MASTER DEVELOPMENT DRAINAGE PLAN FOR GOLD HILL MESA AMENDMENT AND GOLD HILL MESA FILING 9 &10 PRELIMINARY/FINAL DRAINAGE REPORT COLORADO SPRINGS, COLORADO

JUNE 2018

Prepared For:

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Job No. 1713.00

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ENGINEER'S STATEMENT:

This report and plan for the final drainage design of "Gold Hill Mesa" was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or emissions on my part in preparing this report.

6/5/18
Quentin N. Armijo, P.E. 37170 Date

COLORADO REGISTERED QUENTIN N. ARMIJO 37170 PROFESSIONAL ENGINEER
Seal

DEVELOPER'S STATEMENT:

Gold Hill Neighborhood, LLC hereby certifies that the drainage facilities for Gold Hill Mesa shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Gold Hill Mesa, guarantee that the final drainage design review will absolve Gold Hill Neighborhood, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Gold Hill Neighborhood, LLC
Name of Developer

Stephanie D. Edwards 6/5/2018
Authorized Signature Date

Stephanie D. Edwards
Printed Name

Vice President / CMO
Title

142 S. Raven Mine Dr., Ste 200 80905
Address

City of Colorado Springs Statement:

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

Jonathan B. Edwards 06/21/2018
For City Engineer Date

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INTRODUCTION

PURPOSE

The purpose of this amendment is to update the proposed overall drainage patterns based upon the changes associated with the latest concept and development plan for the Gold Hill Mesa Master Development Drainage Plan (MDDP), prepared by Matrix Design Group, Inc., May 2005. The layout of the site has been altered since the original MDDP. The concept plan is being amended to show overall changes to the proposed commercial area and the residential areas, which include the layout and acreage of these areas. In the original MDDP the commercial area was assumed to be 49.8 acres while it is now proposed to be 45 acres. Also in the previous MDDP the overall area tributary (Basin A) to existing Pond 1 has changed from 162.92 acres to 153.25 and the area tributary (Basin B) to existing Pond 2 has changed from 55.66 acres to 46.24. This MDDP amendment identifies onsite drainage patterns for the major basins, and the need to provide the required Water Quality Capture Volumes and the Full Spectrum Detention for existing future developments within the Gold Hill Mesa site based upon the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 & 2 May 2014. The purpose of the Final Drainage Report for Gold Hill Mesa Filings 9 & 10 is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities and size the storm sewer system.

DBPS

The Gold Hill Mesa site lies within the Miscellaneous Drainage Basin and is tributary to Fountain Creek. There is no Drainage Basin Planning Study for the Gold Hill Mesa development.

GENERAL PROJECT DESCRIPTION

The Gold Mesa Concept Plan consists of 219 acres. As mentioned above Gold Hill Mesa Filings No. 9's 7.005 acres consisting of 54 lots & 10's 8.848 acres containing 55 lots are also analyzed as part of this report due to the concurrent submittal of the revised Gold Hill Mesa concept plan and the Development Plan for Filing 9 & 10. The "Final Drainage Repot for Heirloom at Gold Hill Mesa

Filing 8" prepared by Terra Nova Engineering is currently in the process of approval and analyzes Basin B of this MDDP amendment in detail. Pond 2 the existing water quality pond was revised and designed to provide Full Spectrum Detention and water quality for Basin B. The Drainage Letter for Gold Hill Mesa Filing No. 8 is also currently in the process of approval.

This area has been previously studied in the report titled "Master Development Drainage Plan for Gold Hill Mesa", prepared by Matrix Design Group, Inc., revised July 2004 and "Master Development Drainage Plan Addendum for Gold Hill Mesa" Prepared by Terra Nova Engineering and dated May 2011.

The property is located in the east half of Section 14 and west half of section 13, Township 14 South, Range 67 West of the 6th Principal Meridian in the city of Colorado Springs, Colorado, southeast of the intersection of US Highway 24 and 21st Street. (See vicinity map) More specifically, the site is bounded to the north by Highway 24, to the east by Portland Heights subdivision and A-1 Mobile Home Park, to the south by Lower Gold Camp Road, and the west by 21st Street.

An aerial survey done in January of 2012 by Rampart Surveys, Inc. is the basis for the design of the drainage basins.

PROJECT CHARACTERISTICS

The Gold Hill Mesa site lies on south end of the Miscellaneous Drainage Basin. There is no offsite flows entering the site. On the west side of the site the curb and gutter for 21st Street intercepts the flow and keeps it from entering the site. Lower Gold Camp road to the south also intercepts the flow from the south and the properties to the east and north are downstream of Gold Hill Mesa.

Slopes on the site range from 2% to 40% with the steeper slopes. The site has an upper Mesa where a majority of the single family development is located and the slopes are gentler. The lower section contains the future commercial development, detention/water quality ponds and open space. The area between the single family and commercial development contains open space area with steep slopes ranging from 20% to 40%.

The site consists of 7.6% Chaseville-Midway complex (18), 13.6% Razor-Midway complex (75) , 4.1% Usitc Torrifluvents, loamy (101), water 2.5 (111) and 72.2% Dump (114), per the USDA, NRCS web soil survey. The hydrologic group "C" was used to represent the dominant soil type and determine the on site basin overland flow. (See map in appendix)

The undeveloped part of the site consists existing natural grassy vegetation with some areas void of vegetation.

As mentioned above Fountain Creek traverses the site along the northern boundary. In 2010 the construction drawings "Fountain Creek Restoration at Gold Hill Mesa - Ph I / II" improved Fountain Creek by providing a low flow channel, stabilized the side slopes and planted vegetation. The 100-year and 500- year floodplain was also mapped with this restoration. As Development of Gold Hill Mesa approaches the channel the city of Colorado Springs stream side overlay criteria will need to be followed.

Currently 2 existing water quality ponds exist on site. Pond 1is a private existing water quality pond located at the northwest corner of the site and was sized in the original Master Development Drainage Plan for Gold Hill Mesa Property to provide water quality for Basin A's 162.92 acres consisting of single family and commercial development in the original MDDP. With the City of Colorado Springs drainage criteria all future single family and commercial development and existing single family will need to provide Full Spectrum Detention. It is the intent of the developer to modify the existing water quality Pond 1 to provide the Water Quality Capture Volume and Full Spectrum Detention for the entire area tributary to Pond 1.

Pond 2 is an existing private water quality pond located at the northeast corner of the site and was sized to provide water quality for Basin B's 46.24 acres. With the single family Development Plan/Final Plat submittal for "Heirloom at Gold Hill Mesa Filing No. 8" Full Spectrum Detention was required. The existing water quality pond has been designed and upgraded to provide detention for the entire Basin B's 46.24 acres with the "Final Drainage Repot for Heirloom at Gold Hill Mesa Filing 8" prepared by Terra Nova Engineering and currently in the process of approval. With Pond 2

providing Water Quality Capture Volume and Full Spectrum Detention for the 46.24 acres of single family and open space it is the intent to make it a public pond and have the City provide maintenance once the City has accepted the hillside tributary to Pond 2 to be considered stabilized and no more significant erosion is occurring.

The site currently consists of 91ac ± of existing single family development and the rest open space with 2 existing water quality ponds. The remaining development shows approximately 45 ac ± of future commercial development and 23 ac ± of single family development.

HYDROLOGIC ANALYSIS FOR MDDP

MAJOR DRAINAGE BASIN

The Gold Hill Mesa site lies within the Miscellaneous Drainage Basin and a majority of it is developed. Runoff is tributary to Fountain Creek.

METHODOLOGY

The City of Colorado Springs Drainage Criteria, dated May 2014 was resource used in calculating the runoff. The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per section 6 of the criteria. Runoff was calculated using the Rational Method for developed conditions with the exception of Basin A where the SCS method was used due to the acreage being greater than 130. Runoff coefficients were calculated using weighted impervious values for each specific basin.

EXISTING MAJOR SUBBASIN DESCRIPTION (FOR MDDP)

BASIN A

Currently the existing storm runoff from Basin A's 153.25 acres drains overland with slopes ranging from 2% to 40% to the north and east via sheet flow, curb & gutter, and existing storm drain to the existing private water quality pond. The current developed flows are ultimately transported via a public 60" storm drain to water quality Pond 1 while the undeveloped flows sheet flow into the pond or Fountain Creek. The pond ultimately released runoff to the creek.

BASIN B

Currently the runoff within Basin B's 46.24 acres sheet flows to curb & gutter and into the existing

public 30" storm drain into water quality Pond 2 or sheet flows overland into Pond 2.

BASIN C

The area along Fountain Creek that will not be developed sheet flows into Fountain Creek and comprises the 16.12 acres of Basin C. Runoff drains overland into Fountain Creek.

BASIN D

The 2.29 acres along the southern boundary consisting of existing developed single family rear yards sheet flows to a swale where the runoff is directed to an existing area inlet and 18' storm drain routs the flows through the Crown Hill Mesa subdivision storm system.

INTERIM CONDITION PROPOSED MAJOR SUBBASIN DESCRIPTION (FOR MDDP)

With the unknown timing of the full build out of the Gold Hill Mesa commercial property not being known at this time the owner is providing cleanup of the existing Water Quality Pond 1. In the interim condition the pond will provide EURV Detention for all the developed single family development and open space tributary to the existing Water Quality Pond 1, while also providing Water Quality and Full Spectrum Detention for the recently submitted Gold Hill Mesa Filings 9 & 10 and the soon to be submitted Villa De Mesa Townhomes. Below is a description of the interim condition and the section after that will describe the future fully developed site and all the required Water Quality and Full Spectrum Detention required for all that is tributary to Pond 1.

BASIN A

The developed runoff (Q_5 = 98 cfs, Q_{100} = 171 cfs) for Basin A's 130.72 acres of single family area, open space and future commercial area was calculated using the SCS method due to the size of the basin. The developed flows will be transported to water quality Pond 1 via the existing 60" public RCP or by overland sheet flow. As mentioned above the pond is going to be cleaned up and with that we are going to add some more volume by raising the top to 6029.00 from a 6028.00. Also the bottom of the pond at the existing WQ outlet will have 2' removed to lower it to a 6020.00. As mentioned above the existing tributary area to the pond will need to have water quality provided. It is noted that 12.42 acres of current undeveloped open space located within Basin A is captured in depressions and bowls, never making it to the existing pond. This area is shown on the MDDP map

as Basin A1. A description of this basin will follow below.

Full Spectrum Detention will now be provided for Gold Hill Mesa Filings No. 9 & 10 and the soon to be submitted Villa De Mesa Townhomes. The pond is being sized to account for Full Spectrum Detention for and water quality for Gold Hill Mesa Filings No. 9 & 10 and the soon to be submitted Villa De Mesa Townhomes and the pond will also continue to provide EURV detention for all the developed single family development and open space tributary to the existing Water Quality Pond 1. In order to make sure the pond volume was sufficient I entered the area for Filing 9 & 10 and the Townhome project (20.24 acres total) into the UD-Detention V3.07 spreadsheet and found the required 100-year detention needed for Gold Hill Mesa Filings No. 9 & 10 and Villa De Mesa Townhomes within Basin A. This yielded a required 0.938 ac-ft for the 100-year minus EURV detention volume. This numbers were then entered into a second UD-Detention V3.07 spreadsheet with the total area and imperviousness for the Basin A. This yielded a required WQCV of 2.126 ac-ft and EURV of 3.506 ac-ft. The above mentioned volume for the 100-year minus EURV detention was also entered into the spreadsheet as User Defined. This gave a total required volume of 6.615 ac-ft. With the regrading to the existing pond it now has a total volume of 21.75 ac-ft. The existing 5' x 5' outlet box with a 30" RCP outlet for the WQCV and EURV year release will be kept in place with the exception of adding a new outlet plate on the front to meet the 3-orifice requirement. The metal plate will have 1 column containing 3 rows the first 2 are 2" wide x 3.36" high orifice holes for an area of 7.32 sq in spaced 28.44" apart starting at 6014.00 the top hole is 2" wide x 3.36" high orifice holes for an area of 20.0 sq in . The WQCV release is 0.90 cfs with a ponding elevation of 6018.59 and takes 40 hours to release. The EURV release is 2.1 cfs, with an elevation of 6020.90 0and takes 72 hours to release. The existing 20' x 6' outlet box will have the grate removed and top cut down 3.37' from 6027.00 to an elevation of 6023.63. The box currently has dual 42" RCP outlets in the interim condition a ½" steel plate will be placed over one of the existing dual 42" RCP outlets and a second plate will be placed 36" above the invert to restrict the 100-year release rate to 151.8 cfs with an elevation of 6025.01 This release is conformance with the predeveloped flow of 163.1 cfs. A 115' long emergency spillway 6027.10 and will pass the 100 year flow with a depth of 0.89' (top of water = 6028.99), leaving 1.01' freeboard.

BASIN B

The developed runoff (Q_5 = 64 cfs, Q_{100} = 126 cfs) for Basin B's 46.24 acres single family area and open space sheet flows to curb & gutter and into the existing public 30" storm drain into water quality Pond 2 or sheet flows overland into Pond 2. Pond 2 is currently being upgraded in the Heirloom at Gold Hill Mesa Filing No. 8 development from a water quality basin to a 4.609 ac-ft Full Spectrum Extended Detention Basin.

BASIN C

The area along Fountain Creek that will not be developed and some future commercial area curenlty not tributary to Pond 1 sheet flows into Fountain Creek and comprises the 26.06 acres of Basin C. Runoff (Q_5 = 45 cfs, Q_{100} = 90 cfs) drains overland into Fountain Creek.

BASIN D

The 2.29 acres along the southern boundary consisting of developed single family rear yards sheet flows to a swale where the runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) is directed to an existing area inlet and 18" storm drain routs the flows through the Crown Hill Mesa subdivision storm system.

ULITMATE BUILD OUT PROPOSED MAJOR SUBBASIN DESCRIPTION (FOR MDDP)

BASIN A

The developed runoff (Q_5 = 116 cfs, Q_{100} = 202 cfs) for Basin A's 153.25 acres of single family area, open space and future commercial area was calculated using the SCS method due to the size of the basin. The developed flows will be transported to water quality Pond 1 via the existing 60" public RCP or the proposed 36" public RCP that will need to be built with future development. As mentioned above the pond is going to be upgraded to account for the single family Full Spectrum Detention now with the Development Plan/Final Plat Submittal for Gold Hill Mesa Filings No. 9 & 10 triggering the upgrade. The pond is being sized to account for Full Spectrum Detention and water quality for the entire 153.25 acres consisting of the existing developed single family, the current platting of Filings No. 9 & 10, and future single family & commercial development. The UD-Detention V3.07 spreadsheet was used to calculate the required EURV and 100-year detention needed for Basin A. This yielded a required WQCV of 3.387 ac-ft, a EURV volume of 6.678 ac-ft and 7.186 for the 100-year detention volume, for a total volume of 17.251 ac-ft. The current Pond 1

has a volume of 21.750 ac-ft based upon the expansion of the pond in the interim condition. It also has an existing 5' x 5' outlet box with a 30" RCP outlet for the WQCV and EURV release. An existing 20' x 6' outlet box with the grate set at 6027.00 routes the 100-year release using dual 42" RCP outlets into Fountain Creek. One of the existing dual 42" RCP outlets was covered by a steel plate and the other one had a plate set 36" above the invert to keep the 100-year releases at 90% of the pre-developed runoff. An existing 60" RCP routes a majority of the developed upstream runoff into the pond via an existing private concrete energy dissipater.

The pond was expanded to 21. 75 ac-ft in the interim condition and will be upgraded in the ultimate condition when the commercial area starts to develop. The improvements to the pond in the ultimate condition consist of the addition of 12' wide maintenance access roads to the forebays & micropool, a 4' wide trickle channel, energy dissipaters and a 115' long armored spillway with a concrete stem wall. The existing concrete energy dissipater for 60" RCP will need to have a 23.5' x 25' concrete slab with a 2.5' high wall added to the end of it to provide 2,254 cu ft forebay which is 59% of the required 3% WQCV of 3,822 cu ft. It is proposed that when the final design of the commercial piece places the exact location of the storm sewer outfall into the pond the forebay will need to provide a minimum 1.5% or 1911 cu ft to get the total required 3% (See Full Spectrum & Water Quality Calculations in appendix for calculations). A proposed 4' wide trickle channel with 6" curb heads at 1% will route the flow from the forebay to the micropool. The existing 5' x 5' box will be removed and the 30" RCP will be kept in place and attached to the new WQCV and EURV 4' x 4' box with the top set at 6023.63. The bottom of the micropool is 6011.50, the top is 6014 and the initial surcharge volume is set at 6014.33. A metal plate over the front with 1 column containing 3 rows of a 5.78" wide x 2.0" high orifice holes for an area of 11.56 sq in spaced 38.4" apart starting at 6014.00. The WQCV release is 1.5 cfs with an elevation of 6019.49 and takes 40 hours to release. The EURV release is 2.8 cfs, with an elevation of 6023.38 and takes 75 hours to release. The existing 20' x 6' outlet box had the grate removed and top cut down 3.37' from 6027.00 to an elevation of 6023.63 in the interim condition as previously mentioned. The ½" steel plate placed over one of the existing dual 42" RCP outlets will remain and the other steel plate placed in the interim condition 36"above the invert will be removed. This gives a 100-year release rate of 174.8 cfs with an elevation of

6026.48. This release is conformance with the predeveloped flow of 199.5 cfs being 90%. The 115' long emergency spillway placed in the interim condition will now be armored and designed per City of Colorado Springs detail 13.12b Emergency Spillway Profile at Embankment is set at the 6027.10 and will pass the 100 year flow with a depth of 1.09' (top of water = 6028.19) allowing for a freeboard of 0.81'. This is less than the required 1.0', therefore a variance is being requested. The access road acting as the downstream berm for of the emergency spillway will have 2' of buried riprap and a concrete cutoff wall. The downstream slope will have grouted d50=12" riprap with a bury depth of 2' and covered in native soil (See Hydraulic Calculations in appendix for calculations).

BASIN B

The developed runoff (Q_5 = 64 cfs, Q_{100} = 126 cfs) for Basin B's 46.24 acres single family area and open space sheet flows to curb & gutter and into the existing public 30" storm drain into water quality Pond 2 or sheet flows overland into Pond 2. Pond 2 is currently being upgraded in the Heirloom at Gold Hill Mesa Filing No. 8 development from a water quality basin to a 4.609 ac-ft Full Spectrum Extended Detention Basin.

BASIN C

The area along Fountain Creek that will not be developed sheet flows into Fountain Creek and comprises the 16.12 acres of Basin C. Runoff (Q_5 = 16 cfs, Q_{100} = 34 cfs) drains overland into Fountain Creek.

BASIN D

The 2.29 acres along the southern boundary consisting of developed single family rear yards sheet flows to a swale where the runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) is directed to an existing area inlet and 18" storm drain routs the flows through the Crown Hill Mesa subdivision storm system.

HYDRAULIC ANALYSIS

MAJOR DRAINAGEWAYS

As noted above Fountain Creek runs through the northern part of the site and recently had restoration done to it in 2010. With this 100-year & 500-year floodplain was remapped. Due to stream side

overlays no encroachment will happen along Fountain Creek. No portion of the future developed site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0728 F dated March 17, 1997 (see appendix).

HYDROLOGIC ANALYSIS FOR FILING 9 & 10 FDR

EXISTING MINOR SUBBASIN DESCRIPTION (FOR FDR)

The following is a description of the Design Points and the overall existing drainage characteristics for the development of Gold Hill Mesa Filings No. 9 & 10.

Design Point EX-3 is an existing 5' D10-R sump inlet located in Raven Mine Drive. This design point is Inlet #3 in the "Final Drainage Report Gold Hill Mesa Filing No. 1." Runoff (Q_5 = 1.1 cfs, Q_{100} = 2.3 cfs) from Basin EX-C's 1.18 acres sheet flows over undeveloped land and onto the eastern half Raven Mine Drive. Runoff (Q_5 = 1.4 cfs, Q_{100} = 2.7 cfs) from offsite Basin OS-C's 0.47 acres consisting of developed single family lots is routed via side lot line swales into a public alley and then onto Raven Mine Drive. The combined runoff (Q_5 = 2.4 cfs, Q_{100} = 4.7 cfs) of the 2 basins at Design Point EX-3 is captured in the existing inlet then routed via an existing 15" public lateral to the existing 60" RCP in Raven Mine Drive.

Design Point 3 is an existing public 12' D10-R at-grade inlet located at the north end of Raven Mine Drive. This design point is Design point 3 in the "Final Drainage Report Gold Hill Mesa Filing No. 6." Runoff (Q_5 = 1.6 cfs, Q_{100} = 3.4 cfs) from Basin EX-E's 1.60 acres sheet flows over undeveloped land and onto the eastern half Raven Mine Drive. Runoff (Q_5 = 1.4 cfs, Q_{100} = 2.9 cfs) from offsite Basin OS-E's 0.47 acres consisting of the half street section is routed via curb & gutter north to DP-3. The combined runoff (Q_5 = 3.0 cfs, Q_{100} = 6.1 cfs) of the 2 basins at Design Point 3 is captured in the existing inlet then routed via an existing 18" public lateral to the existing 60" RCP in Raven Mine Drive. (See UD-Inlet V4.05 inlet DP-3 existing in the appendix under Hydraulic Calculations.)

Design Point 4 is an existing public 12' D10-R at-grade inlet located at the north end of Raven Mine Drive opposite of DP-3. This design point is Design point 2 in the "Final Drainage Report Gold Hill

Mesa Filing No. 6." Runoff (Q_5 = 4.9 cfs, Q_{100} = 9.6 cfs) from Basin OS-G1's 2.06 acres sheet flows over developed single family lots and onto the western half of Raven Mine Drive and routed via curb & gutter north to DP-3. The existing inlet captures Q_5 = 4.9 cfs, Q_{100} = 8.6 cfs, while Q_{100} = 1.0 cfs flows by and is routed downstream towards Design Point 5 then routed via an existing 18" public lateral to the existing 60" RCP in Raven Mine Drive. (See UD-Inlet V4.05 inlet DP-4 existing in the appendix under Hydraulic Calculations.)

Design Point 5 is an existing overland swale at the north end of Raven Mine Drive that routes runoff offsite. This design point is Design point 4 in the "Final Drainage Report Gold Hill Mesa Filing No. 6." Runoff (Q_5 = 4.9 cfs, Q_{100} = 9.6 cfs) from Basin OS-G1's 2.06 acres sheet flows over developed single family lots and onto the western half of Raven Mine Drive and routed via curb & gutter north to DP-3. The existing inlet captures Q_5 = 4.9 cfs, Q_{100} = 8.6 cfs, while Q_{100} = 1.0 cfs flows by and is routed downstream towards Design Point 5. (See UD-Inlet V4.05 inlet DP-4 existing in the appendix under Hydraulic Calculations.) Runoff (Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs) from Basin OS-G2's 0.06 acres of undeveloped land sheet flows east onto Basing EX-G. Runoff (Q_5 = 0.4 cfs, Q_{100} = 0.8 cfs) from Basin EX-G's 0.29 acres of undeveloped land sheet flows north with the flow by from DP-4 and OS-G2's runoff. The combined runoff (Q_5 = 0.3 cfs, Q_{100} = 3.5 cfs) is routed north by the existing swale in its historic path.

Design Point 6 is an existing overland swale located at the northwest area of the mesa top. Runoff (Q_5 = 7.2 cfs, Q_{100} = 14.3 cfs) from Basin EX-H's 9.57 acres sheet flows northwest over undeveloped open space to DP-6. The runoff is routed north by the existing swale in its historic path.

Basin EX-J's 1.05 acre consist of undeveloped slope along the north end of the mesa top. Runoff (Q_5 = 1.2 cfs, Q_{100} = 2.7 cfs) historically sheet flows north across open space.

Basin EX-F's 1.53 acre consist of undeveloped slope along the east end of the mesa top. This is part of the Basin F from the "Final Drainage Report Heirloom Gold Hill Mesa Filing No. 8" and the area is accounted for in the Full Spectrum Detention design of the EDB located at Pond 2 Runoff (Q_5 = 1.2 cfs, Q_{100} = 2.7 cfs) historically sheet flows northeast across open space and into the proposed

EDB.

Design Point EX-12 is a temporary sediment basin located at the south east corner of the mesa top just north of the Heirloom Gold Hill Mesa Filing No. 8. This design point corresponds to Design point 12 in the "Final Drainage Report Heirloom Gold Hill Mesa Filing No. 8" Runoff (Q_5 = 4.9 cfs, Q_{100} = 9.6 cfs) from Basin OS-H's 1.34 acres of single family developed lots sheet flows over developed single family lots and onto the eastern half of Olympian Drive and routed via curb & gutter north to DP-EX12. Runoff (Q_5 = 4.9 cfs, Q_{100} = 9.6 cfs) from Basin OS-I's 0.22 acres of single family developed lots sheet flows over developed single family lots and onto the western half of Olympian Drive and then is routed via curb & gutter north to DP-EX-12. The combined flow at DP-EX12 (Q_5 = 3.6 cfs, Q_{100} = 7.1 cfs) is routed through the temporary sediment basin and then is discharged down the slope to the EDB at Pond 2. With the design of Filings 9 & 10 this area will be tributary to the newly designed EDB at Pond 1.

PROPOSED MINOR SUBBASIN DESCRIPTION (FOR FDR)

The following is a description of the Design Points and the overall proposed drainage characteristics for the development of Gold Hill Mesa Filings No. 9 & 10. The Design Points were determined using the Rational Method since the total of the area being analyzed is less than 130 acres and the combined acreage at any Design Point is also less than 130 acres.

Design Point EX4 is an existing public 5' sump inlet located in the north curb of Gold Hill Mesa Drive just east of Raven Mine Drive. This design point is Inlet #6 in the "Final Drainage Report Gold Hill Mesa Filing No. 1." Runoff (Q_5 = 1.4 cfs, Q_{100} = 2.8 cfs) from Basin D's 0.62 acres sheet flows to side lot lines and onto a public alley or Favorite Street and then to Gold Hill Mesa Drive. Runoff (Q_5 = 2.8 cfs, Q_{100} = 5.4 cfs) from offsite Basin OS-D's 1.19 acres consisting of developed single family lots is routed via side lot line swales into a public alley and then onto Gold Hill Mesa Drive. The combined runoff (Q_5 = 4.8 cfs, Q_{100} = 9.7 cfs) of the 2 basins at Design Point EX-3 is captured in the existing inlet.

Design Point 1 is a proposed public 12' sump inlet located in the south curb of Mayflower Street just

east of Raven Mine Drive. Runoff (Q_5 = 1.1 cfs, Q_{100} = 2.2 cfs) from offsite Basin OS-C's 0.39 acres sheet flows to side lot lines and onto a public alley to Raven Mine Drive and then north. Runoff (Q_5 = 1.7 cfs, Q_{100} = 3.4 cfs) from Basin C's 1.19 acres consisting of proposed single family lots is routed via side lot line swales onto a public alley and Solitaire Street then onto Raven Mine Drive. Runoff (Q_5 = 1.7 cfs, Q_{100} = 3.4 cfs) from Basin A3's 1.07 acres consisting of proposed single family lots is routed via side lot line swales onto Raven Mine Drive. The combined runoff (Q_5 = 5.4 cfs, Q_{100} = 10.8 cfs) of the 3 basins at Design Point 1A was calculated to check street capacities (See Hydraulic Calculations in appendix). Runoff (Q_5 = 2.4 cfs, Q_{100} = 4.7 cfs) from Basin A1's 1.27 acres consisting of proposed single family lots and open space sheet flows overland to a proposed 1' deep swale and then is directed north onto the south half of Mayflower Street. Runoff (Q_5 = 4.8 cfs, Q_{100} = 9.5 cfs) from Basin A2's 1.76 acres consisting of proposed single family lots is routed via side lot line swales onto public alleys and then directed onto the south half of Mayflower Street. The combined runoff at Design Point 1 is Q_5 = 12.2 cfs, Q_{100} = 23.9 cfs. It is assumed that the flow at Design Points 1 & 2 re split between the 2 inlets. Pipe Run 1 a 24" RCP will route the flow to Design Point 2

Design Point 2 is a proposed public 12' sump inlet located in the north curb of Mayflower Street opposite of Design Pont 1. Runoff (Q_5 = 1.5 cfs, Q_{100} = 3.0 cfs) from Basin B's 0.47 acres sheet flows onto Mayflower Street and then is routed north. The 2-12' inlets at Design Point 1 & 2 are assumed to split the flow, with each capturing Q_5 = 6.7 cfs, Q_{100} = 13.2 cfs. Pipe run 1 a public 18" RCP storm lateral transports the flow (6.7 cfs, Q_{100} = 13.2 cfs) north to Design Point 2. The combined flow of both inlets (13.4 cfs, Q_{100} = 26.3 cfs) is then routed via a public 30" RCP (Pipe Run 2) west to a junction with the existing public 60" RCP in Raven Mine Drive using a concrete collar

Design Point 3 is an existing public 12' D10-R at-grade inlet located at the north end of Raven Mine Drive in the east curb line. This design point is Design point 3 in the "Final Drainage Report Gold Hill Mesa Filing No. 6." Runoff (Q_5 = 1.1 cfs, Q_{100} = 2.1 cfs) from Basin E's 0.38 acres sheet flows over sheet flows to side lot line swales then and onto the eastern half Raven Mine Drive. The at grade inlet captures all of the flow (See UD-Inlet V4.05 inlet DP-3 in the appendix under Hydraulic

Calculations.) The existing 18" public lateral routes the runoff east to the existing 60" RCP in Raven Mine Drive.

Design Point 4 is an existing public 12' D10-R at-grade inlet located at the north end of Raven Mine Drive opposite of DP-3. This design point is Design point 2 in the "Final Drainage Report Gold Hill Mesa Filing No. 6." Runoff (Q_5 = 4.9 cfs, Q_{100} = 9.6 cfs) from Basin OS-G1's 2.06 acres sheet flows over developed single family lots and onto the western half of Raven Mine Drive and routed via curb & gutter north to DP-3. The existing inlet captures Q_5 = 4.9 cfs, Q_{100} = 8.6 cfs, while Q_{100} = 1.0 cfs flows by and is routed downstream towards Design Point 5 then routed via an existing 18" public lateral to the existing 60" RCP in Raven Mine Drive. (See UD-Inlet V4.05 inlet DP-4 in the appendix under Hydraulic Calculations.)

Design Point 5A is a proposed public 12' D10-R at-grade inlet located in the south curb line of Olympian Drive. This inlet was placed to be in conformance with street capacity. Runoff (Q_5 = 3.1 cfs, Q_{100} = 6.1 cfs) from Basin OS-H's 1.34 acres sheet flows over developed lots to side lot line swales and then onto the Solitaire Street then onto Olympian Drive where it is directed north. Runoff (Q_5 = 4.2 cfs, Q_{100} = 8.2 cfs) from Basin H1's 1.82 acres sheet flows over developed lots to side lot line swales and then Olympian where it is directed north. The combined flow of the 2 basins at Design Point 5A is Q_5 = 7.1 cfs, Q_{100} = 13.7 cfs. The 12' at grade inlet captures Q_5 = 6.9 cfs, Q_{100} = 10.7 cfs) while Q_5 = 0.2 cfs, Q_{100} = 3.1 cfs continues down Olympian Drive to Design Point 5 (See UD-Inlet V4.05 inlet DP-5A in the appendix under Hydraulic Calculations.) A proposed 18" public (Pipe Run 5A) storm drain routes the runoff west to Design Point 5.

Design Point 5 is a proposed public 16' sump inlet located in the south curb of Olympian Drive just east of Raven Mine Drive. Runoff (Q_5 = 4.2 cfs, Q_{100} = 8.2 cfs) from Basin H2's 1.78 acres sheet flows to side lot lines and onto a public alley then to Olympian Drive and then east. Runoff (Q_5 = 1.7 cfs, Q_{100} = 3.4 cfs) from Basin H3's 0.75 acres consisting of proposed single family lots is routed via side lot line swales onto an open space tract where a swale direct the flow onto Olympian Drive. Runoff (Q_5 = 1.7 cfs, Q_{100} = 3.4 cfs) from Basin H4's 0.93 acres consisting of proposed single family lots is routed via side lot line swales onto a public alley then to Olympian Drive. The combined

runoff (Q_5 = 8.2 cfs, Q_{100} = 18.6 cfs) of the 3 basins and the flow by from Design Point 5A at Design Point 5C was calculated to check street capacities (See Hydraulic Calculations in appendix). Runoff (Q_5 = 0.8 cfs, Q_{100} = 1.6 cfs) from Basin G's 0.34 acres consisting of proposed single family lots sheet flows overland to the east curb line of Raven Mine Drive. Runoff (Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs) from Basin OS-G2's 0.07 acres consisting of undeveloped open space sheet flows onto the west half of Raven Mine Drive. The combined runoff at Design Point 5 is Q_5 = 9.1 cfs, Q_{100} = 21.2 cfs.

Design Point 6 is a proposed public 16' sump inlet located in the north curb of Raven Mine Drive opposite of Design Pont 5. Runoff (Q_5 = 1.5 cfs, Q_{100} = 3.0 cfs) from Basin OS-I's 0.22 acres sheet flows onto Olympian Drive and then is routed north onto Basin I. Runoff (Q_5 = 4.0 cfs, Q_{100} = 7.8 cfs) from Basin I's 1.69 acres sheet flows onto Olympian Drive and then is routed north to Design Point 6. The 2-16' sump inlets at Design Point 5 & 6 are assumed to split the flow, with each capturing Q_5 = 6.7 cfs, Q_{100} = 14.9 cfs. Pipe run 5 a public 24" RCP storm lateral transports the captured flow and Pipe run 5's flow (Q_5=13.7 cfs, Q_{100} = 25.6 cfs) north to Design Point 6. The combined flow Q_5=20.4 cfs, Q_{100} = 40.4 cfs) of both inlets and Pipe run 5 (is then routed via a public 30" RCP (Pipe run 6) west to a junction with the existing public 60" RCP in Raven Mine Drive to an existing Type 1 Manhole. This 60" RCP routes all the above Design Points to the existing water quality pond that will be upgraded to an EDB with Full Spectrum Detention.

Basin J's 1.25 acre consist of the back half of single family lots along the north end of the mesa top. Runoff (Q_5 = 4.1 cfs, Q_{100} = 8.4 cfs) sheet flows north across open space and to the proposed EDB.

Basin F's 1.14 acres consist of the back half of single family lots the east end of the mesa top. This is part of the bigger Basin F from the "Final Drainage Report Heirloom Gold Hill Mesa Filing No. 8" and the area is accounted for in the Full Spectrum Detention design of the EDB located at Pond 2 Runoff (Q_5 = 3.8 cfs, Q_{100} = 7.7 cfs) sheet flows northeast across open space and into the proposed EDB.

In an effort to protect receiving water and as part of the "four step process to minimize adverse impacts of urbanization" this site was analyzed in the following manner:

1. Reduce Runoff- The new improvements and impervious area to the site will be routed to a proposed private extended detention basin (EDB). In addition to this runoff will be trapped behind the back of walks and curbs. There is also the surface roughing that has been added to the undeveloped slopes that some of the flow will be trapped and infiltrate into the ground. These above mentioned items will reduce the volume of runoff using ponding and infiltration.
2. Treat Slowly Release WQCV- The EDB has been sized and designed to sufficiently capture the required WQCV and slowly release it though the 3 hole outlet, thereby also allowing solids and contaminants to settle out.
3. Stabilize Stream Channel- By reducing the rate of runoff to the adjacent Fountain Creek the site is helping to stabilize the creek. The creek is currently stable as it was regraded with low flow water channel and stabilized with vegetation, selectively placed boulders and plunge pools in 2010 by the City of Colorado Springs.
4. Source Controls- As this development will not include outdoor storage or the potential for the introduction of contaminants to the City's MS4, since it is not an industrial or commercial site, no source controls are proposed or necessary.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 & 2 May 2014. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. The HEC-HMS program was used to calculate the SCS method for Basin A. The Urban Drainage and Flood Control District Manual (UDFCD) Volumes 1-3 were used to size the extended detention basin.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 & 2 May 2014. The pertinent data sheets are included in the appendix of this report. Manning n reports from online calculators were used to check velocities and minimum slopes for the preliminary sizing of the storm drain. The Urban Drainage and Flood Control District Manual (UDFCD) UDSewer 2009 program

was used to calculate the HGL's for both the 5 and 100-year event (see appendix for calcualtions).

WATER QUALITY

In the design of the Extended Detention Basin the City of Colorado Springs Drainage Criteria Volume 2 and the Urban Drainage and Flood Control District Manual Volume 3 were used in the design. Basin A's 153.25 acres from the MDDP with an impervious area of 67.75% was used to size the EDB (see appendix for calculations). The required WQCV was determined to be 3.387 ac-ft. The 115' long armored emergency spillway is set at the 6027.10 with a spillway flow depth of 0.89' giving 0.81' of freeboard to the top of pond (6029.00). Calculations can be found in the appendix under Full Spectrum & Water Quality Calculations.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0728 F dated March 17, 1997 (see appendix). Although Fountain Creek is just north of this area the floodplain does not impact our site.

