAINAGEWAY PLAN

SWMM SCHEMATIC
LOWER TRIBUTARIES

DATE JULY 2013
FIGURE NO. B-5

Subwatershed ID	Area (acres)	Area (sq mi)	Dist to Centroid (ft)	Dist to Centroid (mi)	Length (ft)	Length (mi)	Length-Weighted Slope (ft/ft)	Weighted % Impervious Existing (%)	Weighted % Impervious Future (%)	Depression Storage Pervious (watershed in)	Depression Storage Impervious (watershed in)	Infiltration Initial Rate (in/hr)	Infiltration Decay Coeff. (1/second)	Infiltration Final Rate (in/hr)	Corresponding Basin IDs - 1993 OSP
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			Outlet Curve	
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Chambers Reservoir WQ Pond (SWMM element SG320)				
5837.2	0	0	0.0	0
5838	0.8	334	0.8	0.4
5840	2.8	47285	2.8	2.2
5840.3	3.1	51599	3.1	2.5
5842	4.8	88359	4.8	3.7
5844	6.8	110216	6.8	64.7
5846	8.8	124039	8.8	75.1
5848	10.8	137906	10.8	2671
5849	11.8	145138	11.8	4890
Stonegate Pond (SWMM element SG310)				
5886.3	0	260	0.0	0.00
5887	1	4340	0.7	0.13
5888	2	9086	1.7	0.40
5889	3	24864	2.7	0.75
5890	4	52193	3.7	1.18
5891	5	77199	4.7	1.66
5892	5.7	94517	5.7	2.20
5893	6.7	105201	6.7	7.05
5894	7.7	112546	7.7	32.5
5895	8.7	120451	8.7	41.8
5896	9.7	127914	9.7	43.9
5897	10.7	135421	10.7	45.8
5898	11.7	147109	11.7	47.7
5899	12.7	160614	12.7	49.5
E-470 Pond (SWMM element GA350)				
5782	0	200	0	103
5784	2	21000	2	291
5786	4	58900	4	531
5788	6	115100	6	813
5790	8	192300	8	1134
5792	10	269600	10	1467

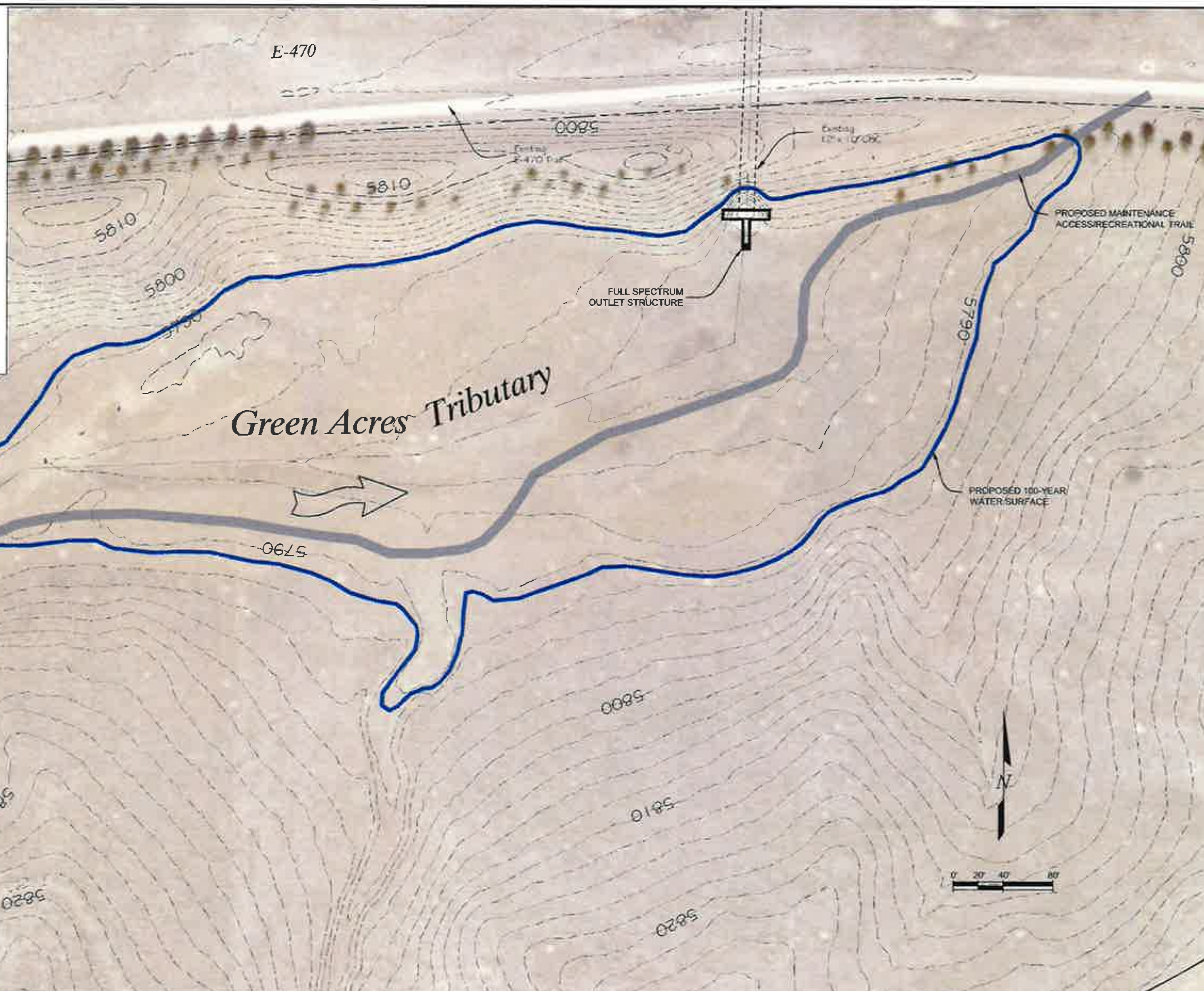
Storage Curve			Outlet Curve	
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Meridian Pond 4A (SWMM element GA311)				
5888.5	0	11333	0.0	0.0
5889	0.5	15901	0.5	0.0
5890	1.5	34312	1.5	0.11
5891	2.5	52329	2.5	0.51
5892	3.5	64920	3.5	1.06
5893	4.5	70257	4.5	1.73
5894	5.5	75559	5.5	58.1
5895	6.5	79701	6.5	219
5896	7.5	83843	7.5	290
5897	8.5	87985	8.5	337
Meridian Pond 4B (SWMM element GA310)				
5891.5	0	0	0.0	0.0
5892	0.5	348	0.5	3.26
5893	1.5	5730	1.5	16.9
5894	2.5	24126	2.5	36.5
5895	3.5	53961	3.5	60.4
5896	4.5	92234	4.5	75.7
5897	5.5	126509	5.5	118
5898	6.5	146888	6.5	147
5899	7.5	153323	7.5	161
5900	8.5	159889	8.5	173
5901	9.5	166733	9.5	185
5902	10.5	173678	10.5	197
5903	11.5	180632	11.5	207
5904	12.5	187664	12.5	217
5905	13.5	194696	13.5	452
5906	14.5	201728	14.5	677
Meridian Pond 4C (SWMM element GA309)				
5917	0	10	0	0.00
5918	1	2120	1	9.22
5919	2	15960	2	26.1
5920	3	33760	3	55.3
5921	4	42906	4	94.6
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

Storage Curve			Outlet Curve	
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Stepping Stone Pond D1 (SWMM element GV301)				
6007.5	0	10	0.0	0.0
6008	0.5	2672	0.5	1.3
6009	1.5	13483	1.5	13.20
6010	2.5	27296	2.5	30.90
6011	3.5	44579	3.5	52.20
6012	4.5	66756	4.5	71.20
6013	5.5	76808	5.5	86.4
6014	6.5	86899	6.5	99
6015	7.5	96990	7.5	151
6016	8.5	107081	8.5	484
Stepping Stone Pond D3 (SWMM element GV302)				
5973.5	0	76487	0.0	0.0
5974	0.5	114069	0.5	0.21
5975	1.5	122270	1.5	0.5
5976	2.5	131136	2.5	13.7
5977	3.5	138533	3.5	87.0
5978	4.5	147406	4.5	193.8
5979	5.5	157864	5.5	207
5980	6.5	167217	6.5	220
5981	7.5	176570	7.5	390
5982	8.5	185923	8.5	915
5983	9.5	195276	9.5	1677

					EXISTING DEVELOPMENT							FUTURE DEVELOPMENT						
SWMM Node	Station (ft)	Channel Reach	Landmark	Design Storm	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:

1. THIS DRAWING IS FOR MASTER PLANNING PURPOSES AND REPRESENTS PRELIMINARY AND CONCEPTUAL ENGINEERING. ALTERNATIVES TO THIS OUTFALL SYSTEM WILL BE CONSIDERED BY LOCAL AGENCIES AND 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 REQUIREMENTS OF THE LOCAL JURISDICTION AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT. 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.
2. 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 DAMAGESFROM LARGER FLOODS. THE RECOMMENDATIONS OF THIS PLAN PROVIDE A SET OF OPTIONS SUBSCRIBED TO BY CITIES, TOWNS AND COUNTIES IN CARRYING OUT THEIR FLOODPLAIN MANAGEMENT AND REGULATORY RESPONSIBILITIES AND OBLIGATIONS.
3. MANY ACTIVITIES THAT OCCUR IN OR AFFECT DITCHES, DRAINAGES, CREEKS, PONDS OR WETLANDS REQUIRE A SECTION 404 PERMIT AUTHORIZATION FROM THE US ARMY CORPS OF ENGINEERS. DURING PRELIMINARY DESIGN, AND PRIOR TO FINAL DESIGN OR STARTING WORK, CONTACT THE CORPS' DENVER REGULATORY OFFICE AT 303-979-4120 FOR APPROPRIATE PERMIT AUTHORITY TO AVOID COMPROMISING AND DELAYING THE COMPLETION OF THE PROJECT.



HYDRAULIC INFORMATION

	EXTENDED DETENTION	100-YR
VOL. A.F.	11	18
W.S. EL.	5789.5	5791
RELEASE RATE, CFS	25	533

MULLER ENGINEERING CO., INC.
CONSULTING ENGINEERS

DESIGN: MDC | DRAWN: SAR | CHECK: JTW

HAPPY CANYON CREEK
MAJOR DRAINAGEWAY PLAN

CONCEPTUAL DESIGN
E-470 POND PLAN

DATE: MARCH 2014
FIGURE NO. G-4

APPENDIX E

Basin Hydrology & SWMM Update

Initially Submitted November 20, 2015

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.

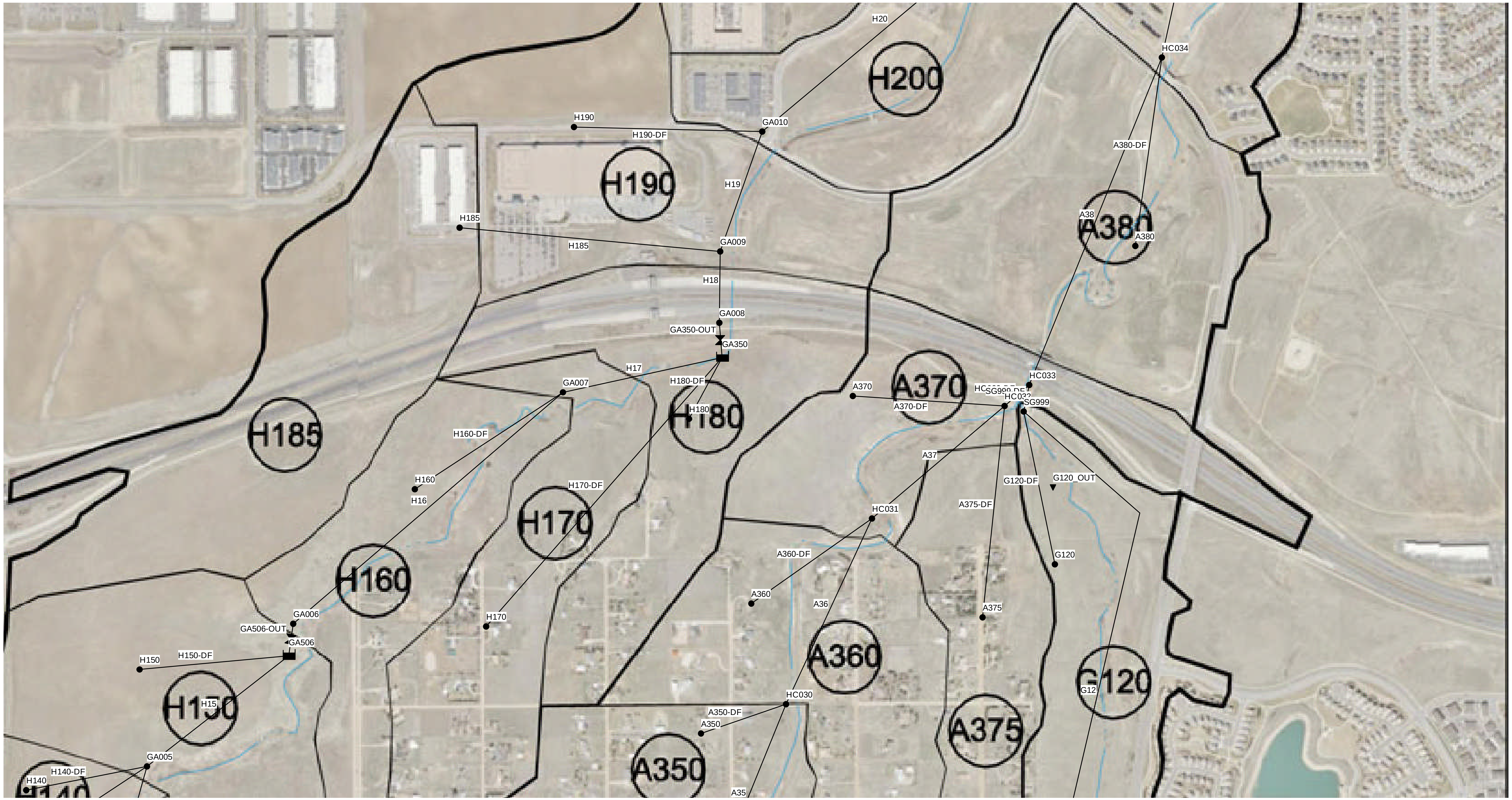
Given the details of the proposed development of Compark South, Manhard Consulting prepared a more detailed delineation of the sub-basin areas in this area. Some of the existing sub-basins included in the 2014 Happy Canyon MDP were also revised per more detailed information currently available. These 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

