FINAL DRAINAGE REPORT FOR BRANDING IRON AT STERLING RANCH FILING NO. 2

EL PASO COUNTY, COLORADO

January 2020

Prepared for:
SR Land, LLC
20 Boulder Crescent, Suite 210
Colorado Springs, CO 80903

Prepared by:

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Project #09-012
EPC Project # SF-19-018

May 7, 2020

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BRANDING IRON AT STERLING RANCH FILING NO. 2

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO REGISTERED
VIRGIL A. SANCHEZ, II
37160
5/7/2020
PROFESSIONAL ENGINEER

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

I, the developer have read and will comply with all the requirements specified in this drainage report and plan.

BY: James Morley
James F Morley

TITLE: Manager
DATE: 3-31-2020

ADDRESS: SR Land, LLC
20 Boulder Crescent, Suite 210
Colorado Springs, CO 80903

EL PASO COUNTY'S STATEMENT

Filed in accordance with the requirements of El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

BY:_____ DATE:_____
Jennifer Irvine, P.E.
County Engineer / ECM Administrator

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FINAL DRAINAGE REPORT FOR
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PURPOSE

This document is the Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 2. This report was previously discussed, as a preliminary drainage report, in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual. The following report is an analysis of the drainage for Branding Iron at Sterling Ranch Filing No. 2, single family lots, onsite and offsite drainage.

GENERAL LOCATION AND DESCRIPTION

Branding Iron at Sterling Ranch Filing No. 2 is located in the SE ¼ of the NW ¼ of Section 33, and the NE ¼ of the SW ¼ of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian within unincorporated El Paso County, Colorado. The site is bound on the north and south by existing detention ponds and to the east by Sand Creek. Existing Dines Boulevard runs along the western site boundary and residential developments (Branding Iron Filing No. 1, Homestead at Sterling Ranch Filing No. 1) bound the site to the west and northwest. Sterling Ranch lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

Branding Iron at Sterling Ranch Filing No. 2 consists of 18.881 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to southwest at grade rates that vary between 2% and 6%.

Land use for Branding Iron at Sterling Ranch Filing No. 2 is currently listed as AG. Grazing Land. Improvements proposed for the site include paved streets, trails, and utilities as normally constructed for a residential development.

SOILS

Soils for this project are delineated by the map in the appendix as Pring Coarse Sandy Loam (71) and is characterized as Hydrologic Soil Types "B". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". Vegetation is sparse, consisting of native grasses and weeds.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets can be found in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017 and in the appendix of this report.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0533 G, effective date December 7, 2018 and revised to reflect LOMR, 08-08-O541P, dated July 23, 2009. An annotated FIRM Panel is included in the Appendix.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual, Volumes I & II, dated November 1991, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County's Engineering Criteria Manual (ECM), 2008). In addition to the ECM, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates. Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method. July 2019 ECM update for MS4 permit.

FOUR STEP PROCESS

Step 1 Employ Runoff Reduction Practices. Roof drains will be directed to side yard swales and where possible to grass lined swales to aid in minimizing direct connection of impervious surfaces.

Step 2 Stabilize streams. – With the full spectrum detention facility in place, the runoff from the proposed residential development will be reduced to predevelopment conditions. The developed discharge from the site is less than existing and therefore is not anticipated to have negative effects on downstream drainageways. An engineered outlet pipe and headwall for Pond 8 was previously constructed to provide for downstream channel protection. Additionally, the Sand Creek Channel will be reinforced with selected areas of riprap bank protection and vegetative slope stabilization.

Step 3 Implement BMPs that provide a water quality capture volume with slow release. – An existing Full Spectrum Detention Facility was planned and constructed to handle tributary flows for this site (see Sterling Ranch Filing No 1 - Pond 8) which will incorporate water quality capture volumes that are intended to slowly drain in 40 hours and excess urban runoff volumes that are intended to drain within 72 hours.

Step 4 Implement site specific and other source control BMPs. – The proposed project will use silt fence, a vehicle tracking control pad, concrete washout area, inlet protection, temporary sediment basins, sediment control logs, mulching and reseeding to mitigate the potential for erosion across the site.

EXISTING DRAINAGE CONDITIONS

The Branding Iron at Sterling Ranch Filing No. 2 site consists of 18.881 acres and is situated west of the Sand Creek Watershed. This area was previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996. More recently the area was studied in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017 (henceforth referred to as "Sterling Ranch Filing Nos. 1&2 MDDP"). Branding Iron at Sterling Ranch Filing No. 2 and the surrounding areas, with the exception of the existing Barbarick Subdivision, have already been graded during the overlot of the subdivision. Please refer to the Sterling Ranch Filing Nos. 1&2 MDDP by MS Civil Consultants for information on historic conditions and overlot drainage patterns.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

The following is a description of the onsite basins, offsite bypass flows and the overall drainage characteristics for the development of Branding Iron at Sterling Ranch Filing No. 2. The development of Branding Iron at Sterling Ranch Filing No. 2 consists of residential streets and cul-de-sacs, proposed storm drainage improvements, and lots located within the filing boundary. The proposed development results in drainage patterns and flow values that are the same or less than those in the Sterling Ranch Filing Nos. 1&2 MDDP. Surface flow is designated as Design Points (DP). The following DPs and Basins were determined using the Rational Method since this method offers a more conservative approach to drainage. It should be noted that all calculations and drainage basins have been revised to reflect the new criteria updates by the El Paso County/City of Colorado Springs Drainage Criteria Manual. For comparison, the **asterisk (*)** symbol in the detailed drainage discussions below represents each Basin or Design Point as labeled in the Sterling Ranch Filing Nos. 1&2 MDDP.

Detailed Drainage Discussion (Design Points)

DP2*, 5.39 acres, consists of Basin B* planned residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=8.0 cfs and Q100=19.3 cfs has been calculated for DP2*. The surface runoff is routed via overlot grading and planned swales to two existing 15' CDOT Type R at-grade inlets. The flows are routed east via a 36" RCP to DP5.

DP5*, 0.80 acres, consists of Basin G* residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin H* existing Dines Boulevard, with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from Sterling Ranch Filing Nos. 1&2 MDDP DP4*. Developed runoff of Q5=4.2 and Q100=19.7 cfs has been calculated for DP5*. The surface runoff is routed via overlot grading and curb and gutter to DP5* which is collected by an existing 15' CDOT type R at-grade inlet. DP5* has an intercepted flow of (Q5=4.2 cfs and Q100=14.7 cfs) and of flowby of (Q5=0.0 cfs and Q100=5.0 cfs).

DP6*, 4.68 acres, consists of Sterling Ranch Filing Nos. 1&2 MDDP Basins J* and K* planned residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Sterling Ranch Filing Nos. 1&2 MDDP Basin I* (Wheatland Drive) and Basin L* (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=14.1 cfs and Q100=26.7cfs has been calculated for DP6*. The surface runoff is routed via overlot grading and curb and gutter to DP6* which is collected by an existing 15' CDOT type R at-grade inlet. DP6* has an intercepted flow of (Q5=12.1 cfs and Q100=17.2 cfs) and of flowby of (Q5=2.0 cfs and Q100=9.5 cfs).

DP18*, 9.74 acres, consists of four cul-de-sacs, streets and residential lots located within Basin GG* with coefficients of 0.38 for the 5-year and 0.55 for the 100-year. DP18* also consists of Basin II* (west half of existing Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year, and flowby from DP5*. Developed runoff of Q5=14.1 cfs and Q100=37.7 cfs has been calculated for DP18*. The surface runoff is routed via overlot grading to the cul-de-sacs and streets. A highpoint at the end of each cul-de-sac routes runoff east, via curb and gutter, towards existing Dines Boulevard. The surface runoff is then routed south to DP18* via existing Dines Boulevard and is collected by an existing 15' CDOT type R at-grade inlet. DP18* has an intercepted flow of (Q5=12.1 cfs and Q100=21.1 cfs) and of flowby of (Q5=2.0 cfs and Q100=16.6 cfs).

DP19, 11.86 acres, consists of proposed Basins BB, DD, FF and HH proposed residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, and Basin JJ* (east half of existing Dines Boulevard), with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP6*. Developed runoff of Q5=20.5 cfs and Q100=52.0 cfs has been calculated for DP19. The cumulative flow of DP18 and DP19 is Q5=34.6 cfs and Q100=89.7 cfs. Per the Minor and Major Storm Capacity Rating Table for Collector Section found in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1", the calculated allowable flows are Q5=34.6 cfs and Q100=110.33 cfs (see Capacity Tables in appendix). The surface runoff is routed via existing overlot grading and curb and gutter to DP19 which is collected by an existing 15' CDOT type R at-grade inlet. DP19 has an intercepted flow of (Q5=15.0 cfs and Q100=23.2 cfs) and of flowby of (Q5=5.5 cfs and Q100=28.8 cfs).

DP20*, 2.19 acres, consists of Basin KK* residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, and Basin MM* (west half of existing Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP18*. Developed runoff of Q5=5.2 cfs and Q100=27.9 cfs has been calculated for DP20*. The surface runoff is routed via overlot grading and curb and gutter to DP20* which is collected by an existing 15' CDOT type R at-grade inlet. DP20* has an intercepted flow of (Q5=5.2 cfs and Q100=17.6 cfs) and of flowby of (Q5=0.0 cfs and Q100=10.3 cfs.

DP21, 0.43 acres, consists of Basin LL residential backyard lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, and Basin NN* (east half of existing Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP19*. Developed runoff of Q5=6.4 cfs and Q100=30.7 cfs has been calculated for DP21. The surface runoff is routed via overlot grading and curb and gutter to DP21 which is collected by an existing 15' CDOT type R at-grade inlet. DP21 has an intercepted flow of (Q5=6.4 cfs and Q100=18.6 cfs) and of flowby of (Q5=0.0 cfs and Q100=12.1 cfs.

DP24, 6.22 acres, consists of Basin RR and Basin SS, proposed residential lots and streets with runoff coefficients of 0.38 (0.08) for the 5-year and 0.55 (0.35) for the 100-year. Developed runoff of Q5=8.0 cfs and Q100=19.8 cfs has been calculated for DP24. The surface runoff is routed via overlot grading and curb and gutter to DP24 which will be collected by a proposed 15' CDOT type R sump inlet. Flows collected by the sump inlet are routed to Design Point 26 by a proposed 24" RCP pipe run (PR1), and continue via Pipe Run 2 (PR2) into the north forebay of existing Pond 8. In the event the inlet should become clogged, the emergency overflow shall be routed through Tract A and into Sand Creek.

DP26, 1.32 acres, consists of Basin TT, proposed residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=2.0 cfs and Q100=4.9 cfs has been calculated for DP26. The surface runoff is routed via overlot grading and curb and gutter to DP26 which will be collected by a proposed 5' CDOT type R sump inlet. Flows collected by the sump inlet are routed into the north forebay of existing Pond 8 via Pipe Run 2 (PR2).

DP27, 33.84 acres, consists of Pond 8 an existing full spectrum detention pond. Runoff tributary to Pond 8 consists of Basin UU* with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year, existing pipe runs PR20*, PR23*, PR26* and proposed pipe run PR2. Developed runoff of Q5=50.0 cfs and Q100=132.0 cfs has been calculated for DP27. A 2.91' X 9' outlet structure is designed to detain and treat all flows reaching DP27. Refer to the Hydraulic Calculations section of the appendix for more information.

Detailed Drainage Discussion (Drainage Basins)

Basins VV and WW, 1.00 acres, consists of proposed residential backyard lots located along the east and south boundaries of the site, with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed combined runoff of Q5=0.9 cfs and Q100=3.0 cfs has been calculated for these basins. Sheet flow produced within the residential backyard lots of Basins VV and WW travels east and south via backyard lot grading towards Sand Creek. Since the total area draining into Sand Creek is less than One acre, no permanent water quality facilities are necessary. No deviation to the EPC code is required or requested.

IMPROVEMENTS TO POND 8

An additional watershed area of 6.22 acres was added to existing Pond 8 from proposed Basin RR and Basin SS. Runoff produced within these basins is collected at Design Point 24 by a proposed 15' CDOT Type R sump inlet and routed to existing Pond 8 via a proposed 24" and existing 30" RCP pipe (Pipe Run 1). The increased volume and hydraulic affects for Pond 8 were analyzed and are summarized in the table below. Adjustments were performed to the design of Pond 8 to accommodate for the increase in tributary impervious area and runoff volume. Refer to the Hydraulic Calculations section of the appendix for more information. A forebay calculation sheet has been included in the appendix. A copy of the draft CD/pond modifications have been included with this report.

Description	MDDP	Branding Iron Fil. No. 2
Watershed Area	28.98 Acres	35.20 Acres
100 yr WSE	7020.59	7021.13
Emergency Spillway Crest EL	7020.60	7021.15
100 yr Volume	2.988 Ac-ft	3.490 Ac-ft
North Forebay Volume Required	643 CF	732 CF
North Forebay Volume Provided	855 CF	855 CF

EROSION CONTROL

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. EPC approved "Early Grading Plan for Sterling Ranch Phase I Onsite Grading & Erosion Control", November 18, 2015. And "Early Grading Plan for Sterling Ranch Phase I Offsite Grading & Erosion Control", December 3, 2015. Grading and Erosion control operations are currently underway (August 2016). Grading and Erosion Control will cease with the final development of the site in the next 12-36 months.

CHANNEL IMPROVEMENTS

Slope grading and intermittent channel bank lining has been proposed for portions of the developable areas adjacent to Sand Creek to protect the developed lots and prevent excessive erosion until the DBPS recommended Sand Creek Channel improvements are installed. The proposed slope grading is intended to reduce outer bank grades and bring uniformity to areas where significant riling and destabilization has

occurred. Proposed channel stabilization improvements includes placement of soil riprap and turf reinforcement matting along embankment toes and along embankment slopes, both of which will function to retain soils and vegetation during heavy rains or larger flood flow events. All disturbed areas, not hardscaped will be re-vegetated with native species grasses, per El Paso County erosion control standards. Storm sewer outfalls into Sand Creek shall be protected by low-tailwater riprap basins. The outfall protection is shown on the accompanying drainage map in the appendix. Refer to the Branding Iron Filing No.2 Grading and Erosion Control Plans for riprap and turf reinforcement map placement and construction details.

Permanently installed check structures and rip-rap channel lining will be installed within Sand Creek Channel to handle the runoff from fully developed Sterling Ranch and up-gradient watershed in accordance with the Sand Creek DBPS. A discussion regarding the timing of these channel improvements is provided in a subsequent paragraph titled Sterling Ranch Filing No. 1 Subdivision Improvement agreement which follows the Construction Costs segment of this report. Financial Assurance shall be posted for the proposed Sand Creek Channel Improvements and Bank Stabilization (Slope Protection and grade control structures).