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. The Gold Hill Mesa Pond 1 Grading, Erosion and Sediment Control Plan has been submitted with this report. Proposed straw bale check dams, silt fence, vehicle traffic control, and reseeding are proposed as erosion control measures.

CONSTRUCTION COST OPINION FOR GOLD HILL MESA FILING NO. 9 Public Reimbursable

It is the engineer's opinion that the proposed Extended Detention Basin should be reimbursable but that determination must be made by the drainage board: at this time it is not reimbursable. In the event that this basin becomes a closed basin there will be no reimbursement.

	Item	Quantity	Unit Price	Cost
1.	EDB Upgrade	1 EA	$ 250,000/EA	$ 250,000
			Total	**$ 250,000**

CONSTRUCTION COST OPINION FOR GOLD HILL MESA FILING NO. 9 Public Non Reimbursable

	Item	Quantity	Unit Price	Cost
1.	18" RCP	40 LF	$ 45/LF	$ 1,800
2.	24" RCP	77 LF	$ 55/LF	$ 4,235
3.	12' D-10R Inlet	2 EA	$ 8,000/EA	$ 16,000
4.	Type 1 Manhole	1 EA	$ 6,000/EA	$ 6,000
5.	Engineering Contingency	1 LS	10%	$ 2,803
			Total	**$ 30,838**

CONSTRUCTION COST OPINION FOR GOLD HILL MESA FILING NO. 10 Public Non Reimbursable

	Item	Quantity	Unit Price	Cost
1.	18" RCP	365 LF	$ 45/LF	$ 16,425
2.	24" RCP	33 LF	$ 55/LF	$ 1,815
3.	30" RCP	63 LF	$ 65/LF	$ 4,095
4.	12' D-10R Inlet	1 EA	$ 8,000/EA	$ 8,000
5.	16' D-10R Inlet	2 EA	$ 10,000/EA	$ 20,000
6.	Type 1 Manhole	1 EA	$ 6,000/EA	$ 6,000
7.	Engineering Contingency	1 LS	10%	$ 5,634
			Total	**$ 61,969**

DRAINAGE FEES

Filing 9

The existing site is in the Miscellaneous Basin. 2018 Drainage fees due prior to final plat recordation for the Gold Hill Mesa Filing No. 9 are as follows:

DRAINAGE FEES: 7.005 acres x $10,555.00 = $ 73,937.78

BRIDGE FEES:	7.005 acres	x	$	0.00	=	$	0.00
POND FEES:							
LAND :	7.005 acres	x	$	0.00	=	$	0.00
FACILITIES:	7.005 acres	x	$	0.00	=	$	0.00
SURCHARGE:	7.005 acres	x	$	0.00	=	$	0.00
					TOTAL	**$**	**73,937.78**

DRAINAGE FEES

Filing 10

The existing site is in the Miscellaneous Basin. 2018 Drainage fees due prior to final plat recordation for the Gold Hill Mesa Filing No. 10 are as follows:

DRAINAGE FEES:	8.848 acres	x	$10,555.00		=	$	93,390.64
BRIDGE FEES:	8.848 acres	x	$	0.00	=	$	0.00
POND FEES:							
LAND :	8.848 acres	x	$	0.00	=	$	0.00
FACILITIES:	8.848 acres	x	$	0.00	=	$	0.00
SURCHARGE:	8.848 acres	x	$	0.00	=	$	0.00
					TOTAL	**$**	**93,390.64**

In the event that this basin becomes a closed basin there will be no drainage fees.

MAINTENANCE

The proposed Extended Detention Basin at pond 1 will take all public water from the western basin of the overall Gold Hill Mesa development and reduce and slowly treat it for water quality and Full Spectrum Detention. Gold Hill Mesa Metro District will provide maintenance for the EDB The storm sewer in Filing 9 & 10 storm are public and will be maintained by the city.

SUMMARY

Development of the Gold Hill Mesa Filings No. 9 & 10 site will not adversely affect the surrounding and downstream developments. Proposed flows, as detailed in this MDDP amendment and previous reports, will follow the drainage patterns outlined in this report and the previous ones studying this area. Similarly all future developments within the site should follow this MDDP amendment. The runoff will be routed to the proposed extended detention basin and reduce the runoff to the allowable historic rates via Full Spectrum Detention while slowly treating the water quality capture volume and in turn helping to stabilize the downstream Fountain Creek banks.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Quentin N. Armijo, P.E.
Senior Project Manager

BIBLIOGRAPHY

"City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 & 2 May 2014"

"Urban Storm Drainage Criteria Manual Volumes 1, 2 & 3." Prepared by Urban Drainage and Flood Control District, March 2017

SCS Soils Map for El Paso County

"Master Development Drainage Plan For The Gold Hill Mesa", Prepared by Matrix Design Group, July 2004.

"Master Development Drainage Plan Addendum for Gold Hill Mesa" Prepared by Terra Nova Engineering and dated May 2011.

"Final Drainage Report for Gold Hill Mesa Filing No. 1A", Prepared by Matrix Design Group, May 2005.

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"Preliminary/Finale Drainage Report for Crown Hills Filing No. 5", prepared by ADP, Inc. dated July 2006.

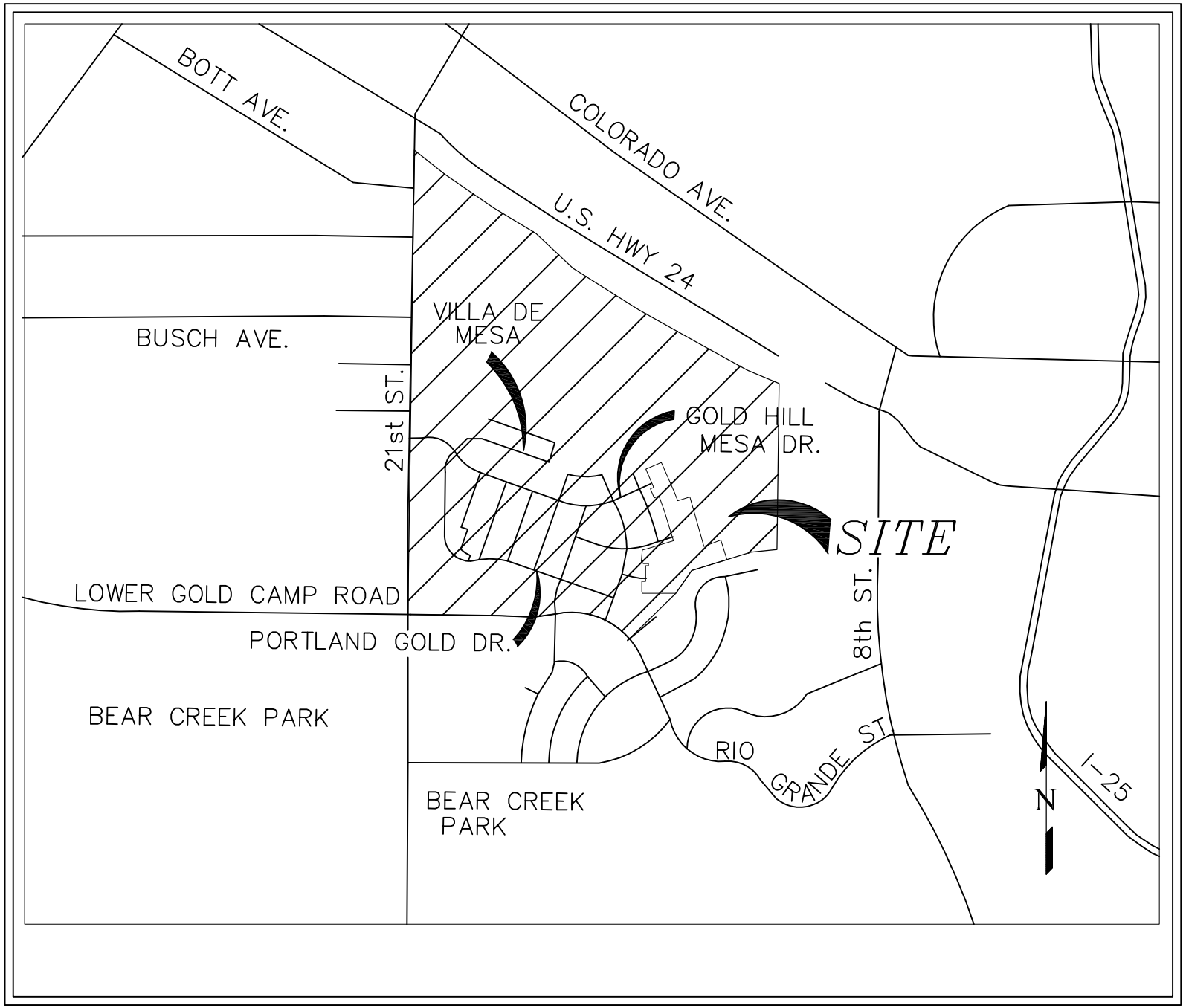
"Final Drainage Report for Gold Hill Mesa Filing No. 7", prepared by Terra Nova Engineering and dated January 2016.

"Final Drainage Report for Gold Hill Mesa Filing No. 7A", prepared by Terra Nova Engineering and dated February 2017

"Final Drainage Report for Heirloom at Gold Hill Mesa Filing No. 8", prepared by Terra Nova Engineering and dated November 2017

"Final Drainage Report for Gold Hill Mesa Filing No. 8", prepared by Terra Nova Engineering and dated November 2017

GENERAL LOCATION MAP



VICINITY MAP

N.T.S.

S.C.S. SOILS MAP

Map Scale: 1:7,540 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

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

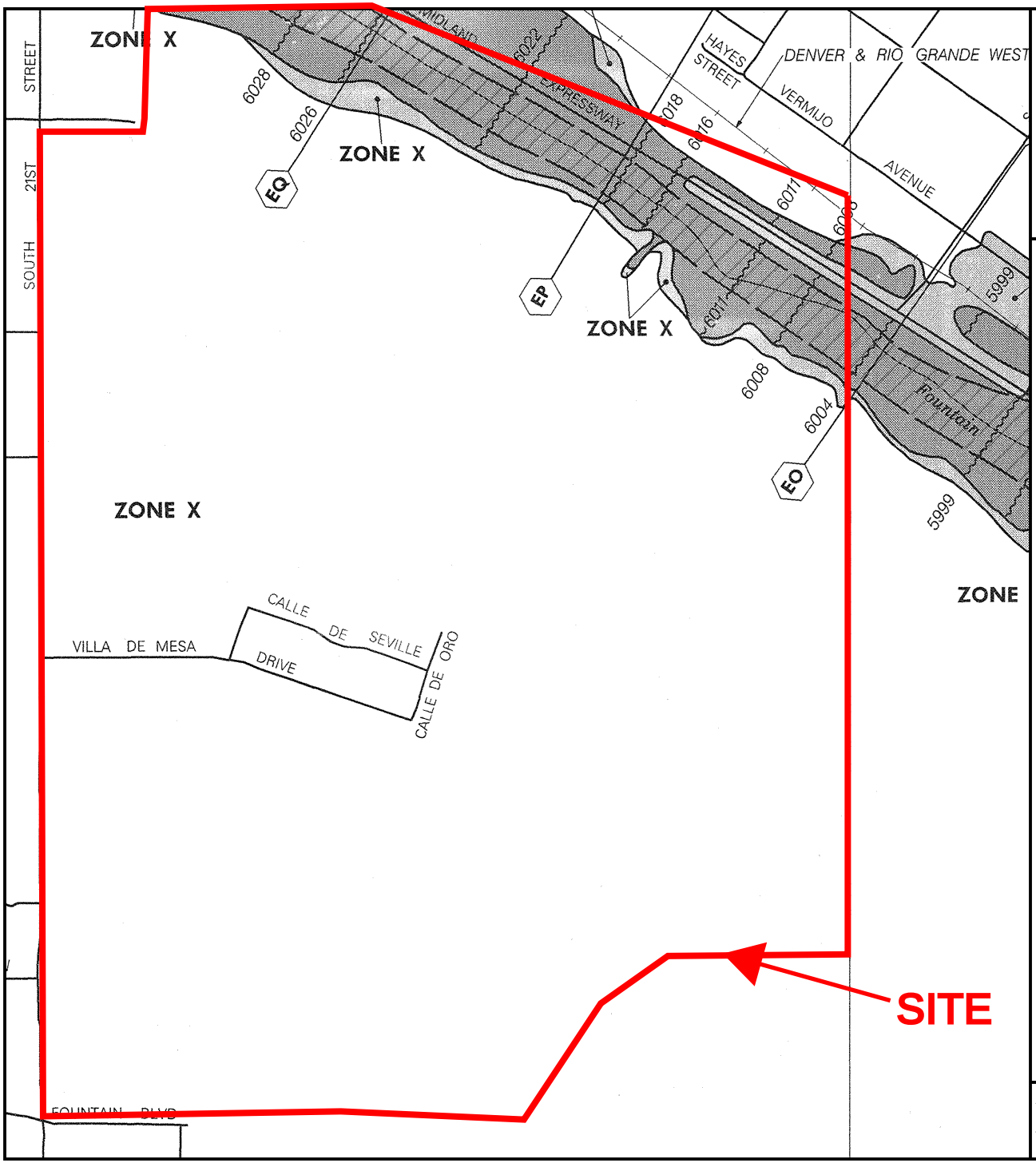
Date(s) aerial images were photographed: Apr 15, 2011—Jun 17, 2014

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

Map Unit Legend

El Paso County Area, Colorado (CO625)				
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI	Hydrological Soils Group
18	Chaseville-Midway complex	16.5	7.6%	A
75	Razor-Midway complex	29.5	13.6%	D
101	Ustic Torrifluvents, loamy	9.0	4.1%	B
111	Water	5.4	2.5%	NA
114	Dumps	157.3	72.3%	NA
Totals for Area of Interest		**217.7**	**100.0%**	

FEMA FIRM MAP



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 728 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0728	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0728	F

MAP NUMBER 08041C0728 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

For Colorado Springs and much of the Fountain Creek watershed, the 1-hour depths are fairly uniform and are summarized in Table 6-2. Depending on the location of the project, rainfall depths may be calculated using the described method and the NOAA Atlas maps shown in Figures 6-6 through 6-17.

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where Z= 6,840 ft/100

These depths can be applied to the design storms or converted to intensities (inches/hour) for the Rational Method as described below. However, as the basin area increases, it is unlikely that the reported point rainfalls will occur uniformly over the entire basin. To account for this characteristic of rain storms an adjustment factor, the Depth Area Reduction Factor (DARF) is applied. This adjustment to rainfall depth and its effect on design storms is also described below. The UDFCD UD-Rain spreadsheet, available on UDFCD's website, also provides tools to calculate point rainfall depths and Intensity-Duration-Frequency curves[2] and should produce similar depth calculation results.

2.2 Design Storms

Design storms are used as input into rainfall/runoff models and provide a representation of the typical temporal distribution of rainfall events when the creation or routing of runoff hydrographs is required. It has long been observed that rainstorms in the Front Range of Colorado tend to occur as either short-duration, high-intensity, localized, convective thunderstorms (cloud bursts) or longer-duration, lower-intensity, broader, frontal (general) storms. The significance of these two types of events is primarily determined by the size of the drainage basin being studied. Thunderstorms can create high rates of runoff within a relatively small area, quickly, but their influence may not be significant very far downstream. Frontal storms may not create high rates of runoff within smaller drainage basins due to their lower intensity, but tend to produce larger flood flows that can be hazardous over a broader area and extend further downstream.

- **Thunderstorms**: Based on the extensive evaluation of rain storms completed in the Carlton study (Carlton 2011), it was determined that typical thunderstorms have a duration of about 2 hours. The study evaluated over 300,000 storm cells using gage-adjusted NEXRAD data, collected over a 14-year period (1994 to 2008). Storms lasting longer than 3 hours were rarely found. Therefore, the results of the Carlton study have been used to define the shorter duration design storms.

  To determine the temporal distribution of thunderstorms, 22 gage-adjusted NEXRAD storm cells were studied in detail. Through a process described in a technical memorandum prepared by the City of Colorado Springs (City of Colorado Springs 2012), the results of this analysis were interpreted and normalized to the 1-hour rainfall depth to create the distribution shown in Table 6-3 with a 5 minute time interval for drainage basins up to 1 square mile in size. This distribution represents the rainfall

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Table 6-9. NRCS Curve Numbers for Pre-Development Thunderstorms Conditions (ARC I)

Fully Developed Urban Areas (vegetation established)[1]	Treatment	Hydrologic Condition	% I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	-----	-----	---	47	61	72	77
Fair condition (grass cover 50% to 75%)	-----	-----	---	29	48	61	69
Good condition (grass cover > 75%)	-----	-----	---	21	40	54	63
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way	-----	-----	---	95	95	95	95
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	-----	-----	---	95	95	95	95
Paved; open ditches (including right-of-way)	-----	-----	---	67	77	83	85
Gravel (including right-of-way)	-----	-----	---	57	70	77	81
Dirt (including right-of-way)	-----	-----	---	52	66	74	77
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	-----	-----	---	42	58	70	75
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	-----	-----	---	91	91	91	91
Developing Urban Areas[1]	**Treatment[2]**	**Hydrologic Condition[3]**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Newly graded areas (pervious areas only, no vegetation)	-----	-----	---	58	72	81	87
Cultivated Agricultural Lands[1]	**Treatment**	**Hydrologic Condition**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Fallow	Bare soil	-----	---	58	72	81	87
	Crop residue cover (CR)	Poor	---	57	70	79	85
		Good	---	54	67	75	79
Row crops	Straight row (SR)	Poor	---	52	64	75	81
		Good	---	46	60	70	77
	SR + CR	Poor	---	51	63	74	79
		Good	---	43	56	66	70
	Contoured (C)	Poor	---	49	61	69	75
		Good	---	44	56	66	72
	C + CR	Poor	---	48	60	67	74
		Good	---	43	54	64	70
	Contoured & terraced (C&T)	Poor	---	45	54	63	66
		Good	---	41	51	60	64
	C&T+ CR	Poor	---	44	53	61	64
		Good	---	40	49	58	63
Small grain	SR	Poor	---	44	57	69	75
		Good	---	42	56	67	74
	SR + CR	Poor	---	43	56	67	72
		Good	---	39	52	63	69
	C	Poor	---	42	54	66	70
		Good	---	40	53	64	69
	C + CR Poor	Poor	---	41	53	64	69
		Good	---	39	52	63	67
	C&T	Poor	---	40	52	61	66
		Good	---	38	49	60	64
	C&T+ CR	Poor	---	39	51	60	64
		Good	---	37	48	58	63
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	---	45	58	70	77
		Good	---	37	52	64	70
	C	Poor	---	43	56	67	70
		Good	---	34	48	60	67
	C&T	Poor	---	42	53	63	67
		Good	---	30	46	57	63

Table 6-9. (continued)

Other Agricultural Lands[1]	Treatment	Hydrologic Condition	% I	HSG A	HSG B	HSG C	HSG D
Pasture, grassland, or range—continuous forage for grazing[4]	-----	Poor	---	47	61	72	77
	-----	Fair	---	29	48	61	69
	-----	Good	---	21	40	54	63
Meadow—continuous grass, protected from grazing and generally mowed for hay	-----	-----	---	15	37	51	60
Brush—brush-weed-grass mixture with brush the major element[5]	-----	Poor	---	28	46	58	67
	-----	Fair	---	18	35	49	58
	-----	Good	---	15	28	44	53
Woods—grass combination (orchard or tree farm)[6]	-----	Poor	---	36	53	66	72
	-----	Fair	---	24	44	57	66
	-----	Good	---	17	37	52	61
Woods[7]	-----	Poor	---	26	45	58	67
	-----	Fair	---	19	39	53	61
	-----	Good	---	15	34	49	58
Farmsteads—buildings, lanes, driveways, and surrounding lots	-----	-----	---	38	54	66	72
Arid and Semi-arid Rangelands[1]	**Treatment**	**Hydrologic Condition[8]**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element	-----	Poor	---	-----	63	74	85
	-----	Fair	---	-----	51	64	77
	-----	Good	---	-----	41	54	70
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	-----	Poor	---	-----	45	54	61
	-----	Fair	---	-----	28	36	42
	-----	Good	---	-----	15	23	28
Pinyon-juniper—pinyon, juniper, or both; grass understory	-----	Poor	---	-----	56	70	77
	-----	Fair	---	-----	37	53	63
	-----	Good	---	-----	23	40	51
Sagebrush with grass understory	-----	Poor	---	-----	46	63	70
	-----	Fair	---	-----	30	42	49
	-----	Good	---	-----	18	27	34
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	-----	Poor	---	42	58	70	75
	-----	Fair	---	34	52	64	72
	-----	Good	---	29	47	61	69

[1.] Average runoff condition, and Ia = 0.1S.

[2.] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3.] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness. Poor: Factors impair infiltration and tend to increase runoff. Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

[4.] Poor: <50%) ground cover or heavily grazed with no mulch. Fair: 50 to 75% ground cover and not heavily grazed. Good: > 75% ground cover and lightly or only occasionally grazed.

[5.] Poor: <50% ground cover. Fair: 50 to 75% ground cover. Good: >75% ground cover.

[6.] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[7.] Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning. Fair: Woods are grazed but not burned, and some forest litter covers the soil. Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

[8.] Poor: <30% ground cover (litter, grass, and brush overstory). Fair: 30 to 70% ground cover. Good: > 70% ground cover.

Table 6-10. NRCS Curve Numbers for Frontal Storms & Thunderstorms for Developed Conditions (ARCII)

Fully Developed Urban Areas (vegetation established)[1]	Treatment	Hydrologic Condition	% I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	-----	-----	---	68	79	86	89
Fair condition (grass cover 50% to 75%)	-----	-----	---	49	69	79	84
Good condition (grass cover > 75%)	-----	-----	---	39	61	74	80
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way	-----	-----	---	98	98	98	98
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	-----	-----	---	98	98	98	98
Paved; open ditches (including right-of-way)	-----	-----	---	83	89	92	93
Gravel (including right-of-way)	-----	-----	---	76	85	89	91
Dirt (including right-of-way)	-----	-----	---	72	82	87	89
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	-----	-----	---	63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	-----	-----	---	96	96	96	96
Urban districts:							
Commercial and business	-----	-----	85	89	92	94	95
Industrial	-----	-----	72	81	88	91	93
Residential districts by average lot size:							
1/8 acre or less (town houses)	-----	-----	65	77	85	90	92
1/4 acre	-----	-----	38	61	75	83	87
1/3 acre	-----	-----	30	57	72	81	86
1/2 acre	-----	-----	25	54	70	80	85
1 acre	-----	-----	20	51	68	79	84
2 acres	-----	-----	12	46	65	77	82
Developing Urban Areas[1]	**Treatment[2]**	**Hydrologic Condition[3]**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Newly graded areas (pervious areas only, no vegetation)	-----	-----	---	77	86	91	94
Cultivated Agricultural Lands[1]	**Treatment**	**Hydrologic Condition**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Fallow	Bare soil	-----	---	77	86	91	94
	Crop residue cover (CR)	Poor	---	76	85	90	93
		Good	---	74	83	88	90
Row crops	Straight row (SR)	Poor	---	72	81	88	91
		Good	---	67	78	85	89
	SR + CR	Poor	---	71	80	87	90
		Good	---	64	75	82	85
	Contoured (C)	Poor	---	70	79	84	88
		Good	---	65	75	82	86
	C + CR	Poor	---	69	78	83	87
		Good	---	64	74	81	85
	Contoured & terraced (C&T)	Poor	---	66	74	80	82
		Good	---	62	71	78	81
	C&T+ CR	Poor	---	65	73	79	81
		Good	---	61	70	77	80
Small grain	SR	Poor	---	65	76	84	88
		Good	---	63	75	83	87
	SR + CR	Poor	---	64	75	83	86
		Good	---	60	72	80	84
	C	Poor	---	63	74	82	85
		Good	---	61	73	81	84
	C + CR Poor	Poor	---	62	73	81	84
		Good	---	60	72	80	83
	C&T	Poor	---	61	72	79	82
		Good	---	59	70	78	81
	C&T+ CR	Poor	---	60	71	78	81
		Good	---	58	69	77	80

Table 6-10. (continued)

Other Agricultural Lands[1]	Treatment	Hydrologic Condition	% I	HSG A	HSG B	HSG C	HSG D
Pasture, grassland, or range—continuous forage for grazing[4]	-----	Poor	---	68	79	86	89
	-----	Fair	---	49	69	79	84
	-----	Good	---	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay	-----	-----	---	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[5]	-----	Poor	---	48	67	77	83
	-----	Fair	---	35	56	70	77
	-----	Good	---	30	48	65	73
Woods—grass combination (orchard or tree farm)[6]	-----	Poor	---	57	73	82	86
	-----	Fair	---	43	65	76	82
	-----	Good	---	32	58	72	79
Woods[7]	-----	Poor	---	45	66	77	83
	-----	Fair	---	36	60	73	79
	-----	Good	---	30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots	-----	-----	---	59	74	82	86
Arid and Semi-arid Rangelands[1]	**Treatment**	**Hydrologic Condition[8]**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element	-----	Poor	---	-----	80	87	93
	-----	Fair	---	-----	71	81	89
	-----	Good	---	-----	62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	-----	Poor	---	-----	66	74	79
	-----	Fair	---	-----	48	57	63
	-----	Good	---	-----	30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory	-----	Poor	---	-----	75	85	89
	-----	Fair	---	-----	58	73	80
	-----	Good	---	-----	41	61	71
Sagebrush with grass understory	-----	Poor	---	-----	67	80	85
	-----	Fair	---	-----	51	63	70
	-----	Good	---	-----	35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	-----	Poor	---	63	77	85	88
	-----	Fair	---	55	72	81	86
	-----	Good	---	49	68	79	84

1. $I_a = 0.1\ S$

2. Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

3. Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness. Poor: Factors impair infiltration and tend to increase runoff. Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

4. Poor: <50%) ground cover or heavily grazed with no mulch. Fair: 50 to 75% ground cover and not heavily grazed. Good: > 75% ground cover and lightly or only occasional

5. Poor: <50% ground cover. Fair: 50 to 75% ground cover. Good: >75% ground cover.

6. CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods

7. Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning. Fair: Woods are grazed but not burned, and some forest litter covers the soil. Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

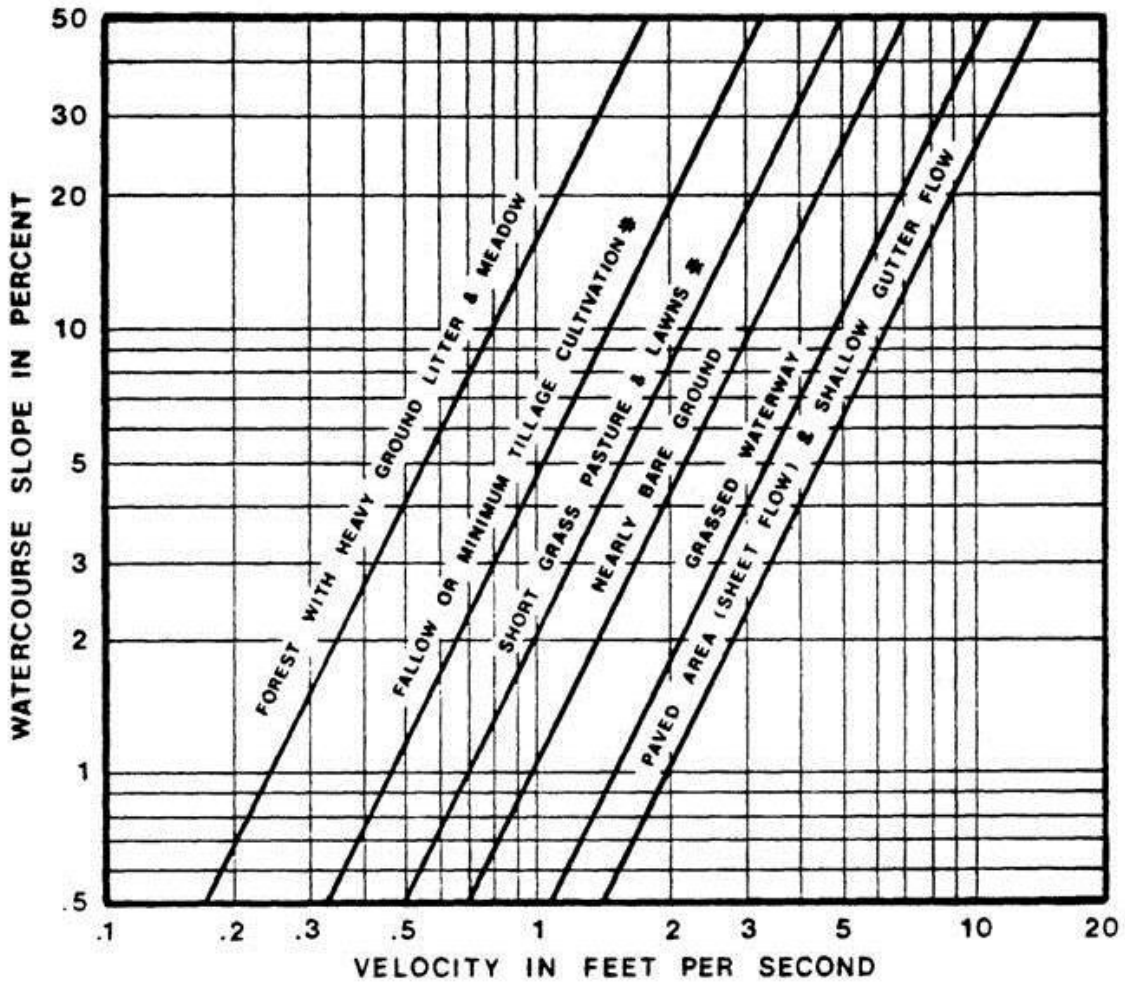
8. Poor: <30% ground cover (litter, grass, and brush overstory). Fair: 30 to 70% ground cover. Good: > 70% ground cover.

4.6 Lag Time

While the NRCS curve numbers are used to calculate the volume of runoff and magnitude of losses, to transform the volume of runoff into a hydrograph using the NRCS dimensionless unit hydrograph, the lag time must be specified. The lag time is defined as the time from the centroid of the rainfall distribution of a storm to the peak discharge produced by the watershed. For this Manual, the lag time is defined as a fraction of the time of concentration (t_c) as shown in Equation 6-13.

$$t_{lag} = 0.6 \cdot t_c \qquad \text{(Eq. 6-13)}$$

Figure 6-25. Estimate of Average Concentrated Shallow Flow



GOLD HILL MESA
(Area Runoff Coefficient Summary)

RATIONAL METHOD

ULTIMATE TRIBUTARY AREA TO POND 1

		COMMERCIAL			*SINGLE FAMILY*			*UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA**	**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**C_5**	**C_{100}**
	(Acres)	*(Acres)*			*(Acres)*			*(Acres)*				
A	153.25	44.96	0.00	0.89	93.58	0.70	0.80	14.73	0.25	0.30	0.45	0.78
B	46.24	0.00	0.82	0.89	15.80	0.70	0.80	30.44	0.25	0.30	0.40	0.47
C	16.12	0.00	0.82	0.89	0.00	0.70	0.80	16.12	0.25	0.30	0.25	0.30
D	2.29	0.00	0.82	0.89	1.15	0.70	0.80	1.15	0.25	0.30	0.48	0.55
Total	217.90	44.96			110.53			62.44				
		95.00%			65.00%			2.00%				
		42.71			71.84			1.25	115.80			
		44.96			93.58			14.73	153.27			
		95.00%			65.00%			2.00%				
		42.71			60.83			0.29	103.83			

QNA
Date: 5/1/2018
Checked by:

TOTAL SITE	Percent impervious =	115.80	/	217.90	53.1%	
POND 1	Percent impervious =	103.83	/	153.27	67.7%	

INTERIM TRIBUTARAY AREA TO POND 1 WITH FILING 9 & 10, VILLA DE MESA TH

		COMMERCIAL			*SINGLE FAMILY*			*UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA**	**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**C_5**	**C_{100}**
	(Acres)	*(Acres)*			*(Acres)*			*(Acres)*				
A	130.72	0.00	0.00	0.89	91.62	0.70	0.80	39.09	0.25	0.30	0.57	0.65
A1	12.42	0.00	0.00	0.89	0.00	0.70	0.80	12.42	0.25	0.30	0.25	0.30
B	46.24	0.00	0.82	0.89	15.80	0.70	0.80	30.44	0.25	0.30	0.40	0.47
C	26.06	0.00	0.00	0.89	0.00	0.70	0.80	26.06	0.25	0.30	0.25	0.30
D	2.29	0.00	0.82	0.89	1.15	0.70	0.80	1.15	0.25	0.30	0.48	0.55
Total	217.73	0.00			108.57			109.17				
		95.00%			65.00%			1.00%				
		0.00			70.57			1.09	71.66			
		0.00			91.62			39.09	130.72			
		95.00%			65.00%			1.00%				
		0.00			59.56			0.39	59.95			

QNA
Date: 5/1/2018
Checked by:

TOTAL SITE	Percent impervious =	71.66	/	217.73	32.9%	
POND 1	Percent impervious =	59.95	/	130.72	45.9%	

GOLD HILL MESA
(Area Runoff Coefficient Summary)

SCS METHOD
ULTIMATE TRIBUTARY AREA TO POND 1

			COMMERCIAL		*SINGLE FAMILY*		*UNDEVELOPED*		*WEIGHTED*
BASIN	**TOTAL**		**AREA**	**CN**	**AREA**	**CN**	**AREA**	**CN**	**CN**
	(Acres)	*(sq mi)*	*(Acres)*		*(Acres)*		*(Acres)*		
A	153.25	0.2395	44.96	94.00	93.58	87	14.73	79	88

INTERIM TRIBUTARAY AREA TO POND 1 WITH FILING 9 & 10, VILLA DE MESA TH

			COMMERCIAL		*SINGLE FAMILY*		*UNDEVELOPED*		*WEIGHTED*
BASIN	**TOTAL**		**AREA**	**CN**	**AREA**	**CN**	**AREA**	**CN**	**CN**
	(Acres)	*(sq mi)*	*(Acres)*		*(Acres)*		*(Acres)*		
A	130.72	0.2042	0.00	94.00	91.62	87	39.09	79	85

GOLD HILL MESA
MDDP AREA DRAINAGE SUMMARY

RATIONAL METHOD
ULTIMATE TRIBUTARY AREA TO POND 1

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
A	153.25	See below for SCS method results														
B	46.24	0.40	0.47	0.25	86	1.9	11.3	509	2.4%	2.0	4.2	15.6	3.4	5.8	64	126
C	16.12	0.25	0.30	0.25	100	5.0	9.3	170	2.4%	2.6	1.1	10.4	4.0	6.9	16	34
D	2.29	0.48	0.55	0.25	86	1.7	11.8	750	4.5%	5.5	2.3	14.0	3.6	6.1	4	8

Calculated by: QNA
Date: 5/1/2018
Checked by: _____

INTERIM TRIBUTARAY AREA TO POND 1 WITH FILING 9 & 10, VILLA DE MESA TH

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
A	130.72	See below for SCS method results														
A1	12.42	0.25	0.30	0.25	100	8.0	8.0	200	6.0%	6.0	0.6	8.6	4.3	7.5	13	28
B	46.24	0.40	0.47	0.25	86	1.9	11.3	509	2.4%	2.0	4.2	15.6	3.4	5.8	64	126
C	26.06	0.25	0.30	0.25	100	5.0	9.3	170	2.4%	2.6	1.1	10.4	4.0	6.9	26	54
D	2.29	0.48	0.55	0.25	86	1.7	11.8	750	4.5%	5.5	2.3	14.0	3.6	6.1	4	8

Calculated by: QNA
Date: 5/1/2018
Checked by: _____

GOLD HILL MESA
MDDP AREA DRAINAGE SUMMARY

SCS METHOD
ULTIMATE TRIBUTARY AREA TO POND 1

	OVERLAND						*SHALLOW STREET FLOW*				*PIPE / CHANNEL FLOW*				T_t	T_t
BASIN	**n**	**P_2**	**Length**	**Height**	**Slope**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**TOTAL**
	Table 6-11	*(in)*	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*	*(ft)*	*(%)*	*(fps)*	*(hr)*	*(ft)*	*(%)*	*(fps)*	*(hr)*	*(hr)*	*(min)*
A	0.24	1.19	86	1.8	0.02	0.3	1040	3.8%	3.9	0.1	3720	4.7%	8.0	0.1	0.5	32.8