Manhard CONSULTING LTD

8008 E. Arapahoe Court, Suite 110, Centennial, CO 80112 ph:303.708.0500 fx:303.708.0400 manhard.com
Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
Construction Managers • Environmental Scientists • Landscape Architects • Planners

COMPARK SOUTH
TOWN OF PARKER, CO
SWMM Model Drainage Area Map

DRAWN BY	
REVISIONS	
DATE	

PROJ. MGR.: RLB
PROJ. ASSOC.: ###
DRAWN BY: RAK
DATE: 11-20-15

SHEET 1 OF 1
CLCPKC3

Plotted: 11/21/2015 10:16 AM Dwg Name: P:\Clcpkc3\ComSouth02-GreenAcresTrib\GAT Hydrology\Drainage Basins 11-20-15.dwg Updated By: adrucker

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	
	UDFCD Original MDP Model	UDFCD Original MDP Model with E-470 Pond Per MCL Topo	UDFCD Original MDP Model with E-470 Pond Per MCL Design	MCL Model with Original MDP Ponds and Channels	MCL Model with New MCL Designed E-470 Pond, Channels, and Storm Sewer
	Inflow (cfs)				
GA005	385.31	385.30	385.30	385.30	385.30
GA506 (Airport 320 Pond)	461.12	461.12	461.12	609.96	609.96
GA006 (Airport 320 Pond Outfall)	407.99	407.98	407.98	472.76	472.76
GA007	460.11	460.11	460.11	494.33	485.03
GA350 (E-470 Pond)	543.24	543.23	543.23	529.93	587.87
GA008 (E-470 Pond Outfall)	533.24	535.79	540.25	523.84	569.98
GA009	601.97	607.56	614.52	523.79	569.89
GA010	620.12	737.02	638.05	876.23*	872.57*

*Node GA010 observes a large increase in flow due to the fact that basin H183 runoff is now being routed straight to Node GA010. In the 2014 UDFCD MDP model, most of this basin was shown to be detained and restricted by the E-470 Pond. We believe this to be inaccurate.

APPENDIX F

Channel & Arch Culvert Hydraulic Design

Initially Submitted November 20, 2015

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

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00430	ft/ft
Discharge	250.00	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	2.99	ft
Elevation Range	0.00 to 5.20 ft	
Flow Area	72.72	ft²
Wetted Perimeter	52.99	ft
Hydraulic Radius	1.37	ft

GAT Channel 10' Bottom 10 ft Shelf 5 YR

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

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Discharge	250.00	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.00
0+00	2.56
0+03	2.50
0+03	0.00
0+13	0.00
0+13	2.50
0+16	2.80
0+26	3.00
0+29	3.06
0+29	11.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.00)	(0+03, 2.50)	0.020
(0+03, 2.50)	(0+26, 3.00)	0.013
(0+26, 3.00)	(0+29, 11.00)	0.020

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	2.29	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

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Discharge	725.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.00
0+00	2.56
0+03	2.50
0+03	0.00
0+13	0.00
0+13	2.50
0+16	2.80
0+26	3.00
0+29	3.06
0+29	11.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.00)	(0+03, 2.50)	0.020
(0+03, 2.50)	(0+26, 3.00)	0.013
(0+26, 3.00)	(0+29, 11.00)	0.020

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	4.21	ft

GAT Section through Arch Culvert - 100 year

Results

Elevation Range	0.00 to 11.00 ft		
Flow Area		68.35	ft²
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

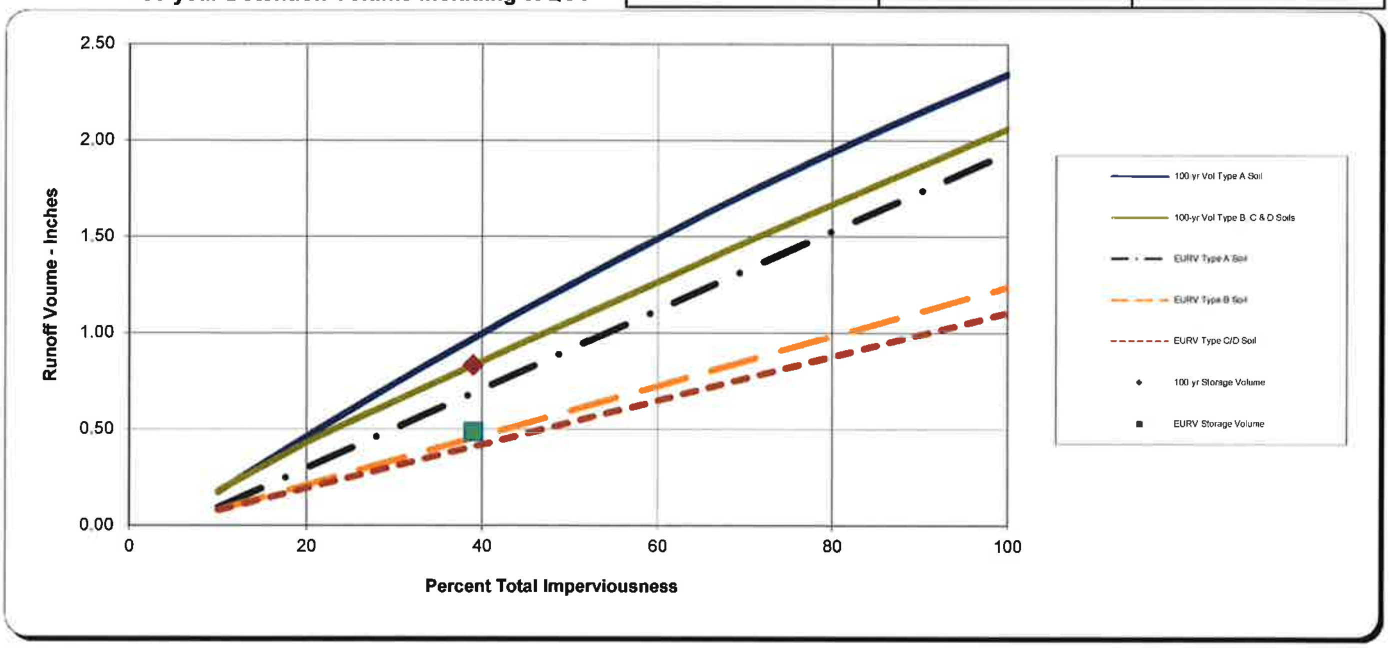
DETENTION VOLUME BY THE FULL SPECTRUM METHOD

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--fo**	
4.125	0.6	0.0018

	Detention Volumes[2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	**(acre-feet)**	
Excess Urban Runoff Volume[4]	0.49	11.10	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV[5]	0.83	18.93	242.29



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.

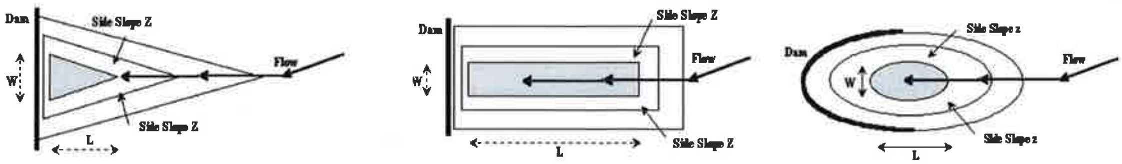
4) EURV approximates the difference between developed and pre-developed runoff volume.

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:



Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	11.10	18.93	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	5,788.00					114,957		2.639	0.000	
	5,789.00		0.00	0.00		127,960	121,459	2.938	2.788	
	5,790.00		0.00	0.00		134,911	252,894	3.097	5.806	
	5,791.00		0.00	0.00		142,080	391,390	3.262	8.985	EURV 11 Ac-ft
	5,792.00		0.00	0.00		149,170	537,015	3.424	12.328	El 5791.42
	5,793.00		0.00	0.00		156,002	689,601	3.581	15.831	100 yr 18 Ac-ft
	5,794.00		0.00	0.00		162,642	848,923	3.734	19.489	El 5793.00
	5,795.00		0.00	0.00		170,252	1,015,370	3.908	23.310	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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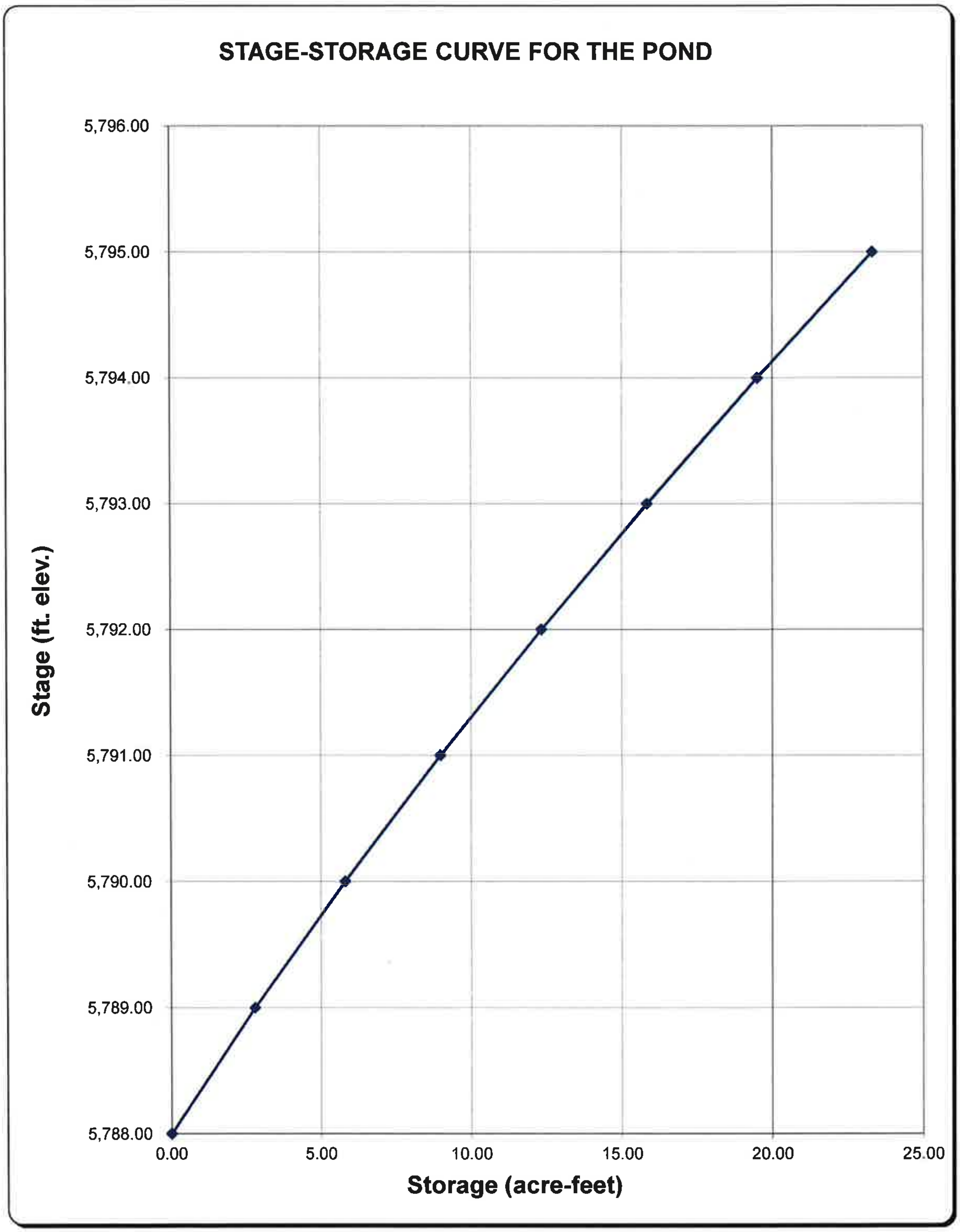
							#N/A		#N/A	
							#N/A		#N/A	

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project:
Basin ID:



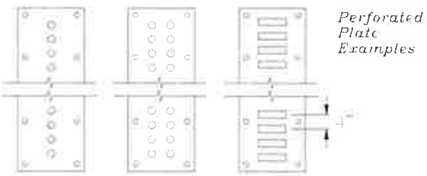
STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: **Compark South**

Basin ID: **Regional Detention Pond**

WQCV Design Volume (Input):