CONSTRUCTION COST OPINION – BRANDING IRON AT STERLING RANCH FIL. NO. 2

Drainage Facilities:
Minor drainage improvements are planned with the development of Branding Iron at Sterling Ranch Filing No. 2. A majority of the construction costs have been accounted for in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017. Any additional improvements and costs are listed below.

Item	Description	Quantity		Unit Cost			Cost
1.	24" RCP	909	LF	$78	/LF		$70,902.00
2.	24" RCP FES	1	EA	$960	/EA		$960.00
3.	5' CDOT Type R Sump Inlet	1	EA	$7,188	/EA		$7,188.00
4.	15' CDOT Type R Sump Inlet	1	EA	$8,345	/EA		$8,345.00
						Total $	**$87,395.00**

DRAINAGE & BRIDGE FEES – BRANDING IRON AT STERLING RANCH FIL. NO. 2

This site is within the Sand Creek Drainage Basin. The 2019 Drainage and Bridge Fees per El Paso County for the BRANDING IRON AT STERLING RANCH FILING NO. 2 site are as follows:

Per Branding Iron at Sterling Ranch Filing No. 2 Plat – **Total Area** **18.881 Acres**

FILING NO. 2 FEES:

Drainage Fees:	18.881 ac	x	53%	x	$18,940.00/ac	=	$ 189,531.25
Bridge Fees:	18.881 ac	x	53%	x	$ 5,559.00/ac	=	$ 55,628.52
						Total	**$ 245,159.77**

STERLING RANCH FILING NO. 1 - SUBDIVISION IMPROVEMENTS AGREEEMENT

Sterling Ranch Filing No. 1 final plat and SIA has been recorded, and addressed the following drainage improvements Not located/and located in the Sand Creek Channel. The following SIA paragraphs outlined drainage for Sterling Ranch in the following manner;

*2. **Drainage and Landscaping Tracts**: Improvements on Tracts A, B, F, H, I, J, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA and CC as identified on the final plat of Filing No. 1 will be completed to the satisfaction of the County and District and, upon said completion, the improvements will be dedicated to and accepted by the District. Improvements on Tract D (Sand Creek) will be completed to the satisfaction of the County and upon said completion; the improvements will be dedicated to and accepted by the County. The ownership and maintenance of storm drain facilities and structures not located on the foregoing tracts shall be determined as follows. All storm pipes shall be owned and maintained by the District except where located in County road rights of way (see Paragraph 5 below), in which case the County shall own and maintain the storm drain facilities and structures, including but not limited to, inlets and manholes. A typical cross section describing the ownership and maintenance responsibilities of drainage improvements within County rights of way is attached as Exhibit C hereto.*

*7. **Timing of Construction and Acceptance**:*

*a. **Drainage Improvements Not Located in Sand Creek Channel**: Except as set forth below in subsection 6.b. (drainage improvements located in Sand Creek Channel), all drainage improvements described in Exhibit A and constructed within the Drainage and Landscaping Tracts identified in paragraph 2 above shall be completed by the Subdivider and District, meeting all applicable standards for preliminary acceptance, prior to the recording of the first replat of Tracts C, E, G, K or BB. In the event that a portion of the drainage improvements are not completed prior to the recording of the first replat, then prior to such recording collateral sufficient in the opinion of the County to assure completion of the improvements must be posted by the Subdivider and a deadline by which such drainage improvements shall be completed shall be established by written agreement.*

*b. **Drainage Improvements Located in Sand Creek Channel (Tract D):** The District agrees that it will construct or cause the construction of all drainage improvements to be located in Tract D as well as future tracts within Sterling Ranch containing the Sand Creek Channel in accordance with the following:*

i. Bank stabilization of the Sand Creek channel shall be required prior to any replats or other final plats adjacent to the channel. The design and installation of said improvements shall be accomplished and guaranteed through the normal subdivision review and collateralization process.

ii. Other drainage improvements in Tract D and future tracts containing the Sand Creek Channel, such as drop structures, check structures and similar stabilization or protection improvements, will be designed and constructed by the District with the final construction drawings to be approved by the County no later than the final platting of the 700th single family lot within the boundaries of the approved Sterling Ranch Sketch Plan and the completion of all said improvements no later than the 800th single family lot with the boundaries of the approved Sterling Ranch Sketch Plan.

iii. In order to assure completion of the drainage improvements required in Subsection 6.b.ii above as well as a fair apportionment of the costs of said drainage improvements amongst adjacent Sterling Ranch subdividers, the District agrees to establish a Sand Creek Channel Drainage Fee to be paid into a District Escrow Fund by adjacent subdividers at the time of final platting. The amount of the fee shall be a minimum of One Thousand Dollars ($1,000.00) per single family lot. The details of the proposed Sand Creek Channel Drainage Fee and the District Escrow Fund shall be agreed to by the parties in advance of the submittal of the first replat of or subdivision of the Master Pad Sites or other property located within Sterling Ranch.

A full copy of the recorded SIA is located in the files of El Paso County and EPC Clerk and Recorders office under Reception No. 218714151

SUMMARY

Development of this site will not adversely affect the surrounding development per this final drainage report with no negative impacts to the neighboring developments. The existing drainage facilities will adequately convey, detain and route runoff from tributary and onsite flows to the Sand Creek Drainage channel. Full Spectrum Detention and Water Quality Ponds will be used to discharge developed flows into Sand Creek per the Urban Drainage criteria flow rates, which are at or less than the historic flow. Care will be taken during construction to accommodate overland flow routes onsite and temporary drainage conditions. Slope grading and intermittent channel bank lining has been proposed for portions of the developable areas adjacent to Sand Creek to protect the developed lots and prevent excessive erosion. The development of the BRANDING IRON AT STERLING RANCH FILING NO. 2 project(s) shall not adversely affect adjacent or downstream property.

REFERENCES

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".

2.) "Urban Storm Drainage Criteria Manuals, Volumes 1-3"

3.) NRSC Web Soil Survey Map for El Paso County. http://websoilsurvey.nrcs.usda.gov

4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date December 7, 2018.

5.) "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996

6.) "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015

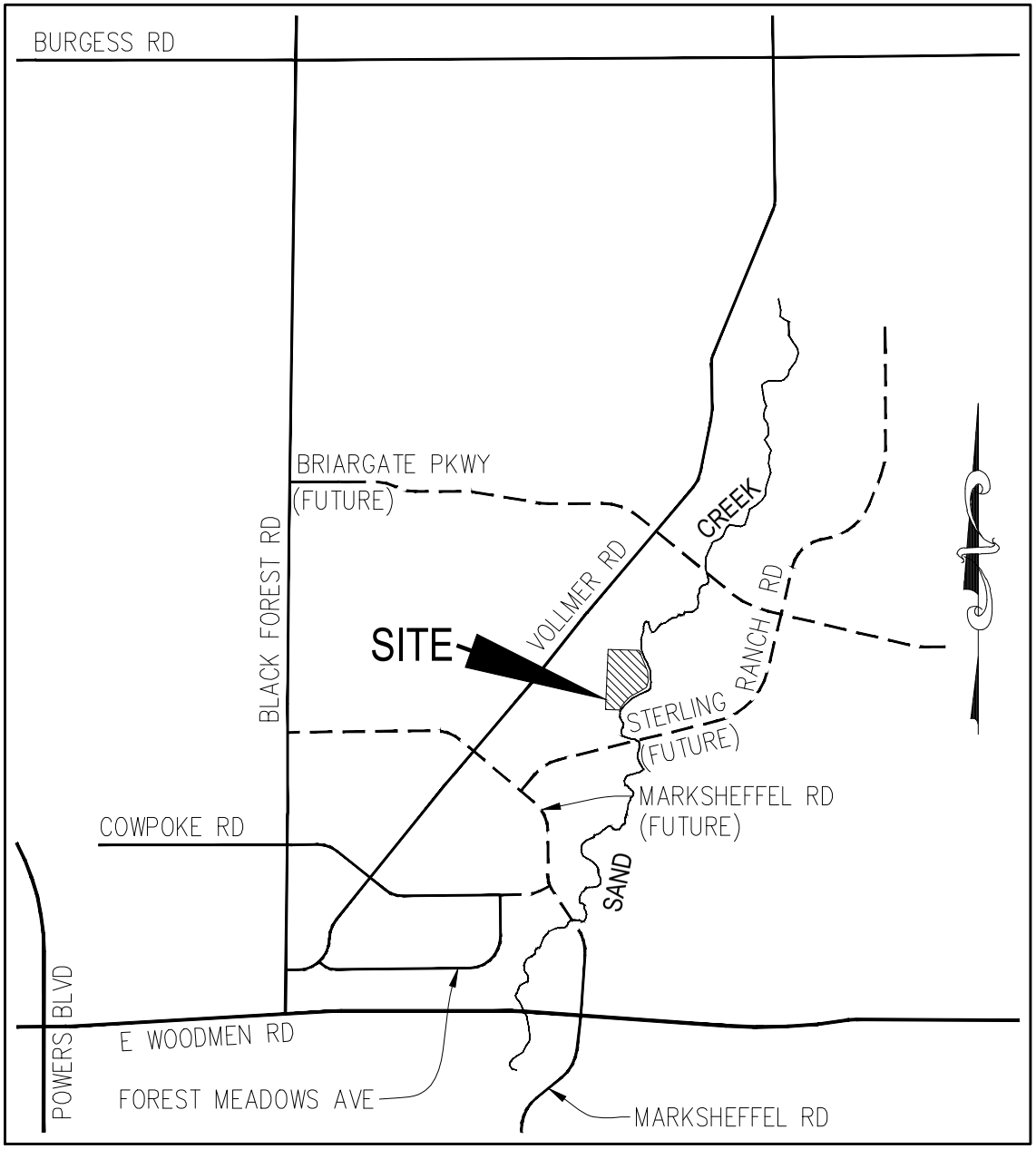
7.) "Sterling Ranch-Phase 1 Onsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015

8.) "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2 and Final Drainage Report for Sterling Ranch Filing No. 1", prepared by M&S Civil Consultants, Inc., dated April 2017

9.) "Sterling Ranch Filing Nos. 1&2 MDDP" prepared by MS Civil Consultants, Inc., dated October 2018.

APPENDIX

VICINITY MAP

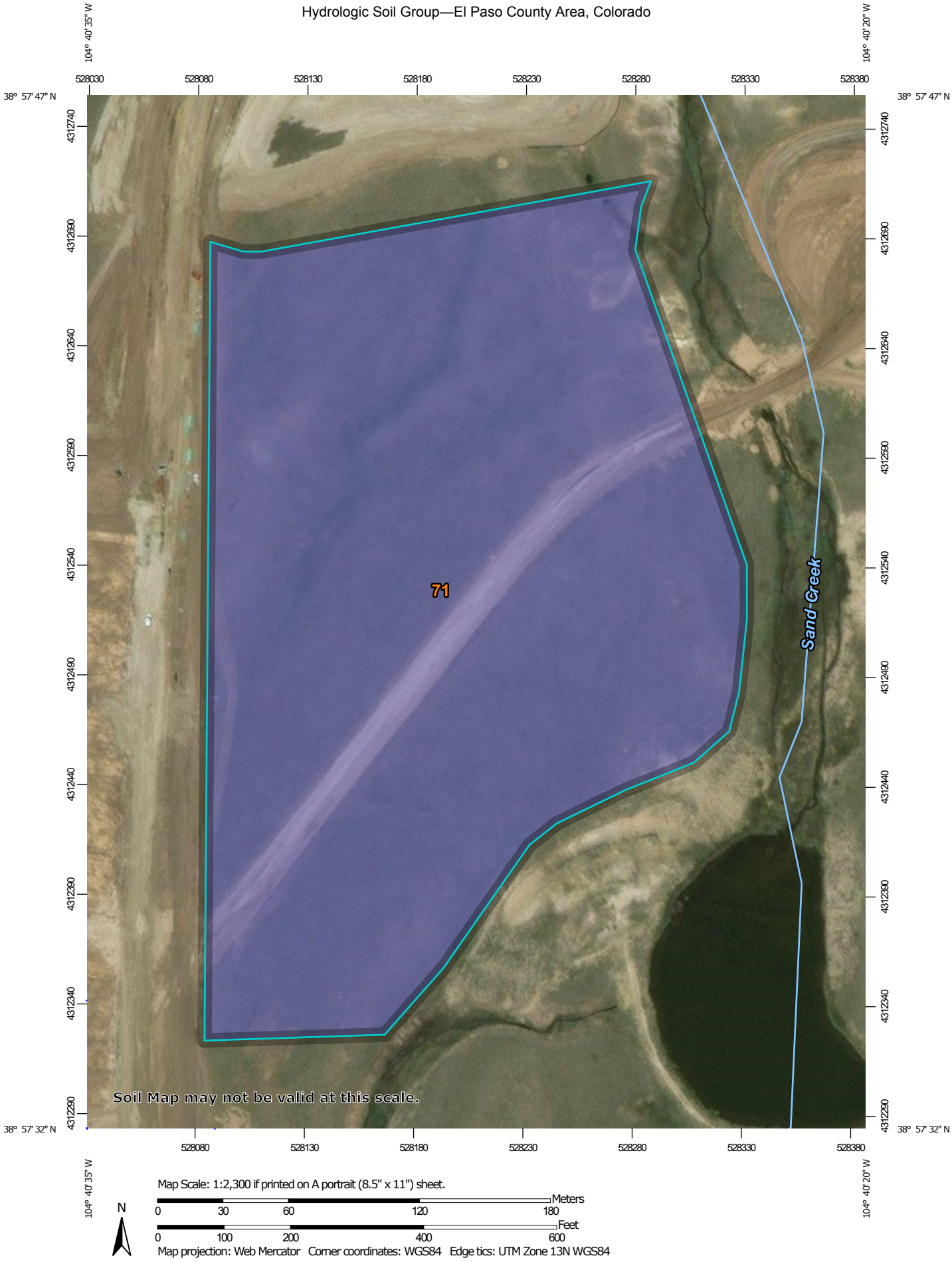


VICINITY MAP

N.T.S.

SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	18.1	100.0%
Totals for Area of Interest			**18.1**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FIRM PANEL W/ REVISED LOMR

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

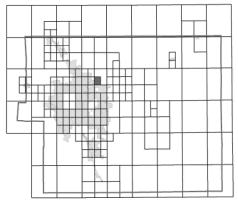
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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

El Paso County Vertical Datum Offset Table

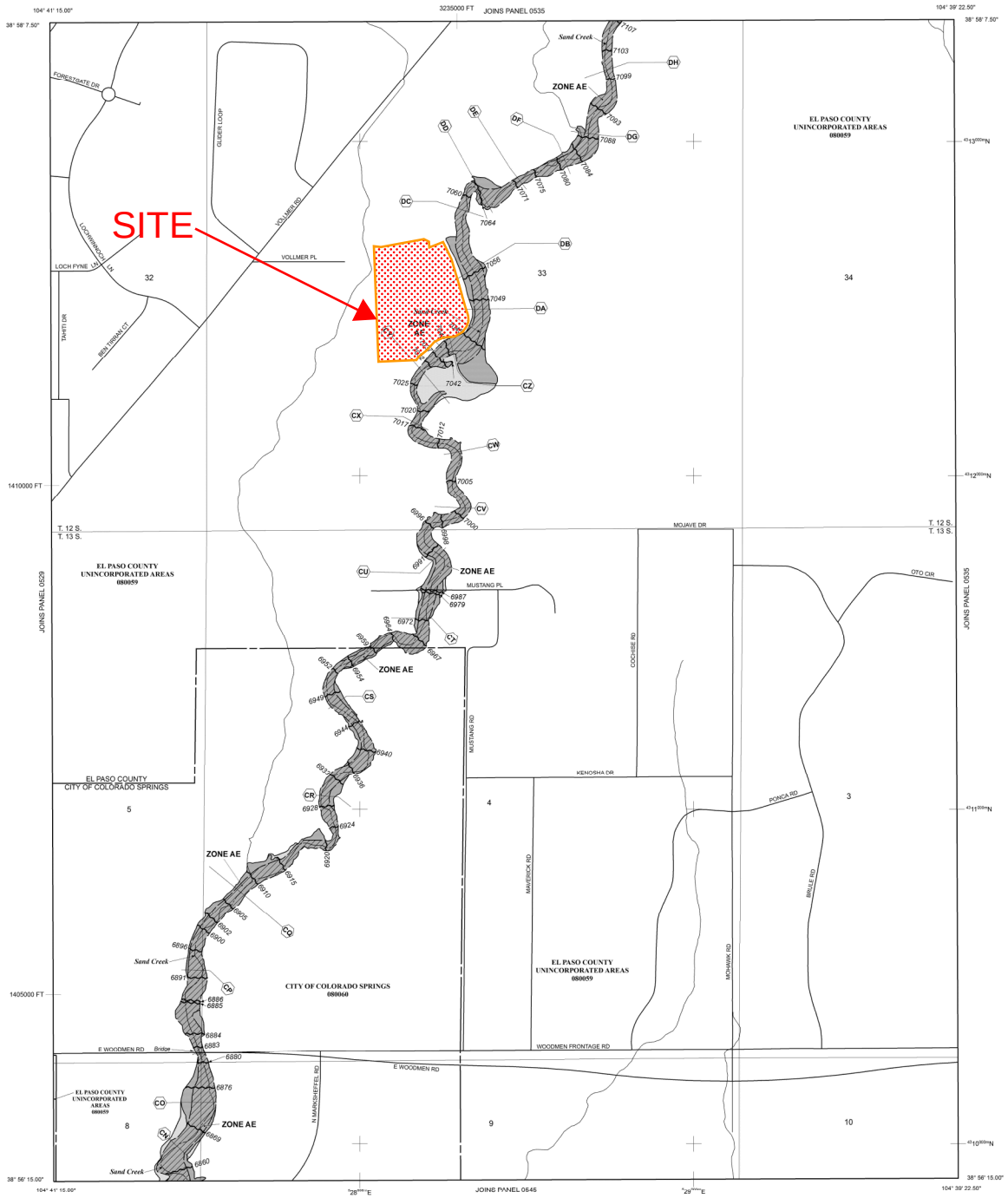
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A Cross section line
23 - - - - - 23 Transect line
97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4278000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0533G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0533	G
EL PASO COUNTY	080059	0533	G

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

MAP NUMBER
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

BRANDING IRON AT STERLING RANCH FILING NO. 2
FINAL DRAINAGE REPORT
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY ***		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
Proposed Area Drainage Summary																	
ONSITE BASINS																	
BB	1.8	0.38	0.55	0.38	100	2	10.3	316	2.2%	3.0	1.7	12.1	12.3	3.8	6.5	***2.6***	***6.4***
DD	2.58	0.38	0.55	0.38	100	2	10.3	400	1.8%	3.0	2.2	12.5	12.8	3.8	6.4	***3.7***	***9.0***
FF	2.72	0.38	0.55	0.38	100	2	10.3	375	2.7%	3.0	2.1	12.4	12.6	3.8	6.4	***3.9***	***9.6***
HH	3.77	0.38	0.55	0.38	100	2	10.3	516	1.9%	3.0	2.8	13.2	13.4	3.7	6.2	***5.3***	***12.9***
LL	0.23	0.22	0.46	0.22	95	4	9.6	0	2.0%	3.0	0.0	9.6	10.5	4.2	7.0	***0.2***	***0.7***
RR	5.93	0.38	0.55	0.38	100	2	10.3	880	2.3%	3.0	4.8	15.2	15.4	3.5	5.9	***7.9***	***19.2***
SS	0.29	0.08	0.35	0.08	20	5	2.8	80	0.5%	2.3	0.6	5.0	10.6	5.2	8.7	***0.1***	***0.9***
TT	1.32	0.38	0.55	0.38	65	1.3	8.3	387	1.3%	3.0	2.1	10.5	12.5	4.1	6.8	***2.0***	***4.9***
VV	0.41	0.22	0.46	0.22	80	1.6	11.3	0	2.0%	2.3	0.0	11.3	10.4	3.9	6.6	***0.4***	***1.2***
WW	0.59	0.22	0.46	0.22	80	2	10.5	0	2.0%	2.3	0.0	10.5	10.4	4.1	6.8	***0.5***	***1.8***
OFFSITE BASINS*																	
B*	5.39	0.38	0.55	0.38	60	1.2	8.0	1381	2.8%	3.0	7.6	16.3	18.0	3.4	5.7	***8.0***	***19.3***
G*	0.61	0.22	0.46	0.22	100	2	12.6	0	2.2%	3.0	0.0	12.6	10.6	4.0	6.8	***0.5***	***1.9***
H*	0.19	0.90	0.96	0.19	10	0.2	0.9	280	2.1%	3.0	1.6	5.0	11.6	5.2	8.7	***0.9***	***1.6***
K*	0.61	0.22	0.46	0.22	75	1.5	10.9	0	2.0%	3.0	0.0	10.9	10.4	4.0	6.7	***0.5***	***1.9***
L*	1.54	0.90	0.96	0.90	10	0.2	0.9	1805	2.1%	3.0	9.9	10.8	20.1	4.0	6.7	***5.6***	***10.0***
GG*	8.72	0.38	0.55	0.38	100	2	10.3	282	1.8%	3.0	1.5	16.3	12.1	3.4	5.7	***11.3***	***27.3***
II*	1.02	0.90	0.96	0.90	10	0.2	0.9	1349	2.2%	3.0	7.4	8.3	17.6	4.4	7.4	***4.0***	***7.2***
JJ*	0.99	0.90	0.96	0.90	10	0.2	0.9	1349	2.2%	3.0	7.4	8.3	17.6	4.4	7.4	***3.9***	***7.0***
KK*	1.97	0.38	0.55	0.38	100	2	10.3	206	1.0%	3.0	1.1	11.5	11.7	3.9	6.6	***2.9***	***7.1***
MM*	0.22	0.90	0.96	0.90	10	0.2	0.9	286	2.1%	3.0	1.6	5.0	11.6	5.2	8.7	***1.0***	***1.8***
NN*	0.2	0.90	0.96	0.90	10	0.2	0.9	286	2.1%	3.0	1.6	5.0	11.6	5.2	8.7	***0.9***	***1.7***
OO*	0.3	0.22	0.46	0.22	100	4	10.1	0	2.0%	3.0	0.0	10.1	10.6	4.1	6.9	***0.3***	***1.0***
PP*	0.37	0.90	0.96	0.90	10	0.2	0.9	400	1.5%	3.0	2.2	5.0	12.3	5.2	8.7	***1.7***	***3.1***
UU*	2.17	0.08	0.35	0.08	50	6	5.7	257	0.5%	2.3	1.9	7.6	11.7	4.5	7.6	***0.8***	***5.8***

* For detailed information on Desing Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

** Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CMN
Date: 3/1/2018
Checked by: VAS

BRANDING IRON AT STERLING RANCH FILING NO. 2
FINAL DRAINAGE REPORT
(Basin Routing Summary)

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T_t)	INTENSITY **		TOTAL FLOWS		
DESIGN POINT	CONTRIBUTING BASINS	CA_5	CA_{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.)	COMMENTS
PROPOSED DRAINAGE BASIN ROUTING SUMMARY																	
2*	B*	2.34	3.39									16.3	3.4	5.7	8.0	19.3	(2) EX. 15' AT-GRADE INLETS
5*	G*, H*, FLOWBY DP4*	1.07	3.02									11.7	3.9	6.5	4.2	19.7	EX. 15' AT-GRADE INLET
6*	I*, J*, K*, L*	3.50	3.97									10.8	4.0	6.7	14.1	26.7	EX. 15' AT-GRADE INLET
18*	GG*, II* FLOWBY DP5*	4.14	7.30									16.3	3.4	5.7	14.1	41.6	EX. 15' AT-GRADE INLET
19	BB, DD, FF, HH, JJ* FLOWBY DP 6*	5.53	8.34									13.2	3.7	6.2	20.5	52.0	EX. 15' AT-GRADE INLET
20*	KK*, MM* FLOWBY DP 18*	1.53	4.89									16.3	3.4	5.7	5.2	27.9	EX. 15' AT-GRADE INLET
21	LL, NN* FLOWBY DP 19*	1.72	4.92									13.2	3.7	6.2	6.4	30.7	EX. 15' AT-GRADE INLET
24	RR, SS	2.28	3.36									15.2	3.5	5.9	8.0	19.8	PROP. 15' SUMP INLET
26	TT	0.50	0.73									10.5	4.1	6.8	2.0	4.9	PROP. 5' SUMP INLET
27	UU*, PR2, PR20*, PR23*, PR26*	14.73	23.15									16.3	3.4	5.7	50.0	132.0	CUMULATIVE DETENTION POND 8 2.91'x9' OUTLET STRUCT.

* For detailed information on Desing Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

** Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CMN
Date: 9/20/2019
Checked by: VAS

BRANDING IRON AT STERLING RANCH FILING NO. 2
FINAL DRAINAGE REPORT
(Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow		Pipe Size
					I_5	I_{100}	Q_5	Q_{100}	
1	DP24	2.28	3.36	15.2	3.5	5.9	8.0	19.8	24" RCP
2	DP26, PR1	2.78	4.09	16.1	3.4	5.7	9.5	23.5	EX 24" RCP

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point
EX - Existing Design Point
FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: CMN
Date: 9/20/2019
Checked by: VAS

Minor Storm Capacity Rating Table for Collector Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.02000	ft/ft
Normal Depth	0.49	ft
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.70
0+10	0.50
0+10	0.50
0+10	0.00
0+12	0.13
0+30	0.49
0+48	0.13
0+50	0.00
0+50	0.50
0+51	0.50
0+60	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.70)	(0+10, 0.50)	0.020
(0+10, 0.50)	(0+51, 0.50)	0.016
(0+51, 0.50)	(0+60, 0.70)	0.020

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00000	8.12	41.00	40.00		

Minor Storm Capacity Rating Table for Collector Section

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00250	11.32	1.39	8.12	41.00	40.00
0.00500	16.01	1.97	8.12	41.00	40.00
0.00750	19.60	2.41	8.12	41.00	40.00
0.01000	22.64	2.79	8.12	41.00	40.00
0.01250	25.31	3.12	8.12	41.00	40.00
0.01500	27.72	3.41	8.12	41.00	40.00
0.01750	29.95	3.69	8.12	41.00	40.00
0.02000	32.01	3.94	8.12	41.00	40.00
0.02250	33.96	4.18	8.12	41.00	40.00
0.02500	35.79	4.41	8.12	41.00	40.00
0.02750	37.54	4.62	8.12	41.00	40.00
0.03000	39.21	4.83	8.12	41.00	40.00
0.03250	40.81	5.03	8.12	41.00	40.00
0.03500	42.35	5.22	8.12	41.00	40.00
0.03750	43.84	5.40	8.12	41.00	40.00
0.04000	45.27	5.58	8.12	41.00	40.00
0.04250	46.67	5.75	8.12	41.00	40.00
0.04500	48.02	5.91	8.12	41.00	40.00
0.04750	49.34	6.08	8.12	41.00	40.00
0.05000	50.62	6.23	8.12	41.00	40.00

0.0233 34.55

Major Storm Capacity Rating Table for Collector Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.02000	ft/ft
Normal Depth	0.70	ft
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.70
0+10	0.50
0+10	0.50
0+10	0.00
0+12	0.13
0+30	0.49
0+48	0.13
0+50	0.00
0+50	0.50
0+51	0.50
0+60	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.70)	(0+10, 0.50)	0.020
(0+10, 0.50)	(0+51, 0.50)	0.016
(0+51, 0.50)	(0+60, 0.70)	0.020

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00000			18.62	61.02	60.00

Major Storm Capacity Rating Table for Collector Section

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00250	36.15	1.94	18.62	61.02	60.00
0.00500	51.12	2.75	18.62	61.02	60.00
0.00750	62.61	3.36	18.62	61.02	60.00
0.01000	72.30	3.88	18.62	61.02	60.00
0.01250	80.83	4.34	18.62	61.02	60.00
0.01500	88.55	4.76	18.62	61.02	60.00
0.01750	95.64	5.14	18.62	61.02	60.00
0.02000	102.25	5.49	18.62	61.02	60.00
0.02250	108.45	5.82	18.62	61.02	60.00
0.02500	114.32	6.14	18.62	61.02	60.00
0.02750	119.90	6.44	18.62	61.02	60.00
0.03000	125.23	6.73	18.62	61.02	60.00
0.03250	130.34	7.00	18.62	61.02	60.00
0.03500	135.26	7.26	18.62	61.02	60.00
0.03750	140.01	7.52	18.62	61.02	60.00
0.04000	144.60	7.77	18.62	61.02	60.00
0.04250	149.05	8.00	18.62	61.02	60.00
0.04500	153.37	8.24	18.62	61.02	60.00
0.04750	157.57	8.46	18.62	61.02	60.00
0.05000	161.67	8.68	18.62	61.02	60.00