Per HEC-HMS

see next sheet for results

TOTAL FLOWS	
Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
116	202

iNTERIM TRIBUTARAY AREA TO POND 1 WITH FILING 9 & 10, VILLA DE MESA TH

	OVERLAND						*SHALLOW STREET FLOW*				*PIPE / CHANNEL FLOW*				T_t	T_t
BASIN	**n**	**P_2**	**Length**	**Height**	**Slope**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**TOTAL**
	Table 6-11	*(in)*	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*	*(ft)*	*(%)*	*(fps)*	*(hr)*	*(ft)*	*(%)*	*(fps)*	*(hr)*	*(hr)*	*(min)*
A	0.24	1.19	86	1.8	0.02	0.3	1040	3.8%	3.9	0.1	3720	4.7%	8.0	0.1	0.5	32.8

Per HEC-HMS

see next sheet for results

TOTAL FLOWS	
Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
98	171

HEC-HMS PARAMETERS AND RESULTS FOR SCS METHOD

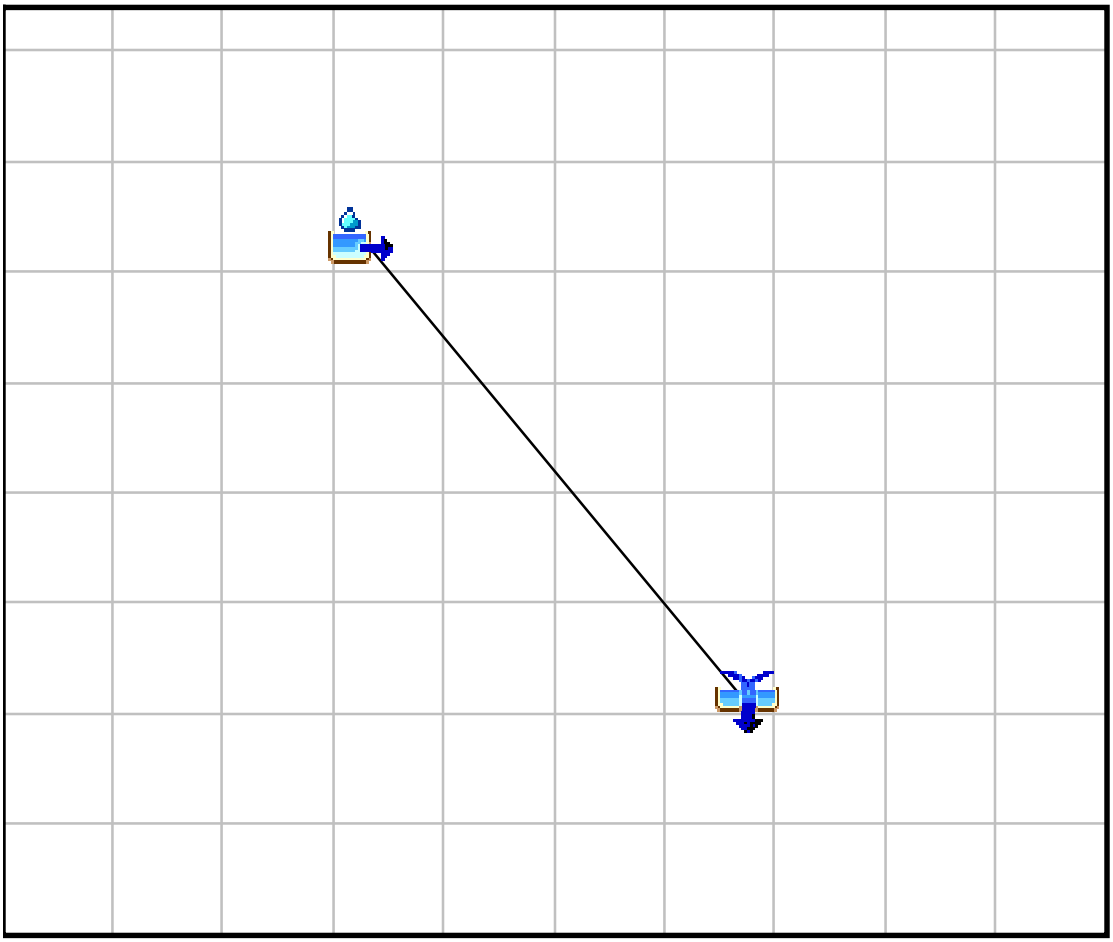
SCS BASIN A

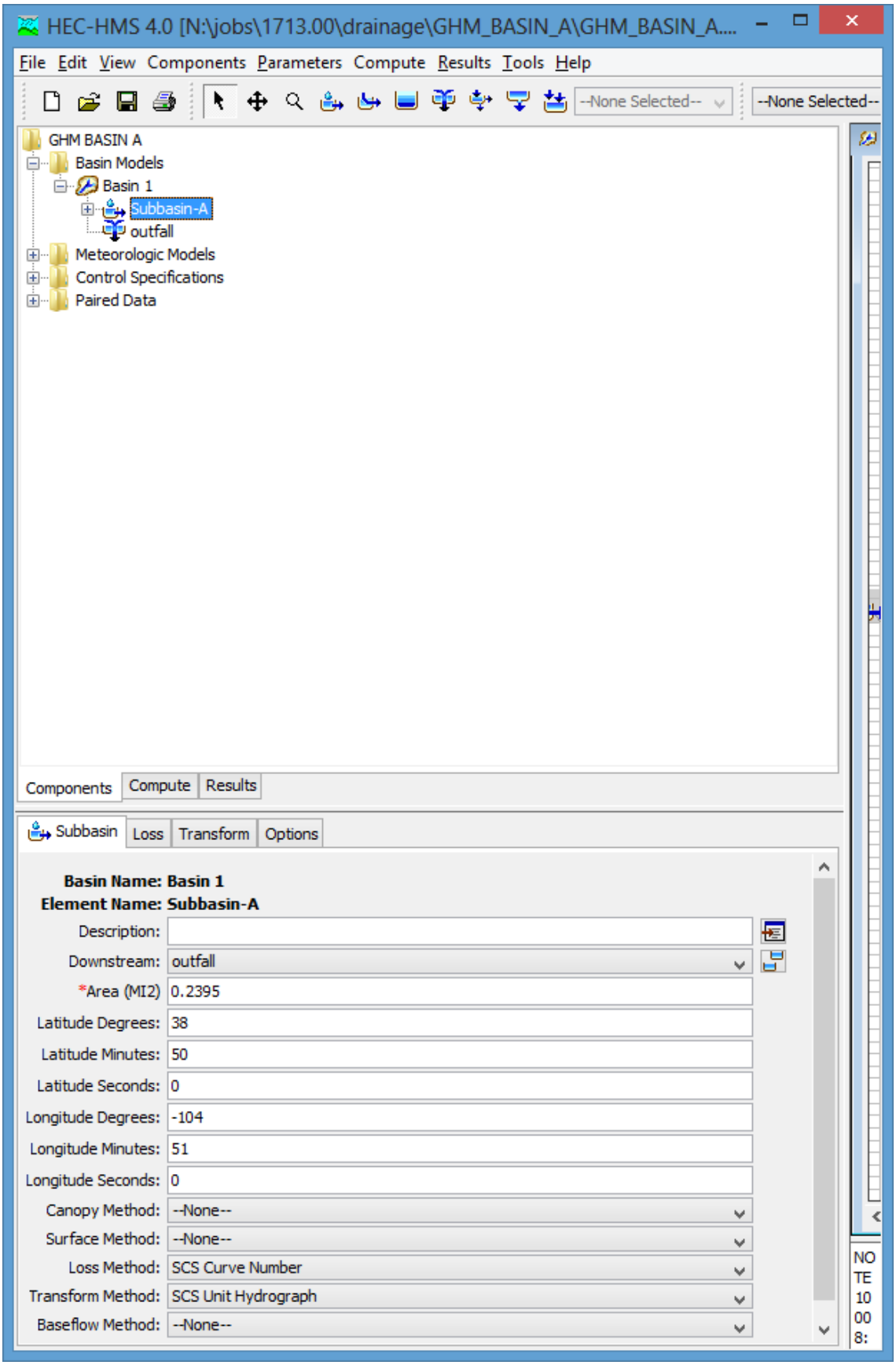
HEC-HMS

Project : GHM BASIN A

Basin Model : Basin 1

Mar 20 09:06:59 MDT 2018

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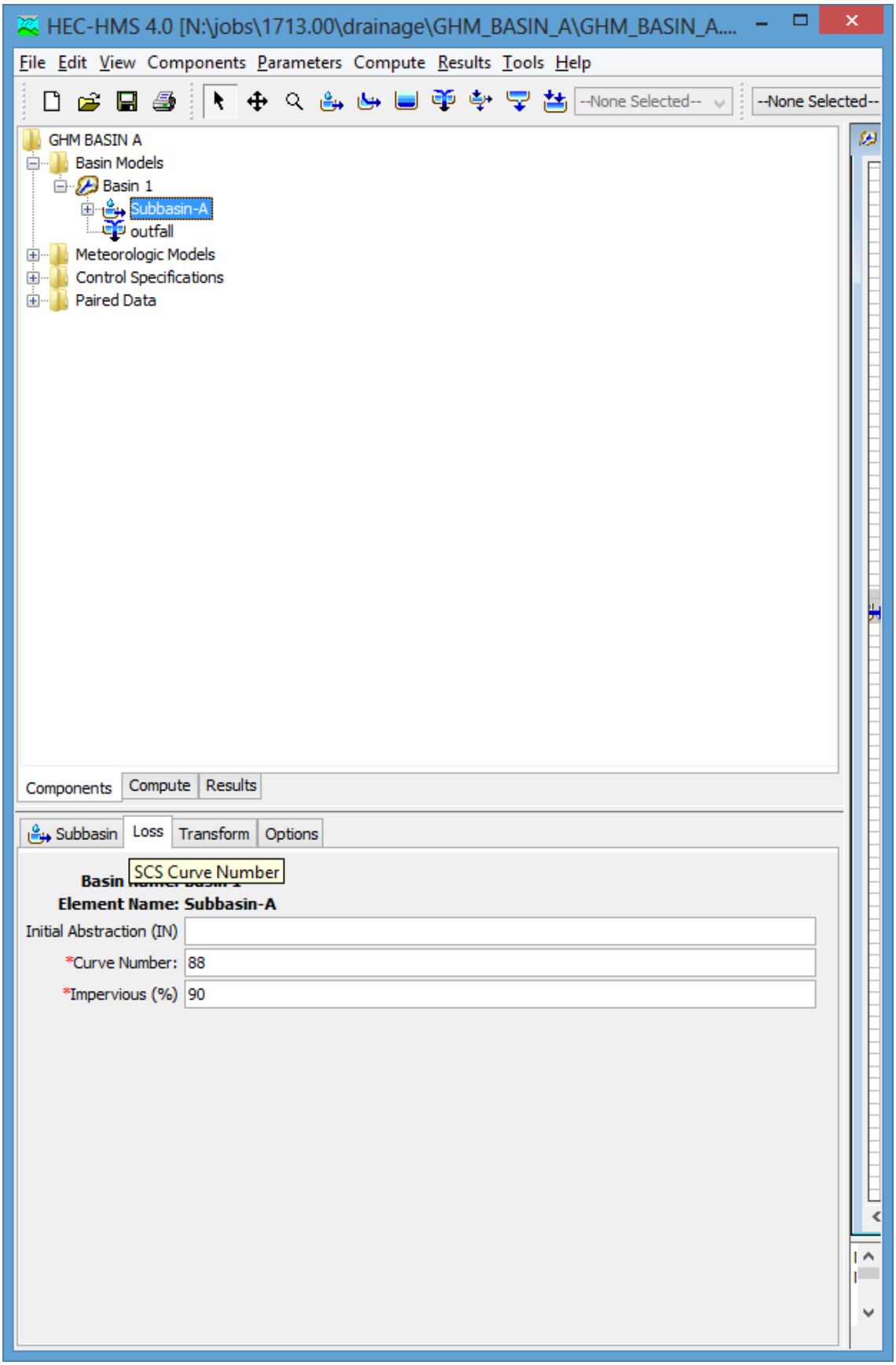
GHM BASIN A
Basin Models
Basin 1
Subbasin-A
outfall
Meteorologic Models
Control Specifications
Paired Data
Components
Compute
Results
Subbasin
Loss
Transform
Options
Basin Name: Basin 1
Element Name: Subbasin-A
Description:
Downstream: outfall
*Area (MI2) 0.2395
Latitude Degrees: 38
Latitude Minutes: 50
Latitude Seconds: 0
Longitude Degrees: -104
Longitude Minutes: 51
Longitude Seconds: 0
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--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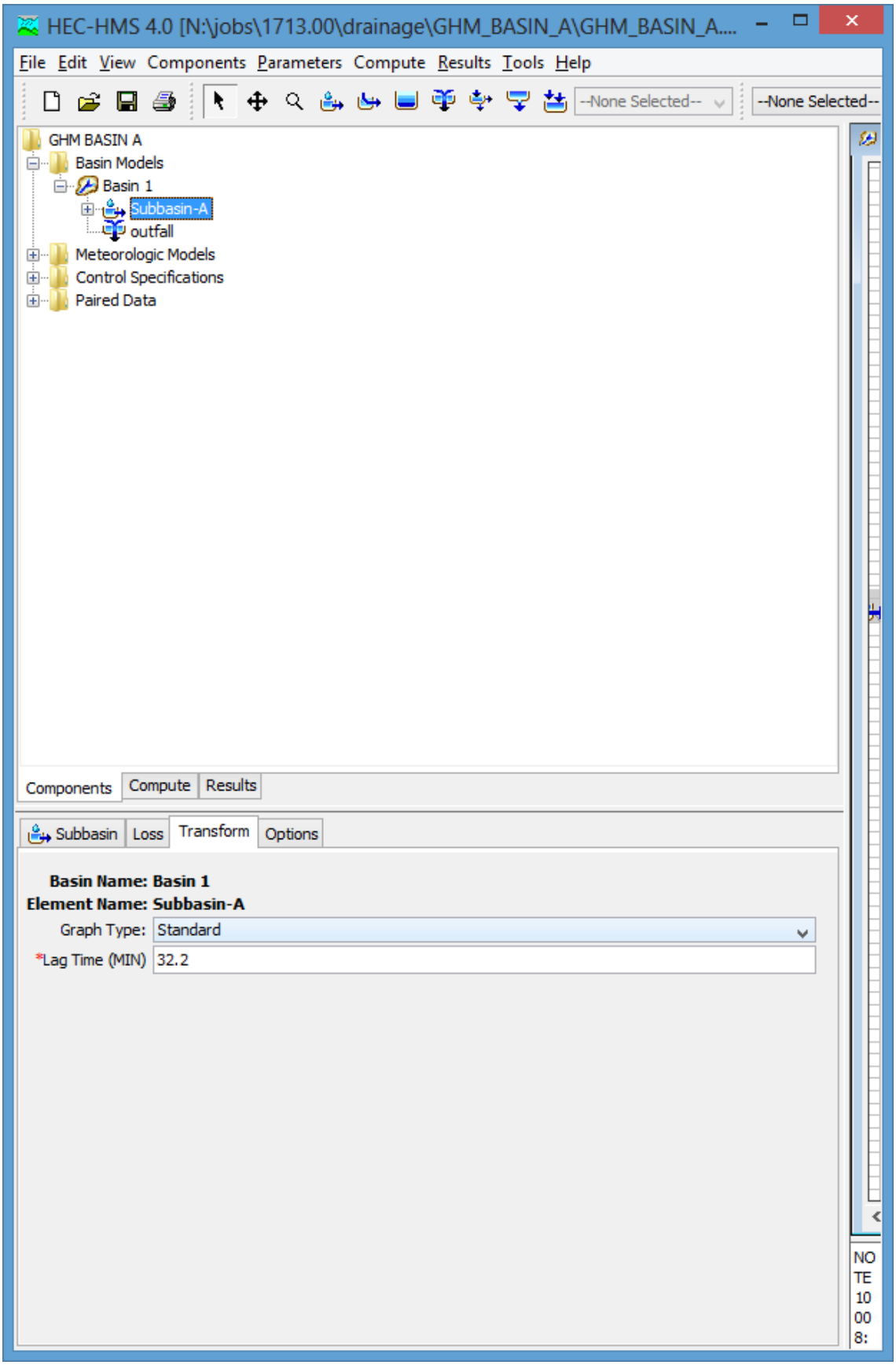
GHM BASIN A
Basin Models
Basin 1
Subbasin-A
outfall
Meteorologic Models
Control Specifications
Paired Data
Components
Compute
Results
Subbasin
Loss
Transform
Options
SCS Curve Number
Element Name: Subbasin-A
Initial Abstraction (IN)
*Curve Number: 88
*Impervious (%) 90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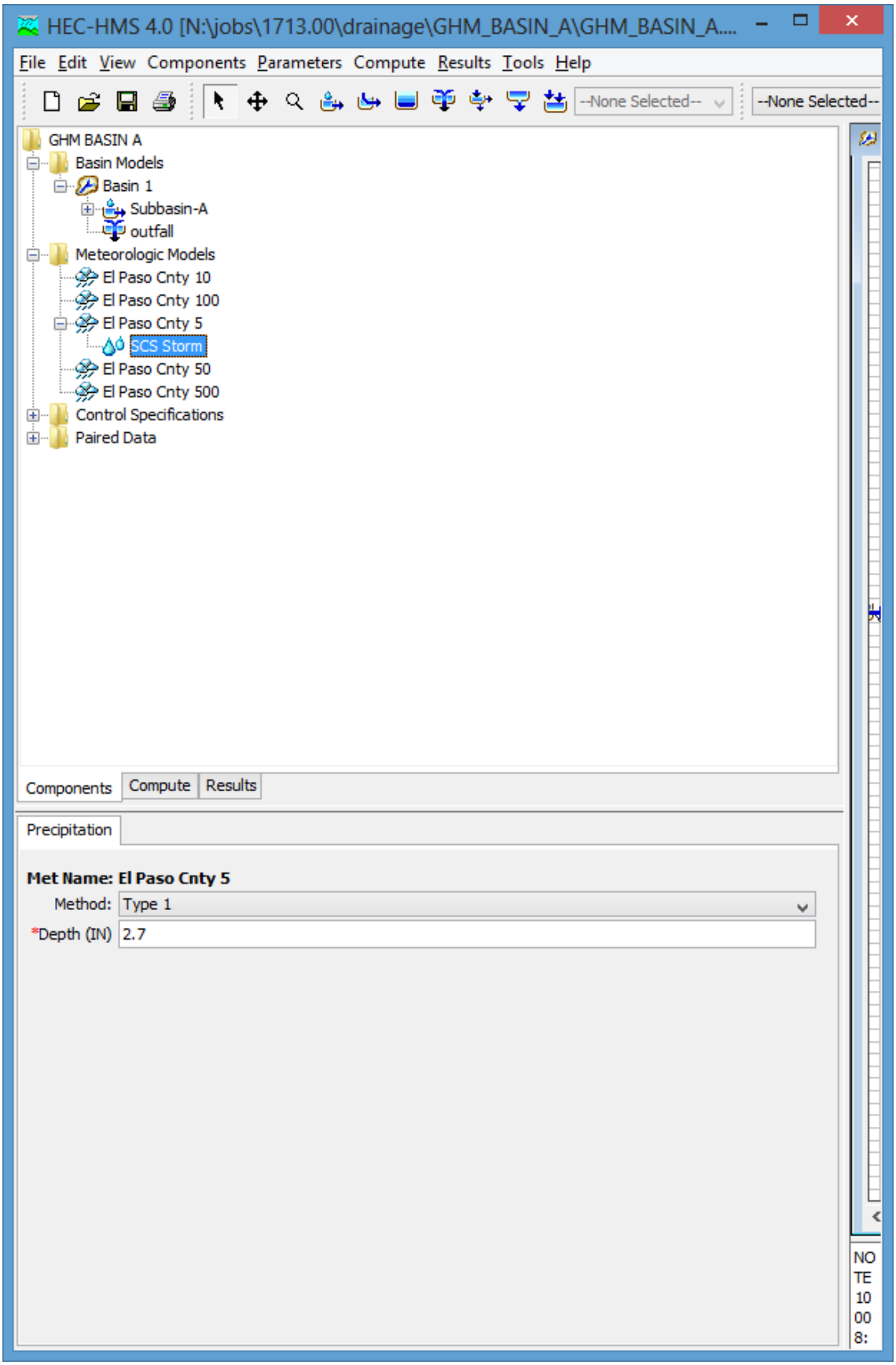
GHM BASIN A
Basin Models
Basin 1
Subbasin-A
outfall
Meteorologic Models
Control Specifications
Paired Data
Components
Compute
Results
Subbasin
Loss
Transform
Options
Basin Name: Basin 1
Element Name: Subbasin-A
Graph Type: Standard
*Lag Time (MIN) 32.2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File Edit View Components Parameters Compute Results Tools Help
--None Selected--
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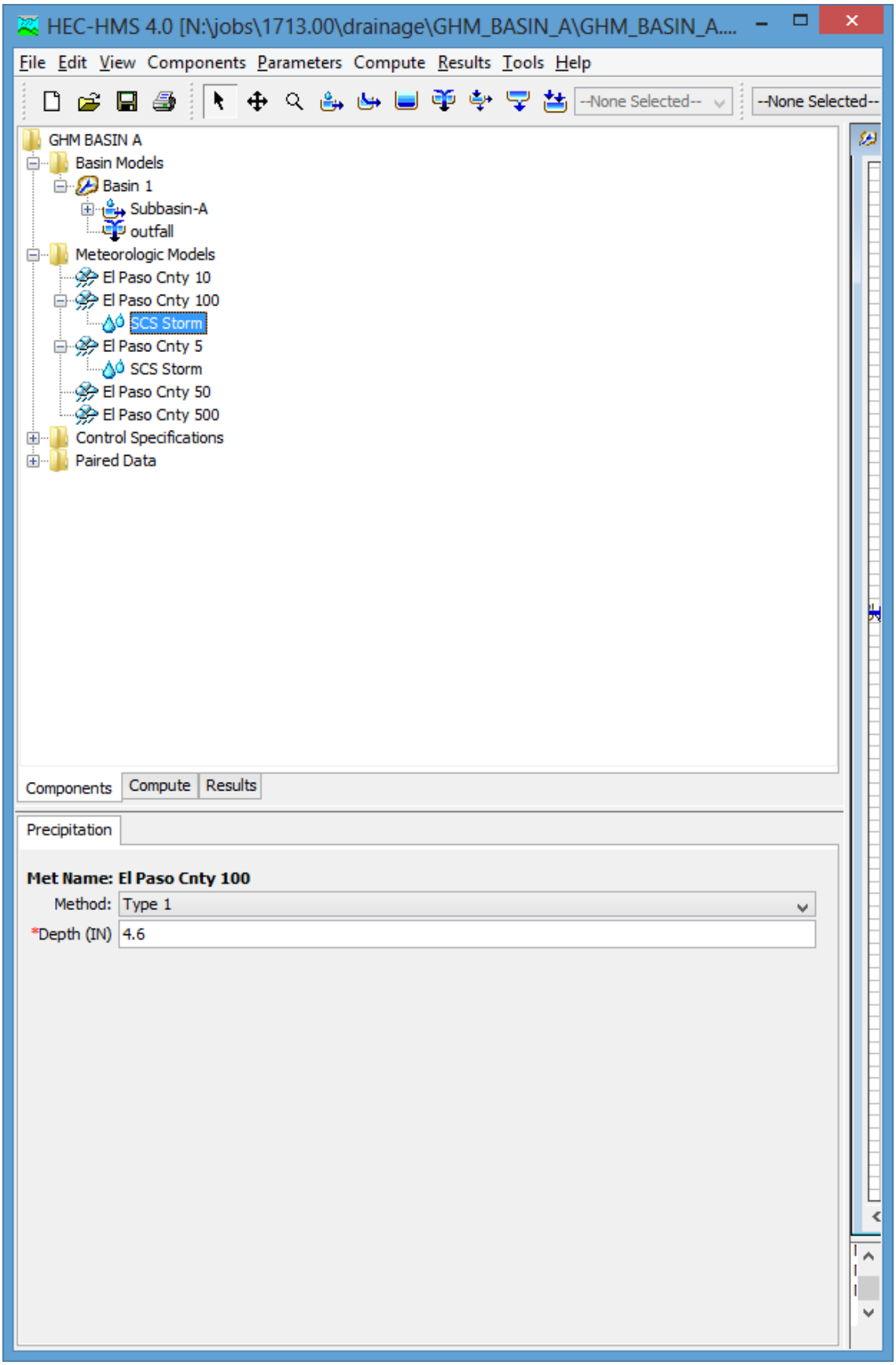
GHM BASIN A
Basin Models
Basin 1
Subbasin-A
outfall
Meteorologic Models
El Paso Cnty 10
El Paso Cnty 100
El Paso Cnty 5
SCS Storm
El Paso Cnty 50
El Paso Cnty 500
Control Specifications
Paired Data
Components
Compute
Results
Precipitation
Met Name: El Paso Cnty 5
Method: Type 1
*Depth (IN) 2.7
NO
TE
10
00
8: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File Edit View Components Parameters Compute Results Tools Help
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GHM BASIN A
Basin Models
Basin 1
Subbasin-A
outfall
Meteorologic Models
El Paso Cnty 10
El Paso Cnty 100
SCS Storm
El Paso Cnty 5
SCS Storm
El Paso Cnty 50
El Paso Cnty 500
Control Specifications
Paired Data
Components
Compute
Results
Precipitation
Met Name: El Paso Cnty 100
Method: Type 1
*Depth (IN) 4.6

Project: GHM BASIN A Simulation Run: Run 2

Start of Run: 30Jan2008, 12:00 Basin Model: Basin 1
End of Run: 30Jun2008, 12:00 Meteorologic Model: El Paso Cnty 5
Compute Time: 20Mar2018, 09:00:02 Control Specifications: Control 1

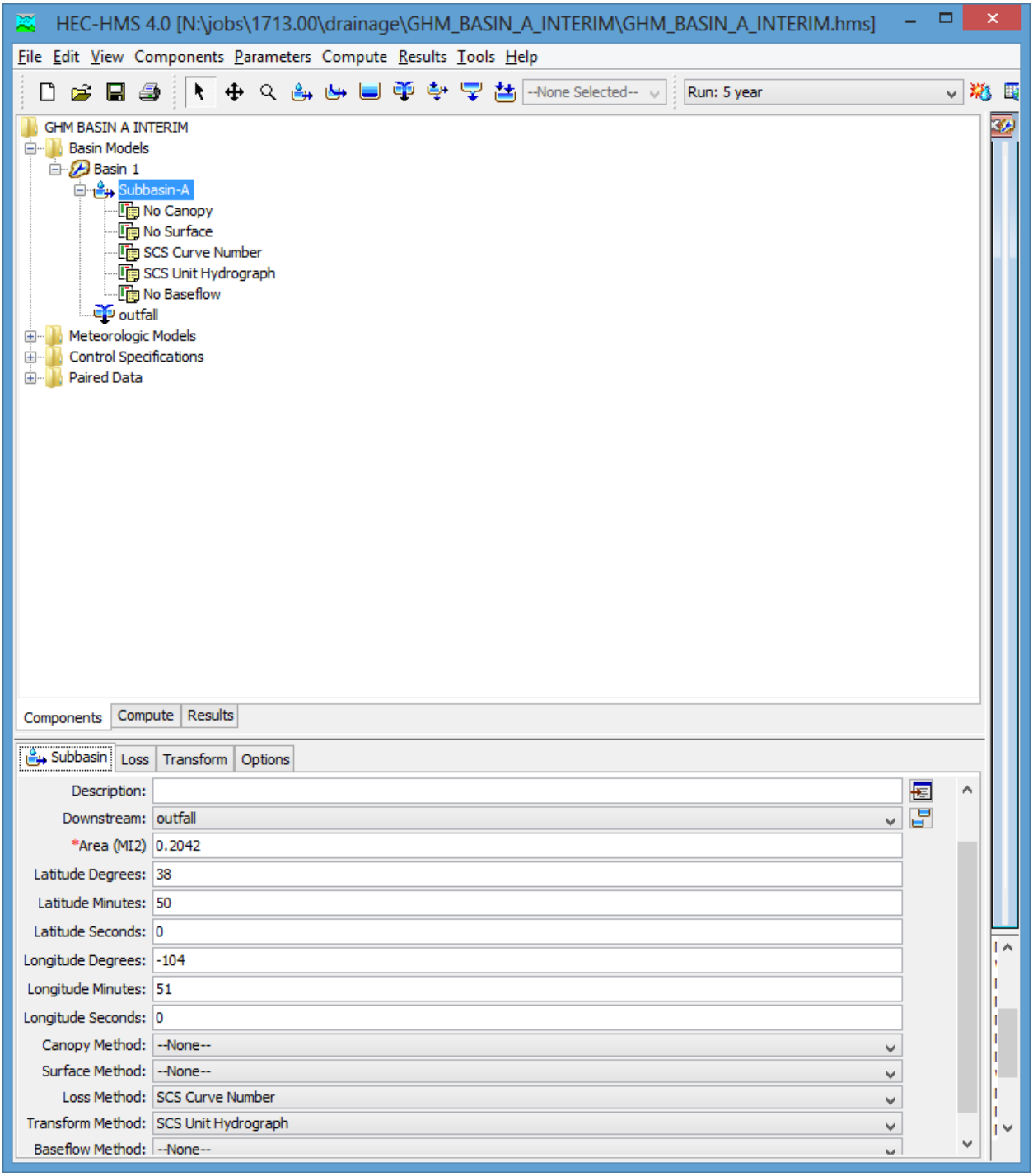
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-A	0.2395	116.4	30Jan2008, 22:20	2.59

Project: GHM BASIN A Simulation Run: 100-year

Start of Run: 30Jan2008, 12:00 Basin Model: Basin 1
End of Run: 30Jun2008, 12:00 Meteorologic Model: El Paso Cnty 100
Compute Time: 20Mar2018, 09:04:34 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-A	0.2395	202.0	30Jan2008, 22:20	4.47