Catchment Imperviousness, I_a =	39.0	percent	Diameter of holes, D =		inches
Catchment Area, A =	273.00	acres	Number of holes per row, N =		
Depth at WQCV outlet above lowest perforation, H =	4	feet		**OR**	
Vertical distance between rows, h =	6.00	inches	Height of slot, H =	2.00	inches
Number of rows, NL =	7.00		Width of slot, W =	4.78	inches
Orifice discharge coefficient, C_o =	0.65				
Slope of Basin Trickle Channel, S =	0.010	ft / ft			
Time to Drain the Pond =	72	hours			



Watershed Design Information (Input):

Percent Soil Type A =	0	%
Percent Soil Type B =	75	%
Percent Soil Type C/D =	25	%

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	0.488	watershed inches
	N/A	
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	**11.103**	**acre-feet**
Outlet area per row, Ao =	9.57	square inches
Total opening area at each row based on user-input above, Ao =	9.57	square inches
Total opening area at each row based on user-input above, Ao =	0.066	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	Row 23	
	5788.08	5788.58	5789.08	5789.58	5790.08	5790.58	5791.08																		
	Collection Capacity for Each Row of Holes in cfs																								
5788.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																		0.00
5788.20	0.1185	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																		0.12
5788.40	0.1951	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																		0.20
5788.60	0.2492	0.0490	0.0000	0.0000	0.0000	0.0000	0.0000																		0.30
5788.80	0.2934	0.1625	0.0000	0.0000	0.0000	0.0000	0.0000																		0.46
5789.00	0.3318	0.2246	0.0000	0.0000	0.0000	0.0000	0.0000																		0.56
5789.20	0.3662	0.2729	0.1200	0.0000	0.0000	0.0000	0.0000																		0.76
5789.40	0.3977	0.3138	0.1960	0.0000	0.0000	0.0000	0.0000																		0.91
5789.60	0.4268	0.3500	0.2499	0.0490	0.0000	0.0000	0.0000																		1.08
5789.80	0.4541	0.3828	0.2940	0.1625	0.0000	0.0000	0.0000																		1.29
5790.00	0.4798	0.4129	0.3324	0.2246	0.0000	0.0000	0.0000																		1.45
5790.20	0.5042	0.4411	0.3667	0.2729	0.1200	0.0000	0.0000																		1.70
5790.40	0.5275	0.4675	0.3981	0.3138	0.1960	0.0000	0.0000																		1.90
5790.60	0.5498	0.4925	0.4272	0.3500	0.2499	0.0490	0.0000																		2.12
5790.80	0.5712	0.5163	0.4545	0.3828	0.2940	0.1625	0.0000																		2.38
5791.00	0.5918	0.5391	0.4802	0.4129	0.3324	0.2246	0.0000																		2.58
5791.20	0.6118	0.5609	0.5046	0.4411	0.3667	0.2729	0.1200																		2.88
5791.40	0.6311	0.5819	0.5278	0.4675	0.3981	0.3138	0.1960																		3.12
5791.60	0.6499	0.6022	0.5501	0.4925	0.4272	0.3500	0.2499																		3.32
5791.80	0.6681	0.6218	0.5715	0.5163	0.4545	0.3828	0.2940																		3.51
5792.00	0.6858	0.6408	0.5922	0.5391	0.4802	0.4129	0.3324																		3.68
5792.20	0.7031	0.6593	0.6121	0.5609	0.5046	0.4411	0.3667																		3.85
5792.40	0.7200	0.6773	0.6314	0.5819	0.5278	0.4675	0.3981																		4.00
5792.60	0.7365	0.6948	0.6502	0.6022	0.5501	0.4925	0.4272																		4.15
5792.80	0.7526	0.7119	0.6684	0.6218	0.5715	0.5163	0.4545																		4.30
5793.00	0.7684	0.7285	0.6861	0.6408	0.5922	0.5391	0.4802																		4.44
5793.20	0.7839	0.7448	0.7034	0.6593	0.6121	0.5609	0.5046																		4.57
5793.40	0.7991	0.7608	0.7203	0.6773	0.6314	0.5819	0.5278																		4.70
5793.60	0.8139	0.7764	0.7367	0.6948	0.6502	0.6022	0.5501																		4.82
5793.80	0.8286	0.7917	0.7529	0.7119	0.6684	0.6218	0.5715																		4.95
5794.00	0.8429	0.8068	0.7686	0.7285	0.6861	0.6408	0.5922																		5.07
5794.20	0.8571	0.8215	0.7841	0.7448	0.7034	0.6593	0.6121																		5.18
5794.40	0.8710	0.8360	0.7993	0.7608	0.7203	0.6773	0.6314																		5.30
5794.60	0.8846	0.8502	0.8142	0.7764	0.7367	0.6948	0.6502																		5.41
5794.80	0.8981	0.8642	0.8288	0.7917	0.7529	0.7119	0.6684																		5.52
5795.00	0.9114	0.8780	0.8431	0.8068	0.7686	0.7285	0.6861																		5.62
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																		#N/A
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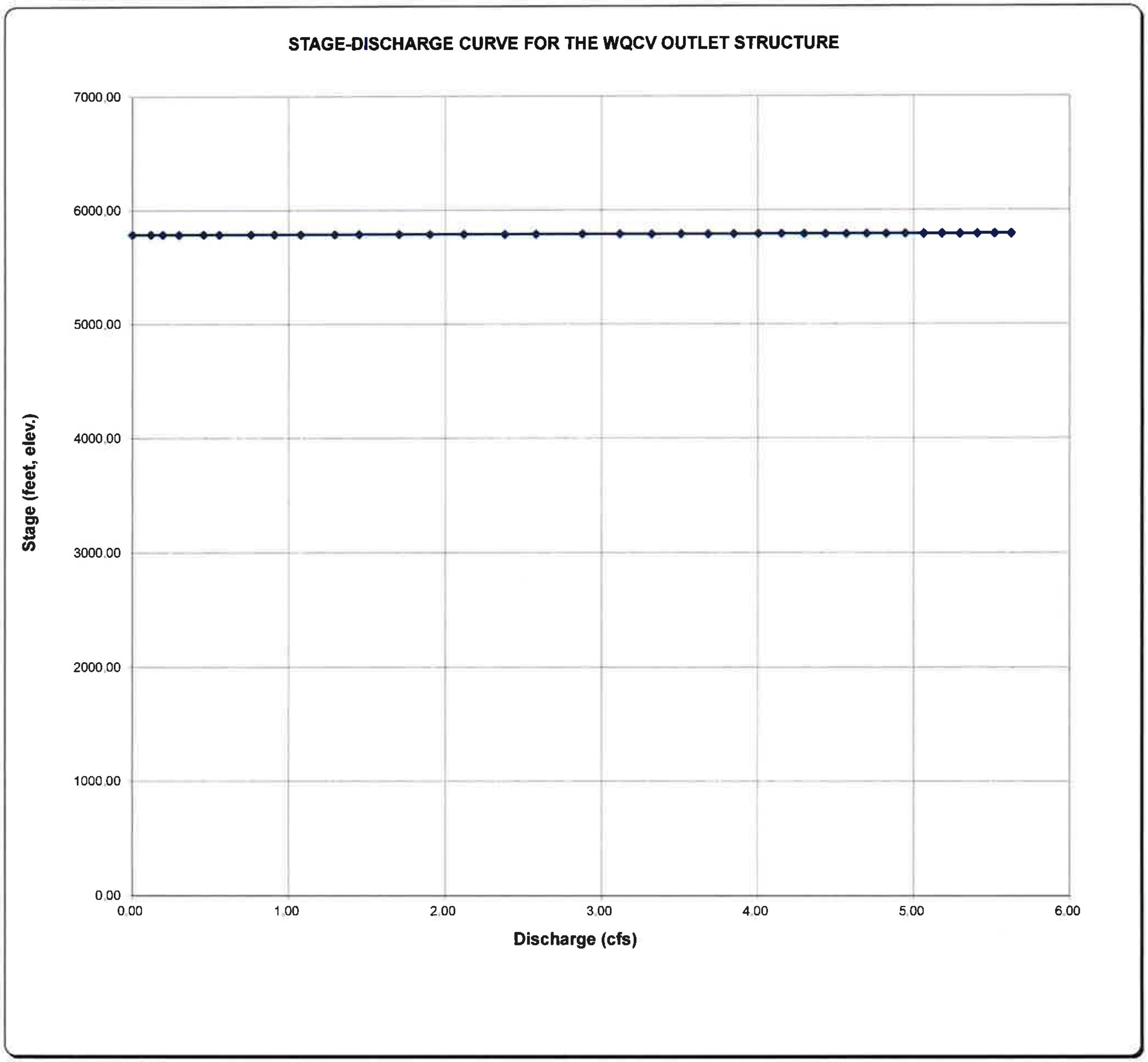
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																		#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																		#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																		#N/A
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

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 El. 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 El 5793.6, 18 Ac-ft
5,795.00	1.00	162,642	170,252	166,404	3.82	23.31	

P:\Clcpkc3\ComSouth02-GreenAcresTrib\Documents\Engineering\StormWater Reports\Data\Pond Vol Calcs 11-9-15.xls

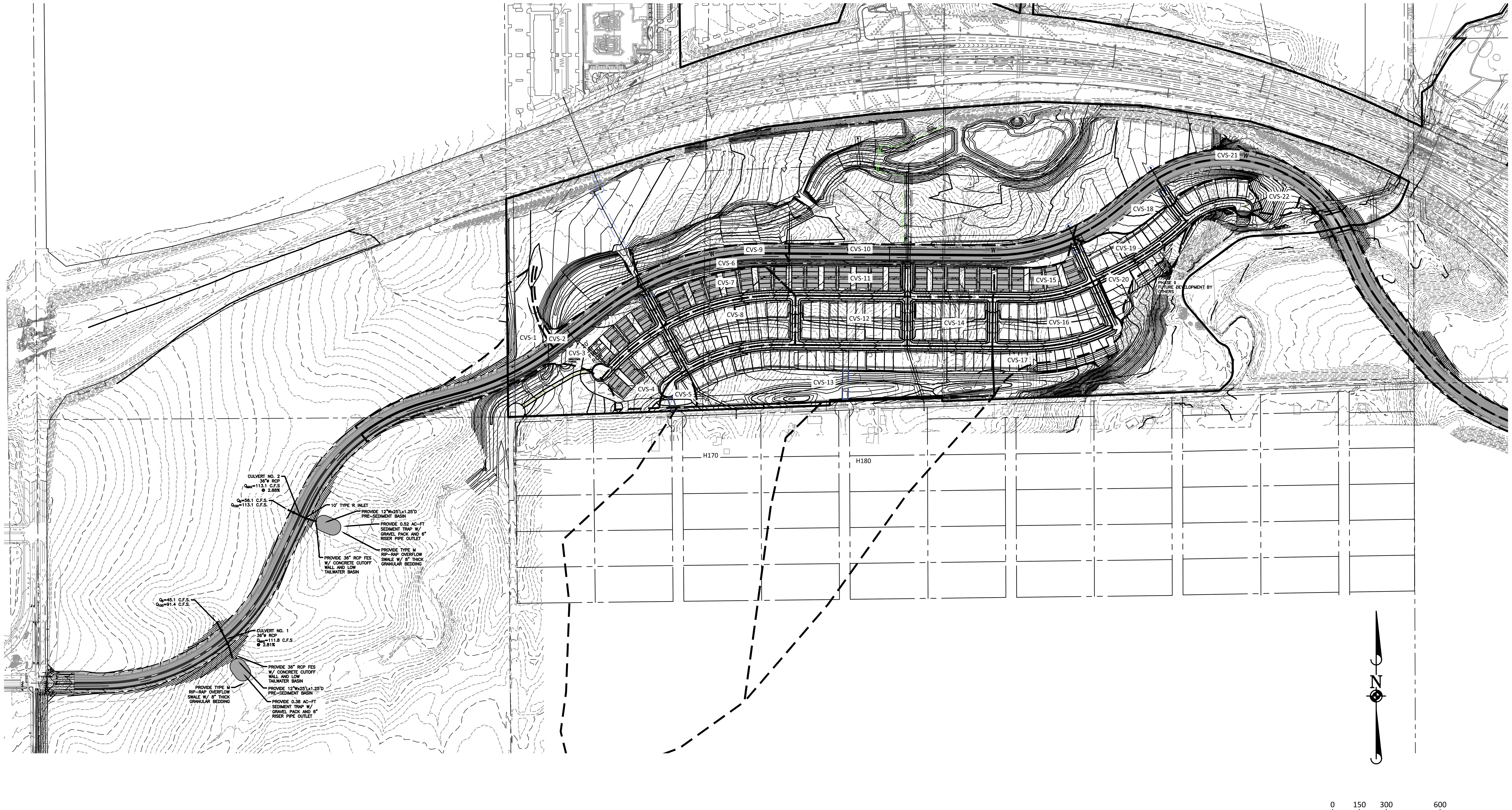
E-470 Proposed Regional FS Pond
Stage - Discharge

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



REVISIONS | DATE | DRAWN BY

Manhard CONSULTING LTD

8008 E. Arapahoe Court, Suite 110, Centennial, CO 80112 ph:303.708.0500 fx:303.708.0400 manhard.com
Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
Construction Managers • Environmental Scientists • Landscape Architects • Planners

COMPARK SOUTH

TOWN OF PARKER, CO

PROPOSED DRAINAGE AREA MAP

PROJ. MGR.:	RLB
PROJ. ASSOC.:	###
DRAWN BY:	RAK
DATE:	11-20-15

SHEET
1 OF 1
CLCPKC3

Plotted: 12/1/2015 9:56 AM Dwg Name: P:\Clcpkc3\ComSouth02-GreenAcresTrib\GAT Hydrology\E-470 Basin Map.dwg Updated By: adrucker