→ 0.0233 110.33

HYDRAULIC CALCULATIONS

BRANDING IRON AT STERLING RANCH FILING NO. 2
FINAL DRAINAGE REPORT
(CDOT Type R Inlet Calculations - Sump Condition)

Urban Minor Arterial Roadway-100' ROW-62' Pavement-6" Vertical Curb
Maximum allowable depth for **MINOR (0.485')** & **MAJOR (0.64')** storm

Inlet Length	Storm	Depth	Eqn. 7-31	Eqn. 7-32	Eqn. 7-29	
			$Q_w=C_wN_wL_eD^{3/2}$	$Q_o=C_oN_o(L_eH_c)(2g(D-0.5H_c))^{1/2}$	$Q_m=C_m(Q_wQ_o)^{1/2}$	
5	Q_5	0.485	6.1	6.5	5.9	**DESIGN POINT 26 (DP26)**
5	Q_{100}	0.64	9.2	8.4	8.2	
6	Q_5	0.485	7.3	7.8	7.0	
6	Q_{100}	0.64	11.1	10.1	9.8	
8	Q_5	0.485	9.7	10.4	9.4	
8	Q_{100}	0.64	14.7	13.4	13.1	
10	Q_5	0.485	12.2	13.0	11.7	
10	Q_{100}	0.64	18.4	16.8	16.4	
12	Q_5	0.485	14.6	15.6	14.0	
12	Q_{100}	0.64	22.1	20.1	19.6	
14	Q_5	0.485	17.0	18.2	16.4	
14	Q_{100}	0.64	25.8	23.5	22.9	
15	Q_5	0.485	18.2	19.5	17.6	**DESIGN POINT 24 (DP24)**
15	Q_{100}	0.64	27.6	25.2	24.5	
16	Q_5	0.485	19.5	20.9	18.7	
16	Q_{100}	0.64	29.5	26.9	26.2	
18	Q_5	0.485	21.9	23.5	21.1	
18	Q_{100}	0.64	33.2	30.2	29.4	
20	Q_5	0.485	24.3	26.1	23.4	
20	Q_{100}	0.64	36.9	33.6	32.7	
22	Q_5	0.485	26.8	28.7	25.8	
22	Q_{100}	0.64	40.6	36.9	36.0	

Table 7-7. Coefficients for various inlets in sumps

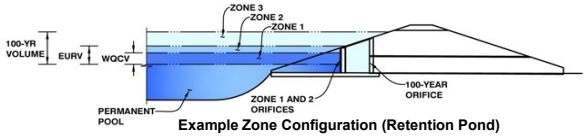
Inlet Type	Nw	Cw	No	Co	Cm
CDOT Type 13 Grate	0.7	3.3	0.43	0.6	0.93
Denver No. 16 Grate	0.73	3.6	0.31	0.6	0.9
Curb Opening for Type 13/No. 16 Combination	1	3.7	1	0.66	0.86
CDOT Type R Curb Opening	1	3.6	1	0.67	0.93

BRANDING IRON AT STERLING RANCH FIL. NO.2

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 8



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Top of MP=7014.54

Selected BMP Type =	**EDB**			
Watershed Area =	35.20	acres		
Watershed Length =	2,151	ft		
Watershed Slope =	0.021	ft/ft		
Watershed Imperviousness =	53.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.630	acre-feet	Optional User Input	
Excess Urban Runoff Volume (EURV) =	2.004	acre-feet	1-hr Precipitation	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.671	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.524	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.238	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.235	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.066	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	6.013	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 6.53 in.) =	16.565	acre-feet	6.53	inches
Approximate 2-yr Detention Volume =	1.581	acre-feet		
Approximate 5-yr Detention Volume =	2.320	acre-feet		
Approximate 10-yr Detention Volume =	2.537	acre-feet		
Approximate 25-yr Detention Volume =	2.653	acre-feet		
Approximate 50-yr Detention Volume =	2.952	acre-feet		
Approximate 100-yr Detention Volume =	3.543	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.630	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.374	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.540	acre-feet
Total Detention Basin Volume =	3.543	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	

Depth Increment = 1 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)
Micropool	--	0.00	--	--	--	10	0.000		
	--	0.33	--	--	--	228	0.005	37	0.001
	--	0.50	--	--	--	457	0.010	93	0.002
7016	--	1.50	--	--	--	7,423	0.170	3,964	0.091
7017	--	2.50	--	--	--	20,206	0.464	17,852	0.410
7018	--	3.50	--	--	--	28,371	0.651	42,140	0.967
7019	--	4.50	--	--	--	33,351	0.766	73,001	1.676
7020	--	5.50	--	--	--	37,998	0.872	108,676	2.495
7021	--	6.50	--	--	--	41,980	0.964	148,665	3.413
7022	--	7.50	--	--	--	46,012	1.056	192,661	4.423
7023	--	8.50	--	--	--	50,147	1.151	240,740	5.527
7024	--	9.50	--	--	--	54,386	1.249	293,007	6.727
7025	--	10.50	--	--	--	58,728	1.348	349,564	8.025
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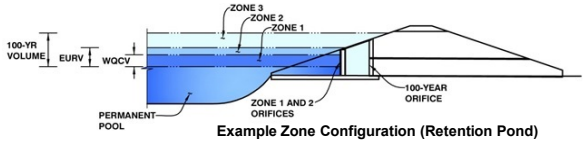
BRANDING IRON AT STERLING RANCH FIL. NO.2

Detention Basin Outlet Structure Design

Project: STERLING RANCH FILING NO. 1
Basin ID: POND 8



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.94	0.630	Orifice Plate
Zone 2 (EURV)	4.92	1.374	Orifice Plate
Zone 3 (100-year)	6.64	1.540	Weir&Pipe (Restrict)
		3.543	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 =	4.92	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	19.48	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	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	1.60	3.20	4.80				
Orifice Area (sq. inches)	2.87	2.90	4.38	2.88				

	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 =	4.74	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	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 =	5.47	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.90	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	18.90	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.45	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	22.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.86	N/A	ft^2
Outlet Orifice Centroid =	1.02	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.06	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.65	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	35.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

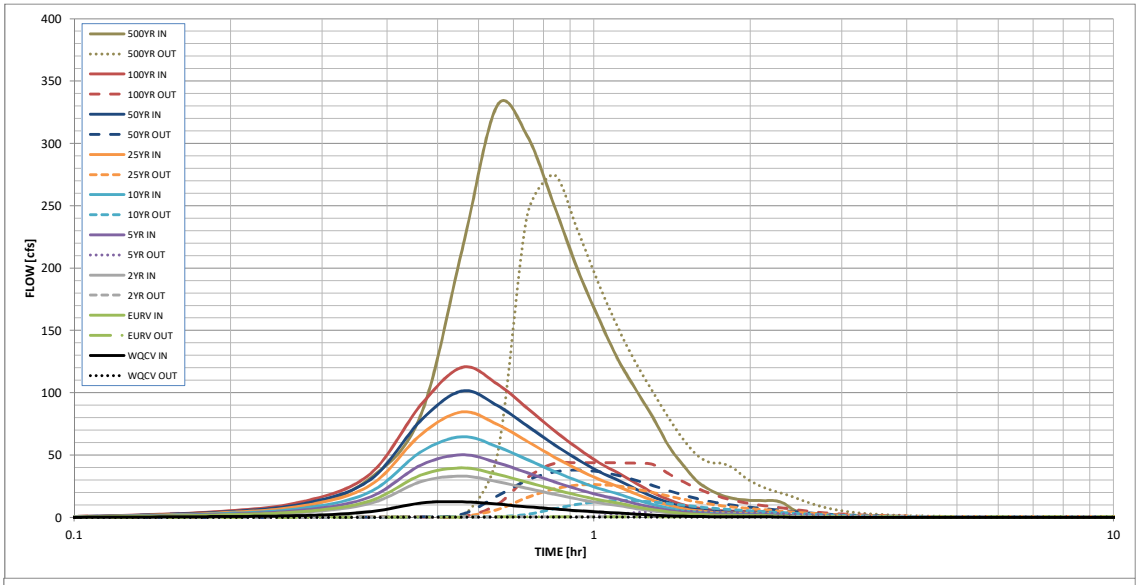
Calculated Parameters for Spillway

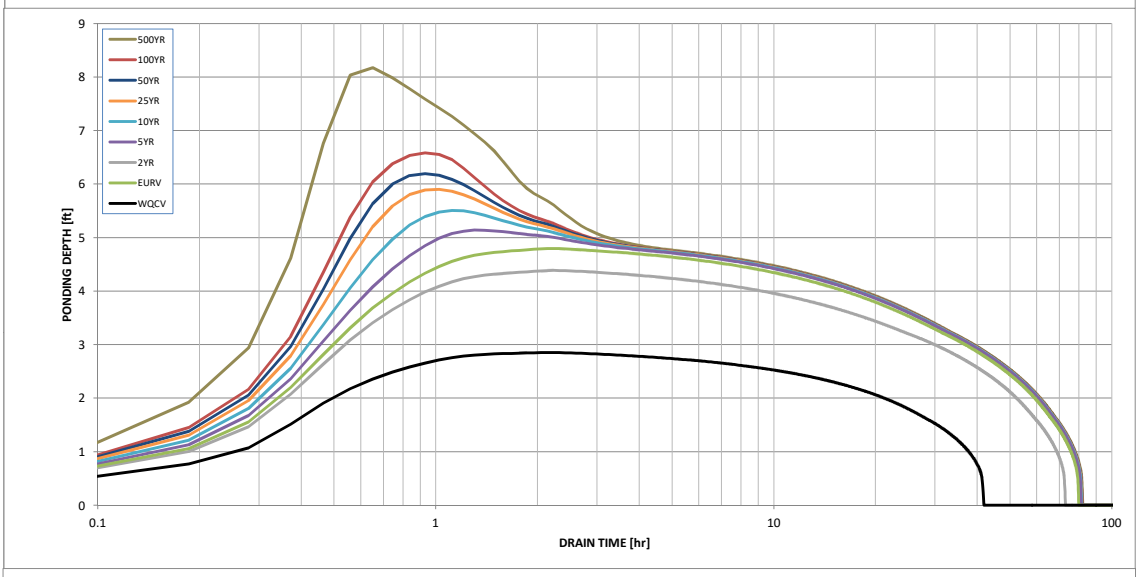
Spillway Design Flow Depth=	1.07	feet
Stage at Top of Freeboard =	8.72	feet
Basin Area at Top of Freeboard =	1.17	acres

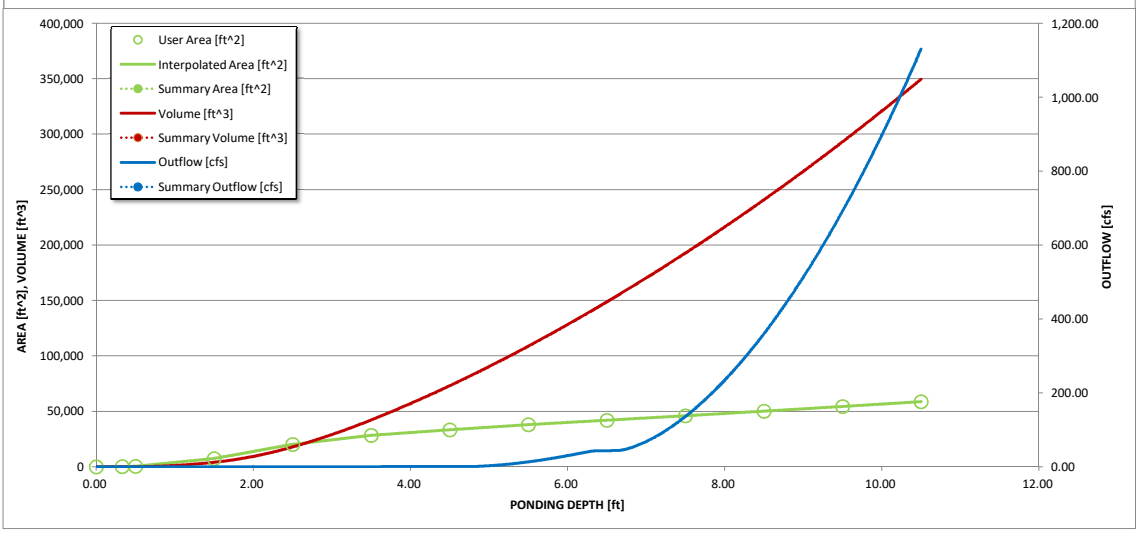
Routed Hydrograph Results

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	6.53
Calculated Runoff Volume (acre-ft) =	0.630	2.004	1.671	2.524	3.238	4.235	5.066	6.013	16.565
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.629	2.003	1.670	2.523	3.237	4.233	5.062	6.008	16.555
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.34	0.78	1.01	1.29	1.83
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	6.0	12.0	27.5	35.6	45.6	64.5
Peak Inflow Q (cfs) =	12.5	39.7	33.2	50.2	64.6	84.7	101.4	120.4	329.9
Peak Outflow Q (cfs) =	0.3	0.8	0.5	5.0	13.4	26.3	37.8	43.8	274.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	1.0	1.1	1.0	4.3
Structure Controlling Flow =	Plate	Overflow Grate 1	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	0.2	0.7	1.3	1.9	2.3	2.6
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) =	39	72	66	72	70	67	65	63	47
Time to Drain 99% of Inflow Volume (hours) =	**41**	77	70	77	77	76	75	74	65
Maximum Ponding Depth (ft) =	2.85	4.80	4.39	5.14	5.51	5.90	6.19	6.59	8.17
Area at Maximum Ponding Depth (acres) =	0.53	0.80	0.75	0.83	0.87	0.91	0.94	0.97	1.12
Maximum Volume Stored (acre-ft) =	0.584	1.902	1.585	2.179	2.495	2.851	3.119	3.490	5.152

Detention Basin Outlet Structure Design







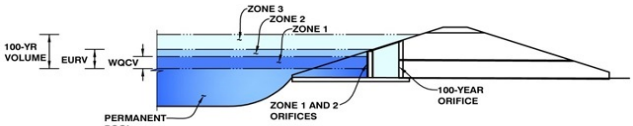
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

STERLING RANCH FILING NOS. 1&2 MDDP **(PREVIOUS VERSION)**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: **STERLING RANCH FILING NO. 1**