SCS BASIN A INTERIM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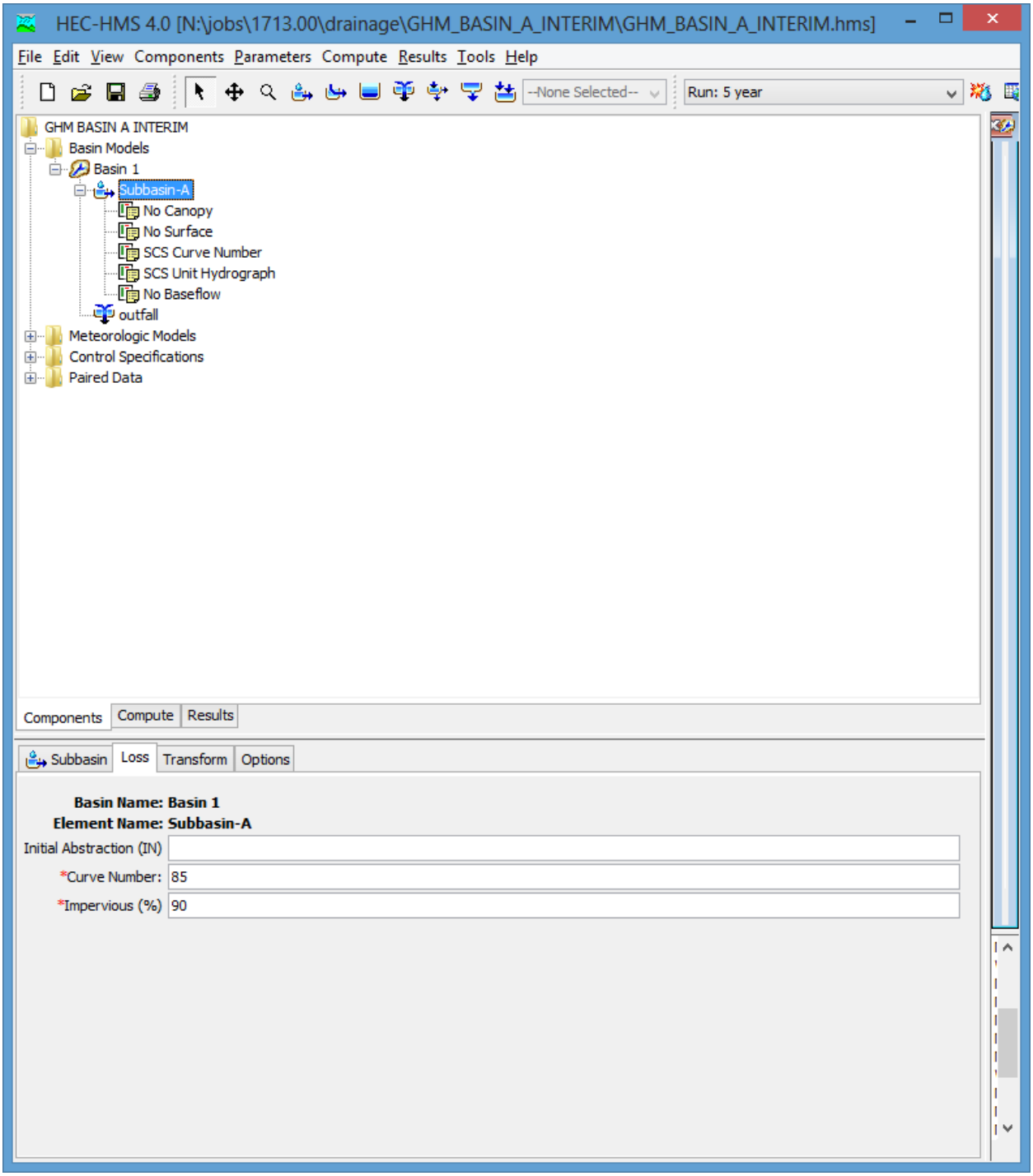
File Edit View Components Parameters Compute Results Tools Help
--None Selected--
Run: 5 year
GHM BASIN A INTERIM
Basin Models
Basin 1
Subbasin-A
No Canopy
No Surface
SCS Curve Number
SCS Unit Hydrograph
No Baseflow
outfall
Meteorologic Models
Control Specifications
Paired Data
Components
Compute
Results
Subbasin
Loss
Transform
Options
Description:
Downstream: outfall
*Area (MI2) 0.2042
Latitude Degrees: 38
Latitude Minutes: 50
Latitude Seconds: 0
Longitude Degrees: -104
Longitude Minutes: 51
Longitude Seconds: 0
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--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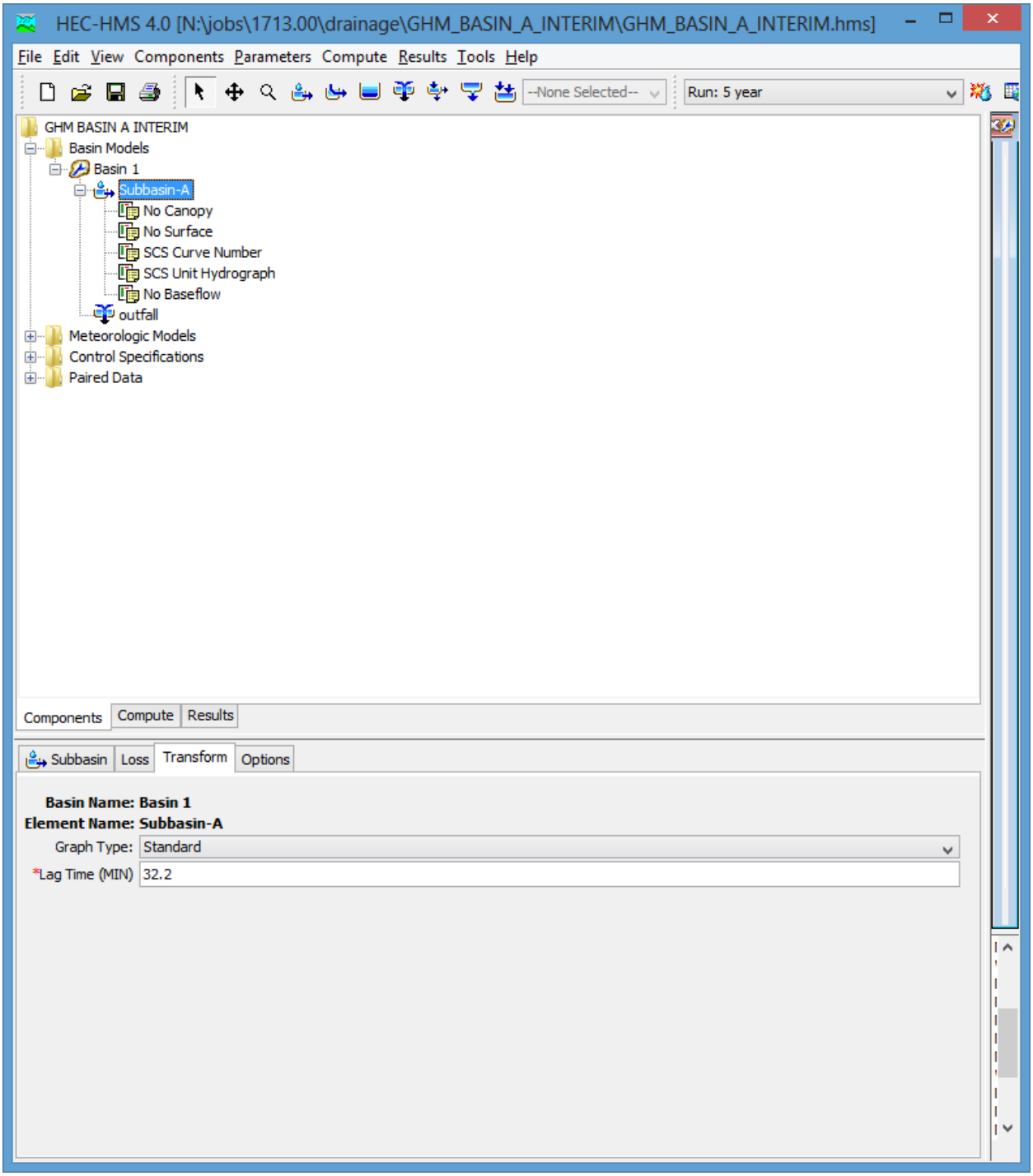
File Edit View Components Parameters Compute Results Tools Help
--None Selected--
Run: 5 year
GHM BASIN A INTERIM
Basin Models
Basin 1
Subbasin-A
No Canopy
No Surface
SCS Curve Number
SCS Unit Hydrograph
No Baseflow
outfall
Meteorologic Models
Control Specifications
Paired Data
Components
Compute
Results
Subbasin
Loss
Transform
Options
Basin Name: Basin 1
Element Name: Subbasin-A
Initial Abstraction (IN)
*Curve Number: 85
*Impervious (%) 90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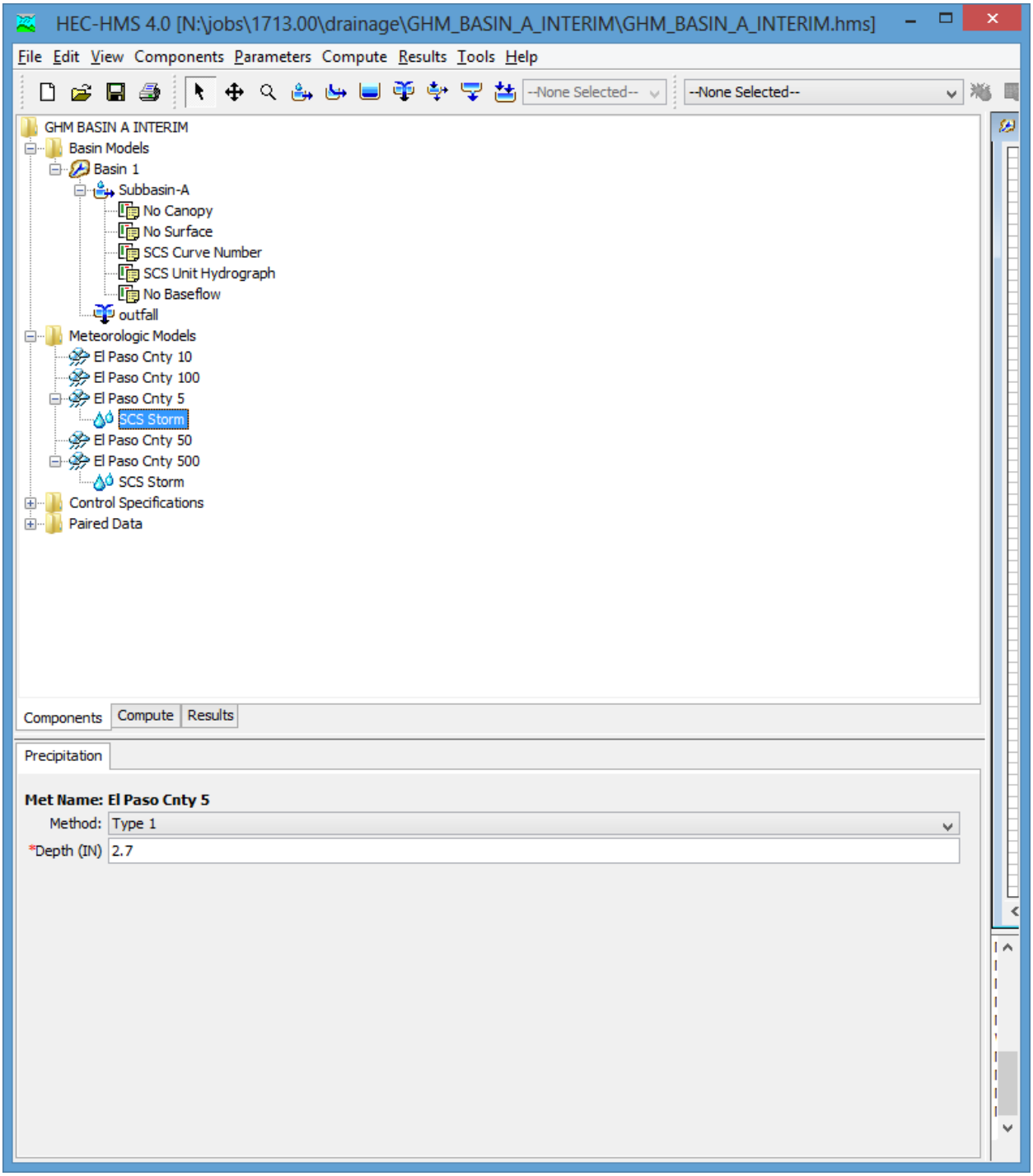
File Edit View Components Parameters Compute Results Tools Help
--None Selected--
Run: 5 year
GHM BASIN A INTERIM
Basin Models
Basin 1
Subbasin-A
No Canopy
No Surface
SCS Curve Number
SCS Unit Hydrograph
No Baseflow
outfall
Meteorologic Models
Control Specifications
Paired Data
Components
Compute
Results
Subbasin
Loss
Transform
Options
Basin Name: Basin 1
Element Name: Subbasin-A
Graph Type: Standard
*Lag Time (MIN) 32.2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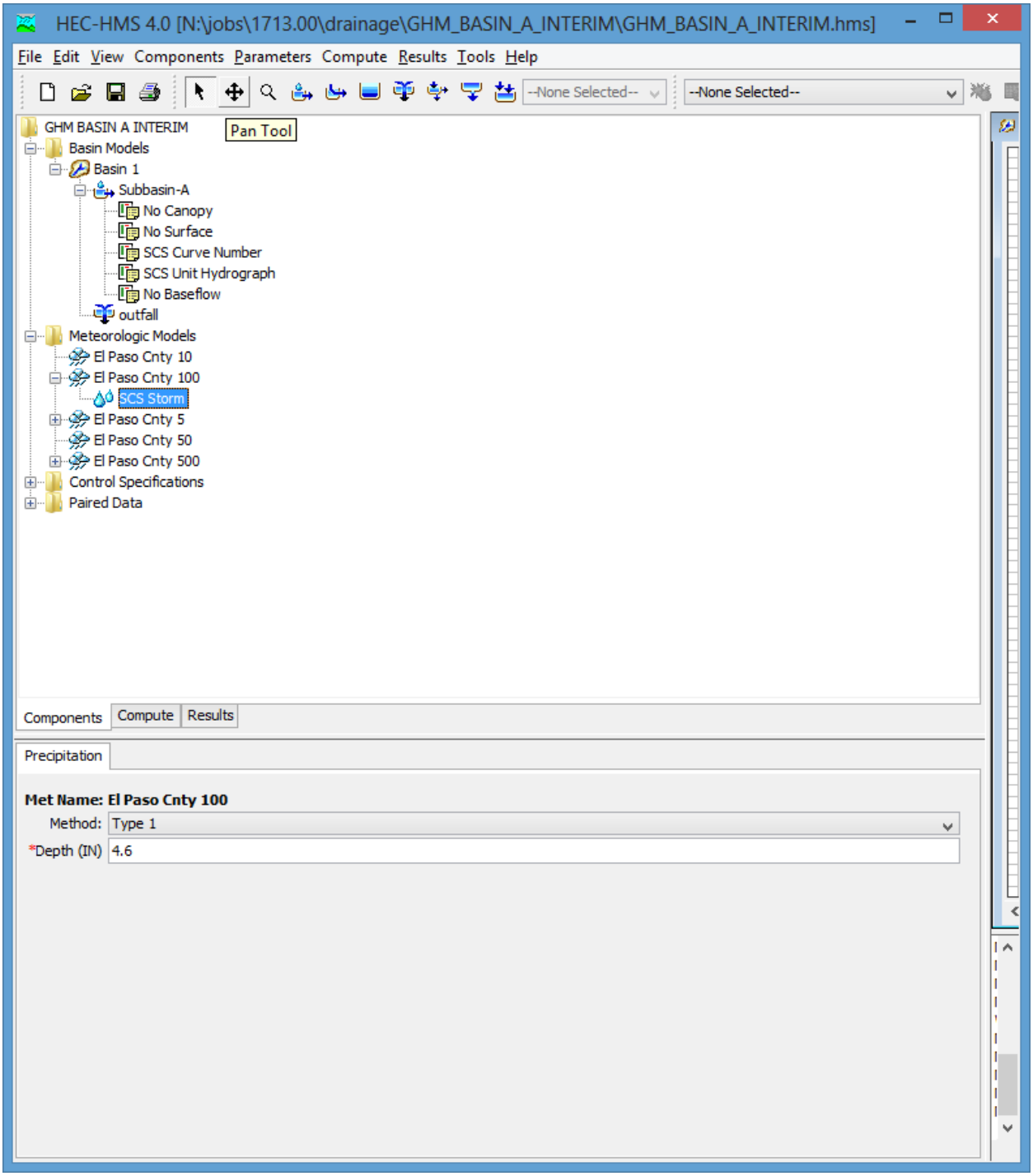
File Edit View Components Parameters Compute Results Tools Help
--None Selected--
--None Selected--
GHM BASIN A INTERIM
Basin Models
Basin 1
Subbasin-A
No Canopy
No Surface
SCS Curve Number
SCS Unit Hydrograph
No Baseflow
outfall
Meteorologic Models
El Paso Cnty 10
El Paso Cnty 100
El Paso Cnty 5
SCS Storm
El Paso Cnty 50
El Paso Cnty 500
SCS Storm
Control Specifications
Paired Data
Components
Compute
Results
Precipitation
Met Name: El Paso Cnty 5
Method:
Type 1
*Depth (IN)
2.7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File Edit View Components Parameters Compute Results Tools Help
--None Selected--
--None Selected--
Pan Tool
GHM BASIN A INTERIM
Basin Models
Basin 1
Subbasin-A
No Canopy
No Surface
SCS Curve Number
SCS Unit Hydrograph
No Baseflow
outfall
Meteorologic Models
El Paso Cnty 10
El Paso Cnty 100
SCS Storm
El Paso Cnty 5
El Paso Cnty 50
El Paso Cnty 500
Control Specifications
Paired Data
Components
Compute
Results
Precipitation
Met Name: El Paso Cnty 100
Method: Type 1
*Depth (IN) 4.6

Project: GHM BASIN A INTERIM Simulation Run: 5 year

Start of Run: 30Jan2008, 12:00 Basin Model: Basin 1
End of Run: 30Jun2008, 12:00 Meteorologic Model: El Paso Cnty 5
Compute Time: 02May2018, 10:32:28 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-A	0.2042	98.1	30Jan2008, 22:20	2.56

Project: GHM BASIN A INTERIM Simulation Run: 100-year

Start of Run: 30Jan2008, 12:00 Basin Model: Basin 1
End of Run: 30Jun2008, 12:00 Meteorologic Model: El Paso Cnty 100
Compute Time: 02May2018, 10:36:23 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-A	0.2042	170.8	30Jan2008, 22:20	4.44

FILING 9 & 10 FDR HYDROLOGIC CALCUALTIONS

GOLD HILL MESA FILING NO. 9 and 10
(Area Runoff Coefficient Summary)

EXISTING CONDITIONS

		STREETS / IMPERVIOUS			*OVERLAND / NONIMPERVIOUS*			*WEIGHTED*	
BASIN	**TOTAL AREA**	**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**C_5**	**C_{100}**
	(Acres)	*(Acres)*			*(Acres)*				
OS-C	0.47	0.47	0.70	0.80	0.00	0.25	0.30	0.70	0.80
EX-C	1.18	0.00	0.70	0.80	1.18	0.25	0.30	0.25	0.30
OS-E	0.47	0.47	0.70	0.80	0.00	0.30	0.30	0.70	0.80
EX-E	1.60	0.00	0.70	0.80	1.60	0.25	0.30	0.25	0.30
EX-F	1.53	0.00	0.70	0.80	1.53	0.25	0.30	0.25	0.30
OS-G1	2.06	2.06	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-G2	0.06	0.00	0.70	0.80	0.06	0.25	0.30	0.25	0.30
EX-G	0.29	0.00	0.70	0.80	0.29	0.25	0.30	0.25	0.30
OS-H	1.34	1.34	0.64	0.74	0.00	0.25	0.30	0.64	0.74
EX-H	9.57	0.00	0.70	0.80	9.57	0.25	0.30	0.25	0.30
OS-I	0.22	0.22	0.64	0.74	0.00	0.25	0.30	0.64	0.74
EX-J	1.05	0.00	0.70	0.80	1.05	0.25	0.30	0.25	0.30

GOLD HILL MESA FILING NO. 9 and 10
(Area Runoff Coefficient Summary)

DEVELOPED CONDITIONS

		STREETS / IMPERVIOUS			*OVERLAND / NONIMPERVIOUS*			*WEIGHTED*	
BASIN	**TOTAL AREA**	**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**C_5**	**C_{100}**
	(Acres)	*(Acres)*			*(Acres)*				
A1	1.27	0.72	0.70	0.80	0.55	0.25	0.30	0.50	0.58
A2	1.76	1.76	0.70	0.80	0.00	0.25	0.30	0.70	0.80
A3	1.07	1.07	0.70	0.80	0.00	0.25	0.30	0.70	0.80
B	0.47	0.47	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-C	0.39	0.39	0.70	0.80	0.00	0.25	0.30	0.70	0.80
C	0.59	0.59	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-D	1.19	1.19	0.70	0.80	0.00	0.30	0.30	0.70	0.80
D	0.62	0.62	0.70	0.80	0.00	0.25	0.30	0.70	0.80
E	0.38	0.38	0.70	0.80	0.00	0.25	0.30	0.70	0.80
F	1.14	1.14	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-G1	2.06	2.06	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-G2	0.07	0.00	0.70	0.80	0.07	0.25	0.30	0.25	0.30
G	0.34	0.34	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-H	1.34	1.34	0.75	0.85	0.00	0.25	0.30	0.64	0.74
H1	1.82	1.82	0.70	0.80	0.00	0.25	0.30	0.70	0.80
H2	1.78	1.78	0.70	0.80	0.00	0.25	0.30	0.70	0.80
H3	0.75	0.75	0.70	0.80	0.00	0.25	0.30	0.70	0.80
H4	0.93	0.93	0.70	0.80	0.00	0.25	0.30	0.70	0.80
OS-I	0.22	0.22	0.70	0.80	0.00	0.25	0.30	0.64	0.74
I	1.69	1.69	0.70	0.80	0.00	0.25	0.30	0.70	0.80
J	1.25	1.25	0.70	0.80	0.00	0.25	0.30	0.70	0.80

21.11

QNA

Date: 5/1/2018

Checked by: _____

GOLD HILL MESA FILING NO. 9 and 10
AREA DRAINAGE SUMMARY

EXISTING CONDITIONS

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
OS-C	0.47	0.70	0.80	0.25	47	1.0	8.5	260	2.7%	3.3	1.3	9.8	4.1	7.1	1.4	2.7
EX-C	1.18	0.25	0.30	0.25	85	5.0	8.2	375	2.4%	1.5	4.2	12.3	3.8	6.5	1.1	2.3
OS-E	0.47	0.70	0.80	0.25	20	0.4	5.7	525	2.3%	3.2	2.7	8.4	4.3	7.6	1.4	2.9
EX-E	1.60	0.25	0.30	0.25	74	4.0	7.8	165	3.0%	1.5	1.8	9.7	4.1	7.2	1.6	3.4
EX-F	1.53	0.25	0.30	0.25	82	10.0	6.3					6.3	4.7	8.4	1.8	3.9
OS-G1	2.06	0.70	0.80	0.25	90	1.8	12.0	688	2.9%	3.4	3.4	15.4	3.4	5.8	4.9	9.6
OS-G2	0.06	0.25	0.30									5.0	5.0	9.1	0.1	0.2
EX-G	0.29	0.25	0.30									5.0	5.0	9.1	0.4	0.8
OS-H	1.34	0.64	0.74	0.25	85	2.0	11.0	363	2.2%	2.1	2.9	13.9	3.6	6.1	3.1	6.1
EX-H	9.57	0.25	0.30	0.25	280	12.0	16.5	773	4.1%	3.0	4.3	20.7	3.0	5.0	7.2	14.3
OS-I	0.22	0.64	0.74	0.25	40	1.0	7.4	136	1.0%	1.8	1.3	8.7	4.3	7.5	0.6	1.2
EX-J	1.05	0.25	0.30	0.25	33	1.0	6.3					6.3	4.7	8.4	1.2	2.7

GOLD HILL MESA FILING NO. 9 and 10
AREA DRAINAGE SUMMARY

DEVELOPED CONDITIONS

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
A1	1.27	0.50	0.58	0.25	120	4.0	11.7	120	3.3%	2.7	0.7	12.4	3.7	6.4	2.4	4.7
A2	1.76	0.70	0.80	0.25	90	4.5	8.9	520	3.3%	4.0	2.2	11.0	3.9	6.8	4.8	9.5
A3	1.07	0.70	0.80	0.25	111	4.5	10.6	400	2.0%	2.9	2.3	12.9	3.7	6.3	2.8	5.4
B	0.47	0.70	0.80	0.25	20	1.0	4.2	643	3.1%	3.5	3.1	7.2	4.5	8.0	1.5	3.0
OS-C	0.39	0.70	0.80	0.25	47	1.0	8.5	260	2.7%	3.3	1.3	9.8	4.1	7.1	1.1	2.2
C	0.59	0.70	0.80	0.25	63	2.0	8.6	162	4.3%	4.1	0.7	9.3	4.2	7.3	1.7	3.4
OS-D	1.19	0.70	0.80	0.25	110	2.0	13.7	366	1.9%	2.8	2.2	15.9	3.4	5.7	2.8	5.4
D	0.62	0.70	0.80	0.25	110	2.0	13.7	470	1.9%	2.8	2.8	16.5	3.3	5.6	1.4	2.8
E	0.38	0.70	0.80	0.25	67	1.5	10.0	114	2.6%	3.3	0.6	10.5	4.0	6.9	1.1	2.1
F	1.14	0.70	0.80	0.25	82	10.0	6.3					6.3	4.7	8.4	3.8	7.7
OS-G1	2.06	0.70	0.80	0.25	90	1.8	12.0	688	2.9%	3.4	3.4	15.4	3.4	5.8	4.9	9.6
OS-G2	0.07	0.25	0.30									5.0	5.0	9.1	0.1	0.2
G	0.34	0.70	0.80	0.25	89	1.5	12.6	365	1.1%	2.0	3.0	15.7	3.4	5.8	0.8	1.6
OS-H	1.34	0.64	0.74	0.25	85	2.0	11.0	363	2.2%	2.1	2.9	13.9	3.6	6.1	3.1	6.1
H1	1.82	0.70	0.80	0.25	115	3.0	12.4	622	1.8%	2.5	4.1	16.6	3.3	5.6	4.2	8.2
H2	1.78	0.70	0.80	0.25	120	3.0	12.9	558	2.3%	3.0	3.1	16.0	3.4	5.7	4.2	8.2
H3	0.75	0.70	0.80	0.25	123	4.5	11.5	218	2.1%	2.1	1.7	13.2	3.7	6.3	1.9	3.7
H4	0.93	0.70	0.80	0.25	96	2.5	11.4	290	2.1%	2.9	1.7	13.0	3.7	6.3	2.4	4.7
OS-I	0.22	0.64	0.74	0.25	40	1.0	7.4	136	1.0%	1.8	1.3	8.7	4.3	7.5	0.6	1.2
I	1.69	0.70	0.80	0.25	40	1.5	6.5	1095	2.6%	2.0	9.1	15.6	3.4	5.8	4.0	7.8
J	1.25	0.70	0.80	0.25	82	10.0	6.3					6.3	4.7	8.4	4.1	8.4

Calculated by: QNA

Date: 5/1/2018

Checked by:

GOLD HILL MESA FILING NO. 9 and 10
SURFACE ROUTING SUMMARY

EXISTING CONDITIONS									
Design Point(s)	*Contributing Basins*	*Area (Acres)*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity*		*Flow*	
						I_5	*I_{100}*	*Q_5*	*Q_{100}*
3	OS-E & E	2.07	0.73	0.86	9.7	4.1	7.2	3.0	6.1
4	OS-G1	2.06	1.44	1.65	15.4	3.4	5.8	4.9	9.6
5	DP 3 & 4 Flow by, OS-G & OS-G2	2.41	0.09	0.60	15.4	3.4	5.8	0.3	3.5
6	EX-H	9.57	2.39	2.87	20.7	3.0	5.0	7.2	14.3
EX3	OS-C & EX-C	1.65	0.63	0.73	12.3	3.8	6.5	2.4	4.7
EX12	OS-H & OS-I	1.56	1.00	1.16	13.9	3.6	6.1	3.6	7.1

GOLD HILL MESA FILING NO. 9 and 10
SURFACE ROUTING SUMMARY

DEVELOPED CONDITIONS									
Design Point(s)	*Contributing Basins*	*Area (Acres)*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity*		*Flow*	
						I_5	*I_{100}*	*Q_5*	*Q_{100}*
1A*	OS-C, C & A3	2.04	1.43	1.64	12.9	3.7	6.3	5.3	10.4
1	A1, A2 & A3,OS-C, & C	5.06	3.30	3.78	12.9	3.7	6.3	12.2	23.9
2	B	0.47	0.33	0.37	7.2	4.5	8.0	1.5	3.0
1 & 2	Flow split between inlets	5.53	3.63	4.15	12.9	3.7	6.3	6.7	13.2
EX4	OS-D & D	1.80	1.44	1.72	16.5	3.3	5.6	4.8	9.7
3	E	0.38	0.27	0.30	10.5	4.0	6.9	1.1	2.1
4	OS-G1	2.06	1.44	1.65	15.4	3.4	5.8	4.9	9.6
5A*	OS-H & H1	3.16	2.13	2.45	16.6	3.3	5.6	7.1	13.7
5B*	DP 5A Flow by, H2 & H3	5.69	1.82	2.57	16.6	3.3	5.6	6.0	14.4
5C*	DP 5B & H4	6.63	2.47	3.31	16.6	3.3	5.6	8.2	18.6
5	DP 3 & 4 FLOWBY, OS-G2, G, DP 5B & H5	9.47	2.73	3.78	16.6	3.3	5.6	9.1	21.2
6	OS-I & I	1.91	1.32	1.52	15.6	3.4	5.8	4.5	8.8
5 & 6	Flow split between inlets	11.39	4.05	5.30	16.6	3.3	5.6	6.7	14.9

* Design Points were analyzed to check for street capacity confomance.

Date: 5/1/2018

Checked by: _____

GOLD HILL MESA FILING NO. 8
PIPE ROUTING SUMMARY

EXISTING CONDITIONS

Pipe Run(s)	*Contributing Design Points*	*Area (Acres)*	*Equivalent* CA_5	*Equivalent* CA_{100}	*Maximum* T_C	*Intensity*		*Flow*	
						I_5	I_{100}	Q_5	Q_{100}
3	DP-3 PICK UP	2.07	0.73	0.85	9.7	4.1	7.2	*3.0*	*6.1*
4	DP-4 PICK UP	2.06	0.36	0.53	15.4	3.4	5.8	1.2	3.1
EX3	DP-EX3	1.65	0.63	0.73	12.3	3.8	6.5	2.4	4.7

GOLD HILL MESA FILING NO. 8
PIPE ROUTING SUMMARY

DEVELOPED CONDITIONS

Pipe Run(s)	*Contributing Design Points*	*Area (Acres)*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity*		*Flow*	
						I_5	*I_{100}*	*Q_5*	*Q_{100}*
1	Flow split between inlets DP-1 & 2	2.77	1.81	2.08	12.9	3.7	6.3	6.7	13.2
2	Total flow at DP-1 & 2	5.53	3.63	4.15	12.9	3.7	6.3	13.4	26.3
EX4**	DP-EX4	1.80	1.44	1.72	16.5	3.3	5.6	11.0	22.2
3	DP3	0.38	0.27	0.30	10.5	4.0	6.9	1.1	2.1
4	DP 4	2.06	1.44	1.48	15.4	3.4	5.8	4.9	8.6
5A	DP 5A	3.16	2.08	1.91	16.6	3.3	5.6	6.9	10.7
5	Flow split between inlets DP-5 & 6+	8.86	4.11	4.56	16.6	3.3	5.6	13.7	25.6
6	Total flow at DP-5 & 6	14.55	6.14	7.21	16.6	3.3	5.6	20.4	40.4

Pipe Run EX 6 also has Q_5 = 6.2 cfs and Q_{100} = 12.5 cfs in the 100 year event contributing to it from Basin M in Gold Hill Mesa Filing No. 1

Calculated by: QNA

Date: 5/1/2018

Checked by: _____

HYDRAULIC CALCULATIONS

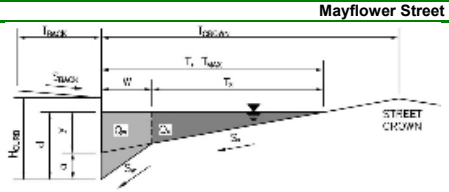
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Mayflower Street



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	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 =	0.035	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.1**	**36.4**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

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

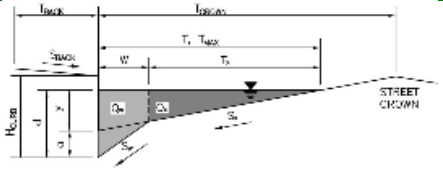
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Olympian Drive



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	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 =	0.024	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**8.4**	**40.4**	**cfs**

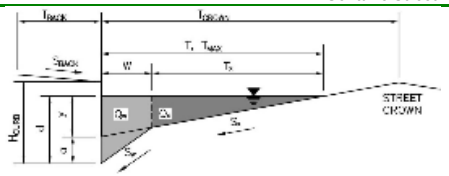
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Solitaire Street



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	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 =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.8**	**34.8**	**cfs**

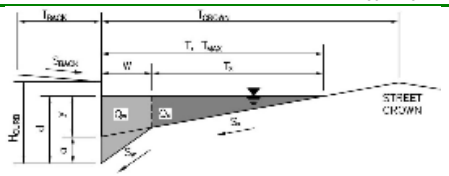
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Inlet DP 3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.021	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

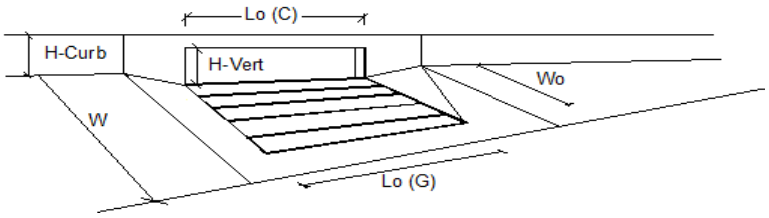
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.6**	**63.6**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	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 =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.1**	**2.1**	**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**	**%**

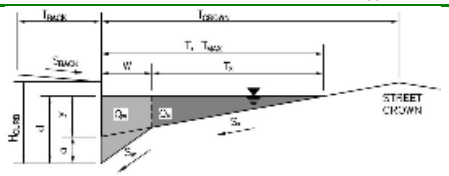
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Inlet DP 4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.021	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

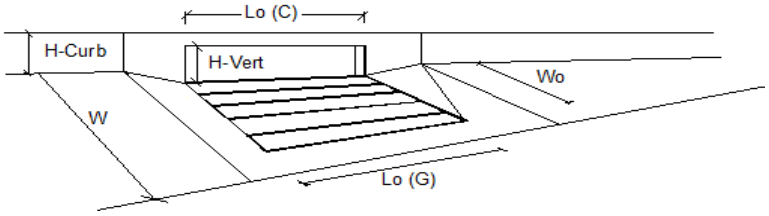
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.6**	**63.6**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	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 =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.9**	**8.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**90**	**%**

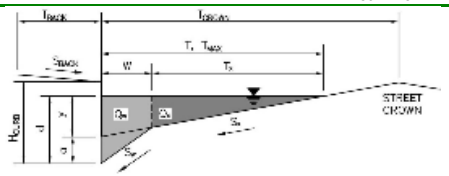
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Inlet DP 5A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	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 =	0.024	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

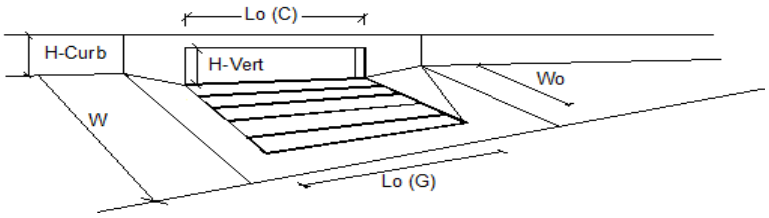
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**8.4**	**40.4**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

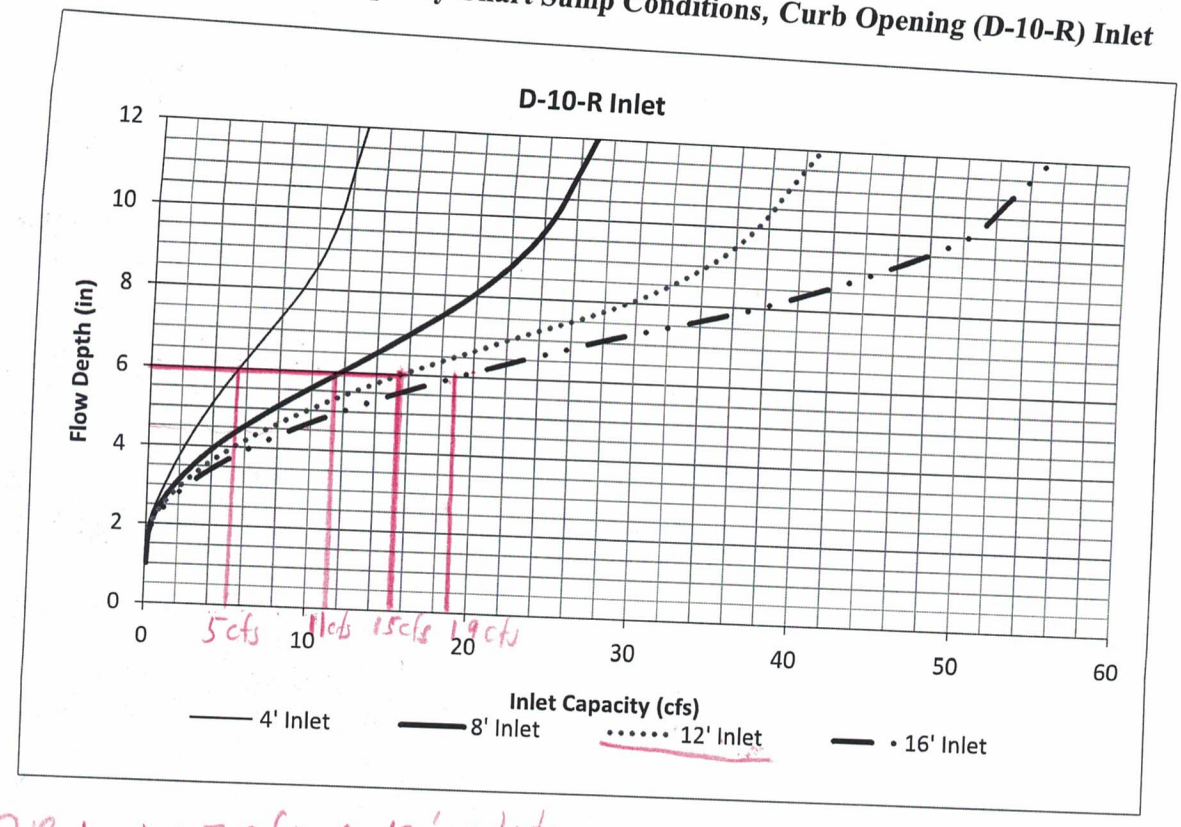
Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	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 =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.9**	**10.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**3.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**78**	**%**

Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet



DP 1 10.7 cfs ∴ 12' inlet
DP 2 10.7 cfs ∴ 12' inlet
DP 5 14.9 cfs ∴ 16' inlet
DP 6 14.9 cfs ∴ 16' inlet
DP EX3 5.5 cfs ∴ 8' inlet

Free Online Manning Pipe Flow Calculator

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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--CAUTION: If you have downloaded the spreadsheet prior to September 24, you may have received incorrect results!--

Pipe Run 1

Proposed 24" Public RCP

Set units: m mm ft in

Pipe diameter, d_0	24 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	2 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	45 %

Results

Flow, Q	13.3247	cfs
Velocity, v	9.7183	ft/sec
Velocity head, h_v	1.4679	ft
Flow area	1.3711	ft^2
Wetted perimeter	2.9412	ft
Hydraulic radius	0.4662	ft
Top width, T	1.9900	ft
Froude number, F	2.06	
Shear stress (tractive force), tau	1.1239	psf

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 2

Proposed 30" Public RCP

Set units: m | mm | ft | in

Pipe diameter, d_0	30 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	2 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	45.3 %

Results

Flow, Q	24.4443	cfs
Velocity, v	11.3116	ft/sec
Velocity head, h_v	1.9886	ft
Flow area	2.1611	ft^2
Wetted perimeter	3.6916	ft
Hydraulic radius	0.5854	ft
Top width, T	2.4889	ft
Froude number, F	2.14	
Shear stress (tractive force), tau	1.4142	psf

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 3

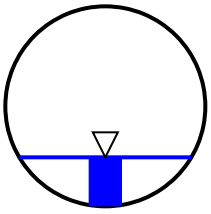
Existing 18" Public RCP

Set units: m | mm | ft | in

Pipe diameter, d_0	18 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.012
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	2 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	24.5 %

Results

Flow, Q	2.1176	cfs
Velocity, v	6.3070	ft/sec
Velocity head, h_v	0.6182	ft
Flow area	0.3358	ft^2
Wetted perimeter	1.5534	ft
Hydraulic radius	0.2161	ft
Top width, T	1.2902	ft
Froude number, F	2.18	
Shear stress (tractive force), tau	0.4589	psf



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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 4

Existing 18" Public RCP

Set units: m | mm | ft | in

Pipe diameter, d_0	18 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.012
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	48.74 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	22.3 %

Results

Flow, Q	8.6635	cfs
Velocity, v	29.4825	ft/sec
Velocity head, h_v	13.5091	ft
Flow area	0.2939	ft^2
Wetted perimeter	1.4754	ft
Hydraulic radius	0.1992	ft
Top width, T	1.2488	ft
Froude number, F	11.30	
Shear stress (tractive force), tau	10.1795	psf

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 5A

Proposed 18" Public RCP

Set units: m | mm | ft | in

Pipe diameter, d_0	18 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	2.14 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	61.5 %

Results

Flow, Q	10.7166	cfs
Velocity, v	9.4007	ft/sec
Velocity head, h_v	1.3735	ft
Flow area	1.1400	ft^2
Wetted perimeter	2.7043	ft
Hydraulic radius	0.4216	ft
Top width, T	1.4598	ft
Froude number, F	1.88	
Shear stress (tractive force), tau	1.2326	psf

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 5

Proposed 24" Public RCP

Set units: m | mm | ft | in

Pipe diameter, d_0	24 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	3.36 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	56.9 %

Results

Flow, Q	25.6450	cfs
Velocity, v	13.8932	ft/sec
Velocity head, h_v	2.9999	ft
Flow area	1.8459	ft^2
Wetted perimeter	3.4184	ft
Hydraulic radius	0.5400	ft
Top width, T	1.9808	ft
Froude number, F	2.54	
Shear stress (tractive force), tau	2.3874	psf

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 6

Proposed 30" Public RCP

Set units: m | mm | ft | in

Pipe diameter, d_0	30 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	1 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	80.7 %

Results

Flow, Q	40.4282	cfs
Velocity, v	9.5249	ft/sec
Velocity head, h_v	1.4100	ft
Flow area	4.2447	ft^2
Wetted perimeter	5.5797	ft
Hydraulic radius	0.7607	ft
Top width, T	1.9732	ft
Froude number, F	1.15	
Shear stress (tractive force), tau	1.2597	psf