Compark South

TOWN OF PARKER, COLORADO
PROPOSED IMPERVIOUSNESS CALCULATIONS
November 20, 2015

CVS-1

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **32.0%**
C_5 (Table RO-5, Type C Soil): **0.31**
C_{100} (Table RO-5, Type C Soil): **0.57**

CVS-2

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **62.0%**
C_5 (Table RO-5, 21% Type B Soil & 79% Type C Soil): **0.47**
C_{100} (Table RO-5, 21% Type B Soil & 79% Type C Soil): **0.64**

CVS-3

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **50.0%**
C_5 (Table RO-5, 80% Type B Soil & 20% Type C Soil): **0.40**
C_{100} (Table RO-5, 80% Type B Soil & 20% Type C Soil): **0.60**

CVS-4

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **45.0%**
C_5 (Table RO-5, 59% Type B Soil & 41% Type C Soil): **0.37**
C_{100} (Table RO-5, 59% Type B Soil & 41% Type C Soil): **0.59**

CVS-5

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		
	Total Area:	0.00	

Percentage Imperviousness: **45.0%**
C_5 (Table RO-5, Type C Soil): **0.37**
C_{100} (Table RO-5, Type C Soil): **0.59**

CVS-6

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		
	Total Area:	0.00	

Percentage Imperviousness: **56.0%**
C_5 (Table RO-5, 12% Type B Soil & 88% Type C Soil): **0.44**
C_{100} (Table RO-5, 12% Type B Soil & 88% Type C Soil): **0.62**

CVS-7

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **55.0%**

C_5 (Table RO-5, Type C Soil): **0.43**

C_{100} (Table RO-5, Type C Soil): **0.62**

CVS-8

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **51.0%**

C_5 (Table RO-5, Type B Soil): **0.36**

C_{100} (Table RO-5, Type B Soil): **0.52**

CVS-9

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		
Pavement/Hardscape	100%		
Landscape	2%		

Total Area: 0.00

Percentage Imperviousness: **78.0%**

C_5 (Table RO-5, Type C Soil): **0.57**

C_{100} (Table RO-5, Type C Soil): **0.68**

CVS-10

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **78.0%**

C_5 (Table RO-5, Type C Soil): **0.61**

C_{100} (Table RO-5, Type C Soil): **0.73**

CVS-11

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **55.0%**

C_5 (Table RO-5, Type C Soil): **0.43**

C_{100} (Table RO-5, Type C Soil): **0.62**

CVS-12

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **55.0%**

C_5 (Table RO-5, Type C Soil): **0.43**

C_{100} (Table RO-5, Type C Soil): **0.62**

CVS-13

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **27.0%**
C_5 (Table RO-5, Type C Soil): **0.29**
C_{100} (Table RO-5, Type C Soil): **0.56**

CVS-14

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%	0.00	0.00
Pavement/Hardscape	100%	0.00	0.00
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **55.0%**
C_5 (Table RO-5, Type C Soil): **0.43**
C_{100} (Table RO-5, Type C Soil): **0.62**

CVS-15

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%	0.00	0.00
Pavement/Hardscape	100%	0.00	0.00
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **50.0%**
C_5 (Table RO-5, Type C Soil): **0.40**
C_{100} (Table RO-5, Type C Soil): **0.60**

CVS-16

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **51.0%**

C_5 (Table RO-5, Type C Soil): **0.41**

C_{100} (Table RO-5, Type C Soil): **0.60**

CVS-17

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%	0.00	0.00
Pavement/Hardscape	100%	0.00	0.00
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **50.0%**

C_5 (Table RO-5, Type C Soil): **0.40**

C_{100} (Table RO-5, Type C Soil): **0.60**

CVS-18

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	2%		#VALUE!

Total Area:

Percentage Imperviousness: **73.0%**

C_5 (Table RO-5, Type C Soil): **0.56**

C_{100} (Table RO-5, Type C Soil): **0.70**

CVS-19

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	0%		#VALUE!

Total Area:

Percentage Imperviousness: **50.0%**
C_5 (Table RO-5, Type C Soil): **0.40**
C_{100} (Table RO-5, Type C Soil): **0.60**

CVS-20

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	0%		#VALUE!

Total Area:

Percentage Imperviousness: **50.0%**
C_5 (Table RO-5, Type C Soil): **0.40**
C_{100} (Table RO-5, Type C Soil): **0.60**

CVS-21

Land Use	Imperviousness (UDFCD Table RO-3)	Total Area (Acres)	Impervious Area (Acres)
Roofs / Walk	90%		#VALUE!
Pavement/Hardscape	100%		#VALUE!
Landscape	0%		#VALUE!

Total Area:

Percentage Imperviousness: **76.0%**
C_5 (Table RO-5, Type C Soil): **0.59**
C_{100} (Table RO-5, Type C Soil): **0.72**

PROPOSED DRAINAGE BASINS
STANDARD FORM SF-2
TIME OF CONCENTRATION

PROJECT: **Compark South**

CALCULATED BY: ASD DATE: November 20, 2015

REVISED BY: DATE:

NOTES:

$T_i = [0.395 \times (1.1 - C_5) \times L^{0.5}] / (S^{0.33})$

$T_t = L / (60 \times V)$ (Velocity from UDFCD Fig. RO-1)

T_C Check = 10 + L/180 (Urbanized Basins Only)

JOB NO: CLCPKC3

SUB-BASIN DATA			INITIAL/OVERLAND TIME (Ti)			TRAVEL TIME (Tt) - (GRASS SWALE)				TRAVEL TIME (Tt) - (PAVEMENT/CURB & GUTTER)				Tc CHECK (urbanized basins)		FINAL Tc (min)	REMARKS
AREA DESIGNATION	RUNOFF COEFFICIENT, C5	AREA, A (acres)	FLOW LENGTH, (ft)	SLOPE (%)	INITIAL TIME, Ti (MIN)	FLOW LENGTH, (ft)	SLOPE (%)	VELOCITY (fps)	TRAVEL TIME Tt, (min)	FLOW LENGTH, (ft)	SLOPE (%)	VELOCITY (fps)	TRAVEL TIME Tt, (min)	TOTAL LENGTH (ft)	MAXIMUM Tc = (L/180 + 10)		
CVS-1	0.57	3.85	140	4.1%	7.1	0								140	10.8	7.1	
CVS-2	0.64	0.94	100	2.0%	6.6	0				480	2.0%	2.8	2.8	580	13.2	9.5	
CVS-3	0.60	5.00	133	1.5%	9.1	0				709	1.3%	2.3	5.2	842	14.7	14.3	
CVS-4	0.59	2.88	100	4.0%	5.8	130	5.5%	1.6	1.3	380	1.3%	2.3	2.8	610	13.4	9.9	
CVS-5	0.59	0.69	143	8.0%	5.5	0								143	10.8	5.5	
CVS-6	0.62	1.71	55	7.0%	3.4	0				774	1.0%	2.0	6.5	829	14.6	9.8	
CVS-7	0.62	2.61	144	1.5%	9.1	0				689	1.1%	2.1	5.5	833	14.6	14.6	
CVS-8	0.52	4.42	100	4.0%	6.6	113	4.0%	1.4	1.3	682	1.0%	2.0	5.7	895	15.0	13.6	
CVS-9	0.68	1.11	100	1.0%	7.5					675	1.0%	2.0	5.6	775	14.3	13.1	
CVS-10	0.73	2.03	100	1.0%	6.7					924	1.0%	2.0	7.7	1024	15.7	14.4	
CVS-11	0.62	7.25	139	1.5%	8.9					887	1.0%	2.0	7.4	1026	15.7	15.7	
CVS-12	0.62	3.95	100	4.7%	5.2	124	4.7%	1.5	1.4	868	1.0%	2.0	7.2	1092	16.1	13.8	
CVS-13	0.56	11.54	100	2.0%	7.7	227	3.5%	1.3	2.9	867	1.0%	2.0	7.2	1194	16.6	16.6	
CVS-14	0.62	3.00	100	5.7%	4.9	127	5.7%	1.7	1.3	723	1.4%	2.4	5.1	950	15.3	11.2	
CVS-15	0.60	2.10	144	1.6%	9.3					772	1.0%	2.0	6.4	916	15.1	15.1	
CVS-16	0.60	3.98	100	5.3%	5.2	129	5.3%	1.6	1.3	564	1.0%	2.0	4.7	793	14.4	11.2	
CVS-17	0.60	2.10	100	15.5%	3.7	115	3.0%	1.2	1.6	990	1.0%	2.0	8.3	1205	16.7	13.5	
CVS-18	0.70	1.49	100	3.5%	4.8	200	3.5%	1.3	2.5					300	11.7	7.3	
CVS-19	0.60	2.39	117	2.0%	7.8					570	1.0%	2.0	4.8	687	13.8	12.5	
CVS-20	0.60	3.05	100	0.0%	27.8	164	3.3%	1.3	2.1	833	0.01	2.1	6.6	1097	16.1	16.1	
CVS-21	0.72	4.50	100	3.1%	4.8					1602	0.03	3.5	7.6	1702	19.5	12.4	
CVS-22	0.62	5.39	100	9.8%	4.1					1009	0.03	3.5	4.9	1109	16.2	8.9	

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

PROJECT: **COMPARK VILLAGE SOUTH, FILING 2** CLCPKC3

CALCULATED BY: RAK DATE: November 20, 2015 100-YEAR
REVISED BY: DATE:

	DIRECT RUNOFF						REMARKS
Basin ID	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	
(1)	(3)	(4)	(5)	(6)	(7)	(8)	(21)
CVS-1	3.85	7.1	0.57	8.0	2.19	**17.5**	
CVS-2	0.94	9.5	0.64	7.2	0.60	**4.3**	
CVS-3	5.00	14.3	0.60	6.0	3.00	**18.1**	
CVS-4	2.88	9.9	0.59	7.1	1.70	**12.0**	
CVS-5	0.69	5.5	0.59	8.6	0.41	**3.5**	
CVS-6	1.71	9.8	0.62	7.1	1.06	**7.5**	
CVS-7	2.61	14.6	0.62	6.0	1.62	**9.7**	
CVS-8	4.42	13.6	0.52	6.2	2.32	**14.3**	
CVS-9	1.11	13.1	0.68	6.3	0.76	**4.8**	
CVS-10	2.03	14.4	0.73	6.0	1.48	**8.9**	
CVS-11	7.25	15.7	0.62	5.8	4.50	**26.0**	
CVS-12	3.95	13.8	0.62	6.1	2.45	**15.0**	
CVS-13	11.54	16.6	0.56	5.6	6.51	**36.6**	
CVS-14	3.00	11.2	0.62	6.7	1.86	**12.5**	
CVS-15	2.10	15.1	0.60	5.9	1.26	**7.4**	
CVS-16	3.98	11.2	0.60	6.7	2.40	**16.2**	
CVS-17	2.10	13.5	0.60	6.2	1.26	**7.8**	
CVS-18	1.49	7.3	0.70	7.9	1.04	**8.2**	
CVS-19	2.39	12.5	0.60	6.4	1.43	**9.2**	
CVS-20	3.05	16.1	0.60	5.7	1.83	**10.4**	
CVS-21	4.50	12.4	0.72	6.4	3.22	**20.8**	
CVS-22	5.39	8.9	0.62	7.3	3.34	**24.5**	