Basin ID: **POND 8**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	28.98	acres		
Watershed Length =	1,550	ft		
Watershed Slope =	0.021	ft/ft		
Watershed Imperviousness =	53.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.518	acre-feet	Optional User Input 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	1.650	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	1.376	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.078	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.666	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.486	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.171	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.951	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 6.53 in.) =	13.638	acre-feet	6.53	inches
Approximate 2-yr Detention Volume =	1.302	acre-feet		
Approximate 5-yr Detention Volume =	1.910	acre-feet		
Approximate 10-yr Detention Volume =	2.089	acre-feet		
Approximate 25-yr Detention Volume =	2.184	acre-feet		
Approximate 50-yr Detention Volume =	2.430	acre-feet		
Approximate 100-yr Detention Volume =	2.917	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.518	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.131	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.268	acre-feet
Total Detention Basin Volume =	2.917	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 = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)
Micropool	--	0.00	--	--	--	10
	--	0.33	--	--	--	228
	--	0.50	--	--	--	457
	--	1.50	--	--	--	7,423
	--	2.50	--	--	--	20,206
	--	3.50	--	--	--	28,371
	--	4.50	--	--	--	33,351
	--	5.50	--	--	--	37,998
	--	6.50	--	--	--	41,980
	--	7.50	--	--	--	46,012
	--	8.50	--	--	--	50,147
	--	9.50	--	--	--	54,386
	--	10.50	--	--	--	58,728
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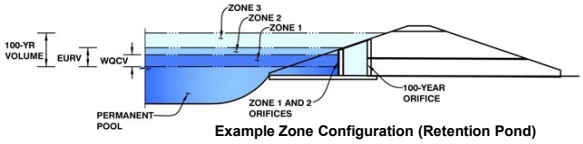
STERLING RANCH FILING NOS. 1&2 MDDP (PREVIOUS VERSION)

Detention Basin Outlet Structure Design

Project: STERLING RANCH FILING NO. 1
Basin ID: POND 8



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.73	0.518	Orifice Plate
Zone 2 (EURV)	4.47	1.131	Orifice Plate
Zone 3 (100-year)	5.98	1.268	Weir&Pipe (Restrict)
		2.917	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 =	4.47	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	16.80	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	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	1.49	2.98					
Orifice Area (sq. inches)	2.49	2.49	5.50					

	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 =	4.47	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	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 =	5.20	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.90	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	18.90	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.45	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	22.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.86	N/A	ft^2
Outlet Orifice Centroid =	1.02	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.06	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	38.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	2.00	feet

Calculated Parameters for Spillway

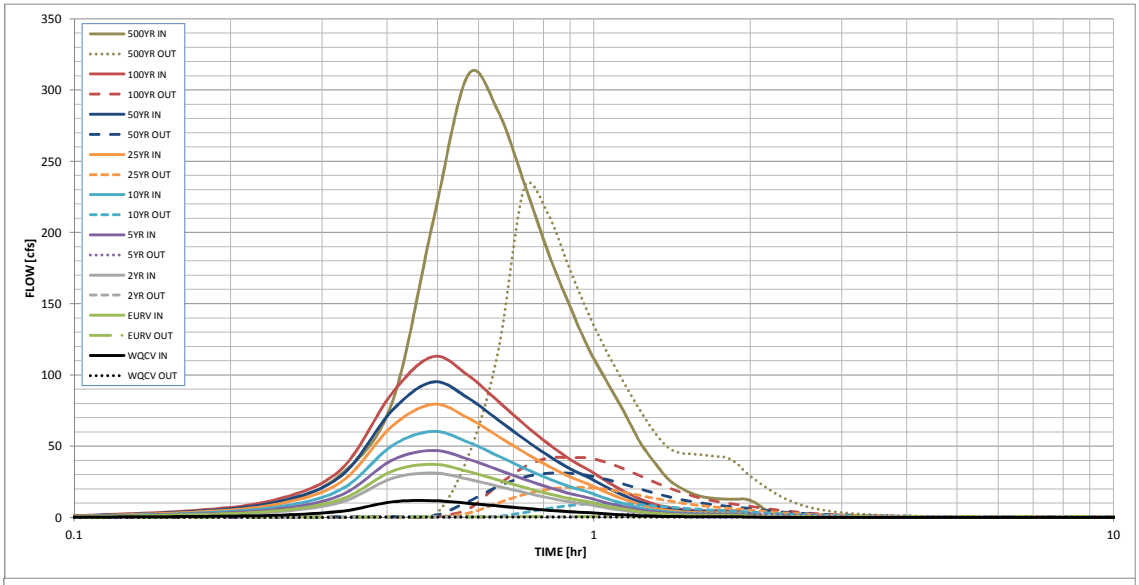
Spillway Design Flow Depth=	0.88	feet
Stage at Top of Freeboard =	9.88	feet
Basin Area at Top of Freeboard =	1.29	acres

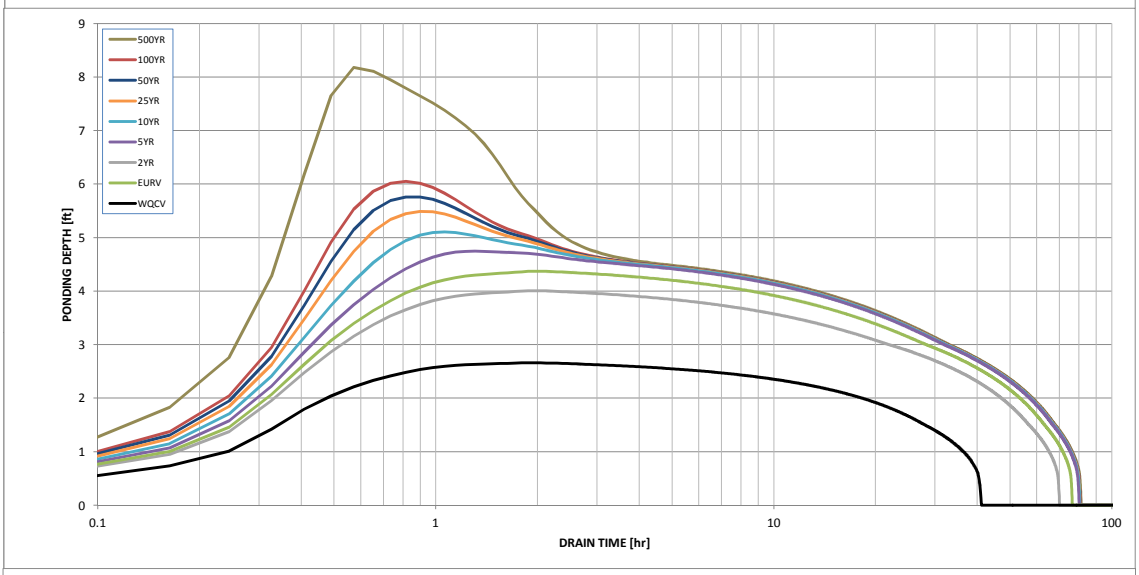
Routed Hydrograph Results

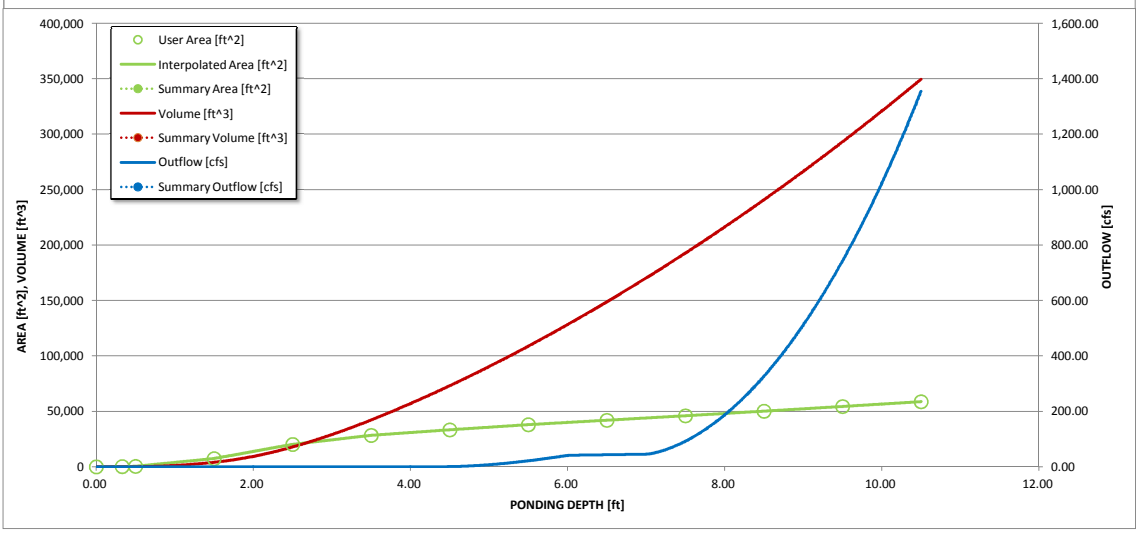
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	6.53
Calculated Runoff Volume (acre-ft) =	0.518	1.650	1.376	2.078	2.666	3.486	4.171	4.951	13.638
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.519	1.650	1.376	2.080	2.667	3.489	4.174	4.948	13.639
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.20	0.40	0.91	1.18	1.50	2.12
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	5.9	11.7	26.4	34.1	43.4	61.3
Peak Inflow Q (cfs) =	11.8	37.3	31.2	47.0	60.4	79.3	95.1	112.8	310.3
Peak Outflow Q (cfs) =	0.2	0.5	0.5	2.9	9.9	21.2	31.0	41.7	231.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.8	0.8	0.9	1.0	3.8
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.5	1.1	1.6	2.2	2.6
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	69	63	71	69	66	65	63	46
Time to Drain 99% of Inflow Volume (hours) =	**40**	73	68	76	76	75	74	73	64
Maximum Ponding Depth (ft) =	2.66	4.37	4.01	4.74	5.11	5.49	5.76	6.05	8.18
Area at Maximum Ponding Depth (acres) =	0.49	0.75	0.71	0.79	0.83	0.87	0.90	0.92	1.12
Maximum Volume Stored (acre-ft) =	0.482	1.577	1.307	1.863	2.154	2.477	2.716	2.988	5.152

STERLING RANCH FILING NOS. 1&2 MDDP (PREVIOUS VERSION)

Detention Basin Outlet Structure Design







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

CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, STE 110
COLORADO SPRINGS, CO 80903
(719) 955-5485

PROJECT: STERLING RANCH FILING No. 1

DATE: POND 8

FOREBAY VOLUMES FOR POND 8

SIZE OF TOTAL CONTRIBUTING AREA = 35.2 ACRES
MIN FOREBAY VOLUME = 3% OF WQCV (UPDED T5, EDB 4)
WQCV POND 8 = 0.584 AC-FT x 3% = 0.0175 AC-FT x $\frac{43560 \text{ CF}}{1 \text{ AC-FT}}$ = 763.17 ≈ 763 CF

NUMBER OF FORE BAYS = 2

CONTRIBUTING AREA TO SOUTH FOREBAY = 1.26 AC
% OF CONTRIBUTING AREA = 1.26 AC / 35.2 AC = 3.6% ≅ 4%
VOLUME REQ. = 4% x 763 CF = 30.52 CF = 31 CF < 33.85 CF SIZED PREVIOUSLY IN SR FILING 1

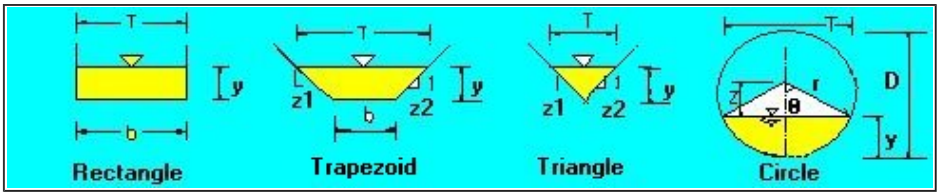
REMAINDER OF AREA TO NORTH FOREBAY
96% x 763 CF = 732 CF REQ VOLUME
VOLUME PROVIDED 570 SQ FT x 1.5 = 855 CUF

855 CUFT PROVIDED > 732 CUFT REQ OK

DESIGN POINT 24
EMERGENCY OVERFLOW PATH

The open channel flow calculator

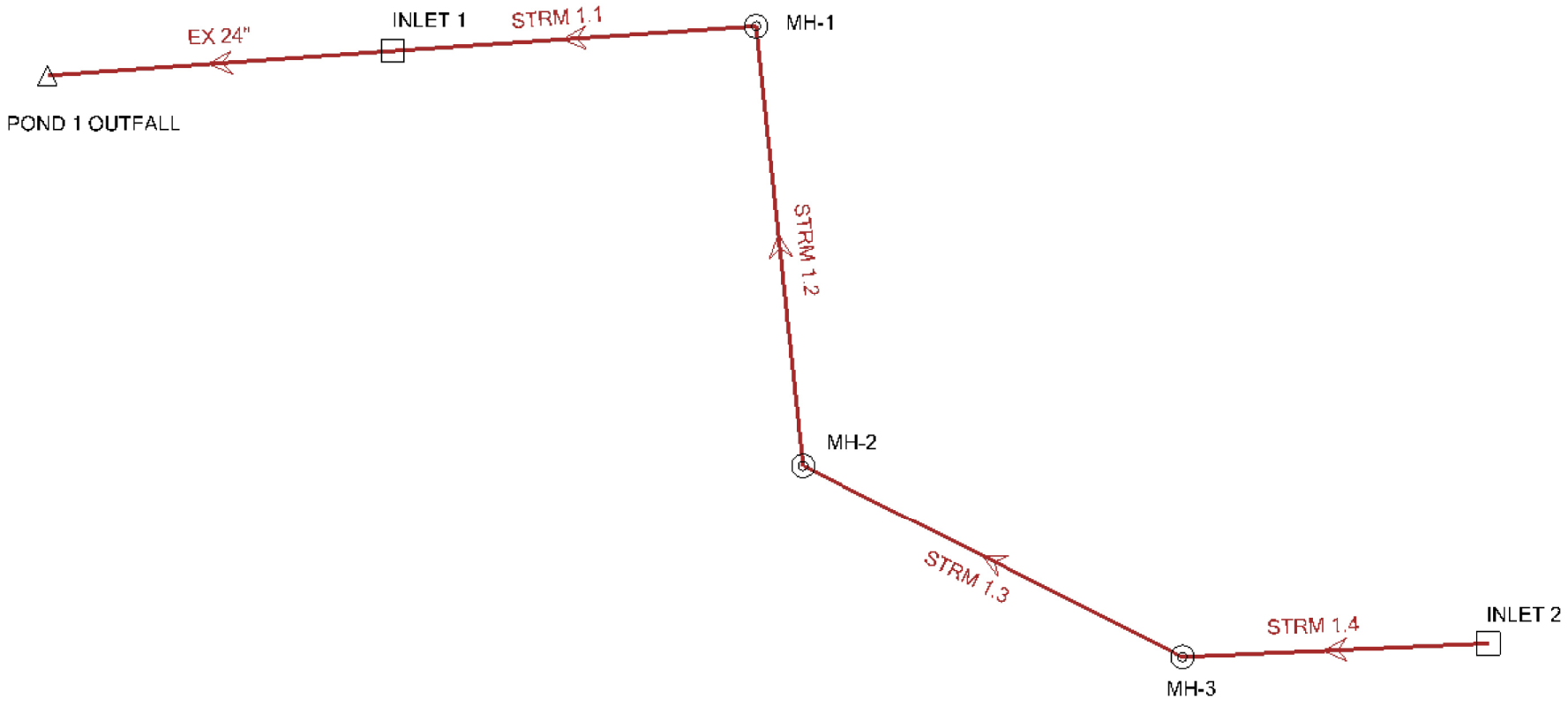
Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .034 ft/ft	Water depth(y): 0.46 ft	Bottom width(b) 6 ft
Flow velocity 5.7606 ft/s	LeftSlope (Z1): 3 to 1 (H:V	RightSlope (Z2): 3 to 1 (H:V
Flow discharge 19.556 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.91 ft	Flow area 3.39 ft^2	Top width(T) 8.76 ft
Specific energy 0.98 ft	Froude number 1.63	Flow status Supercritical flow
Critical depth 0.62 ft	Critical slope 0.0117 ft/ft	Velocity head 0.52 ft