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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run EX3

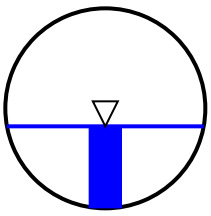
Printable Subtitle

Set units: m mm ft in

Pipe diameter, d_0	15 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	5.99 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	41 %

Results

Flow, Q	5.5726	cfs
Velocity, v	11.7635	ft/sec
Velocity head, h_v	2.1507	ft
Flow area	0.4737	ft^2
Wetted perimeter	1.7372	ft
Hydraulic radius	0.2727	ft
Top width, T	1.2296	ft
Froude number, F	3.34	
Shear stress (tractive force), tau	1.9168	psf



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Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run EX4

Printable Subtitle

Set units: m mm ft in

Pipe diameter, d_0	24 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	.013
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	2.86 % rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	54.7 %

Results

Flow, Q	22.2080	cfs
Velocity, v	12.6292	ft/sec
Velocity head, h_v	2.4789	ft
Flow area	1.7585	ft^2
Wetted perimeter	3.3298	ft
Hydraulic radius	0.5281	ft
Top width, T	1.9911	ft
Froude number, F	2.37	
Shear stress (tractive force), tau	1.9536	psf

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/2/2018 3:55:49 PM	**UDSewer Results Summary** **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.25
Maximum Rural Overland Len. (ft): 100
Maximum Urban Overland Len. (ft): 100
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6152.95

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6156.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE RUN 2	6157.20	13.20	0.00	5.53	0.80	0.70	100.00	2.00	520.00	2.83
PIP RUN 1	6157.20	6.70	0.00	2.78	0.80	0.70	100.00	2.00	520.00	2.83

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	6.65	1.99	86.08	13.20	
PIPE RUN 2	5.75	3.06	8.81	7.16	31.65	6.65	1.99	86.08	13.20	
PIP RUN 1	5.75	3.06	8.81	7.16	15.91	2.22	3.01	46.53	6.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PIPE RUN 2	76.61	6151.10	1.5	6152.25	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PIP RUN 1	29.34	6152.75	2.0	6153.34	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE RUN 2	50.37	10.26	14.66	5.54	10.48	8.64	1.90	Supercritical	13.20	0.00	
PIP RUN 1	32.08	10.21	11.01	4.77	7.44	8.07	2.12	Supercritical	6.70	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PIPE RUN 2	13.20	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
PIP RUN 1	6.70	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6152.95

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)

PIPE RUN 2	6151.10	6152.25	0.00	0.00	6152.95	6153.47	6153.13	0.81	6153.95
PIP RUN 1	6152.75	6153.34	0.09	0.00	6153.56	6154.26	6154.39	0.23	6154.61

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 4.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PIPE RUN 2	76.61	3.50	6.00	6.08	9.10	6.09	2.51	8.40	5.74	2.16	107.25	
PIP RUN 1	29.34	3.00	4.00	5.50	7.89	5.03	2.20	6.72	4.44	1.61	29.29	Sewer Too Shallow

Total earth volume for sewer trenches = 137 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/2/2018 3:56:58 PM	**UDSewer Results Summary** **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.25
Maximum Rural Overland Len. (ft): 100
Maximum Urban Overland Len. (ft): 100
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6152.95

Manhole Input Summary:

	Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	100yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6156.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE RUN 2	6157.20	26.40	0.00	5.53	0.80	0.80	100.00	2.00	520.00	2.83
PIP RUN 1	6157.20	13.20	0.00	2.78	0.80	0.80	100.00	2.00	520.00	2.83

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	6.65	3.97	29.78	26.40	
PIPE RUN 2	5.75	3.06	8.81	7.16	31.65	6.65	3.97	29.78	26.40	
PIP RUN 1	5.75	3.06	8.81	7.16	15.91	2.22	5.94	13.86	13.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PIPE RUN 2	76.61	6151.10	1.5	6152.25	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PIP RUN 1	29.34	6152.75	2.0	6153.34	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE RUN 2	50.37	10.26	21.02	7.19	15.42	10.38	1.81	Supercritical	26.40	0.00	
PIP RUN 1	32.08	10.21	15.69	6.07	10.73	9.71	2.07	Supercritical Jump	13.20	8.30	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE RUN 2	26.40	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
PIP RUN 1	13.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6152.95

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**

PIPE RUN 2	6151.10	6152.25	0.00	0.00	6152.95	6154.00	6154.06	0.74	6154.80
PIP RUN 1	6152.75	6153.34	0.36	0.00	6154.89	6154.89	6155.17	0.12	6155.29

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

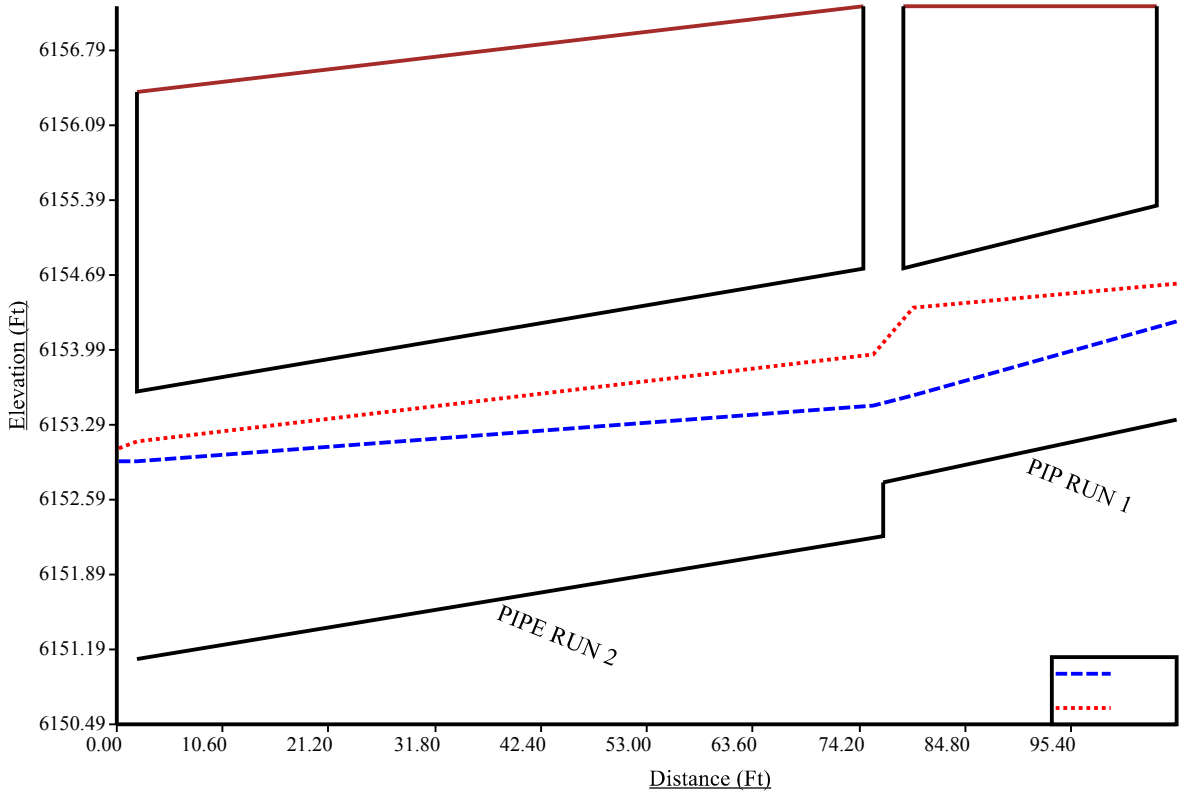
The trench side slope is 1.0 ft/ft
The minimum trench width is 4.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PIPE RUN 2	76.61	3.50	6.00	6.08	9.10	6.09	2.51	8.40	5.74	2.16	107.25	
PIP RUN 1	29.34	3.00	4.00	5.50	7.89	5.03	2.20	6.72	4.44	1.61	29.29	Sewer Too Shallow

Total earth volume for sewer trenches = 137 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

5 -YEAR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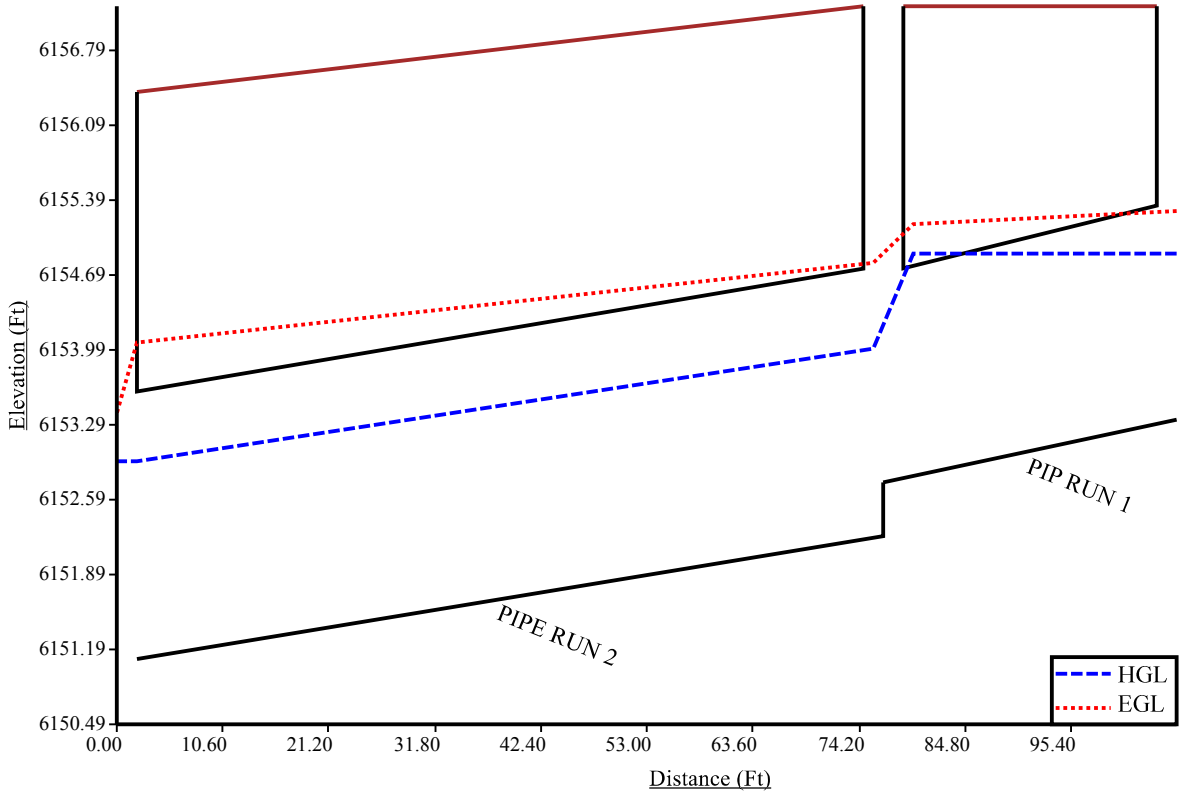
6156.09
6155.39
6154.69
6153.99
6153.29
6152.59
6151.89
6151.19
6150.49
Elevation (Ft)
0.00
10.60
21.20
31.80
42.40
53.00
63.60
74.20
84.80
95.40
Distance (Ft)
PIP RUN 1
PIPE RUN 2

PR 1-2 100Y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6151.19
6150.49
Elevation (Ft)
0.00
10.60
21.20
31.80
42.40
53.00
63.60
74.20
84.80
95.40
Distance (Ft)
PIP RUN 1
PIPE RUN 2
HGL
EGL

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/2/2018 4:17:44 PM	**UDSewer Results Summary** **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6134.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6152.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE RUN 6	6151.12	20.40	0.00	11.39	0.80	0.70	100.00	2.00	500.00	2.83
PIPE RUN 5	6151.12	13.70	0.00	5.69	0.80	0.70	100.00	2.00	500.00	2.83
PIPE RUN 5A	6159.20	6.90	0.00	3.16	0.80	0.70	100.00	2.00	500.00	2.83

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PIPE RUN 6	5.75	2.94	8.69	NaN	NaN	16.19	1.26	NaN	20.40	
PIPE RUN 5	5.75	2.94	8.69	NaN	NaN	7.08	1.94	NaN	13.70	
PIPE RUN 5A	5.75	2.94	8.69	NaN	NaN	2.53	2.73	NaN	6.90	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PIPE RUN 6	59.61	6144.55	1.0	6145.15	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PIPE RUN 5	33.24	6145.67	3.4	6146.80	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

PIPE RUN 5A	363.15	6147.45	2.1	6155.08	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE RUN 6	41.13	8.38	18.40	6.46	14.93	8.36	1.49	Supercritical	20.40	0.00	
PIPE RUN 5	41.83	13.31	15.99	6.16	9.45	11.92	2.74	Supercritical	13.70	0.00	
PIPE RUN 5A	15.26	8.64	12.20	5.41	8.49	8.42	2.01	Supercritical	6.90	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE RUN 6	20.40	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
PIPE RUN 5	13.70	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PIPE RUN 5A	6.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6134.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE RUN 6	6144.55	6145.15	0.00	0.00	6145.80	6146.68	6146.88	0.45	6147.33
PIPE RUN 5	6145.67	6146.80	0.39	0.00	6147.07	6148.13	6148.66	0.06	6148.72
PIPE RUN 5A	6147.45	6155.08	0.31	0.00	6148.45	6156.10	6149.26	7.29	6156.55

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PIPE RUN 6	59.61	3.50	6.00	6.08	13.39	8.24	4.65	10.44	6.76	3.18	120.71	
PIPE RUN 5	33.24	3.00	4.00	5.50	9.90	6.03	3.20	7.64	4.90	2.07	40.71	
PIPE RUN 5A	363.15	2.50	4.00	4.92	6.83	4.21	1.96	7.74	4.66	2.41	312.84	Sewer Too Shallow

Total earth volume for sewer trenches = 474 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/2/2018 4:20:31 PM	**UDSewer Results Summary** **Project Title:** New UDSEWER System Module **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6134.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	100yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6152.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE RUN 6	6151.12	40.40	0.00	11.39	0.80	0.80	100.00	2.00	500.00	2.83
PIPE RUN 5	6151.12	25.60	0.00	5.69	0.80	0.80	100.00	2.00	500.00	2.83
PIPE RUN 5A	6159.20	10.70	0.00	3.16	0.80	0.80	100.00	2.00	500.00	2.83

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PIPE RUN 6	5.75	2.94	8.69	NaN	NaN	16.19	2.50	NaN	40.40	
PIPE RUN 5	5.75	2.94	8.69	NaN	NaN	7.08	3.62	NaN	25.60	
PIPE RUN 5A	5.75	2.94	8.69	NaN	NaN	2.53	4.23	NaN	10.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PIPE RUN 6	59.61	6144.55	1.0	6145.15	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PIPE RUN 5	33.24	6145.67	3.4	6146.80	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

PIPE RUN 5A	363.15	6147.45	2.1	6155.08	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE RUN 6	41.13	8.38	25.65	9.04	24.12	9.55	1.15	Supercritical	40.40	0.00	
PIPE RUN 5	41.83	13.31	21.32	8.68	13.57	13.98	2.56	Pressurized	25.60	33.24	
PIPE RUN 5A	15.26	8.64	15.06	6.77	11.11	9.35	1.86	Supercritical Jump	10.70	146.93	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE RUN 6	40.40	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	
PIPE RUN 5	25.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PIPE RUN 5A	10.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6134.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE RUN 6	6144.55	6145.15	0.00	0.00	6146.56	6147.29	6147.98	0.58	6148.56
PIPE RUN 5	6145.67	6146.80	1.36	0.00	6148.89	6149.31	6149.92	0.42	6150.34
PIPE RUN 5A	6147.45	6155.08	0.75	0.00	6150.52	6156.34	6151.09	5.96	6157.05

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

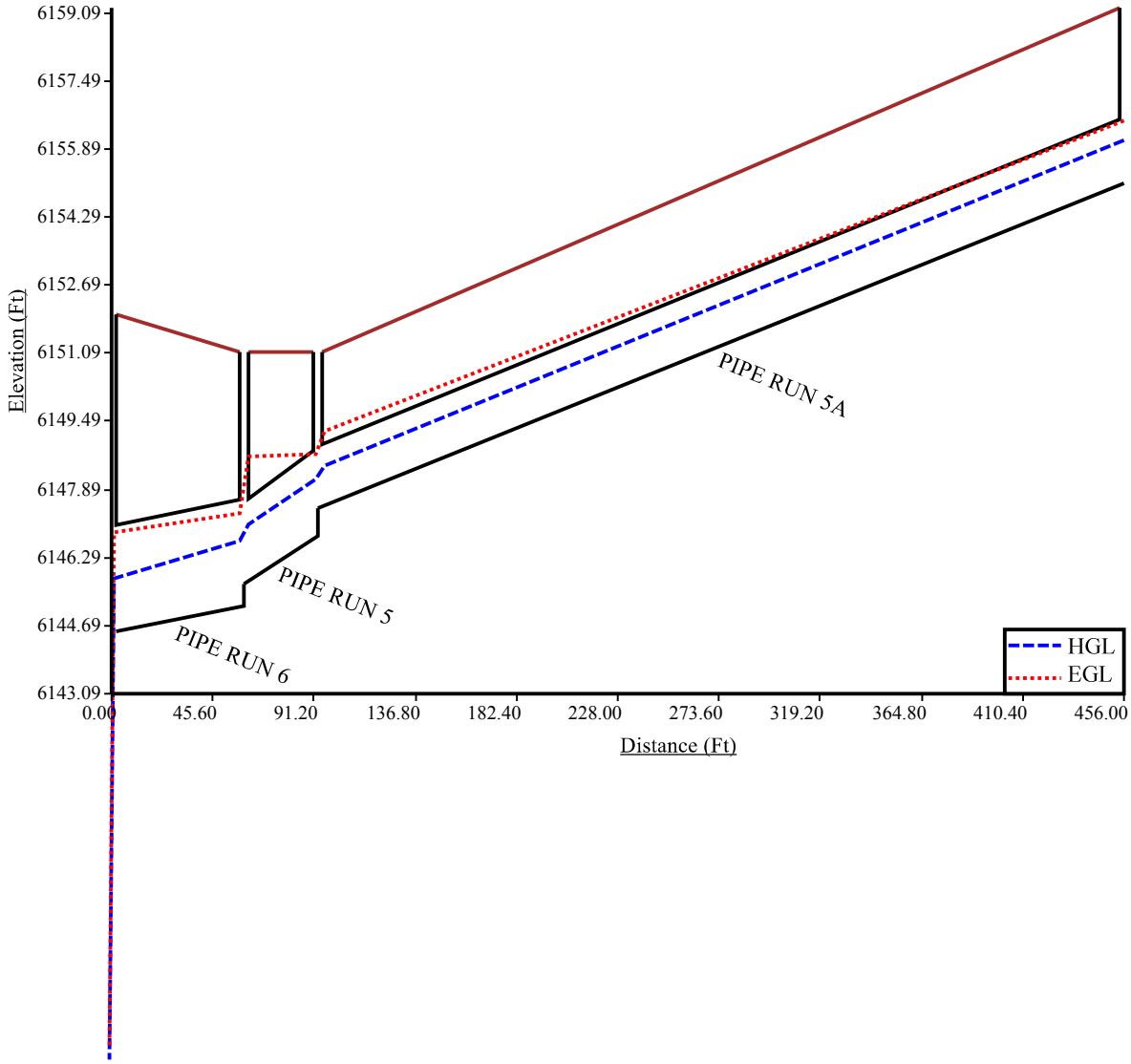
					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PIPE RUN 6	59.61	3.50	6.00	6.08	13.39	8.24	4.65	10.44	6.76	3.18	120.71	
PIPE RUN 5	33.24	3.00	4.00	5.50	9.90	6.03	3.20	7.64	4.90	2.07	40.71	
PIPE RUN 5A	363.15	2.50	4.00	4.92	6.83	4.21	1.96	7.74	4.66	2.41	312.84	Sewer Too Shallow

Total earth volume for sewer trenches = 474 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

PR 5A-6 5Y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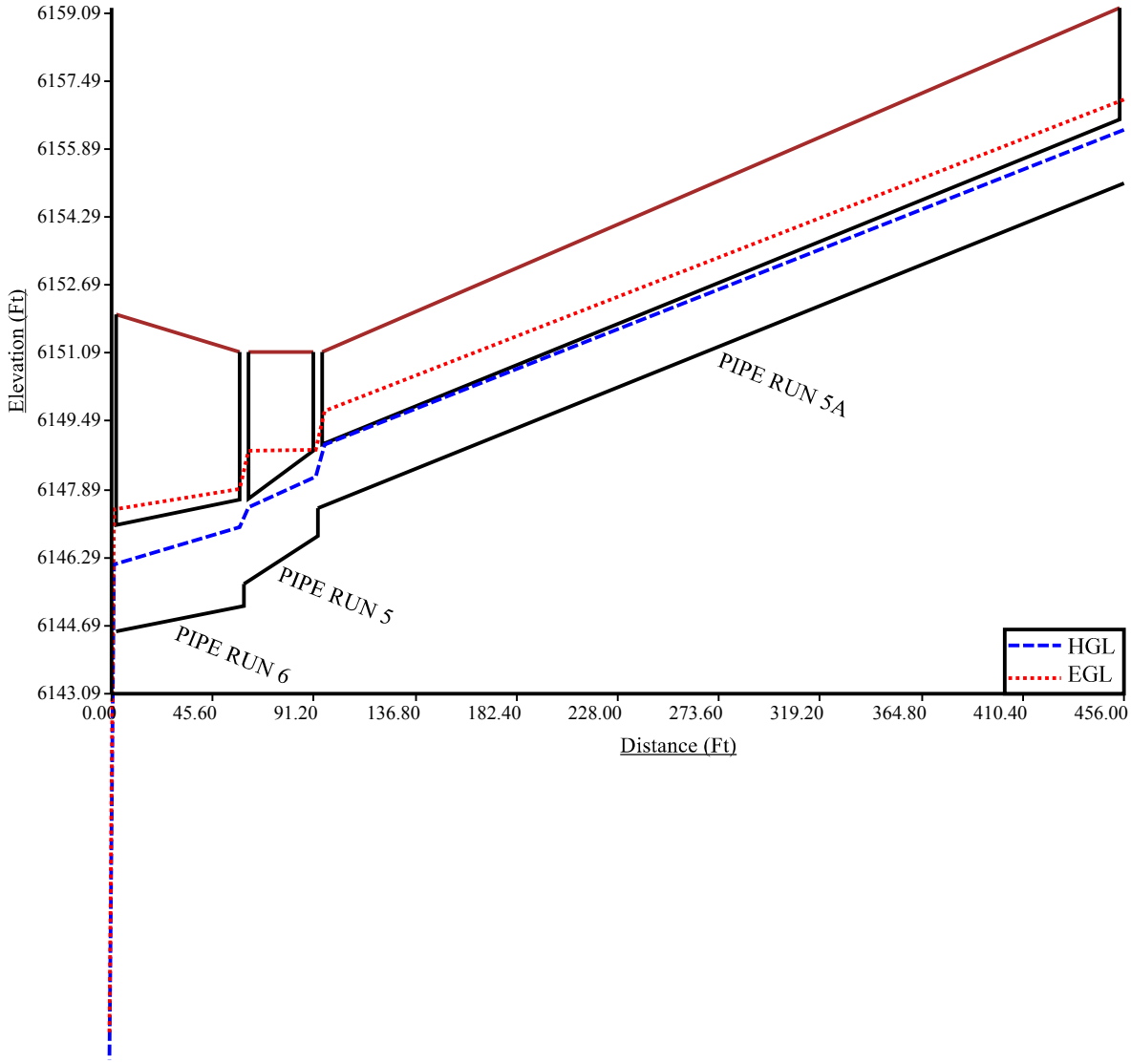
6149.49
6147.89
6146.29
6144.69
6143.09
Elevation (Ft)
0.00
45.60
91.20
136.80
182.40
228.00
273.60
319.20
364.80
410.40
456.00
Distance (Ft)
PIPE RUN 5A
PIPE RUN 5
PIPE RUN 6
HGL
EGL

PR 5A-6 100Y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6151.09
6149.49
6147.89
6146.29
6144.69
6143.09
Elevation (Ft)
0.00
45.60
91.20
136.80
182.40
228.00
273.60
319.20
364.80
410.40
456.00
Distance (Ft)
PIPE RUN 5A
PIPE RUN 5
PIPE RUN 6
HGL
EGL

Trapezoidal Riprap-Lined Waterway Design.xlsm

Landowner	Weir Overflow		County	EL PASO			V 1.2015	
Computed By	QNA		Date	5/1/2018			1/15/2015	
Checked by			Date					

Note: Macros must be enabled in this spreadsheet in order for the "Solve" button to work.

Design flow, Q=	174.8	cfs			WW horiz. Length=	63.0	ft
Slope, S=	0.3333	ft/ft =	3.00	:1	U/S WW F.L. elev=	6029.0	ft
Bottom Width, W=	60	ft			D/S WW F.L. elev=	**6008.0**	ft
Side slope, Z=	3	:1			Waterway drop=	**21.0**	ft
Safety factor=	1.2		Typically 1.2		WW length along slope=	**66.4**	ft
Rock shape =	Angular						
Min. req'd D50=	**8.39**	in			*Spreadsheet formatting key:*		
D50 used=	12.00	in			XXX	*=Input cells*	
n=	**0.058**				**X.XX**	*=Output from "Solve" button*	
Freeboard=	0.50	ft			**X.XX**	*=Other computed output*	
					Red text	*=Instructions, warnings, info*	
Flow depth, d=	**0.37**	ft	**Calculated**				
Critical depth, d_c=	**0.63**	ft					
Critical slope, S_c=	**0.057**	ft/ft	$0.7S_c$ =	**0.0398**	ft/ft		
			$1.3S_c$ =	**0.0740**	ft/ft		
Design slope, S=	0.3333	ft/ft	*Design slope OK. Flow is Supercritical.*				
Velocity=	**7.64**	fps			Est. riprap unit wt=	1.4	Tons/CY
			Rock shape = Angular		Rock Gs =	2.65	

Riprap thickness:

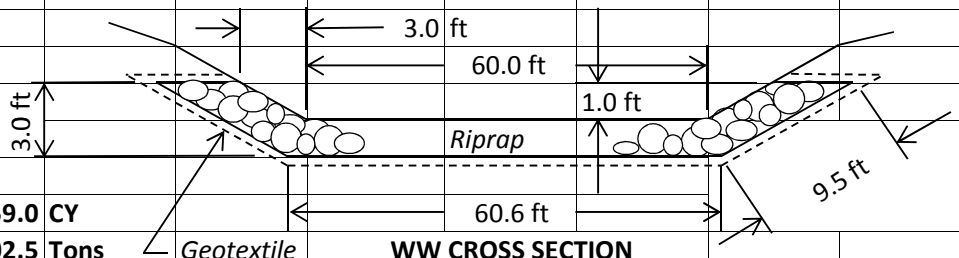
Required riprap gradation for D50 selected

Minimum=	**2.00**	ft	%	Rock dia., inches		Rock weight, lb	
Provided=	2.00	ft	Smaller	min.	max.	min.	max.
			100	**18.0**	**24.0**	**425**	**1007**
Sideslope height:			85	**15.6**	**21.6**	**277**	**734**
Minimum=	**0.87**	ft	50	**12.0**	**18.0**	**126**	**425**
Provided=	1.00	ft	10	**9.6**	**15.6**	**64**	**277**

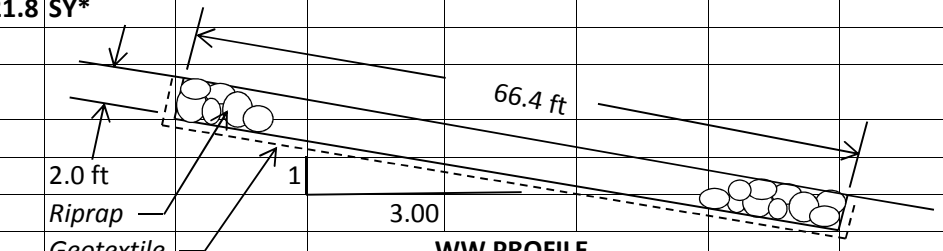
Quantities:

Riprap volume=	**359.0**	**CY**
Approx. weight=	**502.5**	**Tons**
Geotextile area=	**721.8**	**SY***

*Geotextile area includes actual covered surfaces only (no extra for laps or anchorage)



WW CROSS SECTION



WW PROFILE

EDB CALCULATIONS

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches	
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	
***Major Storm: 1-Hour Rain Depth	50-Year Event	2.25	inches	
Optional User Defined Storm	CUHP			
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52		
Max Intensity for Optional User Defined Storm	2.51496			

Designer:	**Quentin Armijo**
Company:	**Terra Nova Engineering**
Date:	**March 2, 2018**
Project:	**Gold Hill Mesa MDDP**
Location:	**Colorado Springs, CO**

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	POND 1
Receiving Pervious Area Soil Type	Clay Loam
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	153.270
Directly Connected Impervious Area (DCIA, acres)	81.309
Unconnected Impervious Area (UIA, acres)	26.370
Receiving Pervious Area (RPA, acres)	15.430
Separate Pervious Area (SPA, acres)	30.160
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	153.270
Directly Connected Impervious Area (DCIA, %)	53.0%
Unconnected Impervious Area (UIA, %)	17.2%
Receiving Pervious Area (RPA, %)	10.1%
Separate Pervious Area (SPA, %)	19.7%
A_R (RPA / UIA)	0.585
I_a Check	0.630
f / I for WQCV Event:	0.2
f / I for 5-Year Event:	0.2
f / I for 50-Year Event:	0.1
f / I for Optional User Defined Storm CUHP:	0.12
IRF for WQCV Event:	0.97
IRF for 5-Year Event:	0.97
IRF for 50-Year Event:	0.99
IRF for Optional User Defined Storm CUHP:	0.99
Total Site Imperviousness: I_{total}	70.3%
Effective Imperviousness for WQCV Event:	69.7%
Effective Imperviousness for 5-Year Event:	69.8%
Effective Imperviousness for 50-Year Event:	70.1%
Effective Imperviousness for Optional User Defined Storm CUHP:	70.2%

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	0.8%	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
This line only for 10-Year Event	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
This line only for 100-Year Event	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
User Defined CUHP CREDIT: Reduce Detention By:	0.2%													

Total Site Imperviousness:	**70.3%**
Total Site Effective Imperviousness for WQCV Event:	**69.7%**
Total Site Effective Imperviousness for 5-Year Event:	**69.8%**
Total Site Effective Imperviousness for 50-Year Event:	**70.1%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**70.2%**

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

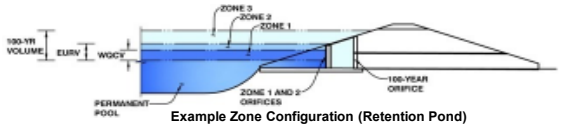
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Gold Hill Mesa MDDP Amendment

Basin ID: Pond 1 100-year Full Spectrum Detention for Filings 9 & 10 and Villa De Mesa Town Homes



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	20.24	acres	
Watershed Length =	1,100	ft	
Watershed Slope =	0.127	ft/ft	
Watershed Imperviousness =	65.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.429	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	1.271	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.213	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.709	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.106	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.688	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.151	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.723	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3 in.) =	4.685	acre-feet	3.00 inches
Approximate 2-yr Detention Volume =	1.138	acre-feet	
Approximate 5-yr Detention Volume =	1.610	acre-feet	
Approximate 10-yr Detention Volume =	1.841	acre-feet	
Approximate 25-yr Detention Volume =	1.964	acre-feet	
Approximate 50-yr Detention Volume =	2.022	acre-feet	
Approximate 100-yr Detention Volume =	2.209	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.429	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.842	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.938	acre-feet
Total Detention Basin Volume =	2.209	acre-feet
Initial Surcharge Volume (ISV) =		ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

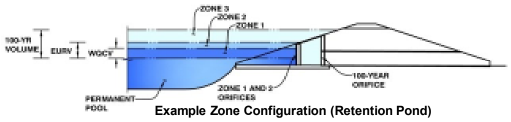
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)
Top of Micropool								

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Gold Hill Mesa MDDP/GHM Filings 9 & 10 FDR

Basin ID: Pond 1 100-Y WQ for Existing & Undeveloped Tributary Area, Full Spectrum Detention for GHM Filings 9 & 10 and Villa De Mesa Town Homes



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	130.72	acres		
Watershed Length =	4,300	ft		
Watershed Slope =	0.034	ft/ft		
Watershed Imperviousness =	45.86%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	2.126	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	5.632	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	5.278	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	7.962	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.403	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	14.557	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	17.650	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	21.525	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	27.927	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	4.948	acre-feet		
Approximate 5-yr Detention Volume =	7.506	acre-feet		
Approximate 10-yr Detention Volume =	8.564	acre-feet		
Approximate 25-yr Detention Volume =	9.319	acre-feet		
Approximate 50-yr Detention Volume =	9.674	acre-feet		
Approximate 100-yr Detention Volume =	11.150	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	2.126	acre-feet	
Zone 2 Volume (EURV - Zone 1) =	3.506	acre-feet	**Total detention volume is less than 100-year volume.**
Zone 3 Volume (User Defined - Zones 1 & 2) =	0.983	acre-feet	
Total Detention Basin Volume =	6.615	acre-feet	
Initial Surcharge Volume (ISV) =	user	ft^3	
Initial Surcharge Depth (ISD) =	user	ft	
Total Available Detention Depth (H_{total}) =	user	ft	
Depth of Trickle Channel (H_{TC}) =	user	ft	
Slope of Trickle Channel (S_{TC}) =	user	ft/ft	
Slopes of Main Basin Sides (S_{main}) =	user	H:V	
Basin Length-to-Width Ratio ($R_{L/W}$) =	user		
Initial Surcharge Area (A_{ISV}) =	user	ft^2	
Surcharge Volume Length (L_{ISV}) =	user	ft	
Surcharge Volume Width (W_{ISV}) =	user	ft	
Depth of Basin Floor (H_{FLOOR}) =	user	ft	
Length of Basin Floor (L_{FLOOR}) =	user	ft	
Width of Basin Floor (W_{FLOOR}) =	user	ft	
Area of Basin Floor (A_{FLOOR}) =	user	ft^2	
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3	
Depth of Main Basin (H_{MAIN}) =	user	ft	
Length of Main Basin (L_{MAIN}) =	user	ft	
Width of Main Basin (W_{MAIN}) =	user	ft	
Area of Main Basin (A_{MAIN}) =	user	ft^2	
Volume of Main Basin (V_{MAIN}) =	user	ft^3	
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet	