Scenario: Base

FlexTable: Conduit Table

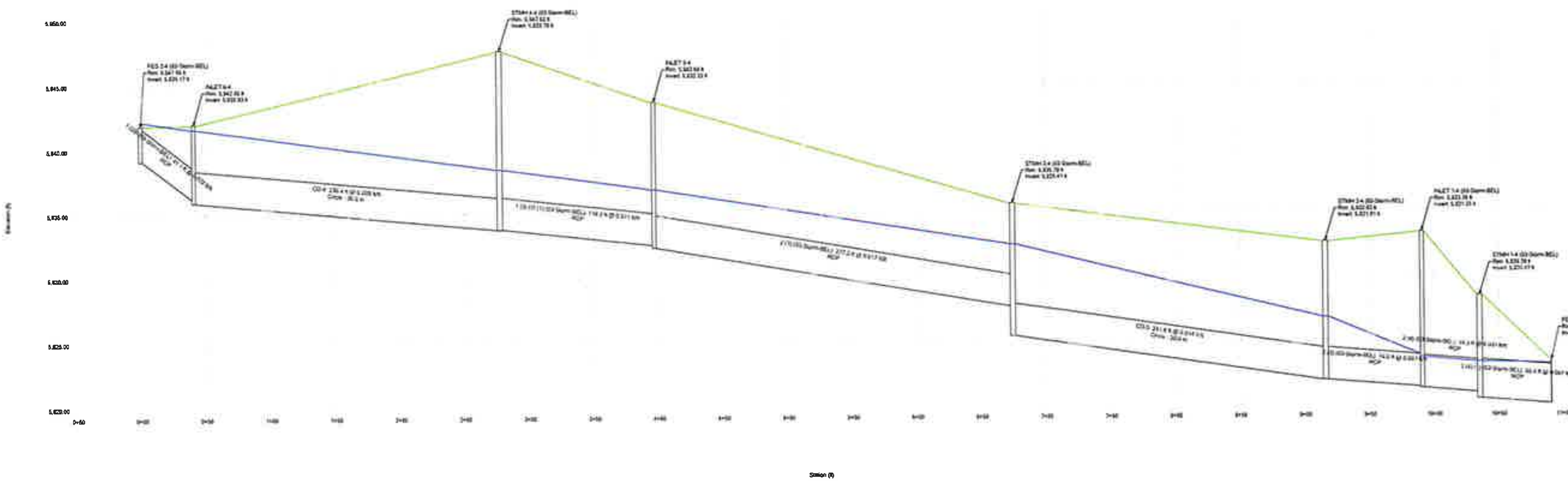
Label	Start Node	Stop Node	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	System Fixed Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
1 (3) (2) (1) (03-Storm-BEL)	STMH 4-4 (03-Storm-BEL)	INLET 5-4	30.0	119.3	0.011	47.81	9.74	5,838.50	5,836.88
2 (1) (03-Storm-BEL)	INLET 5-4	STMH 3-4 (03-Storm-BEL)	30.0	277.3	0.017	51.31	10.45	5,836.88	5,832.54
1 (29) (03-Storm-BEL)	FES 2-4 (03-Storm-BEL)	INLET 6-4	30.0	41.1	0.072	47.81	9.74	5,842.27	5,841.71
1 (41) (03-Storm-BEL)	FES 2-5 (03-Storm-BEL)	INLET 6-5	24.0	42.7	0.040	24.64	14.71	5,837.54	5,835.27
1 (31) (03-Storm-BEL)	INLET 4-4	STMH 3-4 (03-Storm-BEL)	18.0	43.4	0.010	12.00	6.79	5,833.11	5,832.54
2 (5) (03-Storm-BEL)	INLET 2-4	STMH 2-4 (03-Storm-BEL)	18.0	50.3	0.010	18.10	10.24	5,828.27	5,826.78
2 (3) (03-Storm-BEL)	STMH 2-4 (03-Storm-BEL)	INLET 1-4 (03-Storm-BEL)	30.0	74.6	0.007	81.41	16.58	5,826.78	5,823.82
2 (4) (03-Storm-BEL)	INLET 1-4 (03-Storm-BEL)	STMH 1-4 (03-Storm-BEL)	30.0	44.5	0.007	38.90	7.92	5,823.62	5,823.26
2 (6) (03-Storm-BEL)	INLET 3-4	STMH 2-4 (03-Storm-BEL)	18.0	47.3	0.030	0.00	0.00	5,826.78	5,826.78
3 (2) (03-Storm-BEL)	INLET 5-5	STMH 2-5 (03-Storm-BEL)	30.0	293.5	0.030	61.24	16.28	5,823.54	5,814.13
2 (4) (1) (03-Storm-BEL)	STMH 1-4 (03-Storm-BEL)	FES 1-4 (03-Storm-BEL)	36.0	55.4	0.007	38.90	8.77	5,823.26	5,823.10
1 (15) (03-Storm-BEL)	INLET 4-6	INLET 3-6	24.0	35.5	0.010	14.30	7.62	5,822.60	5,822.32
1 (20) (03-Storm-BEL)	INLET 2-6	INLET 1-6	24.0	75.5	0.015	31.50	10.03	5,816.77	5,815.30
1 (23) (03-Storm-BEL)	INLET 1-6	FES1-6	24.0	194.4	0.029	36.30	11.55	5,815.30	5,810.30
1 (37) (03-Storm-BEL)	INLET 4-5	STMH 2-5 (03-Storm-BEL)	18.0	48.3	0.020	12.50	9.42	5,815.30	5,814.09
1 (35) (03-Storm-BEL)	INLET 3-5	STMH 2-5 (03-Storm-BEL)	18.0	48.2	0.020	15.00	9.58	5,815.37	5,814.27

FlexTable: Conduit Table

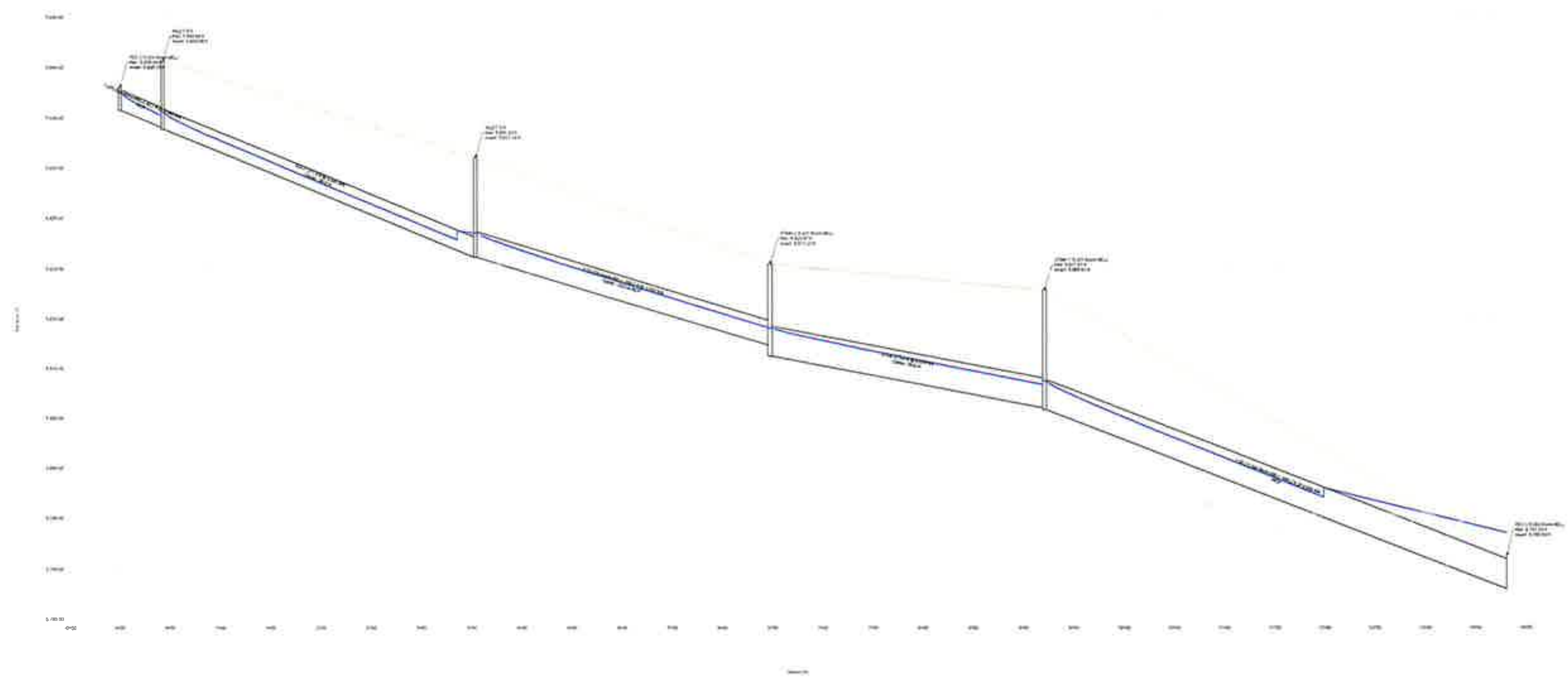
Label	Start Node	Stop Node	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	System Fixed Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
3 (5) (03-Storm-BEL)	INLET 2-5	INLET 1-5	18.0	75.3	0.008	26.00	14.71	5,822.49	5,817.87
1 (11) (03-Storm-BEL)	INLET 1-5	STMH 1-5 (03-Storm-BEL)	18.0	98.0	0.008	34.90	19.75	5,819.54	5,808.72
1 (9) (1) (03-Storm-BEL)	STMH 1-5 (03-Storm-BEL)	FES 1-5 (03-Storm-BEL)	36.0	460.2	0.039	104.11	20.59	5,808.72	5,793.60
CO-2	INLET 2-3	INLET 1-3	24.0	93.0	0.100	18.10	19.01	5,842.09	5,834.11
CO-3	INLET 1-3	O-1	24.0	19.0	0.102	35.60	22.92	5,832.87	5,830.33
CO-4	INLET 6-4	STMH 4-4 (03-Storm-BEL)	30.0	236.4	0.009	47.81	9.74	5,841.71	5,838.50
CO-5	STMH 3-4 (03-Storm-BEL)	STMH 2-4 (03-Storm-BEL)	30.0	241.8	0.014	63.31	12.90	5,832.54	5,826.78
CO-6	INLET 3-6	INLET 2-6	24.0	177.7	0.042	24.00	14.94	5,822.32	5,816.77
CO-7	INLET 6-5	INLET 5-5	24.0	311.0	0.041	24.64	14.84	5,835.63	5,823.54
CO-8	STMH 2-5 (03-Storm-BEL)	STMH 1-5 (03-Storm-BEL)	36.0	273.6	0.019	88.74	14.85	5,814.07	5,808.38

Profile Report

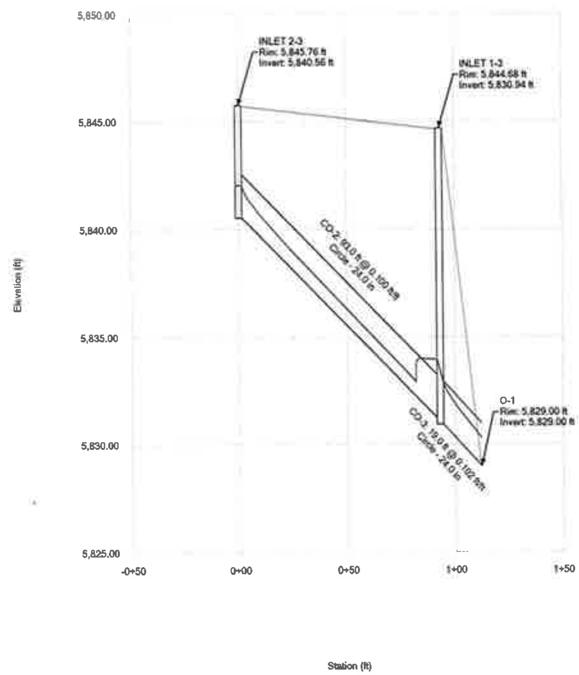
Engineering Profile - Profile - 1 (03-StormCAD.stsw)



Profile Report
Engineering Profile - Profile - 2 (03-StormCAD.stsw)

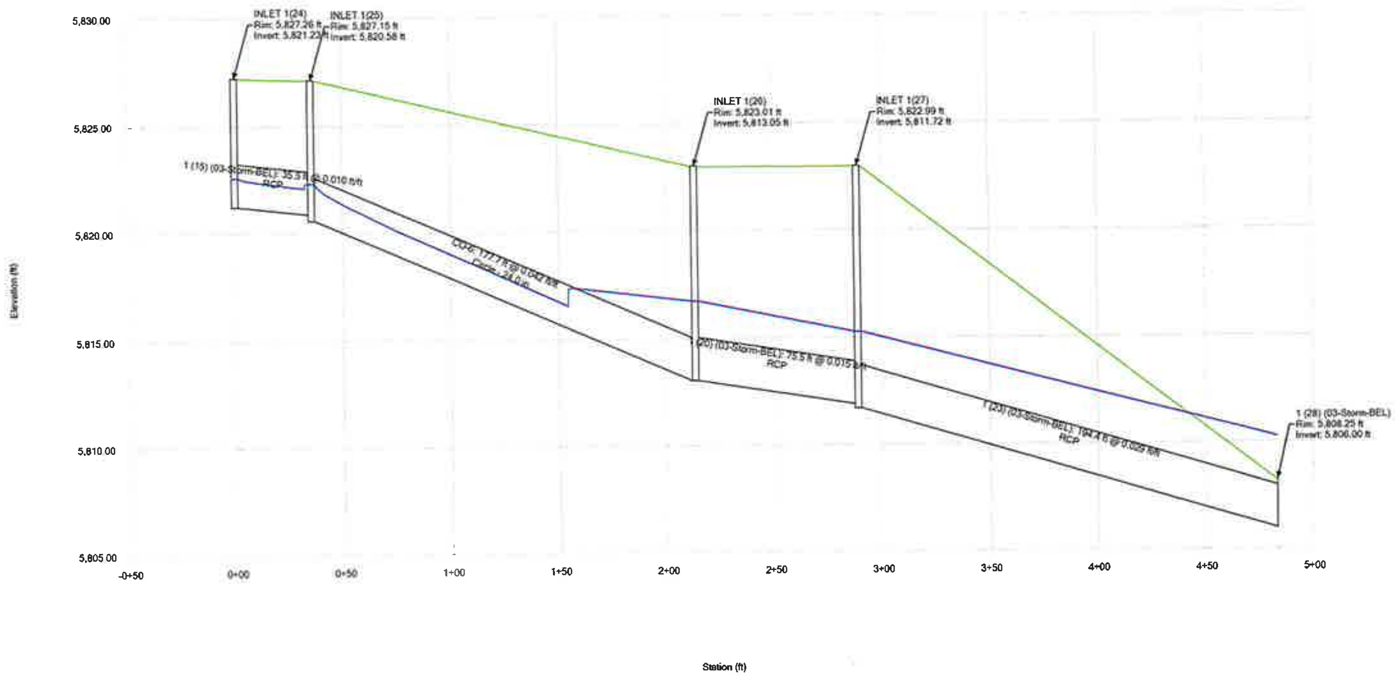


Profile Report
Engineering Profile - Profile - 3 (03-StormCAD.stsw)