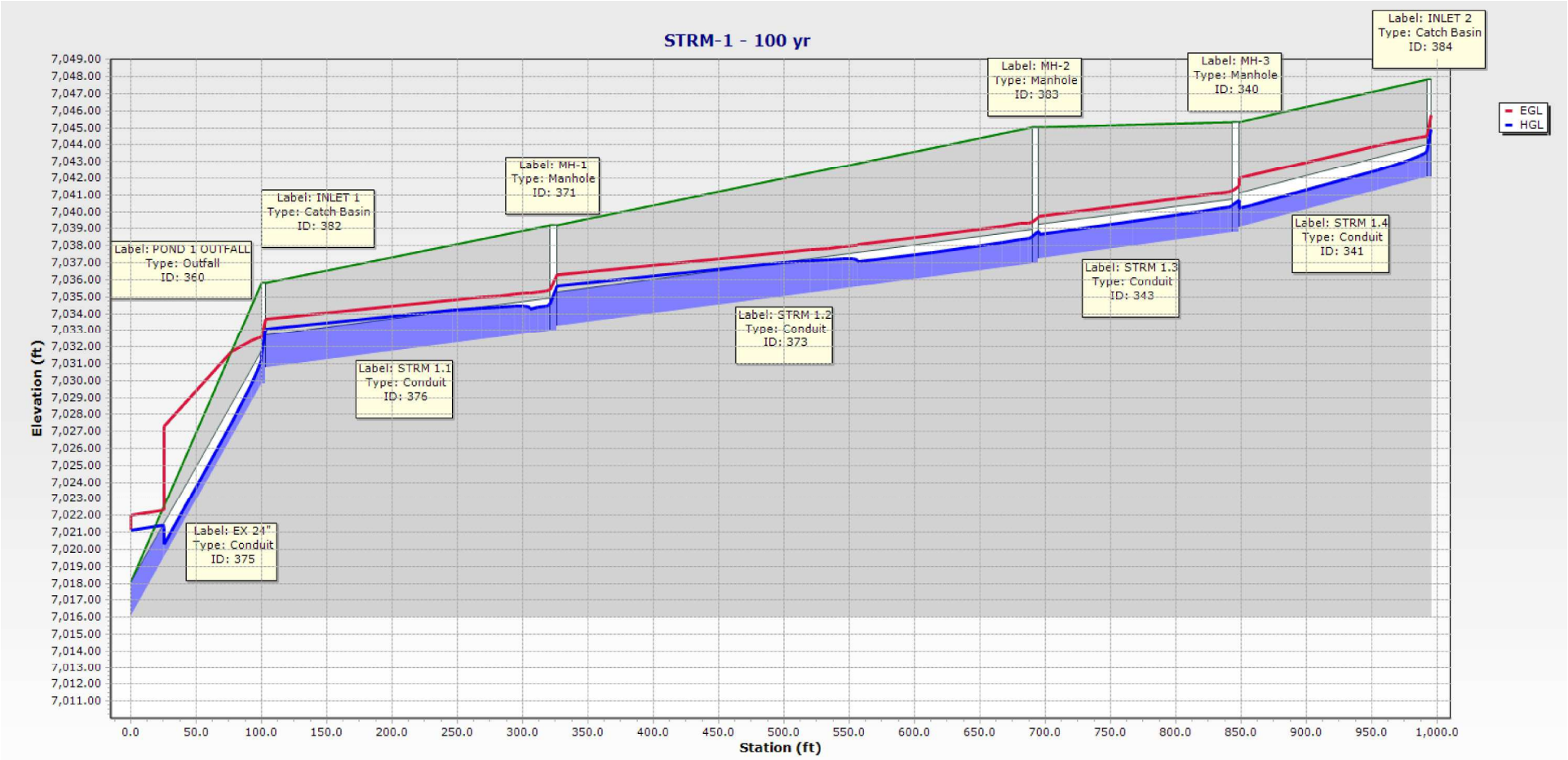
STORM 1 INDEX MAP



Conduit FlexTable: STORM 1 100 YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
STRM 1.4	341	INLET 2	19.80	61.9	148.2	10.71	1.955	1.14	1.60	7,044.48	7,041.52	7,043.64	7,040.71	2.92	7,044.90
STRM 1.3	343	MH-3	19.80	87.3	153.3	8.13	1.229	1.45	1.60	7,041.22	7,039.68	7,040.38	7,038.88	1.50	7,040.71
STRM 1.2	373	MH-2	19.80	87.5	368.9	8.12	1.225	1.45	1.60	7,039.38	7,036.28	7,038.54	7,035.66	2.88	7,038.88
EX 24"	375	INLET 1	23.50	28.3	101.8	22.75	5.476	0.73	1.72	7,032.56	7,022.00	7,031.52	7,021.13	10.39	7,033.08
STRM 1.1	376	MH-1	19.80	87.6	221.5	8.11	1.223	1.45	1.60	7,035.39	7,033.69	7,034.55	7,033.08	1.47	7,035.66

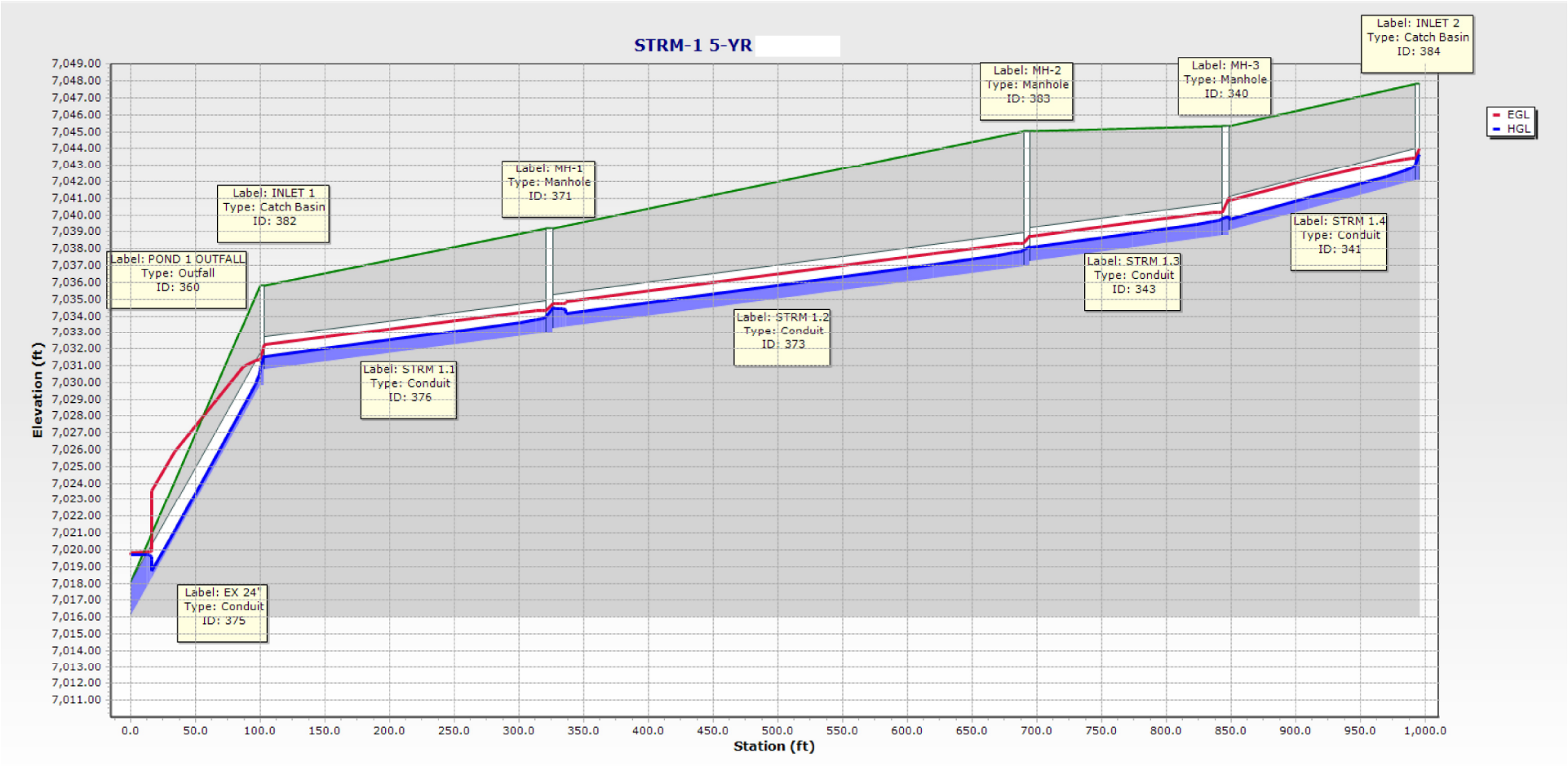
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
7.35	1.500	1.26	7,047.83	7,045.36	7,042.04	7,039.08	Circle - 24.0 in
7.20	0.400	0.34	7,045.36	7,045.05	7,038.78	7,037.24	Circle - 24.0 in
7.20	0.400	0.34	7,045.05	7,039.21	7,036.94	7,033.25	Circle - 24.0 in
6.30	1.500	1.56	7,035.81	7,018.06	7,029.80	7,016.06	Circle - 24.0 in
6.30	1.320	1.11	7,039.21	7,035.81	7,032.95	7,030.74	Circle - 24.0 in


STRM-1 - 100 yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: POND 1 OUTFALL
Type: Outfall
ID: 360
Label: INLET 1
Type: Catch Basin
ID: 382
Label: MH-1
Type: Manhole
ID: 371
Label: MH-2
Type: Manhole
ID: 383
Label: MH-3
Type: Manhole
ID: 340
Label: INLET 2
Type: Catch Basin
ID: 384
Label: EX 24"
Type: Conduit
ID: 375
Label: STRM 1.1
Type: Conduit
ID: 376
Label: STRM 1.2
Type: Conduit
ID: 373
Label: STRM 1.3
Type: Conduit
ID: 343
Label: STRM 1.4
Type: Conduit
ID: 341

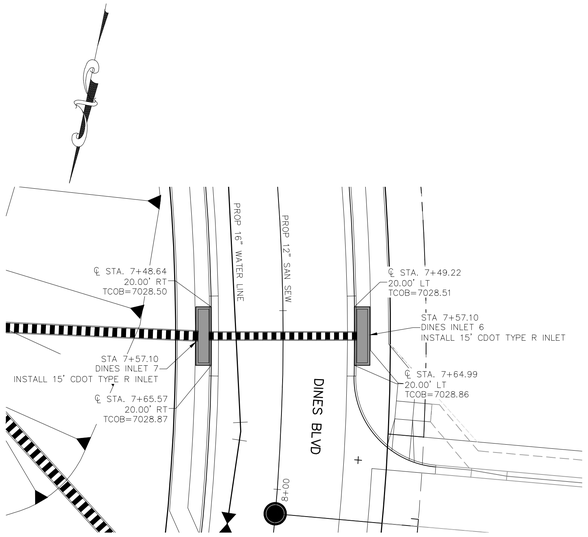
Conduit FlexTable: STORM 1 5 YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
STRM 1.4	341	INLET 2	8.00	25.0	148.2	8.46	2.112	0.68	1.01	7,043.44	7,040.87	7,043.05	7,039.76	3.29	7,043.64
STRM 1.3	343	MH-3	8.00	35.3	153.3	6.59	1.480	0.82	1.01	7,040.18	7,038.74	7,039.79	7,038.06	1.73	7,039.95
STRM 1.2	373	MH-2	8.00	35.4	368.9	6.58	1.476	0.82	1.01	7,038.34	7,034.72	7,037.95	7,034.48	3.47	7,038.11
EX 24"	375	INLET 1	9.50	11.4	101.8	17.59	5.468	0.46	1.10	7,031.35	7,019.83	7,030.90	7,019.69	11.21	7,031.57
STRM 1.1	376	MH-1	8.00	35.4	221.5	6.58	1.475	0.82	1.01	7,034.35	7,032.23	7,033.96	7,031.56	2.40	7,034.48

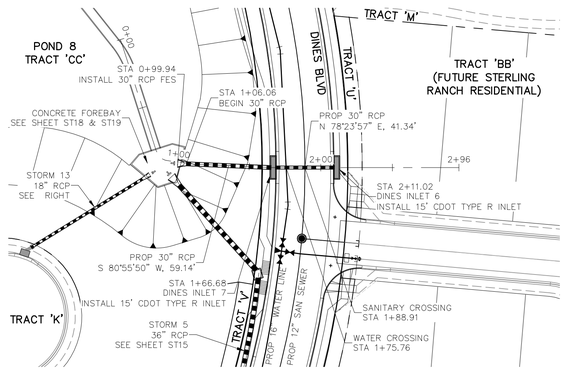
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
5.05	1.500	0.59	7,047.83	7,045.36	7,042.04	7,039.08	Circle - 24.0 in
8.46	0.400	0.16	7,045.36	7,045.05	7,038.78	7,037.24	Circle - 24.0 in
6.59	0.400	0.16	7,045.05	7,039.21	7,036.94	7,033.25	Circle - 24.0 in
6.58	1.500	0.67	7,035.81	7,018.06	7,029.80	7,016.06	Circle - 24.0 in
3.95	1.320	0.52	7,039.21	7,035.81	7,032.95	7,030.74	Circle - 24.0 in