Depth Increment = 0.25 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	352	0.008		
	--	0.25	--	--	--	501	0.012	102	0.002
	--	0.50	--	--	--	651	0.015	244	0.006
	--	0.75	--	--	--	800	0.018	424	0.010
	--	1.00	--	--	--	950	0.022	641	0.015
	--	1.25	--	--	--	3,197	0.073	1,138	0.026
	--	1.50	--	--	--	5,444	0.125	2,195	0.050
	--	1.75	--	--	--	7,691	0.177	3,815	0.088
	--	2.00	--	--	--	9,939	0.228	5,996	0.138
	--	2.25	--	--	--	13,431	0.308	9,016	0.207
	--	2.50	--	--	--	16,923	0.388	12,810	0.294
	--	2.75	--	--	--	20,415	0.469	17,477	0.401
	--	3.00	--	--	--	23,908	0.549	23,018	0.528
	--	3.25	--	--	--	29,130	0.669	29,647	0.681
	--	3.50	--	--	--	34,352	0.789	37,583	0.863
	--	3.75	--	--	--	39,575	0.909	46,824	1.075
	--	4.00	--	--	--	44,797	1.028	57,370	1.317
	--	4.25	--	--	--	47,858	1.099	68,952	1.583
	--	4.50	--	--	--	50,920	1.169	81,299	1.866
	--	4.75	--	--	--	53,981	1.239	94,412	2.167
	--	5.00	--	--	--	57,043	1.310	108,290	2.486
	--	5.25	--	--	--	59,291	1.361	122,831	2.820
	--	5.50	--	--	--	61,538	1.413	137,935	3.167
	--	5.75	--	--	--	63,786	1.464	153,601	3.526
	--	6.00	--	--	--	66,034	1.516	169,828	3.899
	--	6.25	--	--	--	67,142	1.541	186,475	4.281
	--	6.50	--	--	--	68,251	1.567	203,399	4.669
	--	6.75	--	--	--	69,359	1.592	220,601	5.064
	--	7.00	--	--	--	70,467	1.618	238,079	5.466
	--	7.25	--	--	--	71,589	1.643	255,836	5.873
	--	7.50	--	--	--	72,712	1.669	273,874	6.287
	--	7.75	--	--	--	73,834	1.695	292,192	6.708
	--	8.00	--	--	--	74,957	1.721	310,791	7.135
	--	8.25	--	--	--	76,075	1.746	329,670	7.568
	--	8.50	--	--	--	77,193	1.772	348,828	8.008
	--	8.75	--	--	--	78,311	1.798	368,266	8.454
	--	9.00	--	--	--	79,429	1.823	387,983	8.907
	--	9.25	--	--	--	80,559	1.849	407,982	9.366
	--	9.50	--	--	--	81,690	1.875	428,263	9.832
	--	9.75	--	--	--	82,820	1.901	448,827	10.304
	--	10.00	--	--	--	83,951	1.927	469,673	10.782
	--	10.25	--	--	--	85,092	1.953	490,803	11.267
	--	10.50	--	--	--	86,233	1.980	512,219	11.759
	--	10.75	--	--	--	87,374	2.006	533,920	12.257
	--	11.00	--	--	--	88,515	2.032	555,906	12.762
	--	11.25	--	--	--	89,679	2.059	578,180	13.273
	--	11.50	--	--	--	90,842	2.085	600,746	13.791
	--	11.75	--	--	--	92,005	2.112	623,601	14.316
	--	12.00	--	--	--	93,168	2.139	646,748	14.847
	--	12.25	--	--	--	94,336	2.166	670,186	15.385
	--	12.50	--	--	--	95,504	2.192	693,916	15.930
	--	12.75	--	--	--	96,672	2.219	717,938	16.482
	--	13.00	--	--	--	97,840	2.246	742,252	17.040
	--	13.25	--	--	--	99,028	2.273	766,861	17.605
	--	13.50	--	--	--	100,215	2.301	791,766	18.176
	--	13.75	--	--	--	101,403	2.328	816,969	18.755
	--	14.00	--	--	--	102,591	2.355	842,468	19.340
	--	14.25	--	--	--	103,787	2.383	868,265	19.933
	--	14.50	--	--	--	104,983	2.410	894,361	20.532
	--	14.75	--	--	--	106,180	2.438	920,757	21.138
	--	15.00	--	--	--	107,376	2.465	947,451	21.750
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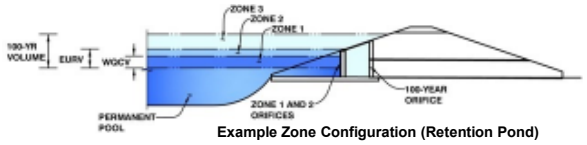
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Gold Hill Mesa MDDP/GHM Filings 9 & 10 FDR

Basin ID: Pond 1 100-Y WQ for Existing & Undeveloped Tributary Area, Full Spectrum Detention for GHM Filings 9 & 10 and Villa De Mesa Town Homes



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.72	2.126	Orifice Plate
Zone 2 (EURV)	7.11	3.506	Orifice Plate
Zone 3 (User)	7.70	0.983	Weir&Pipe (Restrict)
		6.615	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	7.11	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	28.44	inches
Orifice Plate: Orifice Area per Row =	7.32	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.083E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.40	4.80					
Orifice Area (sq. inches)	7.32	7.32	7.32					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	9.63	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	20.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	9.63	N/A	feet
Over Flow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.57	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	84.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	42.00	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	3.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	36.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	8.78	N/A	ft^2
Outlet Orifice Centroid =	1.61	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.37	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	13.10	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	115.00	feet
Spillway End Slopes =	8.00	H:V
Freeboard above Max Water Surface =	1.01	feet

Calculated Parameters for Spillway

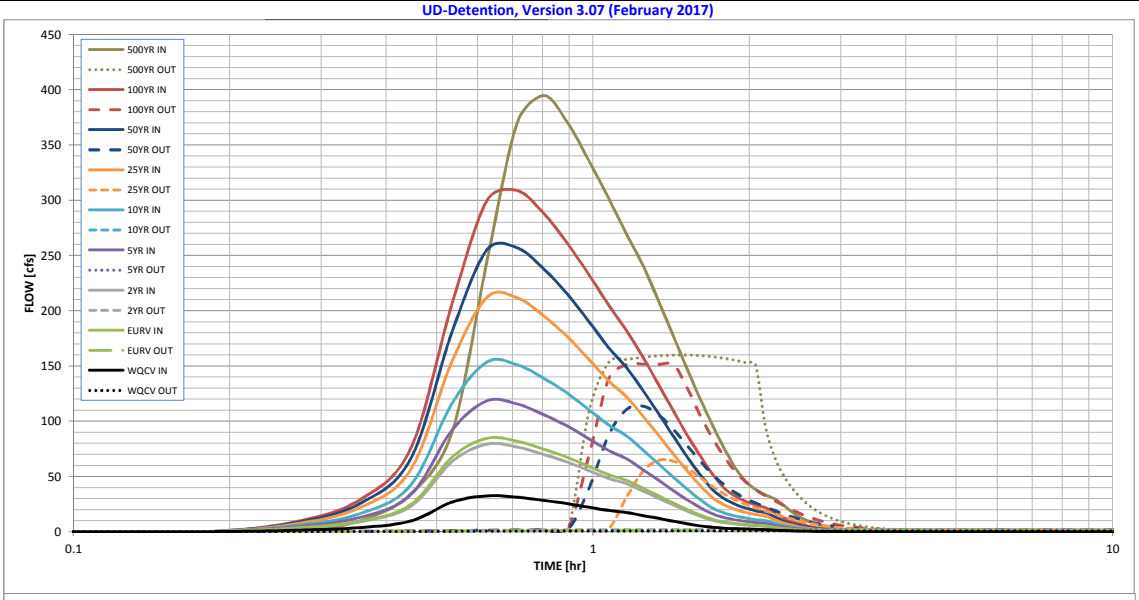
Spillway Design Flow Depth=	0.89	feet
Stage at Top of Freeboard =	15.00	feet
Basin Area at Top of Freeboard =	2.47	acres

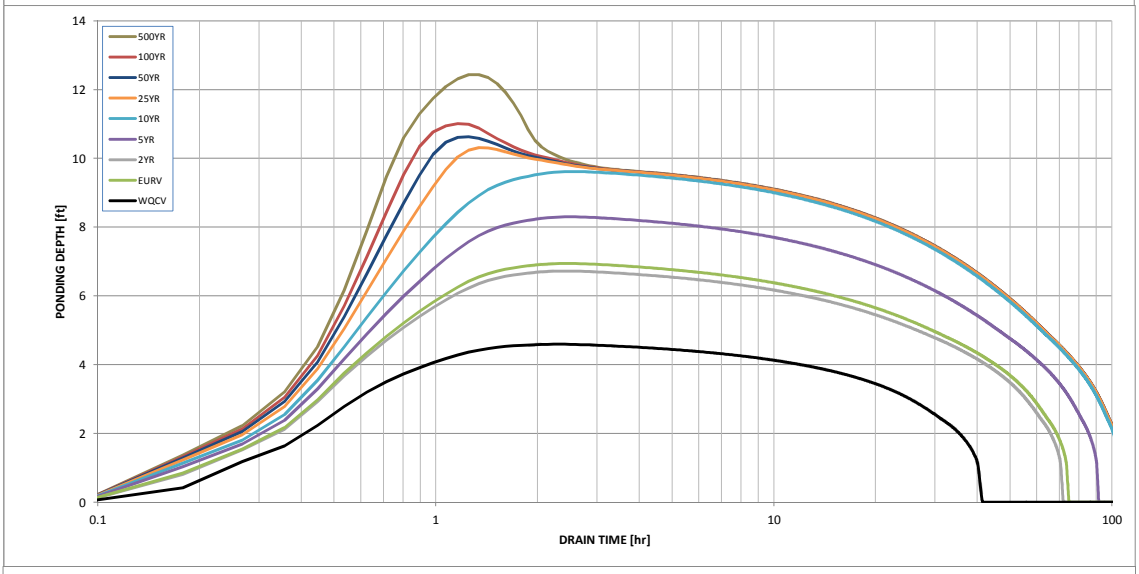
Routed Hydrograph Results

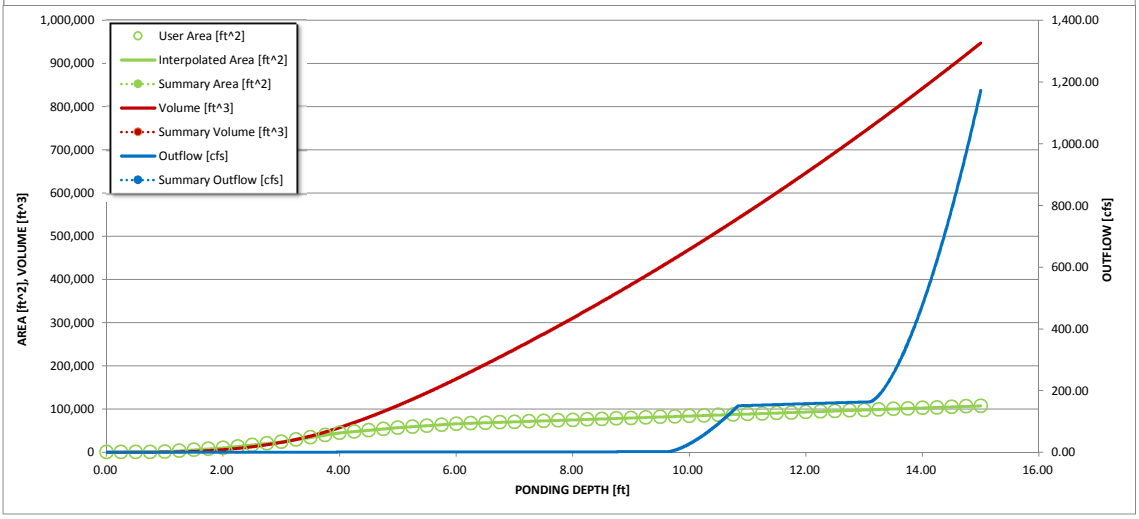
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.00
Calculated Runoff Volume (acre-ft) =	2.126	5.632	5.278	7.962	10.403	14.557	17.650	21.525	27.927
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.126	5.632	5.271	7.960	10.397	14.548	17.651	21.523	27.926
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.11	0.31	0.72	0.95	1.25	1.73
Predevelopment Peak Q (cfs) =	0.0	0.0	1.8	14.5	40.1	94.4	124.6	163.1	225.9
Peak Inflow Q (cfs) =	32.5	84.6	79.3	118.4	153.5	212.1	256.9	308.7	394.7
Peak Outflow Q (cfs) =	0.9	1.5	1.5	1.8	2.0	64.8	113.6	151.8	160.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.0	0.7	0.9	0.9	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.7	1.3	1.8	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	65	82	96	94	92	90	87
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	69	88	103	102	101	100	98
Maximum Ponding Depth (ft) =	4.59	6.94	6.72	8.30	9.62	10.31	10.63	11.01	12.44
Area at Maximum Ponding Depth (acres) =	1.19	1.61	1.59	1.75	1.89	1.96	1.99	2.03	2.18
Maximum Volume Stored (acre-ft) =	1.973	5.369	5.017	7.638	10.038	11.365	11.997	12.782	15.777

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







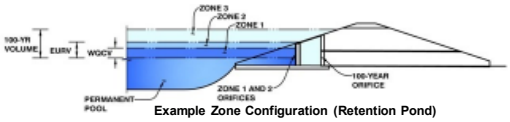
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Gold Hill Mesa MDDP Amendment

Basin ID: Pond 1 100-year Detention & Water Quality for Ultimate Development



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	153.27	acres	
Watershed Length =	4,330	ft	
Watershed Slope =	0.032	ft/ft	
Watershed Imperviousness =	67.75%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	3.387	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	10.065	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	9.625	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	13.461	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	16.483	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	20.825	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	24.318	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	28.619	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3 in.) =	35.865	acre-feet	3.00 inches
Approximate 2-yr Detention Volume =	9.031	acre-feet	
Approximate 5-yr Detention Volume =	12.678	acre-feet	
Approximate 10-yr Detention Volume =	14.513	acre-feet	
Approximate 25-yr Detention Volume =	15.459	acre-feet	
Approximate 50-yr Detention Volume =	15.894	acre-feet	
Approximate 100-yr Detention Volume =	17.251	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	3.387	acre-feet
Zone 2 Volume (EURV - Zone 1) =	6.678	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	7.186	acre-feet
Total Detention Basin Volume =	17.251	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

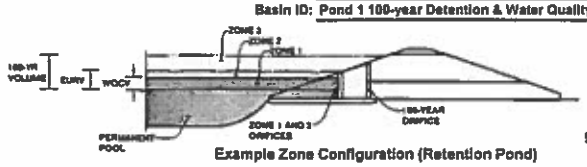
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	352	0.008		
	--	0.25	--	--	--	501	0.012	102	0.002
	--	0.50	--	--	--	651	0.015	244	0.006
	--	0.75	--	--	--	800	0.018	424	0.010
	--	1.00	--	--	--	950	0.022	641	0.015
	--	1.25	--	--	--	3,197	0.073	1,138	0.026
	--	1.50	--	--	--	5,444	0.125	2,195	0.050
	--	1.75	--	--	--	7,691	0.177	3,815	0.088
	--	2.00	--	--	--	9,939	0.228	5,996	0.138
	--	2.25	--	--	--	13,431	0.308	9,016	0.207
	--	2.50	--	--	--	16,923	0.388	12,810	0.294
	--	2.75	--	--	--	20,415	0.469	17,477	0.401
	--	3.00	--	--	--	23,908	0.549	23,018	0.528
	--	3.25	--	--	--	29,130	0.669	29,647	0.681
	--	3.50	--	--	--	34,352	0.789	37,583	0.863
	--	3.75	--	--	--	39,575	0.909	46,824	1.075
	--	4.00	--	--	--	44,797	1.028	57,370	1.317
	--	4.25	--	--	--	47,858	1.099	68,952	1.583
	--	4.50	--	--	--	50,920	1.169	81,299	1.866
	--	4.75	--	--	--	53,981	1.239	94,412	2.167
	--	5.00	--	--	--	57,043	1.310	108,290	2.486
	--	5.25	--	--	--	59,291	1.361	122,831	2.820
	--	5.50	--	--	--	61,538	1.413	137,935	3.167
	--	5.75	--	--	--	63,786	1.464	153,601	3.526
	--	6.00	--	--	--	66,034	1.516	169,828	3.899
	--	6.25	--	--	--	67,142	1.541	186,475	4.281
	--	6.50	--	--	--	68,251	1.567	203,399	4.669
	--	6.75	--	--	--	69,359	1.592	220,601	5.064
	--	7.00	--	--	--	70,467	1.618	238,079	5.466
	--	7.25	--	--	--	71,589	1.643	255,836	5.873
	--	7.50	--	--	--	72,712	1.669	273,874	6.287
	--	7.75	--	--	--	73,834	1.695	292,192	6.708
	--	8.00	--	--	--	74,957	1.721	310,791	7.135
	--	8.25	--	--	--	76,075	1.746	329,670	7.568
	--	8.50	--	--	--	77,193	1.772	348,828	8.008
	--	8.75	--	--	--	78,311	1.798	368,266	8.454
	--	9.00	--	--	--	79,429	1.823	387,983	8.907
	--	9.25	--	--	--	80,559	1.849	407,982	9.366
	--	9.50	--	--	--	81,690	1.875	428,263	9.832
	--	9.75	--	--	--	82,820	1.901	448,827	10.304
	--	10.00	--	--	--	83,951	1.927	469,673	10.782
	--	10.25	--	--	--	85,092	1.953	490,803	11.267
	--	10.50	--	--	--	86,233	1.980	512,219	11.759
	--	10.75	--	--	--	87,374	2.006	533,920	12.257
	--	11.00	--	--	--	88,515	2.032	555,906	12.762
	--	11.25	--	--	--	89,679	2.059	578,180	13.273
	--	11.50	--	--	--	90,842	2.085	600,746	13.791
	--	11.75	--	--	--	92,005	2.112	623,601	14.316
	--	12.00	--	--	--	93,168	2.139	646,748	14.847
	--	12.25	--	--	--	94,336	2.166	670,186	15.385
	--	12.50	--	--	--	95,504	2.192	693,916	15.930
	--	12.75	--	--	--	96,672	2.219	717,938	16.482
	--	13.00	--	--	--	97,840	2.246	742,252	17.040
	--	13.25	--	--	--	99,028	2.273	766,861	17.605
	--	13.50	--	--	--	100,215	2.301	791,766	18.176
	--	13.75	--	--	--	101,403	2.328	816,969	18.755
	--	14.00	--	--	--	102,591	2.355	842,468	19.340
	--	14.25	--	--	--	103,787	2.383	868,265	19.933
	--	14.50	--	--	--	104,983	2.410	894,361	20.532
	--	14.75	--	--	--	106,180	2.438	920,757	21.138
	--	15.00	--	--	--	107,376	2.465	947,451	21.750

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Gold Hill Mesa MDDP Amendment

Basin ID: Pond 1 100-year Detention & Water Quality for Ultimate Development



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	5.66	3.387	Orifice Plate
Zone 2 (EURV)	9.63	6.678	Orifice Plate
Zone 3 (100-year)	13.10	7.186	Weir&Pipe (Restrict)
		17.251	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	9.63	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	11.56	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.028E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	3.20	6.40					
Orifice Area (sq. inches)	11.56	11.56	11.56					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	9.63	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	20.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	9.63	N/A	feet
Over Flow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.73	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	84.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	42.00	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	3.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	42.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	9.62	N/A	ft^2
Outlet Orifice Centroid =	1.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	13.10	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	115.00	feet
Spillway End Slopes =	8.00	H:V
Freeboard above Max Water Surface =	0.81	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.09	feet
Stage at Top of Freeboard =	15.00	feet
Basin Area at Top of Freeboard =	2.47	acres

Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.00
Calculated Runoff Volume (acre-ft) =	3.387	10.065	9.625	13.461	16.483	20.825	24.318	28.619	35.865
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	3.385	10.054	9.617	13.449	16.473	20.806	24.299	28.597	35.840
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.12	0.32	0.75	1.00	1.30	1.80
Predevelopment Peak Q (cfs) =	0.0	0.0	2.2	18.0	49.4	115.7	152.7	199.5	276.1
Peak Inflow Q (cfs) =	53.3	154.3	147.8	204.3	249.0	310.3	359.9	419.2	516.2
Peak Outflow Q (cfs) =	1.5	2.8	2.8	47.2	98.2	163.5	168.5	174.8	187.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.6	2.0	1.4	1.1	0.9	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.5	1.1	1.9	2.0	2.0	2.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	71	69	72	70	68	66	65	62
Time to Drain 99% of Inflow Volume (hours) =	40	75	73	77	77	76	75	74	73
Maximum Ponding Depth (ft) =	5.49	9.38	9.15	10.17	10.53	10.90	11.47	12.48	14.49
Area at Maximum Ponding Depth (acres) =	1.41	1.86	1.84	1.94	1.98	2.02	2.08	2.19	2.41
Maximum Volume Stored (acre-ft) =	3.138	9.589	9.163	11.092	11.799	12.539	13.729	15.864	20.508

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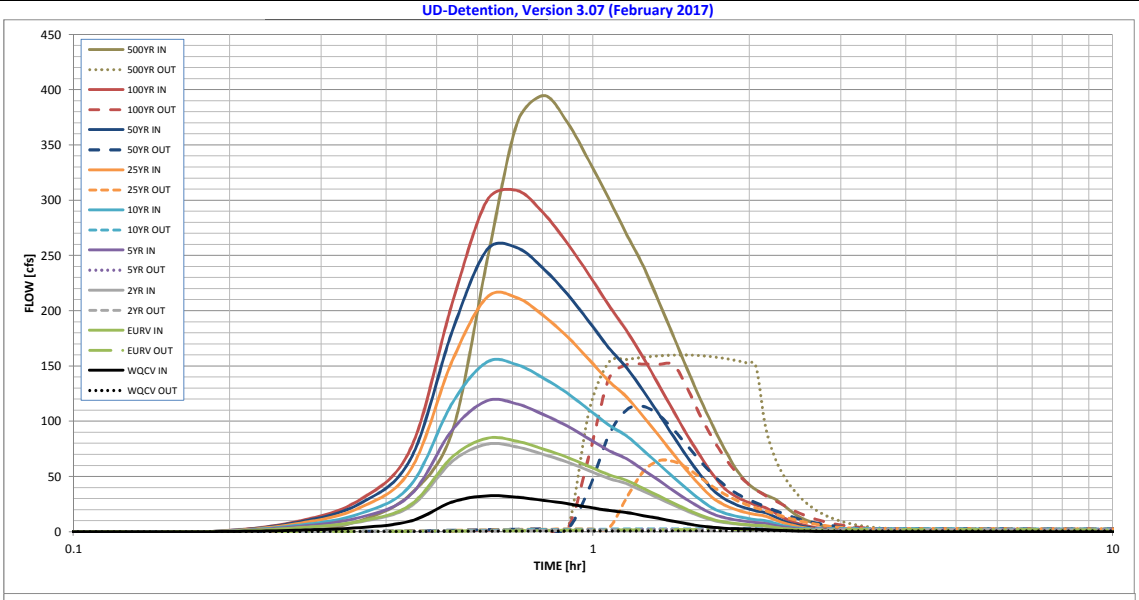
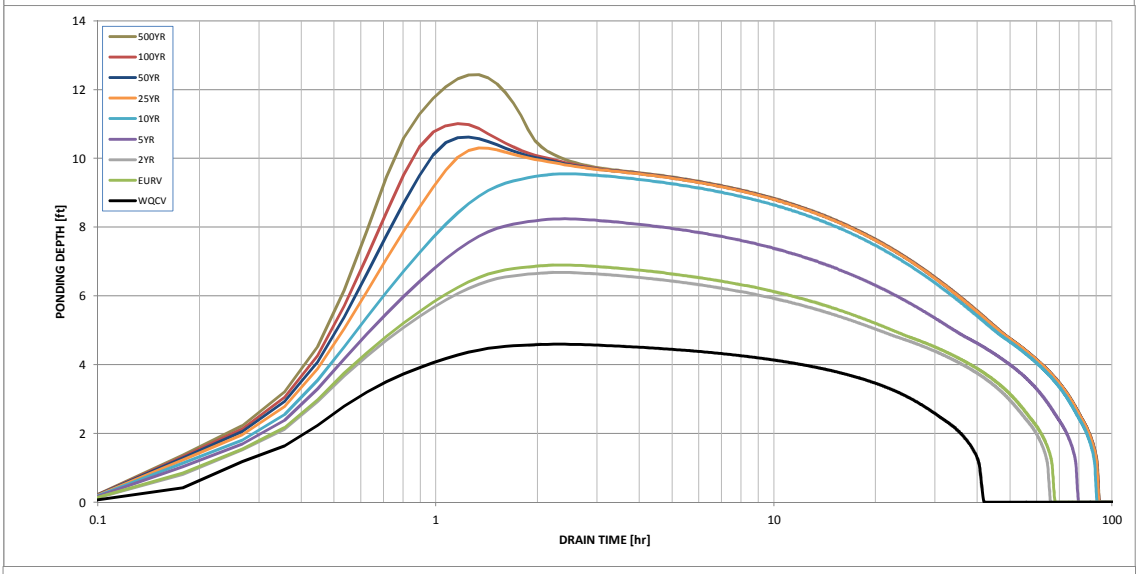
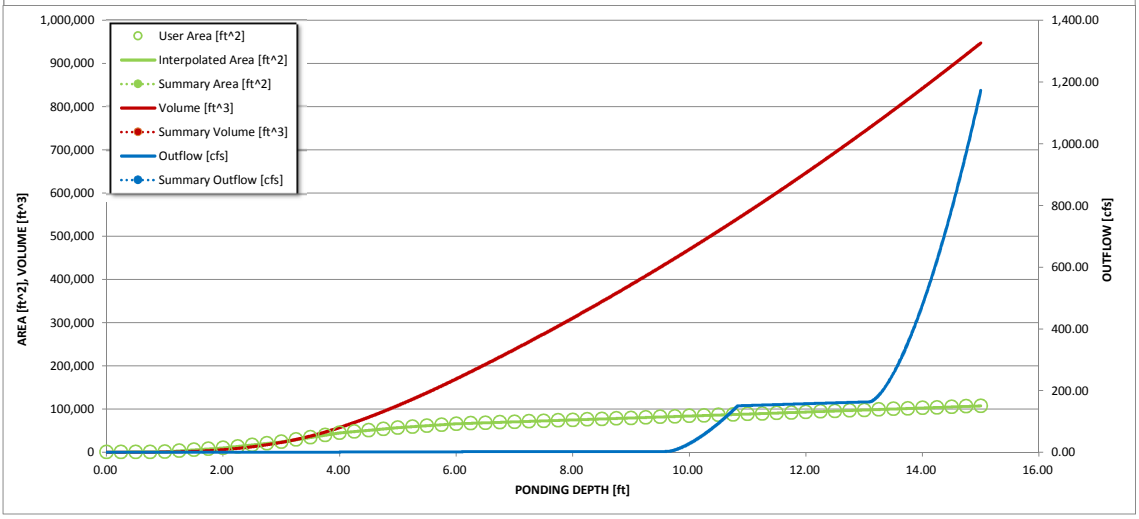






S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

FORBAY VOLUMES

EXISTING EAST FORBAY VOLUME

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
19.50	246				
		246	3	737	
22.50	246				737

End Area Method: 737 C.F.
0.017 A.F.

ADDED ON EAST FORBAY VOLUME

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
18.50	607				
		607	2.5	1517	
21.00	607				1517

End Area Method: 1517 C.F.
0.035 A.F.

Total East Forebay Volume= 2254 C.F.
0.052 A.F.

Required Forbay Volume = 3% of WQCV

WQCV =	3.39	ac-ft
WQCV =	147,552	cu-ft
3% of WQCV =	4426.56	cu-ft
1.5% of WQCV =	2213.28	cu-ft

split between existing forebay & future forebay for future comercial development

Future forebay required to provide minimum 2213.28 cu ft of volume.

HEIRLOOM AT GOLD HILL MESA POND 1
FORBAY WALL NOTCH

Wall Notch

Notch to releae 3% of the undetained 100-year peak discharge

100-y peak discharge	=	174.82	cfs
3%	=	5.24	

The general form of the equation for horizontal crested weirs is Q = CLH3/2 where:

Q = Weir flow discharge (cfs)	**5.24**	
C = Weir flow coefficient	3.4	
H = Depth of flow over the weir (ft)	2.50	Opening Height
L = Length of the weir (ft)	**0.39**	Length
L = Length of the weir (in)	**5**	

Notch to releae 3% of the undetained 100-year peak discharge is 5" wide by 18" high

Other Calculators

- Air Flow Conversion Calculator
- Atmospheric Calculator
- Block Wall Calculator
- Concrete Column Calculator
- Concrete Volume Calculator
- Energy Conversion Calculator
- Isentropic Flow Relations Calculator
- Laser Real Time Unit Converter
- Normal Flow Relations Calculator
- Oblique Flow Relations Calculator
- Open-channel Flow Calculator
- Properties of Welds Treated as Lines Calculator
- Shaft Speed Calculator
- Torque Transmitted by Clutch Calculator
- Water Pump Engineering
- Back to ENGINEERING.com

Open-Channel Flow

This calculator uses Chézy and Manning's formula to calculate the wetted perimeter, hydraulic radius, flow area, Chézy coefficient and flow velocity.

For experimental values of Manning's **n** factor, **click here**

Required Information

Enter the Slope:	.01	**Enter the Channel Top Width (ft):**	4
Enter the Channel Bottom Width (ft):	4	**Enter the Channel Height (ft):**	.5
Enter the Flow Depth (ft):	.5	**Enter the n value:**	.013

Results

The wetted perimeter is 5 **ft** — **The flow is** 12.44456 **ft^3/s**

The flow area is 2 **ft^2** — **The flow is** 5585.11887 **gal/min**

The hydraulic radius is 0.4 **ft** — **The velocity is** 6.222280 **ft/s**

The C value is 98.38289

Calculate Reset

VARIANCE REQUEST

June 6, 2018

City Water Resources Engineering Division

30 S. Nevada Avenue

Colorado Springs, CO 80903

Attention: Johnathan Schirer

RE: Gold Hill Mesa MDDP Amendment and Gold Hill Mesa Filings 9 & 10 Preliminary/Final Drainage Report

Dear Johnathan,

This letter is submitted as the official submittal of a request for a variance per the DCM Volume 1, Chapter 1 Section 10.0. DCM Volume 1, for Gold Hill Mesa MDDP Amendment and Gold Hill Mesa Filings 9 & 10 Preliminary/Final Drainage Report. This request is to allow for a relief from the minimum 1' of freeboard based upon Chapter 13 Section 5.5. This is for 1' from the water height in overflow condition at the spillway to the top of the embankment.

Location
The property is located in the east half of Section 14 and west half of section 13, Township 14 South, Range 67 West of the 6th Principal Meridian in the city of Colorado Springs, Colorado, southeast of the intersection of US Highway 24 and 21st Street. (See vicinity map) More specifically, the site is bounded to the north by Highway 24, to the east by Portland Heights subdivision and A-1 Mobile Home Park, to the south by Lower Gold Camp Road, and the west by 21st Street.

The existing pond is currently sized to provide water quality for the entire area (153.27 ac) tributary to it. This includes the existing & future single family development and future commercial development. The pond is being upgraded to provide Full Spectrum Detention and Water Quality for this entire area. With this upgrade all the required features are being installed, which consist of the addition of 12' wide maintenance access roads to the forebays & micropool, a 4' wide trickle channel, energy dissipaters and a 115' long armored spillway with a concrete stem wall. The existing concrete energy dissipater for 60" RCP will need to have a 23.5' x 25' concrete slab with a 2.5' high wall added to the end of it to provide the required 3% WQCV.

Terra Nova Engineering, Inc. on behalf of Gold Hill Neighborhood, LLC is requesting a variance to the requirement for a minimum 1.0' of freeboard, based upon DCM Volume 1, Chapter 13 Section 5.5. This variance is requesting that we be allowed the 0.81' of freeboard that can be provided based upon the existing site constraints.

The volume of the pond is maxed out based upon the site constraints. These constraints are the existing creek to the north, and the steep side slopes to the south, west and east of the pond. This lack of volume does not allow the minimum 1' of freeboard. The length of the weir to obtain the 1' of freeboard would essentially be the length of the pond (+/-140') and would not be practical to maintain or construct.

The lack of 0.19' of freeboard is not seen as detriment or hazard as the emergency spillway will route the flow directly into Fountain Creek. There is no developed land or public facilities in the area to be affected by a failure in the spillway.

The elevation of the spillway is 6027.10. The elevation of the top of the embankment is 6029.00. The elevation of the water flowing over the spillway in an emergency is 6028.19. This is 0.81' of freeboard.

There is 1.90' of difference in from the spillway to the top of the embankment. The top of the spillway is 6027.10 and the 100year water surface elevation is 6026.24. This is 0.86' of freeboard provided below the spillway. We do not have the 1' from the water height in overflow condition at the spillway to the top of the embankment. However, runoff would still make its way into Fountain Creek with causing any ill affects to any facility.

There will be no increase peak flows in Fountain Creek. The Extended Detention Basin will restrict flows to the allowable release rate based upon the Full Spectrum design.

The Extended Detention Basin will also provide water quality prior to being release into the Fountain Creek. In case of failure in the outlet system and the emergency spillway is needed the lack of the 1' of freeboard would not make a difference. There will be no decrease in water quality in Fountain Creek if this variance is granted.

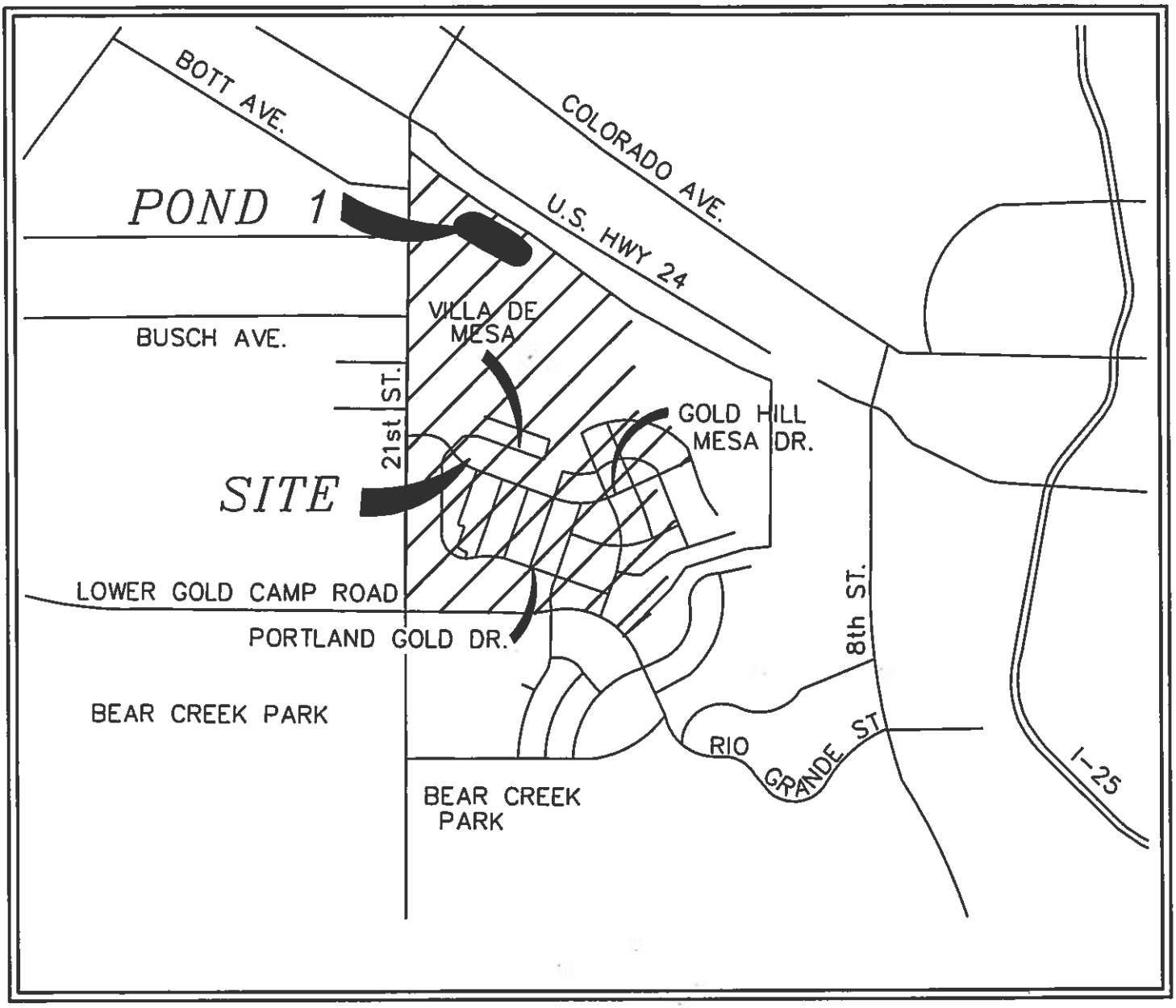
This variance request is submitted for your review and approval. If you have any questions, please contact me at 719-635-6422.

Sincerely,

Terra Nova Engineering, Inc.