Profile Report

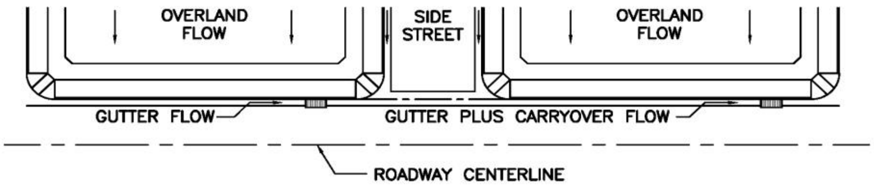
Engineering Profile - Profile - 4 (03-StormCAD.stsw)



Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-3



Show Details

Design Flow: ONLY if already determined through other methods:

		Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel):	*Q_{Known} =	17.5	17.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) \wedge C_3$

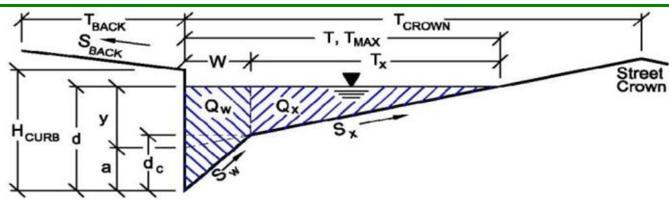
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	17.5	17.5	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} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

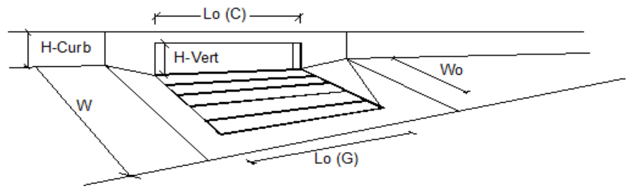
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**59.7**	**59.7**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
Inlet ID: INLET 1-3

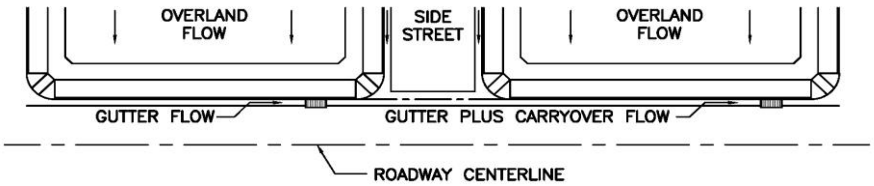


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**17.49**	**17.49**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-3



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =	4.3	4.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

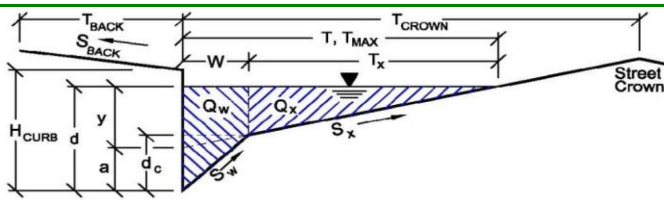
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.3	4.3	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 2-3**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

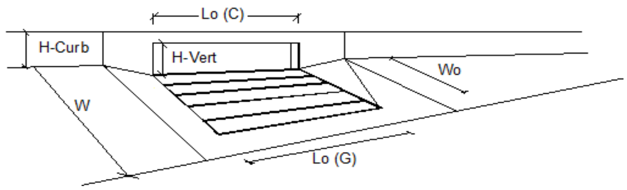
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**59.7**	**59.7**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

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

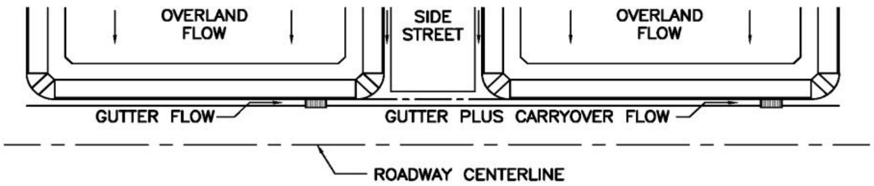


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.30**	**4.30**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.3	4.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

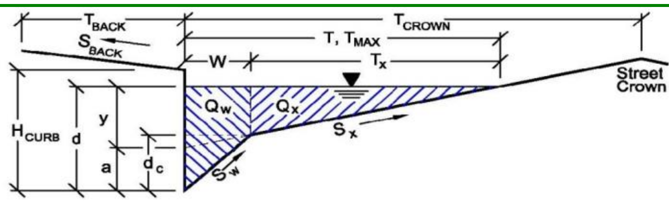
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.3	4.3	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 1-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

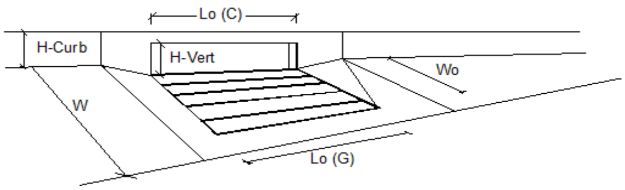
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**59.7**	**59.7**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
Inlet ID: INLET 1-4

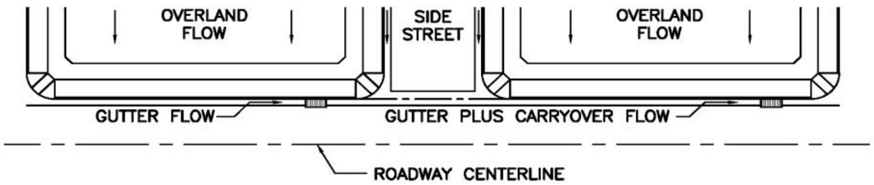


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.30**	**4.30**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-4



Show Details

Design Flow: ONLY if already determined through other methods:

		Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel):	*Q_{Known} =	18.1	18.1	cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

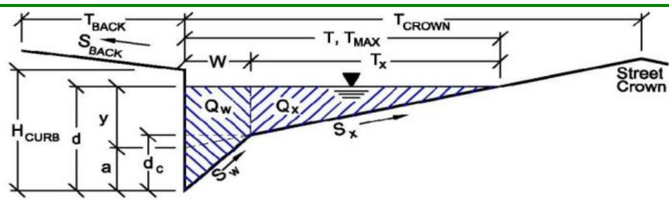
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**18.1**	**18.1**	**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 2-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

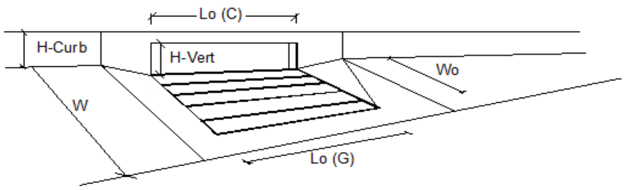
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**59.7**	**59.7**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

Project: **COMPARK SOUTH**
Inlet ID: **INLET 2-4**

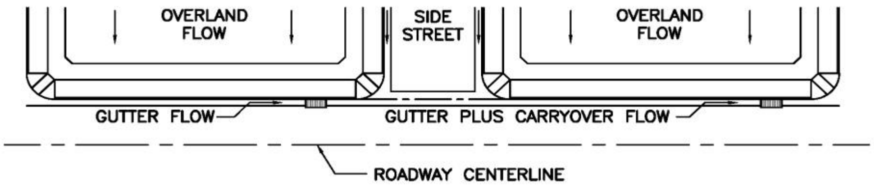


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**18.04**	**18.04**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 4-4



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =	12.0	12.0	cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{\wedge} C_3$

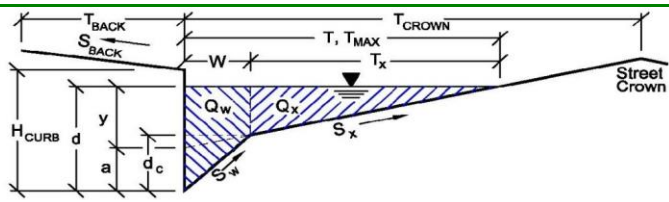
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**12.0**	**12.0**	**cfs**

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

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

Project: **COMPARK SOUTH**

Inlet ID: **INLET 4-4**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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} =	0.012	

				Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =		30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =		8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)			☐	☐	check = yes

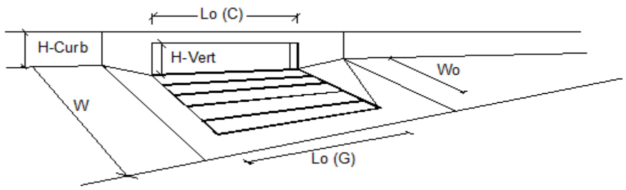
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**59.7**	**59.7**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

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



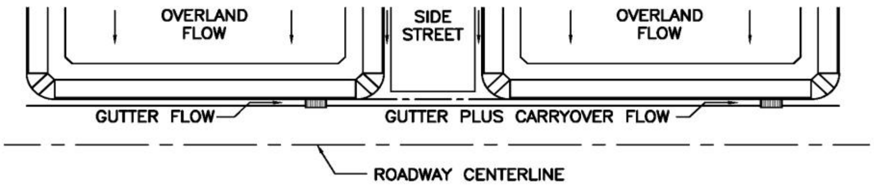
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**12.00**	**12.00**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH

Inlet ID: INLET 5-4



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =	3.5	3.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) \wedge C_3$

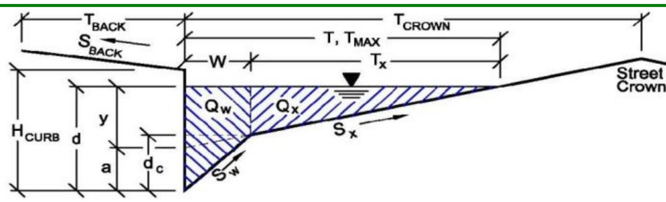
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	3.5	3.5	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 5-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

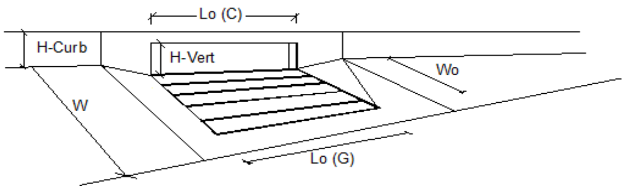
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**59.7**	**59.7**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

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

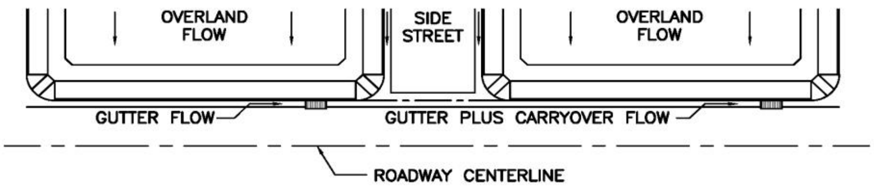


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.45**	**3.45**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**99**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
***Q_{Known} =**	8.9	8.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) \wedge C_3$

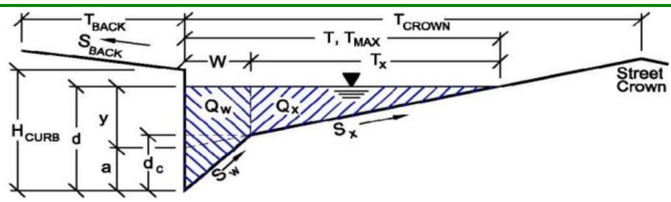
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**8.9**	**8.9**	**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 1-5**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

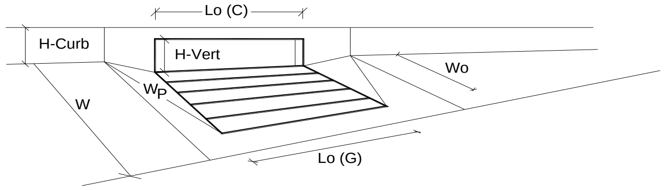
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET IN A SUMP OR SAG LOCATION

Project = **COMPARK SOUTH**

Inlet ID = **INLET 1-5**

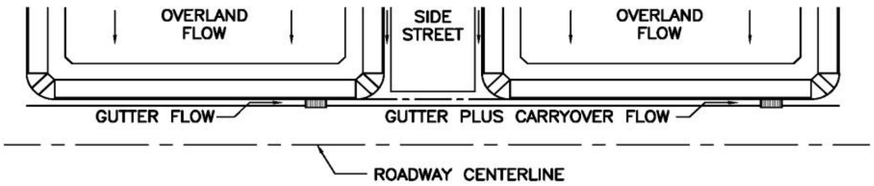


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.0	8.0	inches ☐ 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_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**9.3**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	8.9	8.9	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-5



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =	26.0	26.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)$ ^ C_3

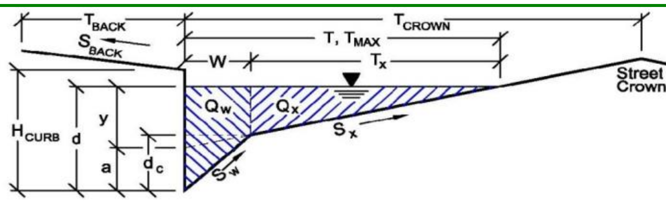
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**26.0**	**26.0**	**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 2-5



Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0		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		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

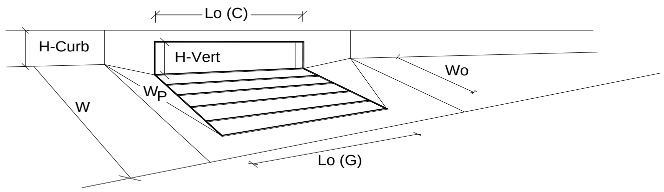
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET IN A SUMP OR SAG LOCATION