STRM-1 5-YR
Label: INLET 2
Type: Catch Basin
ID: 384
Label: MH-2
Type: Manhole
ID: 383
Label: MH-3
Type: Manhole
ID: 340
Label: MH-1
Type: Manhole
ID: 371
Label: INLET 1
Type: Catch Basin
ID: 382
Label: POND 1 OUTFALL
Type: Outfall
ID: 360
Label: STRM 1.4
Type: Conduit
ID: 341
Label: STRM 1.3
Type: Conduit
ID: 343
Label: STRM 1.2
Type: Conduit
ID: 373
Label: STRM 1.1
Type: Conduit
ID: 376
Label: EX 24"
Type: Conduit
ID: 375
EGL
HGL
Elevation (ft)
Station (ft)

MODIFICATIONS TO POND 8



STORM 6
INLET DETAILS
SCALE: 1"=20'

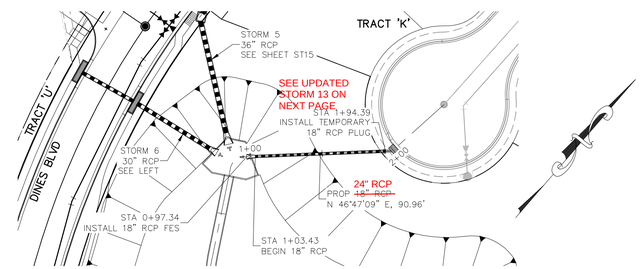


STORM 6

1" = 50'

0 25 50 100

Scale in Feet

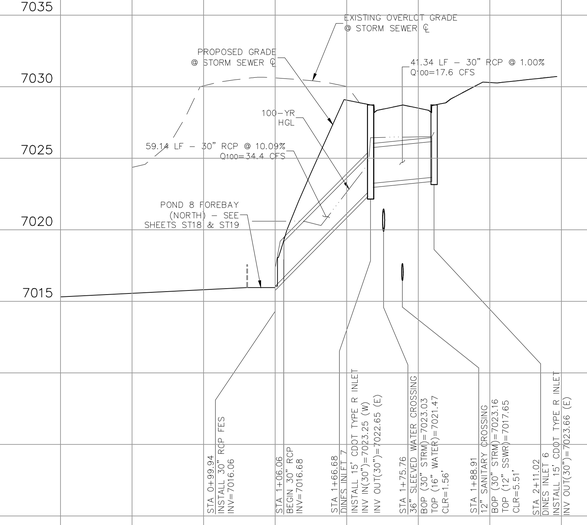


STORM 13 STA 0+97.34 TO 1+94.39

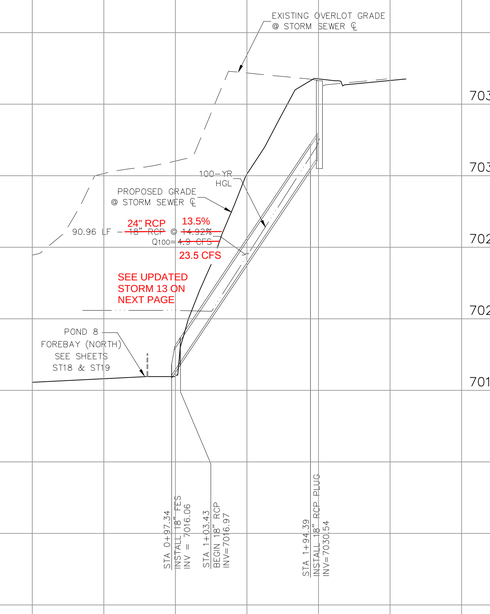
NOTES:
STA 0+99.94 TO STA 1+24.00 (NEXT FULL JOINT) TIE PIPE SEGMENTS TOGETHER W/4-$\frac{3}{4}$" CANOPY TYPE ROD LUG JOINT FASTENERS.

REINFORCED CONCRETE PIPE INSTALLED BETWEEN STA 0+99.94 AND STA 1+66.68 SHALL BE FABRICATED USING A CONCRETE MIX DESIGN THAT RESULTS IN A MIN. 5000 PSI COMPRESSIVE STRENGTH.

NOTE:
STA 1+00.00 TO STA 1+24.00 (NEXT FULL JOINT) TIE PIPE SEGMENTS TOGETHER W/4-$\frac{3}{4}$" CANOPY TYPE ROD LUG JOINT FASTENERS.



STORM 6



STORM 13 STA 0+97.34 TO 1+94.39

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

STERLING RANCH FILING NO. 1
STORM SEWER PLANS

PROJECT NO. 09-002 | FILE: \dwg\Const Dwg\Storm - District\ST16.dwg | DATE: 01/02/2018
DESIGNED BY: ET | DRAWN BY: ELY | CHECKED BY: VAS | SCALE HORIZ: 1"=50' VERT: 1"=5'
SHEET 20 OF 28 | ST16

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER 37160

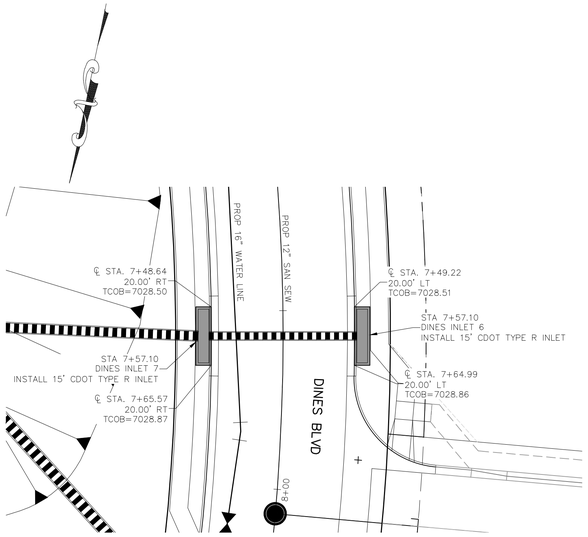
REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D.	BY:	DATE:

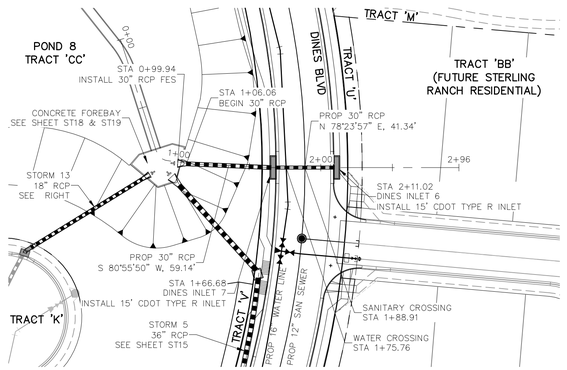
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

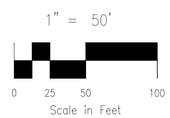
File: O:\09002A\Sterling Ranch District\dwg\Const Dwg\Storm - District\ST16.dwg Plotstamp: 2/7/2017 2:17 PM

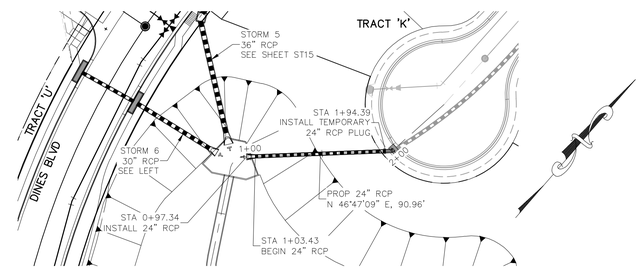


STORM 6
INLET DETAILS
SCALE: 1"=20'



STORM 6





STORM 13 STA 0+97.34 TO 1+94.39

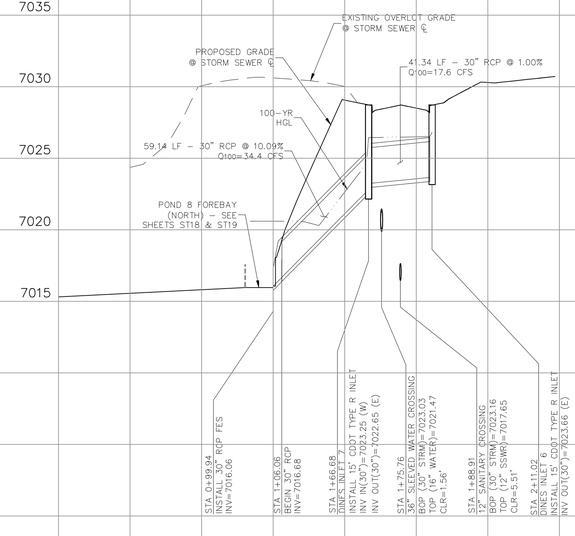
UPDATED STORM 13

UPSIZE PIPE TO
EITHER 24" OR 30"
(SHOWN AS 24")

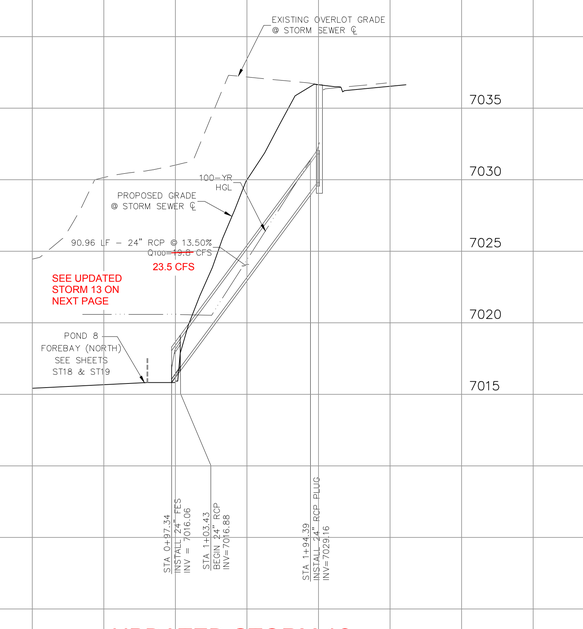
NOTES:
STA 0+99.94 TO STA 1+24.00 (NEXT FULL JOINT) TIE PIPE SEGMENTS TOGETHER W/4-$\frac{3}{4}$" CANOPY TYPE ROD LUG JOINT FASTENERS.

REINFORCED CONCRETE PIPE INSTALLED BETWEEN STA 0+99.94 AND STA 1+66.68 SHALL BE FABRICATED USING A CONCRETE MIX DESIGN THAT RESULTS IN A MIN. 5000 PSI COMPRESSIVE STRENGTH.

NOTE:
STA 1+00.00 TO STA 1+24.00 (NEXT FULL JOINT) TIE PIPE SEGMENTS TOGETHER W/4-$\frac{3}{4}$" CANOPY TYPE ROD LUG JOINT FASTENERS.



STORM 6



UPDATED STORM 13

STORM 13 STA 0+97.34 TO 1+94.39

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

STERLING RANCH FILING NO. 1
STORM SEWER PLANS

PROJECT NO. 09-002	FILE: \dwg\Const Dwg\Storm - District\ST16.dwg		
DESIGNED BY: ET	SCALE	DATE: 01/02/2018	ST16
DRAWN BY: ELY	HORIZ: 1"=50'	SHEET 16 OF 28	
CHECKED BY: VAS	VERT: 1"=5'		

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D.	BY:	DATE:

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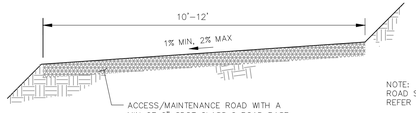
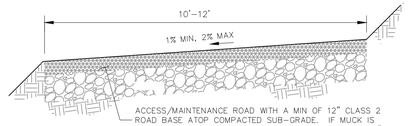
CAUTION



NOTE:
ROAD SLOPE DIRECTION VARIES REFER TO PLAN

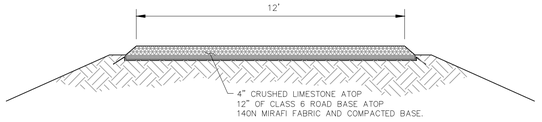
MAINTENANCE & ACCESS ROAD ABOVE EURV TYPICAL SECTION

NOT TO SCALE



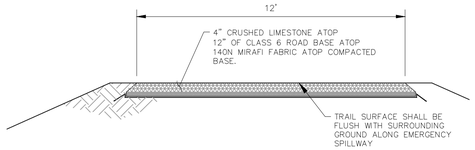
MAINTENANCE & ACCESS ROAD BELOW EURV TYPICAL SECTION

NOT TO SCALE



12' MAINTENANCE & ACCESS ROAD & PEDESTRIAL TRAIL - TYPICAL SECTION

NOT TO SCALE



12' MAINTENANCE & ACCESS ROAD & PEDESTRIAL TRAIL - SPILLWAY SECTION

NOT TO SCALE

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
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NOTE:
REFER TO STERLING RANCH FILING NO.1 GRADING AND EROSION PLAN FOR POND EMBANKMENT AND CHANNEL STABILIZATION ADJACENT TO PROPOSED FACILITY.

1" = 20'
0 10 20 40
Scale in Feet

100 YEAR FLOODPLAIN
SAND CREEK CHANNEL
TERMINATE 12' REGIONAL TRAIL/12' MAINTENANCE ACCESS ROAD
TOP OF BERM =7024.0
12' MAINTENANCE ACCESS ROAD & PEDESTRIAN TRAIL
100 YR FLOODPLAIN
7012.00
30" RCP FES W/TOEWALL
8.5' X 20.5' RIPRAP APRON D50=12" 24" THICK SEE SHEET ST22
7012.0 (FIELD VERIFY)
30" RCP STORM SEE SHT 17
BEGIN EMBANKMENT WITH SOIL KEYWAY SEE SHEET ST22
USE UPDATED SPILLWAY DESIGN AND TRAIL ALIGNMENT SEE SHEET ST20A
MODIFIED TYPE D CDOT WATER QUALITY OUTLET STRUCTURE SEE SHEET ST20
10' MAINTENANCE ACCESS ROAD SEE DETAIL ABOVE
POTENTIAL PLAYGROUND/ SPORTS COURT SITE
12' MAINTENANCE ACCESS ROAD, SEE DETAIL ABOVE
7014.97
USE UPDATED BOX DETAIL
INV=7014.54
END LF CHANNEL INV=7014.54
10' MAINTENANCE ACCESS ROAD
7014.0 (FIELD VERIFY)
EMERGENCY SPILLWAY AND RIPRAP RUNDOWN D50 = 18" SOIL RIPRAP SEE DETAIL SHEET ST21
7023.22
7022.6
7021.15
7020.6
EMERGENCY SPILLWAY CREST SEE SHEET ST21
7016.06
24" RCP ~~18" RCP~~ STORM SEE SHEET ST16
24" RCP ~~18" RCP~~ FES
CONCRETE LINED FOREBAY (NORTH) SEE SHEET ST19
7015.08
7015.20
END LF CHANNEL INV=7015.96
7015.68
7015.57
36" RCP FES
36" RCP STORM SEE SHEET ST15
CONC LOW FLOW TRICKLE CHANNEL SEE SHEET ST19
7015.53
7015.95
END LF CHANNEL INV=7016.03
CONCRETE LINED FOREBAY (SOUTH) SEE SHEET ST22
USE UPDATED BOX DETAIL
INV=7016.06
END EMBANKMENT WITH SOIL KEYWAY
30" RCP FES
30" RCP STORM SEE SHEET ST16
POND WARNING SIGN (TYP) SEE SHEET ST22
36" RCP ~~30" RCP~~ STORM. SEE SHEET ST17
FUTURE TRAIL W/CHANNEL REALIGNMENT (LOCATION TO BE DETERMINED)
BEGIN 12' REGIONAL TRAIL/12' MAINTENANCE ACCESS ROAD
DINES BLVD.