Quentin Armijo, PE

Colorado PE 37170



VICINITY MAP

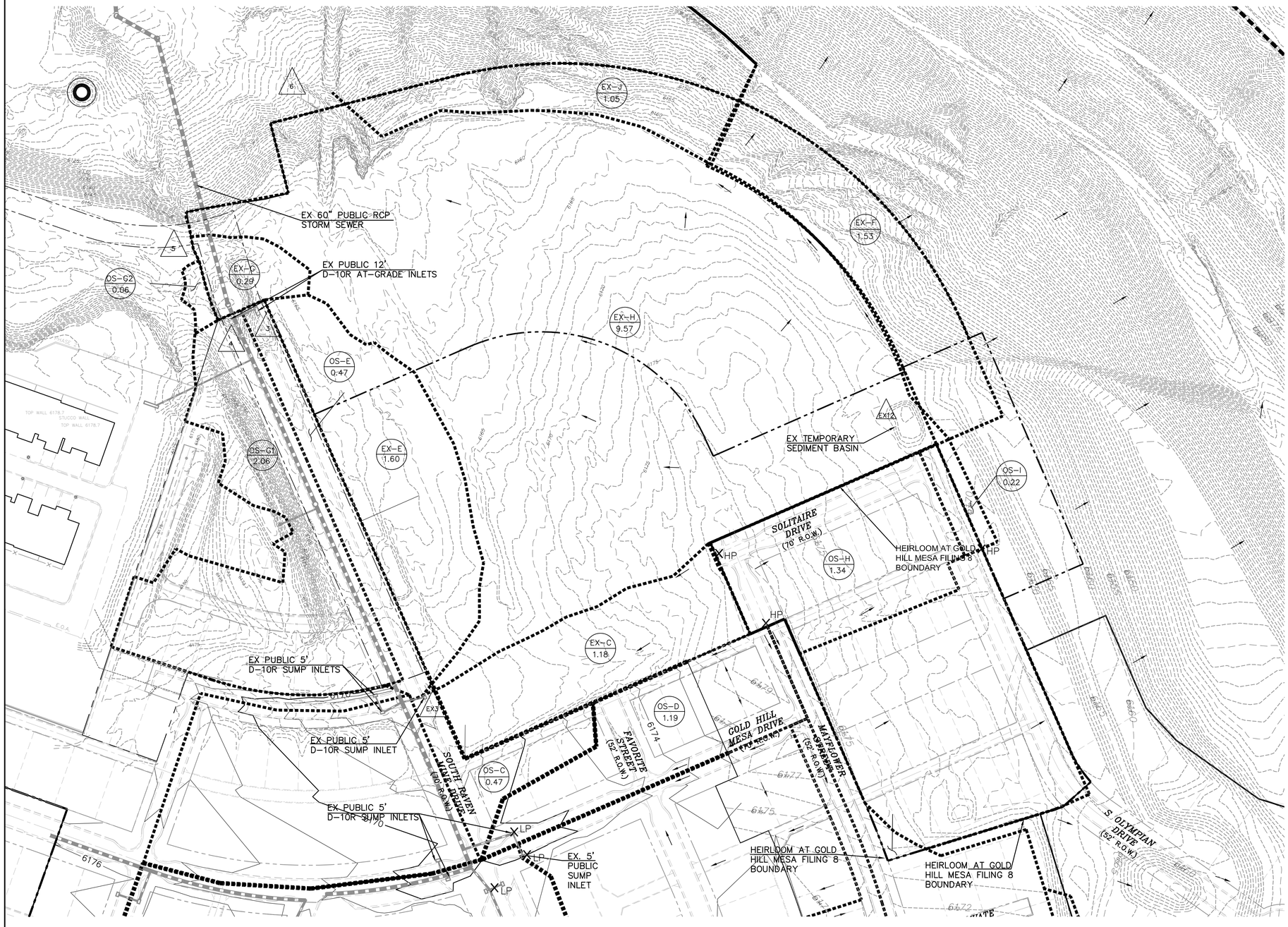
N.T.S.

DRAINAGE MAPS

GOLD HILL MESA FILING NO. 9 & 10
COLORADO SPRINGS, CO
EXISTING DRAINAGE MAP
MAY 2018

DESIGN POINT SUMMARY

DP	CONTRIBUTING BASINS	AREA AC.	Q5 CFS	Q100 CFS	INLET SIZE/TYPE	OWNER
3	OS-E & E	2.07	3.0	6.1	EX 12' D10-R SUMP	PUBLIC
4	OS-G1	2.06	4.9	9.6	EX 12' D10-R AT-GRADE	PUBLIC
5	DP-3 & 4 FLOW BY, OS-G & OS-G2	2.41	0.3	3.5	EX 12' D10-R AT-GRADE	PUBLIC
6	EX-H	9.57	7.2	14.3	NO INLET FLOW CHK	
EX3	OS-C & EX-C	1.65	2.4	4.7	EX 5' D10-R SUMP	PUBLIC
EX12	OS-H & OS-I	1.56	3.6	7.1	EX TEMP SEDIMENT BASIN	



EXISTING CONDITIONS

BASIN	ACRES	Q5 CFS	Q100 CFS
OS-C	0.47	1.40	2.7
EX-C	1.18	1.10	2.3
OS-E	0.47	1.40	2.9
EX-E	1.60	1.60	3.4
EX-F	1.53	1.80	3.9
OS-G1	2.06	4.90	9.6
OS-G2	0.06	0.10	0.2
EX-G	0.29	0.40	0.8
OS-H	1.34	3.10	6.1
EX-H	9.57	7.20	14.3
OS-I	0.22	0.60	1.2
EX-J	1.05	1.20	2.7

LEGEND

10' EX CONTOUR 6810
2' EX CONTOUR 6802
PROPOSED FLOW DIRECTION
BASIN BOUNDARY
TIME OF CONCENTRATION
BASIN ID — A
ACREAGE — 0.37
DESIGN POINT — 3

N

60' 0 60' 120'
SCALE: 1"=60'

THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

QUENTIN ARMIJO, PROFESSIONAL ENGINEER
COLORADO P.E. NO. 37170

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY ALL APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING AND SURVEYING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
GOLD HILL NEIGHBORHOOD, LLC
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FAX: 719-635-6426
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GOLD HILL MESA FILING NO. 9 & 10

EXISTING DRAINAGE MAP

DESIGNED BY	QNA
DRAWN BY	DLM
CHECKED BY	QNA
H-SCALE	1"=60'
V-SCALE	NA
JOB NO.	1713.00
DATE ISSUED	5/1/18
SHEET NO.	1 OF 1

GOLD HILL MESA FILING NO. 9 & 10
COLORADO SPRINGS, CO
PROPOSED DRAINAGE MAP
MAY 2018

PIPE RUN SUMMARY

PIPE RUN	CONTRIBUTING DESIGN POINTS	AREA AC.	Q5 CFS	Q100 CFS	MIN. SLOPE	SIZE	TYPE	OWNER
1	FLOW SPLIT BETWEEN INLETS DP-1 & 2	1.89	6.7	13.2	2.00%	24"	RCP	PUBLIC
2	Total flow at DP-1 & 2	5.53	13.4	26.3	1.50%	30"	RCP	PUBLIC
EX4**	DP-EX4	1.80	11.0	22.2	2.00%	EX 18"	RCP	PUBLIC
3	DP 3	0.38	1.1	2.1	2.00%	EX 18"	RCP	PUBLIC
4	DP 4	2.06	4.9	8.6	48.74%	EX 18"	RCP	PUBLIC
5A	DP5A	3.16	6.9	10.7	2.14%	18"	RCP	PUBLIC
5	FLOW SPLIT BETWEEN INLETS DP-5 & 6	5.69	13.7	25.6	3.36%	24"	RCP	PUBLIC
6	TOTAL FLOW AT DP-5 & 6	11.39	20.4	40.4	1.00%	30"	RCP	PUBLIC

DESIGN POINT SUMMARY

DP	CONTRIBUTING BASINS	AREA AC.	Q5 CFS	Q100 CFS	INLET SIZE/TYPE	OWNER
1A*	OS-C, C & A3	2.04	5.3	10.4	NO INLET ST. CAP CHK	PUBLIC
1	A1, A2 & A3, OS-C, & C	5.06	12.2	23.9	12' D10-R SUMP	PUBLIC
2	B	5.53	1.5	3.0	12' D10-R SUMP	PUBLIC
1 & 2	FLOW SPLIT BETWEEN INLETS	3.78	6.7	13.2	NO INLET FLOW CHK	
EX4	OS-D & D	1.80	4.8	9.7	EX 5' D10-R SUMP	PUBLIC
3	E	0.38	1.1	2.1	EX 12' D10-R AT-GRADE	PUBLIC
4	OS-G1	2.06	4.9	9.6	EX 12' D10-R AT-GRADE	PUBLIC
5A*	OS-H & H1	3.16	7.1	13.7	12' D10-R AT-GRADE	PUBLIC
5B*	DP 5A FLOW BY, H2 & H3	5.69	6.0	14.4	NO INLET ST. CAP CHK	
5C*	DP-5B & H4	6.63	8.2	18.6	NO INLET ST. CAP CHK	
5	DP 3 & 4 FLOWBY, OS-G2, G, DP 5B & H5	9.47	9.1	21.2	12' D10-R SUMP	PUBLIC
6	OS-I & I	1.91	4.5	8.8	12' D10-R SUMP	PUBLIC
5 & 6	FLOW SPLIT BETWEEN INLETS	11.39	6.7	14.9	NO INLET FLOW CHK	

* Design Points were analyzed to check for street capacity conformance.

LEGEND

- 10' EX CONTOUR — 6810
- 2' EX CONTOUR — 6802
- 10' PROP. CONTOUR — 6810
- 2' PROP. CONTOUR — 6802
- PROPOSED FLOW DIRECTION
- BASIN BOUNDARY
- TIME OF CONCENTRATION
- BASIN ID — A
- ACREAGE — 0.37
- DESIGN POINT — 3

PROPOSED CONDITIONS

BASIN	ACRES	Q5 CFS	Q100 CFS
A1	1.27	2.4	4.7
A2	1.76	4.8	9.5
A3	1.07	2.8	5.4
B	0.47	1.5	3.0
OS-C	0.39	1.1	2.2
C	0.59	1.7	3.4
OS-D	1.19	2.8	5.4
D	0.62	1.4	2.8
E	0.38	1.1	2.1
F	1.14	3.8	7.7
OS-G1	2.06	4.9	9.6
OS-G2	0.07	0.1	0.2
G	0.34	0.8	1.6
OS-H	1.34	3.1	6.1
H1	1.82	4.2	8.2
H2	1.78	4.2	8.2
H3	0.75	1.9	3.7
H4	0.93	2.4	4.7
OS-I	0.22	0.6	1.2
I	1.69	4.0	7.8
J	1.25	4.1	8.4

N

60' 0 60' 120'

SCALE: 1"=60'

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QUENTIN ARMIJO, PROFESSIONAL ENGINEER
COLORADO P.E. NO. 37170

REVISIONS

NO.	DESCRIPTION	DATE

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GOLD HILL MESA FILING NO. 9 & 10

PROPOSED DRAINAGE MAP

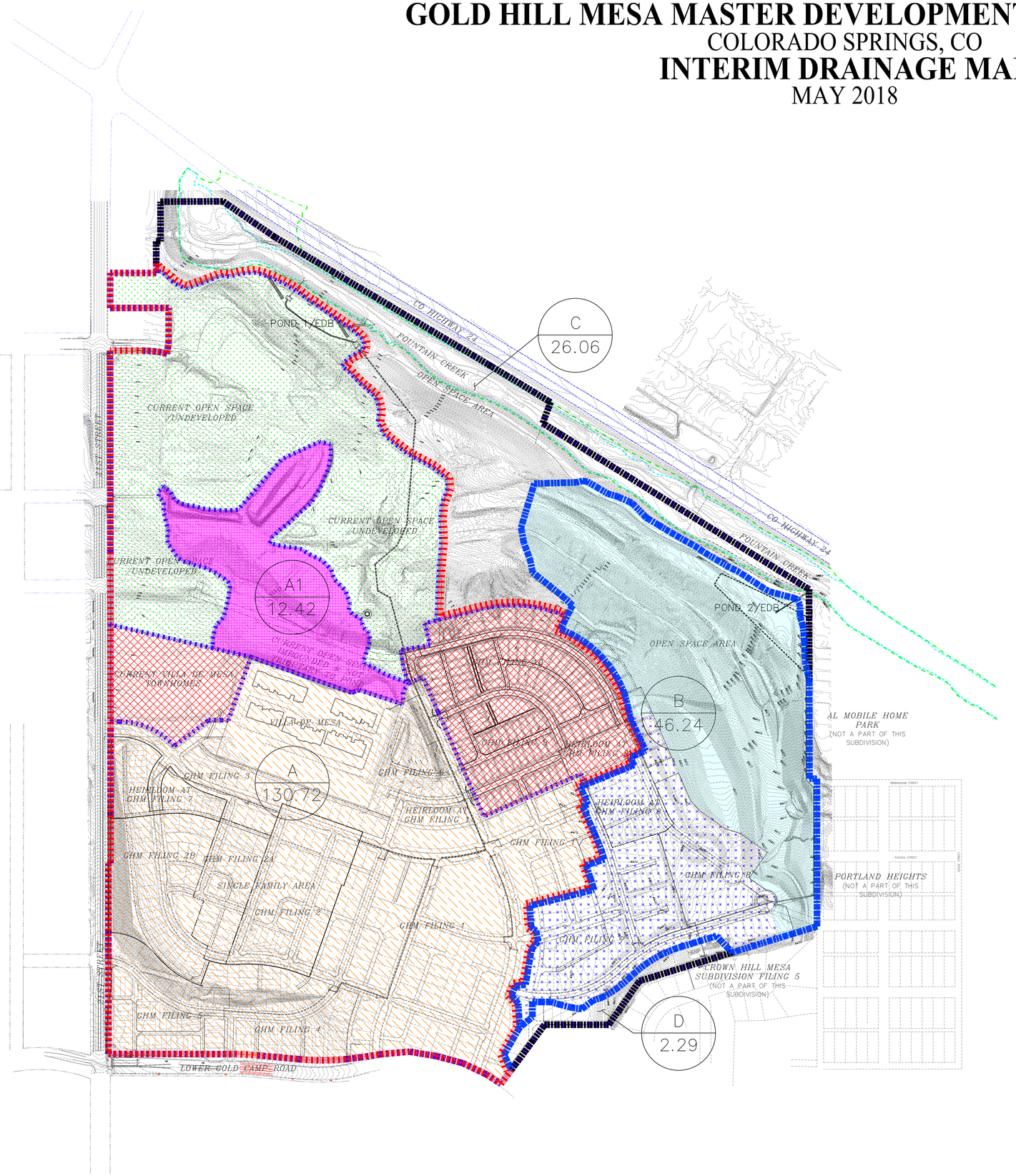
DESIGNED BY	QNA
DRAWN BY	DLM
CHECKED BY	QNA
H-SCALE	1"=60'
V-SCALE	NA
JOB NO.	1713.00
DATE ISSUED	5/16/18
SHEET NO.	1 OF 1

GOLD HILL MESA MASTER DEVELOPMENT DRAINAGE PLAN

COLORADO SPRINGS, CO

INTERIM DRAINAGE MAP

MAY 2018



INTERIM LEGEND

- 10' EX CONTOUR
- BASIN ID
- ACREAGE
- BASIN BOUNDARY
- BASIN TRIBUTARY TO POND 1
- BASIN TRIBUTARY TO POND 2
- POND 1 CURRENT SINGLE FAMILY DEVELOPMENT TRIBUTARY W/ FULL SPECTRUM DETENTION & WATER QUALITY
- POND 1 EXISTING SINGLE FAMILY TRIBUTARY W/ WATER QUALITY
- POND 1 OPEN SPACE NOT TRIBUTARY DUE TO IMPOUNDMENT
- POND 1 OPEN SPACE AREA TRIBUTARY W/ WATER QUALITY
- POND 2 CURRENT UNDEVELOPED AREA W/ FULL SPECTRUM DETENTION & WATER QUALITY
- POND 2 CURRENT DEVELOPMENT W/ FULL SPECTRUM DETENTION & WATER QUALITY

6810

A
0.37

PROPOSED CONDITIONS

BASIN	ACRES	Q5 CFS	Q100 CFS
A	130.72	116	202
A1	12.42	13	28
B	46.24	64	126
C	26.06	26	54
D	2.29	4	8

N

20' 0 200' 400'

SCALE: 1"=200'

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GOLD HILL MESA MASTER DEVELOPMENT DRAINAGE

INTERIM DRAINAGE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=200'
V-SCALE	NA
JOB NO.	1713.00
DATE ISSUED	5/1/18
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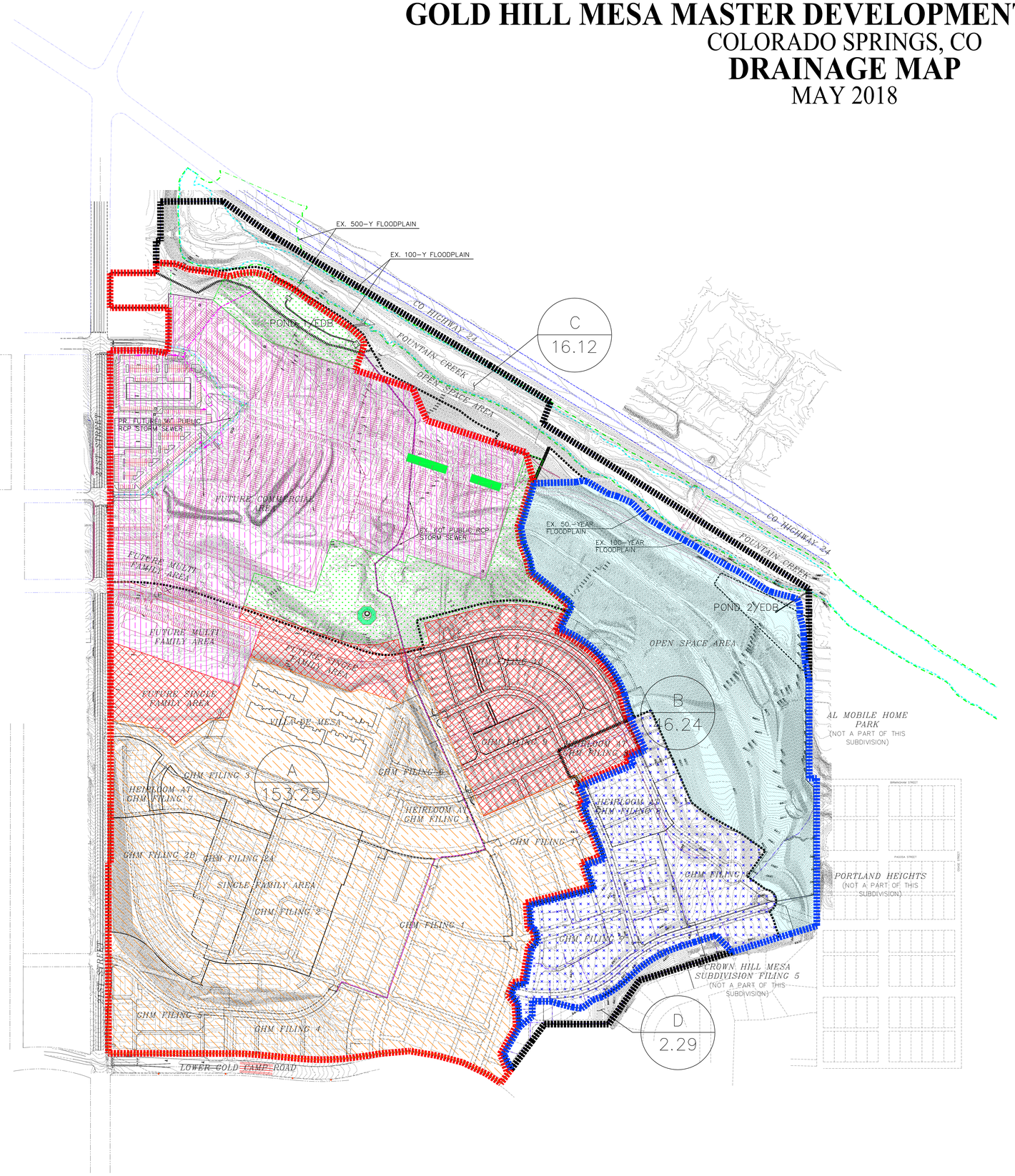
GOLD HILL MESA MASTER DEVELOPMENT DRAINAGE PLAN

COLORADO SPRINGS, CO

DRAINAGE MAP

MAY 2018



ULTIMATE LEGEND

- 10' EX CONTOUR
- BASIN ID
- ACREAGE
- BASIN BOUNDARY
- BASIN TRIBUTARY TO POND 1
- BASIN TRIBUTARY TO POND 2
- POND 1 CURRENT OR FUTURE SINGLE FAMILY DEVELOPMENT W/ FULL SPECTRUM DETENTION & WATER QUALITY
- POND 1 EXISTING SINGLE FAMILY DEVELOPED W/ FULL SPECTRUM & WATER QUALITY
- POND 1 FUTURE COMMERCIAL AREA W/ FULL SPECTRUM DETENTION & WATER QUALITY
- POND 1 OPEN SPACE AREA W/ FULL SPECTRUM DETENTION & WATER QUALITY
- POND 2 CURRENT UNDEVELOPED AREA W/ FULL SPECTRUM DETENTION & WATER QUALITY
- POND 2 CURRENT DEVELOPMENT W/ FULL SPECTRUM DETENTION & WATER QUALITY

6810

A
0.37

PROPOSED CONDITIONS

BASIN	ACRES	Q5 CFS	Q100 CFS
A	153.25	139	202
B	46.24	64	126
C	16.12	16	34
D	2.29	4	8

N

20' 0 200' 400'

SCALE: 1"=200'

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GOLD HILL MESA MASTER DEVELOPMENT DRAINAGE

DRAINAGE MAP

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DRAWN BY	QNA
CHECKED BY	
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JOB NO.	1713.00
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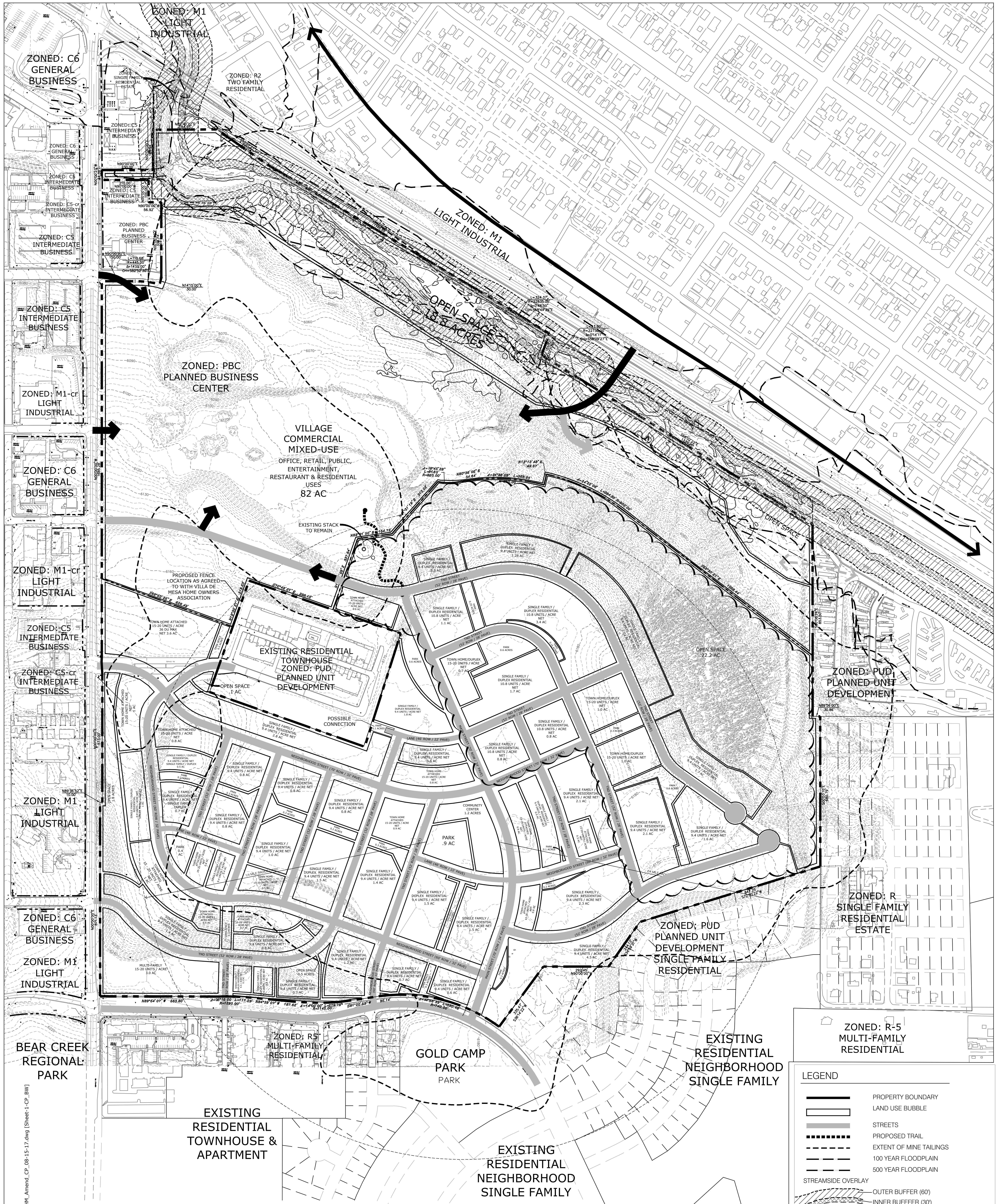
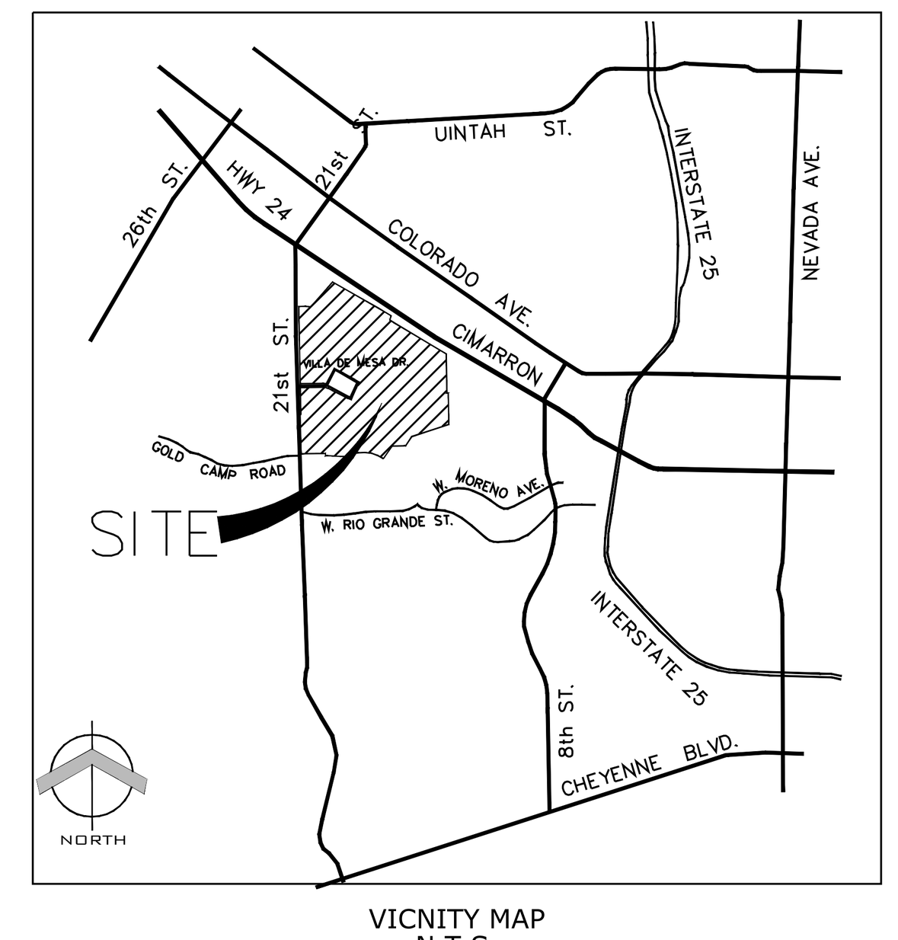


P:\Gold Hill\Gold Hill\Drawings\Planning\GHM_Amend_CP_08-15-17.dwg [Sheet-1-CP_BW]

AMENDMENT HISTORY			
City LUR File Number	Amendments	Date	Amendment Description
CPC CP 04-00127	A3MN13	2/18/2015	Minor Amendment: Revise densities and street classifications in SW corner. Update Phasing Plan
CPC CP 04-00127	A4MN15	4/23/2015	City Comments: Densities revised to reflect existing, approved, and planned land uses
CPC CP 04-00127	A5MJ15	8/21/2015	Major Amendment: Revise road design & densities North of Community Center. Update Phasing Plan.
		11/8/2017	Minor Amendment: Revise road design and densities in North East corner of development.



VICINITY MAP
N.T.S.

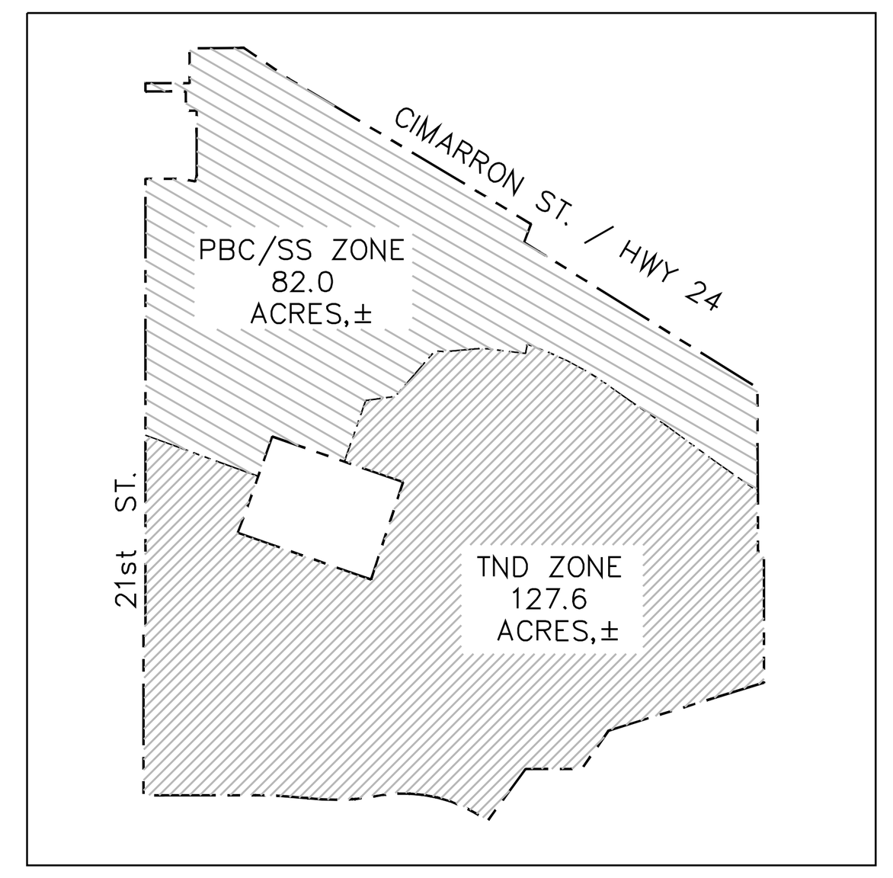
TND LEGAL DESCRIPTION

A TRACT OF LAND BEING A PORTION OF THAT TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208073596 OF THE RECORDS OF THE EL PASO COUNTY CLERK AND RECORDER TOGETHER WITH A PORTION OF THAT TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208105695 OF SAID COUNTY RECORDS, AND A PORTION OF VILLA DE MESA DRIVE AS PLATTED IN VILLA DE MESA FILING NO. 1 AS RECORDED IN PLAT BOOK K-2 AT PAGE 6 OF SAID COUNTY RECORDS, AND GOLD HILL MESA FILING NO. 1A AS RECORDED UNDER RECEPTION NO. 206712350 OF SAID COUNTY RECORDS, AND GOLD HILL MESA FILING NO. 1B AS RECORDED UNDER RECEPTION NO. 209712955 OF SAID COUNTY RECORDS, AND GOLD HILL MESA FILING NO. 1C AS RECORDED UNDER RECEPTION NO. 211713111 OF SAID COUNTY RECORDS, AND GOLD HILL MESA FILING NO. 2 AS RECORDED UNDER RECEPTION NO. 210713027 OF SAID COUNTY RECORDS, AND HEIRLOOM AT GOLD HILL MESA FILING NO. 1 AS RECORDED UNDER RECEPTION NO. 210713025 OF SAID COUNTY RECORDS, AND HEIRLOOM AT GOLD HILL MESA FILING NO. 2 AS RECORDED UNDER RECEPTION NO. 210713070 OF SAID COUNTY RECORDS, AND HEIRLOOM AT GOLD HILL MESA FILING NO. 5 AS RECORDED UNDER RECEPTION NO. 211713112 OF SAID COUNTY RECORDS, SAID TRACT OF LAND BEING LOCATED IN THE EAST ONE-HALF (E1/2) OF SECTION 14 AND THE WEST ONE-HALF OF THE WEST ONE-HALF (W1/2 W1/2) OF SECTION 13, TOWNSHIP 14 SOUTH, RANGE 67 WEST OF THE 6TH P.M., IN THE CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWESTERLY CORNER OF GOLD HILL MESA DRIVE AND ECLIPSE DRIVE AS PLATTED IN SAID GOLD HILL MESA FILING NO. 1A, AS MONUMENTED BY A NO. 5 REBAR WITH ALUMINUM SURVEYORS CAP STAMPED "MATRIX PLS 32822" FROM WHICH THE NORTHWESTERLY CORNER OF ECLIPSE DRIVE AND SOLITARE STREET, AS MONUMENTED BY A NO. 5 REBAR WITH ALUMINUM SURVEYORS CAP STAMPED "MATRIX PLS 32822" BEARS N19°27'14"E, A DISTANCE OF 235.31 FEET AND IS THE BASIS OF BEARINGS USED HEREIN;