Project = **COMPARK SOUTH**

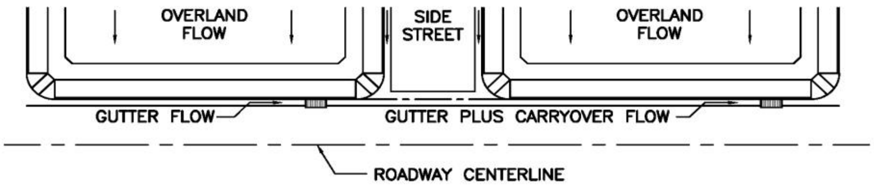
Inlet ID = **INLET 2-5**



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)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.0	8.0	inches ☐ 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_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**29.9**	**29.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	26.0	26.0	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 3-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	15.0	15.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = C_1 * P_1 / (C_2 + T_c) ^ C_3

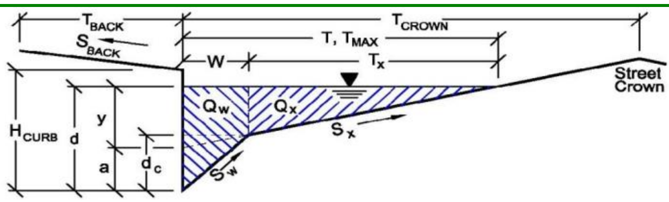
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	15.0	15.0	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 3-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

				Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =		30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =		8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)			☐	☐	check = yes

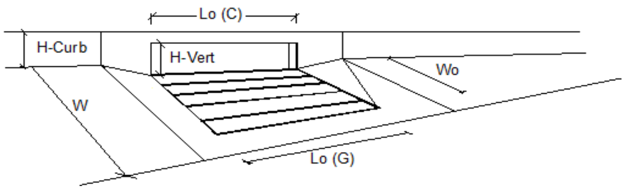
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**34.5**	**34.5**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

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

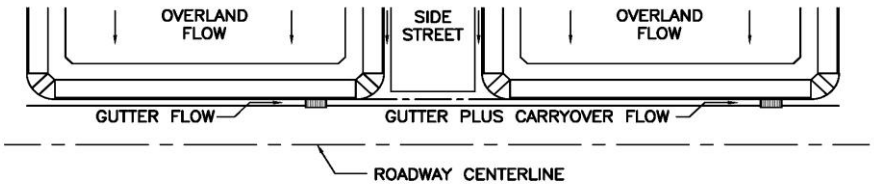


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**14.99**	**14.99**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 4-5



Show Details

Design Flow: ONLY if already determined through other methods:

(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	12.5	12.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

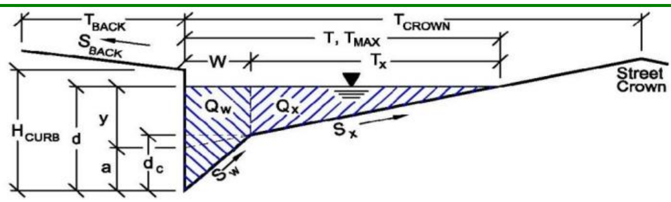
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	12.5	12.5	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 4-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft		
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft		
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013			
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches		
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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 =	0.005	ft/ft		
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012			
		Minor Storm	Major Storm		
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft	
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches	
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes	
		Minor Storm	Major Storm		
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**34.5**	**34.5**	**cfs**	

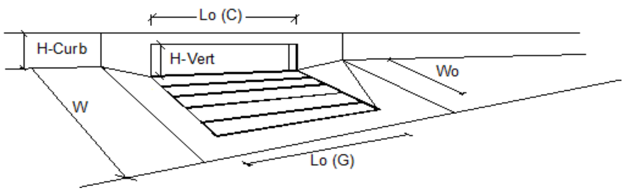
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

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

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

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

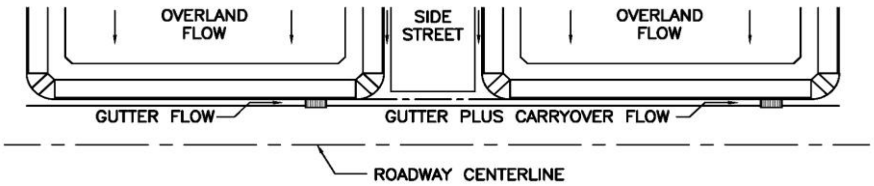


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**12.50**	**12.50**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

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



Show Details

Design Flow: ONLY if already determined through other methods:

		Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel):	*Q_{Known} =	36.6	36.6	cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

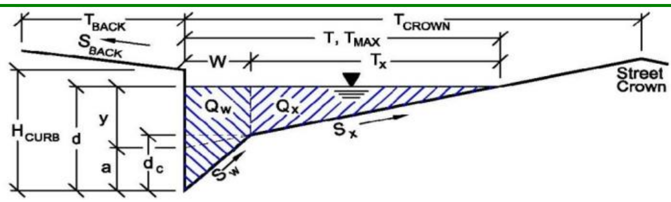
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	36.6	36.6	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 5-5**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

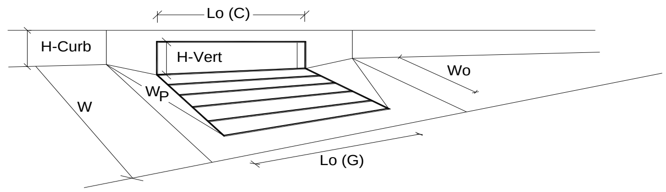
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET IN A SUMP OR SAG LOCATION

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

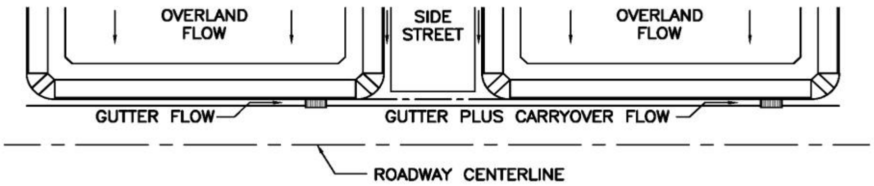


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.0	8.0	inches ☐ 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_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**41.4**	**41.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	36.6	36.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: Inlet 1-6



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =	4.8	4.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) \wedge C_3$

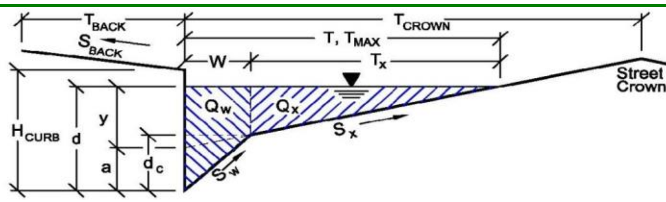
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.8	4.8	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	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

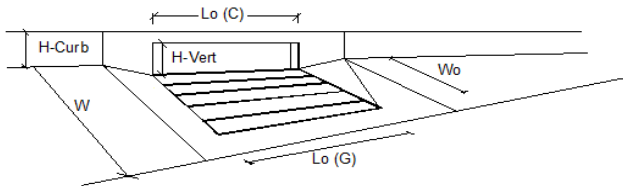
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**34.5**	**34.5**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH
Inlet ID: Inlet 1-6

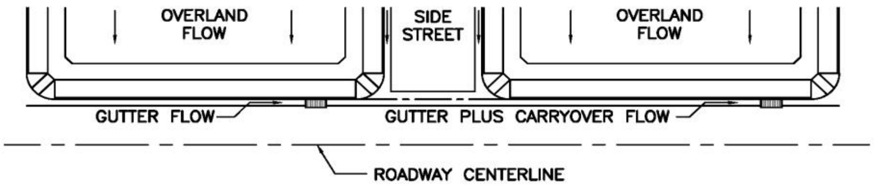


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.80**	**4.80**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: Inlet 2-6



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	7.5	7.5	cfs

<--- FILL IN THIS SECTION OR…

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

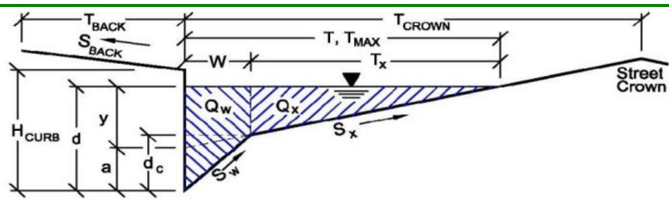
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	7.5	7.5	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	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

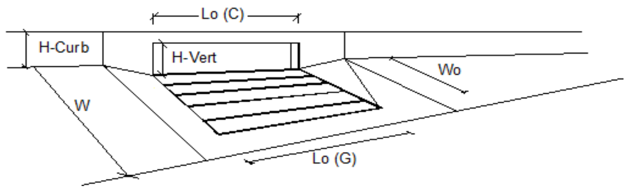
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**34.5**	**34.5**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

Project: **COMPARK SOUTH**
Inlet ID: **Inlet 2-6**

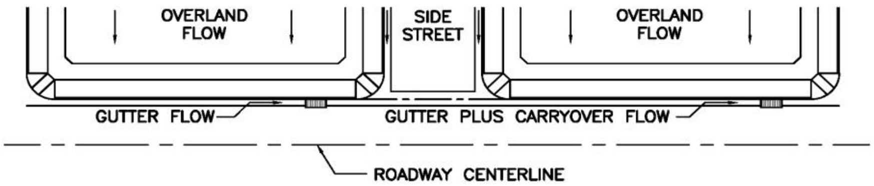


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.50**	**7.50**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: Inlet 3-6



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =	9.7	9.7	cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

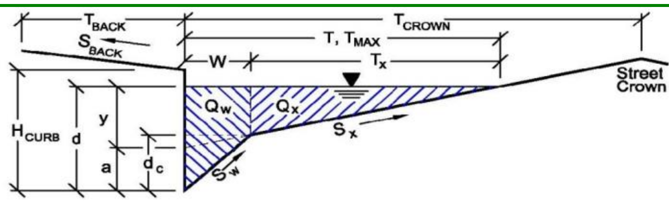
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	9.7	9.7	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 3-6**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

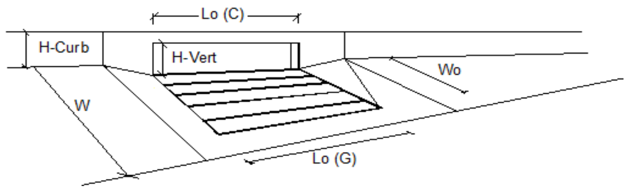
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**34.5**	**34.5**	**cfs**

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'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

Project: **COMPARK SOUTH**
Inlet ID: **Inlet 3-6**

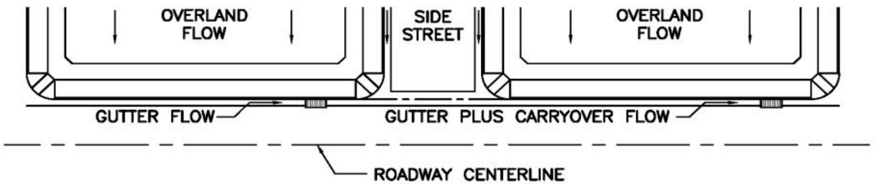


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**9.70**	**9.70**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: **COMPARK SOUTH**
Inlet ID: **Inlet 4-6**



Show Details

Design Flow: ONLY if already determined through other methods:

		Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel):	*Q_{Known} =	14.3	14.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^\wedge C_3$

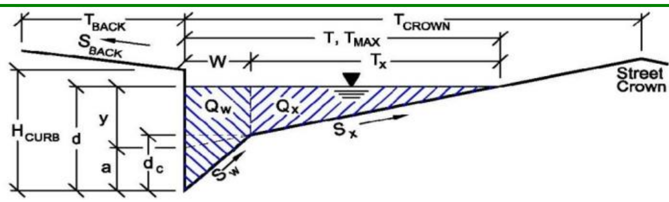
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**14.3**	**14.3**	**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 4-6



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	33.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

			Minor Storm	Major Storm	
	Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	8.0	inches
	Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**34.5**	**34.5**	**cfs**

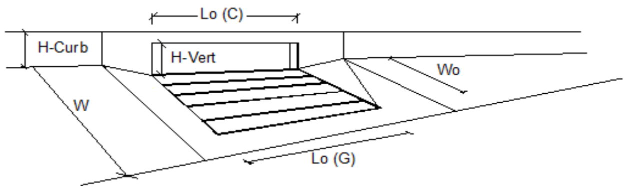
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

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

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

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)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**14.30**	**14.30**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

APPENDIX I

Miscellaneous Drainage Improvement Design

Initially Submitted November 20, 2015

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

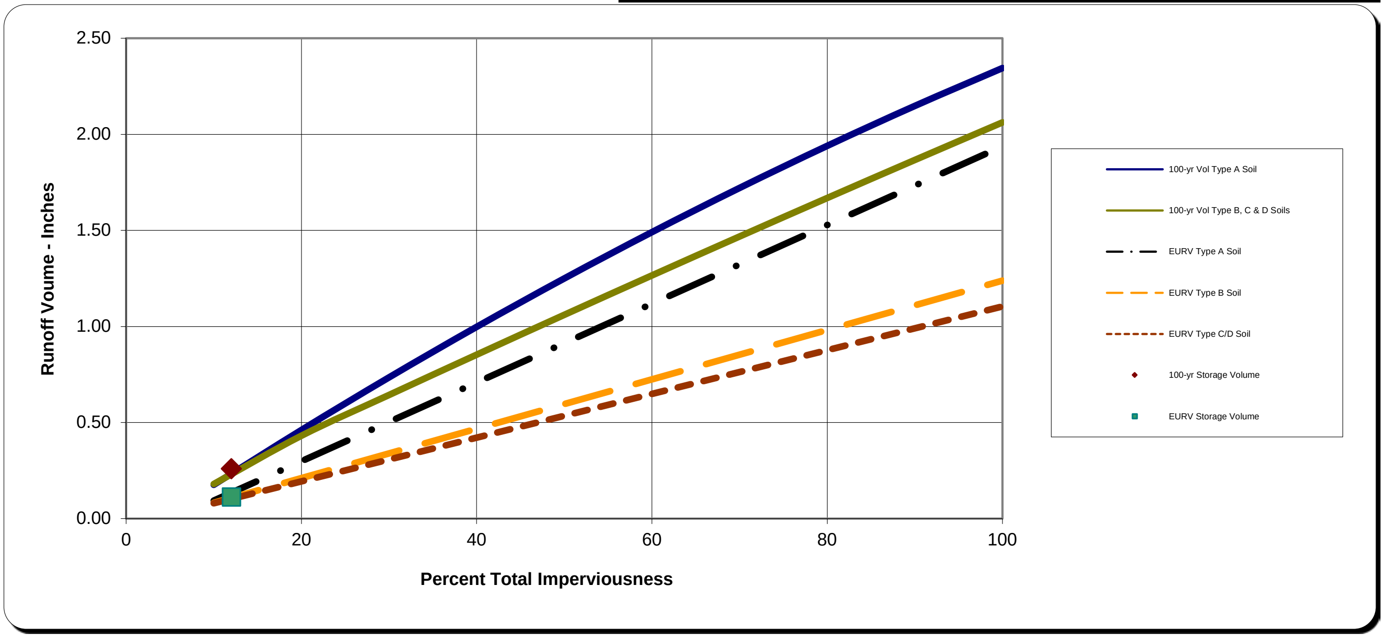
Project: Compark South
Basin ID: GAT-1

* 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
Type B		0.0
Type C or D	100.0%	17.5

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay
Initial--f_i	Final--fo	Coefficient--a
3	0.5	0.0018

	Detention Volumes [2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	(acre-feet)	
Excess Urban Runoff Volume[4]	0.11	0.16	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.26	0.38	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

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

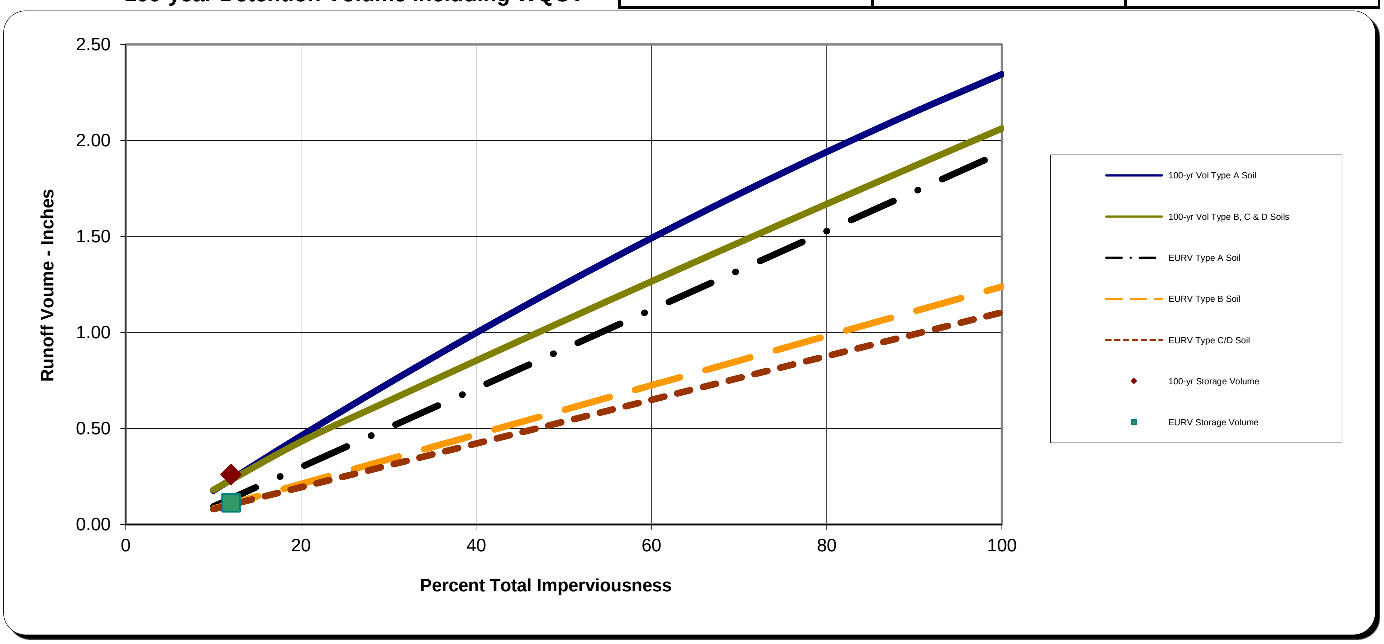
Project: Compark South
Basin ID: GAT-2

* 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)	
Excess Urban Runoff Volume[4]	0.11	0.23	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.26	0.52	24.00



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.

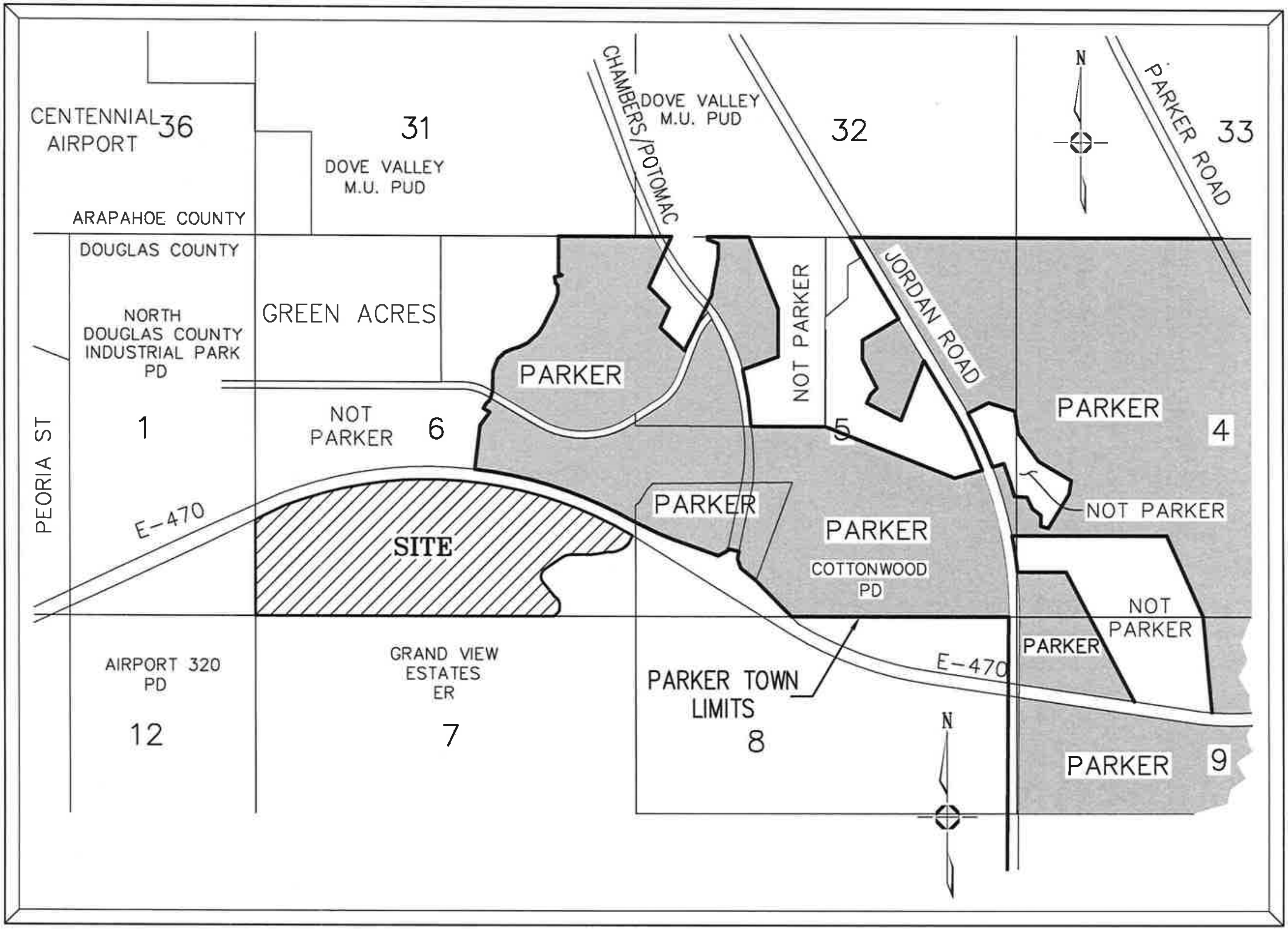
4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

MAPS

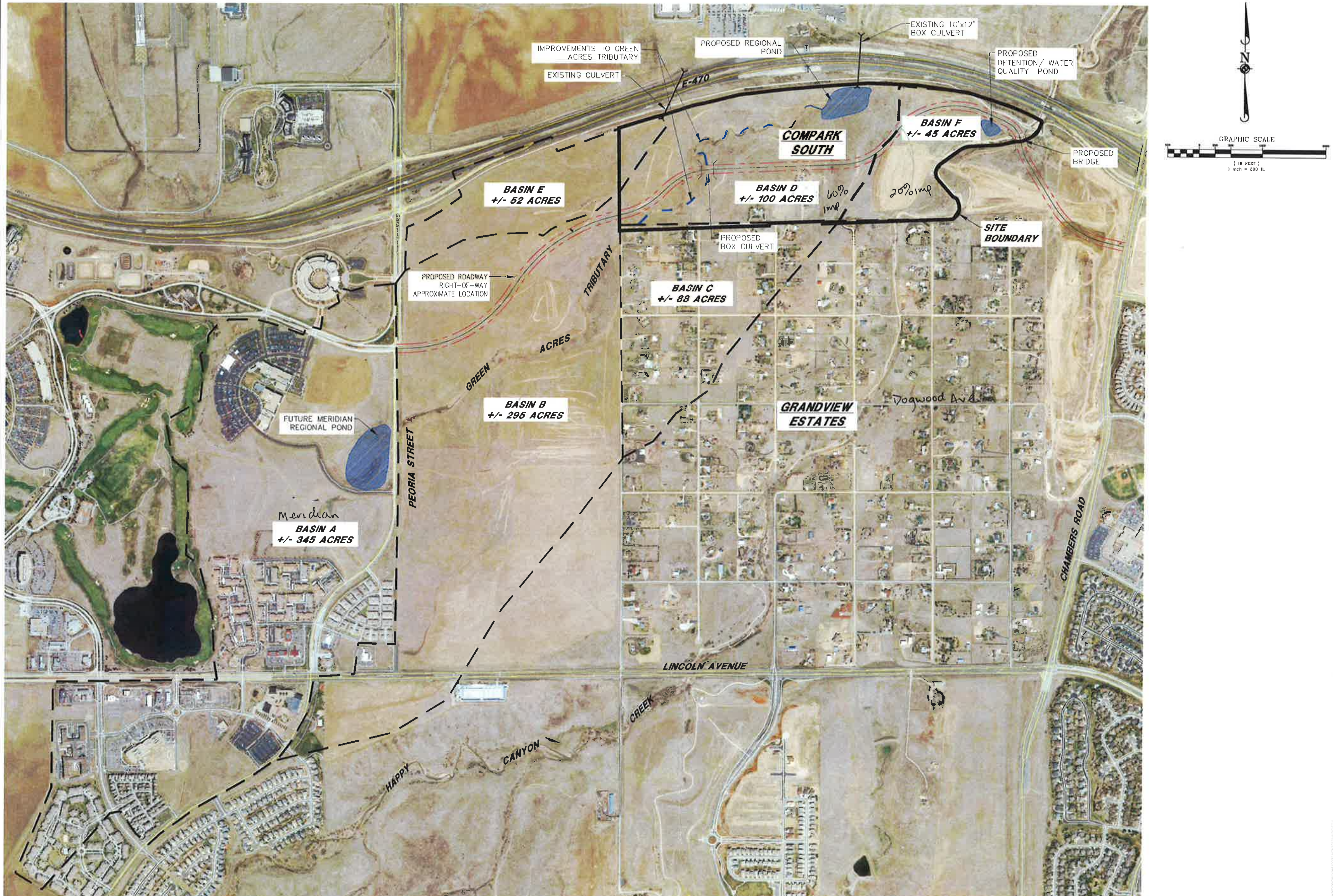
Vicinity Map
Overall Basin Drainage Plan

Initially Submitted November 20, 2015



VICINITY MAP

N.T.S.



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Construction Managers • Environmental Scientists • Landscape Architects • Planners

CHAMBERS CROSSING
PARKER, COLORADO
GREEN ACRES TRIBUTARY DRAINAGE EXHIBIT

PROJ. MGR.:	RB
PROJ. ASSOC.:	JK
DRAWN BY:	JK
DATE:	08/30/11
SCALE:	+/- 1"=500'

EXHIBIT
1
CLCPKC3 110482