THENCE N21°05'21"E, A DISTANCE OF 2031.65 FEET TO THE TRUE POINT OF BEGINNING OF SAID TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208073596 OF SAID COUNTY RECORDS;
THENCE ALONG SAID TRACT OF LAND AND THE TRACT DESCRIBED IN BOOK 2033 AT PAGE 614 OF SAID COUNTY RECORDS THE FOLLOWING TWO (2) COURSES: 1.) THENCE ALONG THE ARC OF A 22,735.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 00°14'11", AN ARC LENGTH OF 93.80 FEET (THE LONG CHORD OF WHICH BEARS S58°09'27"E, A LONG CHORD DISTANCE OF 93.80 FEET) TO A POINT OF TANGENT; 2.) THENCE S58°02'22"E, A DISTANCE OF 1337.30 FEET (1339.21 OF RECORD) TO A POINT ON THE WESTERLY LINE OF A TRACT OF LAND DESCRIBED IN BOOK 2889 AT PAGE 547 OF SAID COUNTY RECORDS; THENCE S00°08'24"E ALONG SAID TRACT OF LAND AND SAID WESTERLY LINE, A DISTANCE OF 590.79 FEET TO THE POINT OF BEGINNING OF THE TRACT OF LAND HEREIN DESCRIBED; THENCE ALONG SAID TRACT OF LAND THE FOLLOWING THREE (3) COURSES: 1.) THENCE S00°08'24"E, A DISTANCE OF 273.36 FEET; 2.) THENCE S89°49'53"E, A DISTANCE OF 33.82 FEET (N89°56'50"E, A DISTANCE OF 30.86 OF RECORD) TO A POINT ON THE WESTERLY LINE OF PORTLAND HEIGHTS AS RECORDED IN PLAT BOOK I AT PAGE 55 OF SAID COUNTY RECORDS;
3.) THENCE S00°03'10"E ALONG SAID WESTERLY LINE, A DISTANCE OF 673.18 FEET TO THE NORTHEASTERLY CORNER OF CROWN HILL MESA SUBDIVISION FILING NO. 5, RECORDED UNDER RECEPTION NO. 203085273 OF SAID COUNTY RECORDS; THENCE CONTINUING ALONG SAID TRACT OF LAND AND SAID CROWN HILL MESA SUBDIVISION FILING NO. 5 THE FOLLOWING THREE (3) COURSES: 1.) THENCE S72°53'24"W, A DISTANCE OF 847.36 FEET (S72°50'22"W, A DISTANCE OF 847.31 FEET OF RECORD); 2.) THENCE S35°03'23"W, A DISTANCE OF 244.08 FEET (S34°59'31"W, A DISTANCE OF 244.13 FEET OF RECORD); 3.) THENCE N89°58'15"W, A DISTANCE OF 292.46 FEET (N90°00'00"W, A DISTANCE OF 292.45 FEET OF RECORD) TO THE NORTHEASTERLY CORNER OF TRACT D AS PLATTED IN SAID GOLD HILL MESA FILING NO. 1A; THENCE S36°22'39"W ALONG SAID TRACT OF LAND, SAID CROWN HILL MESA FILING NO. 5 AND SAID GOLD HILL MESA FILING NO. 1A, A DISTANCE OF 335.19 FEET (S36°14'22"W, A DISTANCE OF 335.47 FEET OF RECORD OF SAID CROWN HILL MESA SUBDIVISION FILING NO. 5) TO THE MOST WESTERLY CORNER OF SAID CROWN HILL MESA SUBDIVISION FILING NO. 5 SAID POINT ALSO BEING A POINT ON THE NORTHERLY RIGHT-OF-WAY LINE OF LOWER GOLD CAMP ROAD AS PLATTED IN CROWN HILL MESA SUBDIVISION FILING NO. 3 RECORDED UNDER RECEPTION NO. 200156380 OF SAID COUNTY RECORDS, SAID POINT ALSO BEING THE SOUTHEASTERLY CORNER OF TRACT G AS PLATTED IN SAID GOLD HILL MESA FILING NO. 1A; THENCE CONTINUING ALONG SAID TRACT OF LAND, SAID CROWN HILL MESA SUBDIVISION FILING NO. 3 AND SAID GOLD HILL MESA FILING 1A THE FOLLOWING THREE (3) COURSES: 1.) THENCE ALONG THE ARC OF A 740.00 FOOT RADIUS CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 44°56'39", AN ARC LENGTH OF 580.47 FEET (THE LONG CHORD OF WHICH BEARS N76°10'47"W, A LONG CHORD DISTANCE OF 565.71 FEET); 2.) THENCE S81°20'53"W, A DISTANCE OF 95.14 FEET (S81°15'00"W, A DISTANCE OF 94.85 FEET OF RECORD); 3.) THENCE ALONG THE ARC OF A 1,145.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 03°00'43", AN ARC LENGTH OF 60.19 FEET (THE LONG CHORD OF WHICH BEARS S82°51'15"W, A LONG CHORD DISTANCE OF 60. 18 FEET) TO THE SOUTHWESTERLY CORNER OF TRACT A AS PLATTED IN SAID GOLD HILL MESA FILING NO. 1A; THENCE CONTINUING ALONG SAID TRACT OF LAND AND SAID NORTHERLY RIGHT-OF-WAY LINE THE FOLLOWING FOUR (4) COURSES: 1.) THENCE ALONG THE ARC OF A 1,145.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 10°59'17", AN ARC LENGTH OF 219.59 FEET (THE LONG CHORD OF WHICH BEARS S89°51'15"W, A LONG CHORD DISTANCE OF 219.25 FEET); 2.) THENCE N84°39'07"W, A DISTANCE OF 187.62 FEET; 3.) THENCE ALONG THE ARC OF A 1,280.00 FOOT RADIUS CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 05°15'00", AN ARC LENGTH OF 117.29 FEET (THE LONG CHORD OF WHICH BEARS N87°16'37"W, A LONG CHORD DISTANCE OF 117.25 FEET); 4.) THENCE N89°54'07"W, A DISTANCE OF 563.80 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY LINE OF SOUTH 21ST STREET; THENCE CONTINUING ALONG SAID TRACT OF LAND AND SAID RIGHT-OF-WAY LINE THE FOLLOWING THREE (3) COURSES: 1.) THENCE N00°00'00"E, A DISTANCE OF 869.87 FEET; 2.) THENCE N89°36'52"E, A DISTANCE OF 10.00 FEET; 3.) THENCE N00°00'00"E, A DISTANCE OF 571.95 FEET (572.11 FEET OF RECORD) TO THE NORTHWEST CORNER OF COMMON AREA C AS PLATTED IN SAID VILLA DE MESA FILING NO. 1 SAID POINT ALSO BEING THE SOUTHWESTERLY CORNER OF VILLA DE MESA DRIVE AS PLATTED IN SAID VILLA DE MESA FILING NO. 1; THENCE CONTINUING ALONG SAID EASTERLY RIGHT-OF-WAY LINE THE FOLLOWING THREE (3) COURSES: 1.) THENCE N03°20'27"W, A DISTANCE OF 59.26 FEET; 2.) THENCE N00°02'05"E, A DISTANCE OF 21.00 FEET TO THE NORTHWESTERLY CORNER OF SAID VILLA DE MESA DRIVE, SAID POINT ALSO BEING THE SOUTHWESTERLY CORNER OF TRACT A AS PLATTED IN SAID VILLA DE MESA FILING NO. 1; 3.) THENCE N00°02'05"E ALONG SAID TRACT A, A DISTANCE OF 351.07 FEET; THENCE S69°53'25"E, A DISTANCE OF 626.50 FEET TO A POINT ON THE WESTERLY LINE OF PARCEL 1 AS DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 205069916 OF SAID COUNTY RECORDS; THENCE S19°30'27"W ALONG SAID WESTERLY LINE, A DISTANCE OF 145.17 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL 1; THENCE S19°30'27"W ALONG THE SOUTHERLY EXTENSION OF SAID PARCEL 1, A DISTANCE OF 83.63 FEET TO THE NORTHWESTERLY CORNER OF PARCEL 3 AS DESCIBED IN SAID DEED, SAID POINT ALSO BEING A POINT ON SAID TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECPTION NO. 208073596 OF SAID COUNTY RECORDS; THENCE ALONG SAID PARCEL 3 AND SAID TRACT OF LAND THE FOLLOWING TWO (2) COURSES: 1.) THENCE S19°30'27"W, A DISTANCE OF 82.08 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL 3; 2.) THENCE S70°32'46"E, A DISTANCE OF 138.37 FEET TO THE SOUTHEASTERLY CORNER OF SAID PARCEL 3; THENCE CONTINUING ALONG SAID TRACT OF LAND THE FOLLOWING TWO (2) COURSES: 1.) THENCE S70°32'46"E, A DISTANCE OF 594.76 FEET; 2.) THENCE N18°07'03"E, A DISTANCE OF 172.99 FEET TO THE MOST SOUTHERLY CORNER OF PARCEL 2 AS DESCRIBED IN SAID DEED; THENCE ALONG SAID PARCEL 2 AND SAID TRACT OF LAND THE FOLLOWING TWO (2) COURSES: 1.) THENCE N18°07'03"E, A DISTANCE OF 360.94 FEET TO THE NORTHEASTERLY CORNER OF SAID PARCEL 2; 2.) THENCE N70°48'55"W, A DISTANCE OF 322.05 FEET; THENCE N19°11'09"E, A DISTANCE OF 337.65 FEET; THENCE N82°01'50"E, A DISTANCE OF 46.62 FEET TO A POINT ON SAID TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208073596 OF SAID COUNTY RECORDS; THENCE N82°01'50"E, A DISTANCE OF 108.10 FEET; THENCE N41°31'19"E, A DISTANCE OF 313.02 FEET; THENCE ALONG THE ARC OF A 250.00 FOOT RADIUS CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 18°45'28", AN ARC LENGTH OF 81.85 FEET (THE LONG CHORD OF WHICH BEARS S88°15'03"E, A LONG CHORD DISTANCE OF 81.48 FEET); THENCE N80°36'05"E, A DISTANCE OF 34.64 FEET; THENCE ALONG THE ARC OF A 850.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 24°28'58", AN ARC LENGTH OF 363.21 FEET (THE LONG CHORD OF WHICH BEARS S87°09'26"E, A LONG CHORD DISTANCE OF 360.45 FEET); THENCE N13°13'48"E, A DISTANCE OF 49.67 FEET; THENCE ALONG THE ARC OF A 905.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 24°22'05", AN ARC LENGTH OF 384.90 FEET (THE LONG CHORD OF WHICH BEARS S64°41'53"E, A LONG CHORD DISTANCE OF 382.01 FEET); THENCE S52°30'51"E, A DISTANCE OF 1,068.44 FEET TO THE POINT OF BEGINNING;

SAID TRACT CONTAINS 127.58 ACRES OF LAND, MORE OR LESS.



ZONING MAP 1" = 1000'

PBC LEGAL DESCRIPTION

A TRACT OF LAND BEING A PORTION OF THAT TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208073569 OF THE RECORDS OF THE EL PASO COUNTY CLERK AND RECORDERS OFFICE TOGETHER WITH A PORTION OF THAT TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208105695 OF SAID RECORDS , TRACT OF LAND BEING LOCATED IN THE EAST ONE-HALF (E1/2) OF SECTION 14, TOWNSHIP 14 SOUTH, RANGE 67 WEST OF THE 6TH P.M., IN THE CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWESTERLY CORNER OF GOLD HILL MESA DRIVE AND ECLIPSE DRIVE AS PLATTED IN GOLD HILL MESA FILING NO. 1A, AS RECORDED UNDER RECEPTION NO. 206712350 OF THE RECORDS OF THE EL PASO COUNTY CLERK AND RECORDERS OFFICE, AS MONUMENTED BY A NO. 5" REBAR WITH ALUMINUM SURVEYORS CAP STAMPED "MATRIX PLS 32822" FROM WHICH THE NORTHWESTERLY CORNER OF ECLIPSE DRIVE AND SOLITARE STREET, AS MONUMENTED BY A NO.5 REBAR WITH ALUMINUM SURVEYORS CAP STAMPED "MATRIX PLS 32822" BEARS N19°27'14"E, A DISTANCE OF 235.31 FEET AND IS THE BASIS OF BEARINGS USED HEREIN;

THENCE N14°02'20"W, A DISTANCE OF 2997.06 FEET TO A RECOVERED C.D.O.T RIGHT-OF-WAY MARKER, SAID POINT BEING THE POINT OF COMMENCEMENT OF SAID DEED RECORDED UNDER RECEPTION NO. 208105695 OF SAID RECORDS, SAID POINT ALSO BEING THE NORTHEASTERLY CORNER OF A PARCEL OF LAND DESCRIBED IN QUIT CLAIM DEED RECORDED UNDER RECEPTION NO. 202126489 OF SAID RECORDS, SAID POINT ALSO BEING ON THE SOUTHWESTERLY RIGHT-OF-WAY LINE OF THAT TRACT OF LAND DESCRIBED IN BOOK 1961 AT PAGE 983 OF SAID RECORDS, SAID POINT BEING THE POINT OF BEGINNING; THENCE ALONG THE SOUTHERLY AND EASTERLY LINES OF SAID SOUTHWESTERLY RIGHT-OF-WAY AND ALONG BOUNDARY LINE OF SAID DEED THE FOLLOWING THREE (3) COURSES: 1. THENCE S55°22'27"E, A DISTANCE OF 281.84 FEET; 2. THENCE S59°09'04"E, A DISTANCE OF 1146.85 FEET TO A POINT OF CURVE; 3. THENCE ALONG THE ARC OF A 22,835.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 00°48'50", AN ARC LENGTH OF 324.37 FEET (THE LONG CHORD OF WHICH BEARS S58°44'39"E, A LONG CHORD DISTANCE OF 324.37 FEET) TO A POINT ON THE WESTERLY LINE OF THAT TRACT OF LAND DESCRIBED IN BOOK 2974 AT PAGE 468 OF SAID RECORDS; THENCE S20°31'59"W ALONG SAID WESTERLY LINE, A DISTANCE OF 101.92 FEET TO A POINT ON CURVE, SAID POINT BEING A POINT ON THE NORTHWESTERLY BOUNDARY LINE OF A TRACT OF LAND DESCRIBED IN BOOK 2033 AT PAGE 614 OF SAID RECORDS, SAID POINT BEING THE TRUE POINT OF BEGINNING OF SAID DEED RECORDED UNDER RECEPTION NO. 20873596 OF SAID RECORDS; THENCE EASTERLY ALONG THE NORTHERLY LINE OF SAID TRACT DESCRIBED IN BOOK 2033 AT PAGE 614 AND SAID DEED RECORDED UNDER RECEPTION NO. 20873596 THE FOLLOWING TWO (2) COURSES: 1. THENCE ALONG THE ARC OF A 22,735.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 00°14'11", AN ARC LENGTH OF 93.80 FEET (THE LONG CHORD OF WHICH BEARS S58°09'27"E, A LONG CHORD DISTANCE OF 93.80 FEET) TO A POINT OF TANGENT; 2. THENCE S58°02'22"E, A DISTANCE OF 1337.30 FEET (1339.21 RECORD) TO A POINT ON THE WESTERLY LINE OF A TRACT OF LAND DESCRIBED IN BOOK 2889 AT PAGE 547 OF SAID RECORDS; THENCE S00°08'20"E ALONG SAID WESTERLY LINE AND ALONG SAID DEED, A DISTANCE OF 590.79 FEET; THENCE N52°30'51"W, A DISTANCE OF 1068.43 FEET TO A POINT OF CURVE; THENCE ALONG THE ARC OF A 905.00 FOOT RADIUS CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 24°22'06", AN ARC LENGTH OF 384.90 FEET (THE LONG CHORD OF WHICH BEARS N64°41'53"W, A LONG CHORD DISTANCE OF 382.01 FEET); THENCE S13°13'48"W, A DISTANCE OF 49.67 FEET TO A POINT ON CURVE; THENCE ALONG THE ARC OF A 850.00 FOOT RADIUS CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 24°28'58", AN ARC LENGTH OF 363.21 FEET (THE LONG CHORD OF WHICH BEARS N87°09'26"W, A LONG CHORD DISTANCE OF 360.45 FEET) TO A POINT OF TANGENT; THENCE S80°36'05"W, A DISTANCE OF 34.64 FEET TO A POINT OF CURVE; THENCE ALONG THE ARC OF A 250.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 18°45'28", AN ARC LENGTH OF 81.85 FEET (THE LONG CHORD OF WHICH BEARS N88°15'03"W, A LONG CHORD DISTANCE OF 81.48 FEET); THENCE S41°31'19"W, A DISTANCE OF 313.02 FEET; THENCE S82°01'50"W, A DISTANCE OF 108.10 FEET TO A POINT ON THE BOUNDARY OF SAID TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 208073596 OF SAID RECORDS; THENCE S82°01'50"W, A DISTANCE OF 46.62 FEET; THENCE S19°11'09"W, A DISTANCE OF 337.64 FEET TO A POINT ON THE NORTHERLY LINE OF PARCEL 2 AS DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 205069916 OF SAID RECORDS; THENCE N70°48'51"W ALONG SAID NORTHERLY LINE, A DISTANCE OF 167.19 FEET TO THE NORTHWEST CORNER OF SAID PARCEL 2; THENCE N70°48'51"W ALONG THE WESTERLY EXTENSION OF SAID PARCEL 2, A DISTANCE OF 197.72 FEET TO THE NORTHEASTERLY CORNER OF PARCEL 1 AS DESCRIBED IN SAID DEED; THENCE ALONG THE NORTHERLY AND WESTERLY LINE OF SAID PARCEL 1 THE FOLLOWING TWO (2) COURSES: 1. THENCE N70°48'51"W, A DISTANCE OF 33.24 FEET; 2. THENCE S19°30'27"W, A DISTANCE OF 219.53 FEET; THENCE N69°53'25"W, A DISTANCE OF 626.50 FEET TO A POINT ON THE EASTERLY RIGHT- OF-WAY LINE OF 21st STREET; THENCE N00°02'05"E ALONG SAID EASTERLY RIGHT-OF-WAY LINE, A DISTANCE OF 217.86 FEET TO A RECOVERED NO. 4 REBAR AT THE NORTHWESTERLY CORNER OF TRACT A AS PLATTED IN SAID VILLA DE MESA FILING NO. 1; THENCE N00°02'05"E ALONG SAID EASTERLY RIGHT-OF-WAY LINE, A DISTANCE OF 1116.81 FEET TO A RECOVERED NO. 4 REBAR AT A POINT ON THE SOUTHERLY LINE OF MOORE'S SUBDIVISION AS RECORDED IN PLAT BOOK A-3 AT PAGE 79 OF SAID RECORDS SAID POINT ALSO BEING A POINT ON THE BOUNDARY LINE OF SAID DEED RECORDED UNDER RECEPTION NO. 208105695 OF SAID RECORDS; THENCE ALONG THE SOUTHERLY AND EASTERLY LINE OF SAID MOORE'S SUBDIVISION AND SAID DEED THE FOLLOWING FOUR (4) COURSES: 1. THENCE N89°59'35"E, A DISTANCE OF 150.11 FEET (N90°00'00"E, A DISTANCE OF 150.00 FEET RECORD) TO A POINT OF CURVE; 2. THENCE ALONG THE ARC OF A 445.00 FOOT RADIUS CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 14°15'00", AN ARC LENGTH OF 110.68 FEET (THE LONG CHORD OF WHICH BEARS S82°52'55"E, A LONG CHORD DISTANCE OF 110.39 FEET); 3. THENCE N14°16'20"E, A DISTANCE OF 30.01 FEET (N14°15'00"E, A DISTANCE OF 30.00 FEET RECORD); 4. THENCE N00°01'29"E, A DISTANCE OF 30.89 FEET TO THE SOUTHEASTERLY CORNER OF LOT 1 AS PLATTED IN MOORE'S SUBDIVISION FILING NO. 2 AS RECORDED IN PLAT BOOK B-4 AT PAGE 93 OF SAID RECORDS; THENCE N00°01'29"E ALONG THE EAST LINE OF SAID MOORE'S SUBDIVISION FILING NO. 2 AND SAID DEED, A DISTANCE OF 307.85 FEET (N00°00'00"E RECORD); THENCE N89°59'35"W ALONG THE NORTHERLY LINE OF SAID MOORE'S SUBDIVISION FILING NO. 2 AND SAID DEED, A DISTANCE OF 56.90 FEET (N90°00'00"W, A DISTANCE OF 56.92 FEET RECORD) TO THE SOUTHEASTERLY CORNER OF K&J SUBDIVISION AS RECORDED IN PLAT BOOK W-2 AT PAGE 21 OF SAID RECORDS; THENCE N00°01'15"W (N00°00'00"E RECORD) ALONG THE EASTERLY LINE OF SAID K&J SUBDIVISION AND SAID DEED, SAID LINE ALSO BEING THE EASTERLY LINE OF A TRACT OF LAND DESCRIBED IN DEED RECORDED UNDER RECEPTION NO. 202065987 OF SAID RECORDS, A DISTANCE OF 144.62 FEET; THENCE S89°56'58"E ALONG THE SOUTHERLY LINE OF THE DRAINAGE EASEMENT AS SHOWN ON THE PLAT OF GOLDEN CYCLE SUBDIVISION NO.1 AS RECORDED IN PLAT BOOK A-2 AT PAGE 54 OF SAID RECORDS AND SAID DEED, A DISTANCE OF 19.99 FEET TO THE SOUTHEASTERLY CORNER OF SAID EASEMENT; THENCE N00°01'15"W ALONG THE EASTERLY LINE OF SAID GOLDEN CYCLE SUBDIVISION NO. 1 AND SAID DEED, A DISTANCE OF 180.82 FEET;
THENCE N89°43'24"E ALONG THE NORTHERLY LINE OF THAT PARCEL OF LAND DESCRIBED IN QUIT CLAIM DEED RECORDED UNDER RECEPTION NO. 202126489 OF SAID RECORDS AND SAID DEED, A DISTANCE OF 284.79 FEET TO THE MOST NORTHEASTERLY CORNER OF SAID PARCEL, SAID POINT ALSO BEING THE POINT OF BEGINNING;

SAID TRACT CONTAINS 82.00 ACRES OF LAND, MORE OR LESS.

TND SITE DATA

SITE ACREAGE: 127.6
EXISTING ZONING: TND
OWNER: GOLD HILL MESA PARTNERS, LLC
GOLDEN CYCLE INVESTMENTS, LLC
142 S. RAVEN MINE DR
COLORADO SPRINGS, CO 80905

PBC/SS SITE DATA

SITE ACREAGE: 82.0
EXISTING ZONING: PBC/SS
OWNER: GOLD HILL MESA PARTNERS, LLC
GOLDEN CYCLE INVESTMENTS, LLC
142 S. RAVEN MINE DR
COLORADO SPRINGS, CO 80905

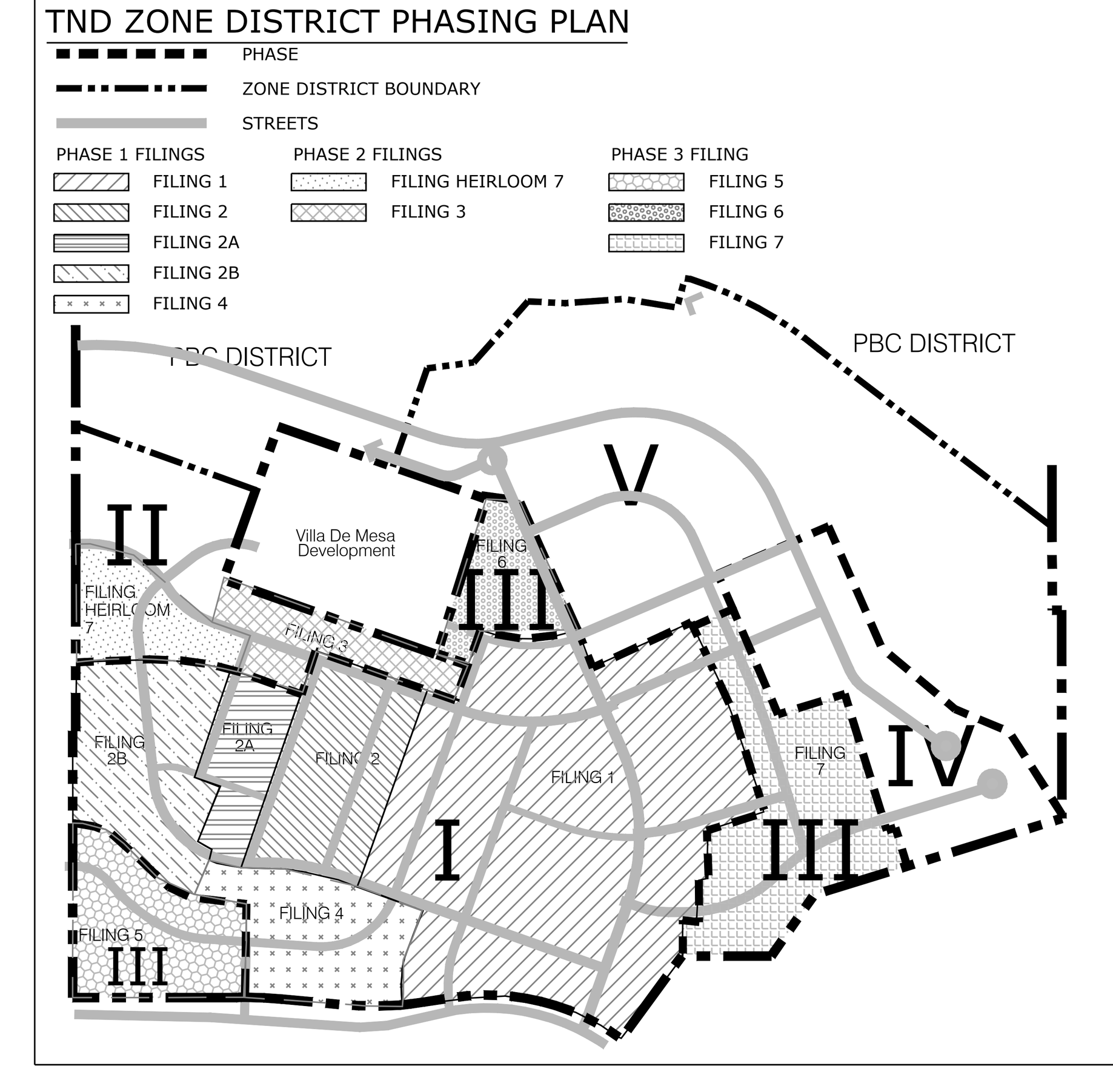
TND LAND USE CHART

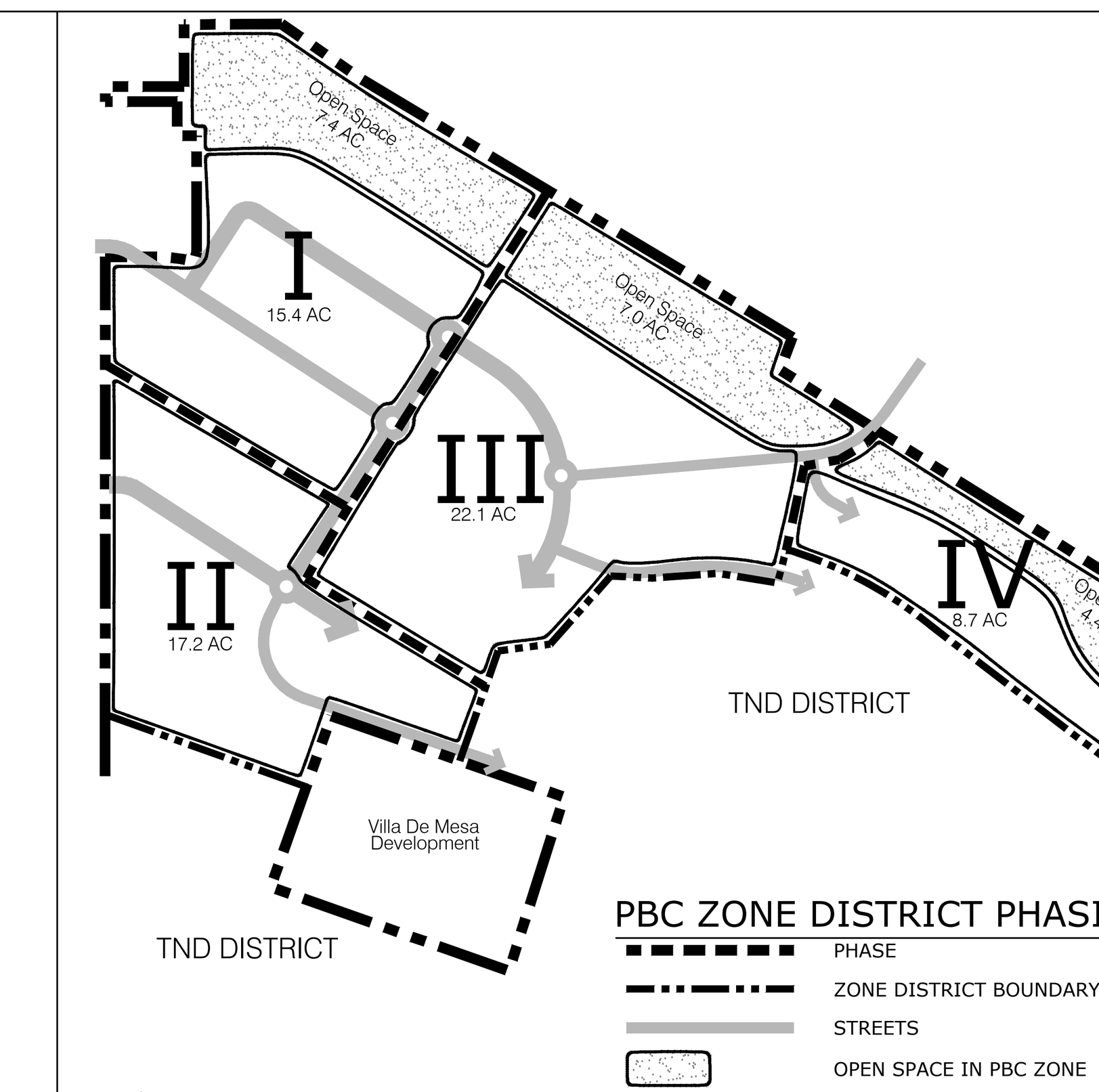
GROSS ACRES	127.6 ACRES TND	
LAND USE	REQUIRED	PROVIDED
-SINGLE FAMILY ATTACHED OR DETACHED HOUSING, TWO FAMILY DWELLING UNITS	30% / 38 ACRES	40% / 52.2 ACRES
-MULTI-FAMILY HOUSING AND TOWNHOUSES	15% / 19 ACRES	14% / 18.2 ACRES
-OPEN SPACE / PARKS/ PLAZA / SQUARE / COURTYARD (PUBLIC OR PRIVATE)	15% / 19 ACRES	23% / 29.35 ACRES
-CIVIC USE AND/OR COMMERCIAL (COMMUNITY CENTER, SPECIAL USE AREAS, RETAIL, PARKING, OFFICE, INDUSTRIAL)	5% / 6 ACRES	2% / 1.4 ACRES
(ALL PERCENTAGES ARE EXPRESSED AS GROSS ACREAGE) CIRCULATION ACREAGE IS DISTRIBUTED AS A PORTION OF ALL LAND USE TYPES.		

GENERAL NOTES:

1. THIS PROPERTY IS SUBJECT TO THE FINDINGS SUMMARY AND CONCLUSIONS OF A GEOLOGICAL HAZARD REPORT PREPARED BY CTL/THOMPSON, INC. DATED OCTOBER 9, 2002. A COPY OF SAID REPORT HAS BEEN PLACED WITHIN FILE CPC ZC 02-232 AND CPC CP 02-231 OF THE CITY OF COLORADO SPRINGS, DEVELOPMENT SERVICE DIVISION. CONTACT DEVELOPMENT SERVICES 30 SOUTH NEVADA AVENUE, SUITE 105, COLORADO SPRINGS, CO, IF YOU WOULD LIKE TO REVIEW SAID REPORT.
2. THIS PROPERTY IS SUBJECT TO THE FINDINGS SUMMARY AND CONCLUSIONS OF THE VOLUNTARY CLEANUP PLAN (VCUP) PREPARED BY SPECTRUM SERVICES. A COPY OF SAID REPORT AND THE COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENT APPROVAL LETTER DATES DECEMBER 20, 2002 HAS BEEN PLACED WITHIN FILE CPC ZP 02-232 AND CPC CP 02-231 OF THE CITY OF COLORADO SPRINGS, DEVELOPMENT SERVICE DIVISION. CONTACT DEVELOPMENT SERVICES 30 SOUTH NEVADA AVENUE, SUITE 301, COLORADO SPRINGS, CO, IF YOU WOULD LIKE TO REVIEW SAID REPORT. THE MATERIALS MANAGEMENT PLAN IS CONTAINED WITHIN THE VCUP.
3. THE GOLD HILL MESA PROPERTY WILL UTILIZE THE SEVEN PRINCIPALS OF XERISCAPE WHEN DESIGNING LANDSCAPE AREAS FOR THE PROJECT. THIS EFFORT WILL ALSO BE COORDINATED WITH ESTABLISHED ENVIRONMENTAL REVIEW AS DISCUSSED IN THE VCUP.
4. ALL PARKS WITHIN THE GOLD HILL MESA AREA DEVELOPMENT SHALL BE OWNED AND MAINTAINED BY THE GOLD HILL MESA DISTRICT.
5. ACCESS TO U.S. HIGHWAY 24 AS ILLUSTRATED ON THIS PLAN IS NOT APPROVED WITH THIS PLAN. AN ACCESS PERMIT/APPROVAL IS REQUIRED BY THE COLORADO DEPARTMENT OF TRANSPORTATION (CDOT).
6. HIGHWAY 24 ACCESS PHASING:
   A. A RIGHT-IN/RIGHT-OUT ACCESS TO HIGHWAY 24 IN THE VICINITY OF 15TH STREET WILL BE PERMITTED
   B. AT SUCH TIME AS AN INTERCHANGE IS CONSTRUCTED AT HIGHWAY 24 AND 21ST STREET, THE RIGHT-IN PORTION OF THE ACCESS WILL BE REMOVED AND THE RIGHT-OUT ACCESS MAY BE RECONFIGURED TO WORK WITH RAMPS AND OTHER IMPROVEMENTS
   C. IN CONJUNCTION WITH THE INTERCHANGE DESIGN FOR HIGHWAY 24 AND 21ST STREET, A 15TH STREET OVERPASS OR SPLIT DIAMOND INTERCHANGE WILL BE STUDIED TO DETERMINE THE BEST ACCESS FOR THE AREA
7. A MIX OF HOUSING DENSITIES AND TYPES WILL BE PROVIDED IN THE RESIDENTIAL NEIGHBORHOOD.
8. A LIGHTING AND SIGNAGE PLAN WILL BE PROVIDED WITH EACH DEVELOPMENT PLAN.
9. A TRANSIT STOP WILL BE PROVIDED AT A LOCATION MUTUALLY AGREEABLE WITH THE SPRINGS TRANSIT.
10. WHEN GOLD HILL MESA IS DEVELOPED, CIVIC USE, COMMERCIAL USE, AND THE SPECIAL USE AREA WILL BE DESIGNED TO PROVIDE APPROPRIATE PUBLIC OR PRIVATE PLAZAS, COURTYARDS, AND OR SQUARES.
11. GRADING FOR THE HILLSIDE RESIDENTIAL AREA (PHASE V) SHALL BE DONE IN CONJUNCTION WITH OR BEFORE THE COMMERCIAL MIXED USE AREA.
12. A SIDEWALK SHALL BE PROVIDED ALONG THE EAST SIDE OF 21ST STREET WHEN THE STREET IS IMPROVED.
13. A HOMEOWNERS ASSOCIATION OR OTHER ENTITY SHALL BE ESTABLISHED TO MAINTAIN COMMON AREAS/PARKS AND POSSIBLY PRIVATE LANDSCAPE AREAS AS WELL.
14. A PASSIVE-VENTING RADON SYSTEM SHALL BE INSTALLED FOR EACH STRUCTURE CONSTRUCTED IN THE SITE.
15. TRAFFIC CALMING TECHNIQUES WILL BE USED FOR THE MAIN STREET ALONG THE EAST SIDE OF THE SITE.
16. RIGHT-OF-WAY ADJACENT TO THE SITE WILL BE DEDICATED AS REQUIRED PER CITY STANDARDS.
17. FUTURE WALL CONSTRUCTION SURROUNDING THE VILLA DE MESA NEIGHBORHOOD, SHALL BE BUILT TO MATCH THE EXISTING WALL ALONG THE SOUTH AND WEST BOUNDARIES. THE EASTERN PORTION OF THE WALL SHALL BE CONSTRUCTED PRIOR TO OR IN CONJUNCTION WITH THE 1.9 ACRE TOWN HOME AREA BETWEEN RAVEN MINE DRIVE AND VILLA DE MESA. THE NORTHERN PORTION OF THE WALL SHALL BE BUILT PRIOR TO OR IN CONJUNCTION WITH THE DEVELOPMENT OF THE ROADWAY IMMEDIATELY ADJACENT TO VILLA DE MESA, OR WHEN COMMERCIAL DEVELOPMENT IS WITHIN FIVE HUNDRED FEET OF THE VILLA DE MESA BOUNDARY LINE. FINAL GRADING, DRAINAGE, AND OTHER DETAILS SHALL BE PROVIDED TO VILLA DE MESA PRIOR TO COMMENCING ANY WORK. (REMOVED PER CITY COUNCIL ACTION ON 9-27-11)
18. FULL IMPROVEMENTS TO LOWER GOLD CAMP ROAD SHALL BE COMPLETED IN CONJUNCTION WITH THE FIRST DEVELOPMENT PLAN. COMPLETED.
19. A PEDESTRIAN CONNECTION WILL BE PROVIDED WITH THE DEVELOPMENT OF THE SMOKESTACK AREA TO THE RESIDENTIAL AREA ON THE UPPER MESA.
20. THE FIRST DEVELOPMENT PLAN FOR THIS SITE SHALL BE REVIEWED AND APPROVED BY CITY COUNCIL. COMPLETED.
21. THIS PROPERTY IS WITHIN THE CITY'S STREAMSIDE ORDINANCE. CITY PLANNING RECOGNIZES THAT THIS PROPERTY IS SUBJECT TO TO A VCUP AS REGULATED BY THE STATE (CDPHE).
22. THE DEVELOPMENT PLAN WILL ILLUSTRATE THE DESIGN INTENT OF THE PROJECT AS WELL AS HOW SIGNAGE AND LIGHTING WILL BE APPLIED.
23. A TRAFFIC STUDY ADDRESSING THE PBC-ZONED AREA WILL BE REQUIRED BEFORE DEVELOPMENT BEGINS IN THAT AREA TO DETERMINE THE NEEDED ROADWAY IMPROVEMENTS TO ACCOMMODATE THE ADDITIONAL TRAFFIC.
24. APPROPRIATE STREET IMPROVEMENTS SUCH AS A MEDIAN, ROUND-ABOUT, OR OTHER APPROPRIATE STREET IMPROVEMENTS SHALL BE PROVIDED FOR AT THE 21st STREET AND LOWER GOLD CAMP ROAD INTERSECTION.
25. DEVELOPMENT PLANS ADJACENT TO THE STREAM WILL BE REVIEWED USING THE STREAMSIDE REVIEW CRITERIA.

TND ZONE DISTRICT PHASING PLAN





PBC ZONE DISTRICT PHASING PLAN

PHASE
ZONE DISTRICT BOUNDARY
STREETS
OPEN SPACE IN PBC ZONE

PBC PHASE 1 AREA: 15.4 AC
PBC PHASE 2 AREA: 17.2 AC
PBC PHASE 3 AREA: 22.1 AC
PBC PHASE 4 AREA: 8.7 AC

Land Planning
Landscape Architecture
Urban Design
NES
N.E.S. Inc.
508 South Tejon Street
Colorado Springs, CO 80903
Tel. 719.471.0073
Fax 719.471.0267
www.nescolorado.com

PLANNER / LANDSCAPE ARCHITECT

IN ASSOCIATION WITH

Terra Nova Engineering, Inc.
815 S. 25TH STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

GOLD HILL MESA

CONCEPT PLAN

GOLD HILL MESA, LLC

PROJECT INFO

DATE:	Feb 11, 2011
PROJECT MGR.:	T.SEIBERT
PREPARED BY:	D.DEITEMEYER

SEAL

ISSUE INFO

DATE:	BY:	DESCRIPTION:
08/21/15	SF	Major Amendment
12/07/15	SF	Per City Comments
11/8/17	JBS	Minor Amendment

ISSUE / REVISION

SHEET TITLE

GOLD HILL MESA CONCEPT PLAN

SHEET NUMBER

1

OF 1

PLAN FILE #

CPC CP 04-00127-A5MJ15