FULL SPECTRUM DETENTION POND 8 SITE PLAN

SCALE 1"=20'

TRAIL NOTES:

1. TRAIL SURFACING SHALL BE CURSHED LIMESTON 3/8" MINUS WITH FINES. CASTLE CONCRETE "COLORADO WHITE FINES" OR EQUIVALENT.
2. TRAIL SURFACING SHALL BE COMPACTED WITH A ROLLER
3. LANDSCAPE FABRIC SHALL BE MIRAFI 140N WITH A RUNNING WITH OF 8" MIN.

POND 8 FULL SPECTRUM DETENTION BASIN DATA
WQ WATER SURFACE EL=7017.20
WQ VOLUME=0.48 AC-FT
EURV WATER SURFACE EL=7018.91
EURV VOLUME=1.58 AC-FT
100-YR WATER SURFACE EL=7020.60
SPILLWAY CREST EL=7020.6
TOP OF EMBANKMENT EL=7024.0
100-YR VOLUME=2.99 AC-FT
100-YR INFLOW=112.8
100-YR RELEASE=41.7 CFS

LEGEND

FUT	EXISTING
FUT	FUTURE
PROP	PROPOSED
	PROP MAJ CONT
	PROP MIN CONT
	EXIST MAJ CONT
	EXIST MIN CONT
	PERM. EROSION CONTROL BLANKET
	RIPRAP
	REGIONAL TRAIL/MAINT. ROAD
	STABILZED MAINTENANCE ROAD ABOVE EURV
	STABILIZED MAINT. ROAD BELOW EURV
	CONC LOW FLOW CHANNEL
	EX. FLOW ARROW
	PROP. FLOW ARROW
	CONSTRUCTION LIMITS
	PROPERTY LINE
	PROP STORM SEWER PIPE
	EASEMENT LINE
	WARNING SIGN

STERLING RANCH FILING NO. 1
FULL SPECTRUM DET. POND 8 SITE PLAN

PROJECT NO. 09-002 | FILE: \dwg\Const Dwg\Storm - District\ST18.dwg | DATE: 01/02/2018 | SHEET 22 OF 28 | ST18

DESIGNED BY: ET | DRAWN BY: ELY | CHECKED BY: VAS | SCALE HORIZ: 1"=20' VERT: N/A

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D. BY:	DATE:

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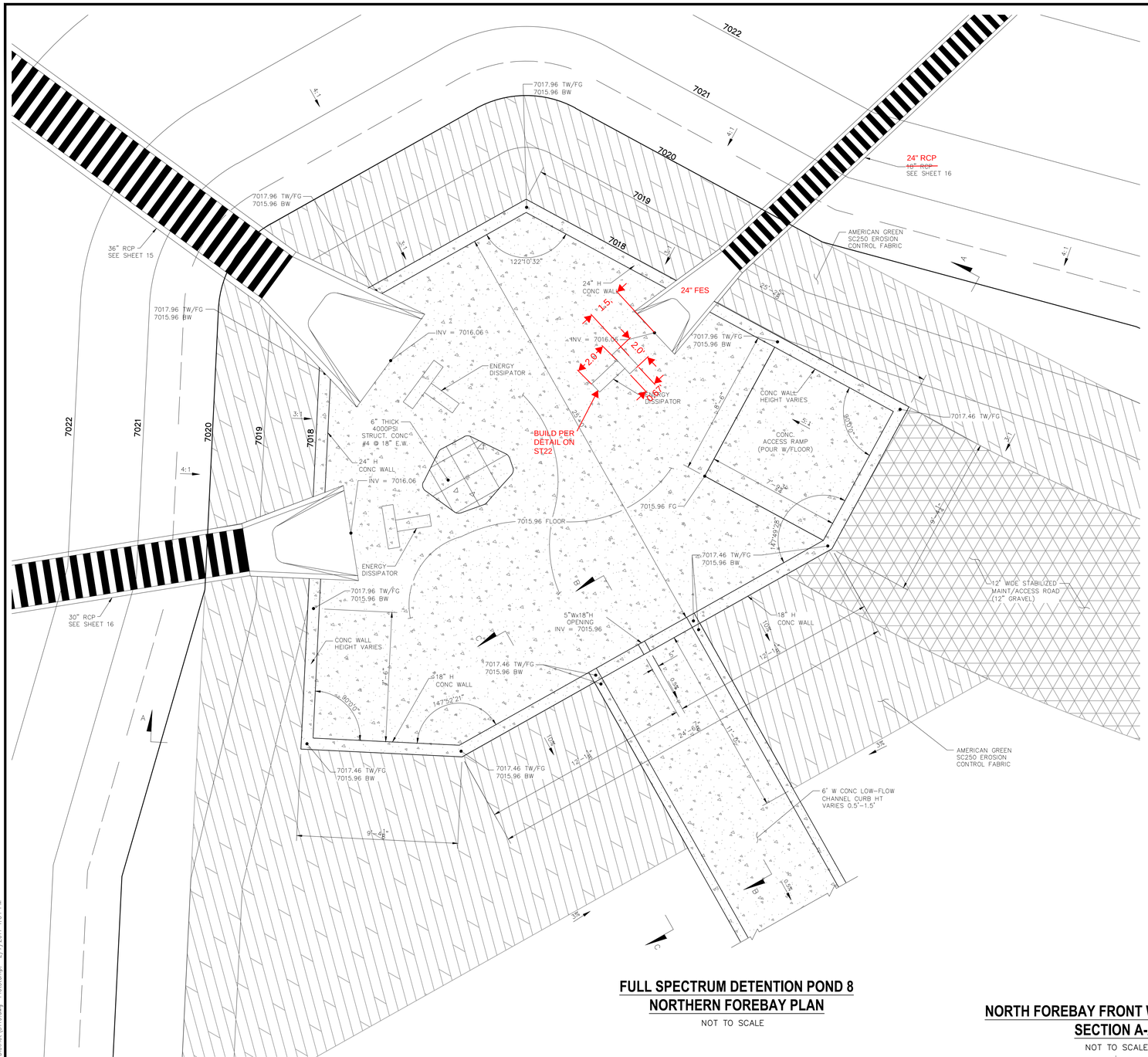
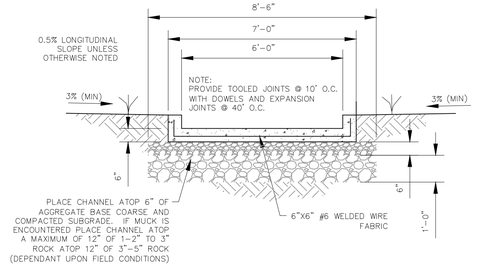
CAUTION

File: Q:\09002A\Sterling Ranch District\dwg\Const Dwg\Storm - District\ST18.dwg Plotstamp: 1/7/2017 1:42 PM



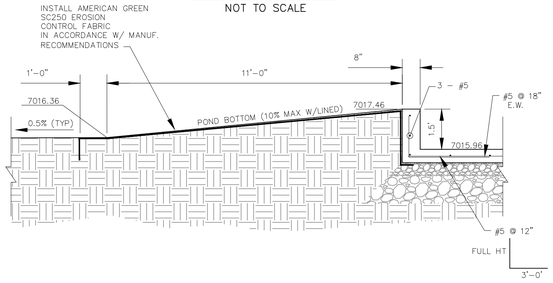
FULL SPECTRUM DETENTION POND 8
NORTHERN FOREBAY PLAN

NOT TO SCALE



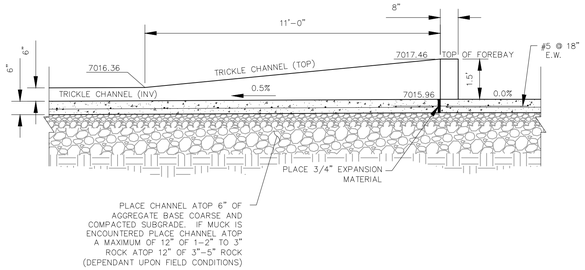
LOW FLOW CHANNEL
TYPICAL SECTION

NOT TO SCALE



SLOPE GRADING BELOW NORTHERN FOREBAY
SECTION C-C

NOT TO SCALE

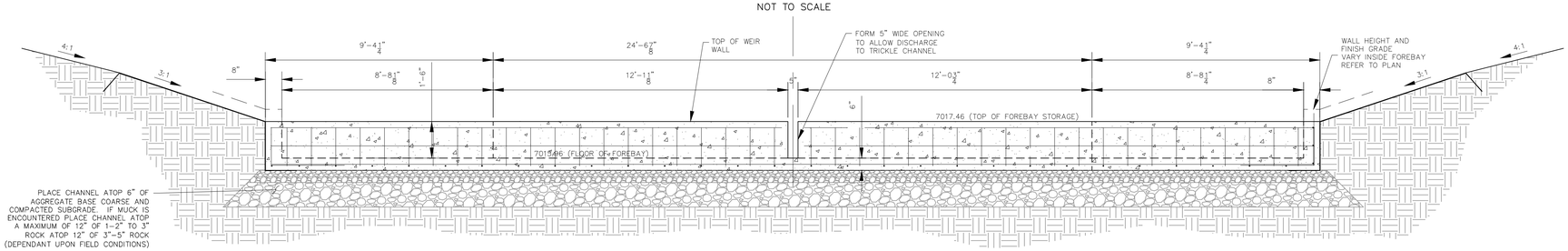


LOW FLOW CHANNEL AT NORTH FOREBAY
SECTION B-B

NOT TO SCALE

NORTH FOREBAY FRONT WALL W/NOTCH
SECTION A-A

NOT TO SCALE



FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

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STERLING RANCH FILING NO. 1
FULL SPECTRUM DET. POND 8 DETAILS

PROJECT NO. 09-002	FILE: \dwg\Const Dwg\Street & Storm Plans\ST19.dwg	DATE: 01/02/2018	SHEET 23 OF 28
DESIGNED BY: ET	SCALE		ST19
DRAWN BY: ELY	HORIZ: 1"=50'		
CHECKED BY: VAS	VERT: 1"=5'		

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.

COLORADO REGISTERED PROFESSIONAL ENGINEER 37160

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D. BY:	DATE:

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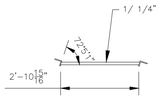
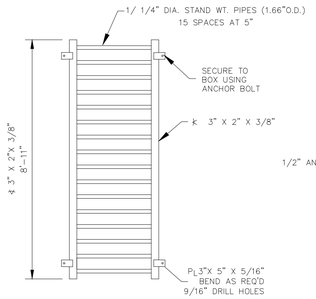
CAUTION

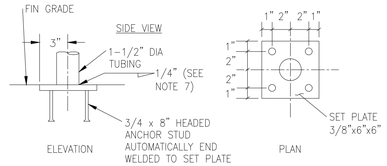
File: O:\09002A\Sterling Ranch District\dwg\Const Dwg\Storm - District\ST19.dwg Photostamp: 2/7/2017 1:34 PM



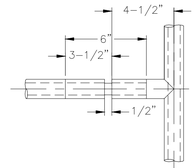
SECTION
NOT TO SCALE



GRATE PLAN
NOT TO SCALE



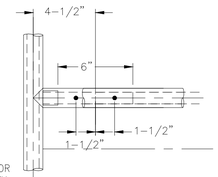
SET PLATE ANCHOR DETAILS
(NTS)



EXPANSION JOINT DETAIL
(NTS)

MECHANICAL TUBING, 1/4" MIN. WALL THICKNESS, 1/16" CHAMFER BOTH ENDS. REAM PIPE FOR SLIP FIT 0.03" MAX. CLEARANCE

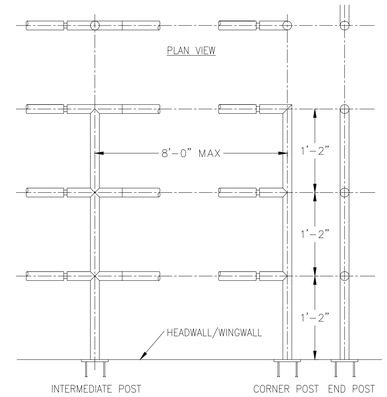
13/32" DRILL AND CSK. PIPE 1/16" DEEP BOTH SIDES. PROVIDE 3/8" DIA SOFT STEEL ROD SUITABLE FOR FIELD RIVETING, GRIND SMOOTH.

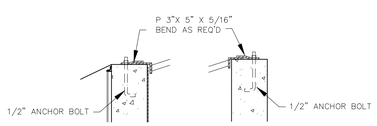


FIXED JOINT DETAIL
(NTS)

1) WELD PLATES MAY BE SUBSTITUTED FOR PIPE EMBEDMENT.
2) CONTRACTOR TO SUBMIT SHOP DRAWINGS TO ENGINEER OF RECORD FOR APPROVAL PRIOR TO FABRICATION.
3) DESIGN CRITERIA SHALL BE IN ACCORDANCE WITH AASHTO STANDARDS.
4) HANDRAIL DESIGN SHALL BE COMPATIBLE WITH THE DESIGN OF THE WINGWALLS AND HEADWALLS.
5) RAILING POSTS SHALL BE SET TO NORMAL TO GRADE. RAILS SHALL RUN PARALLEL TO THE SLOPES OF THEE TOP OF WALLS.
6) ALL RAILS SHALL BE FREE OF ANY SHARP EDGES OR CORNERS.

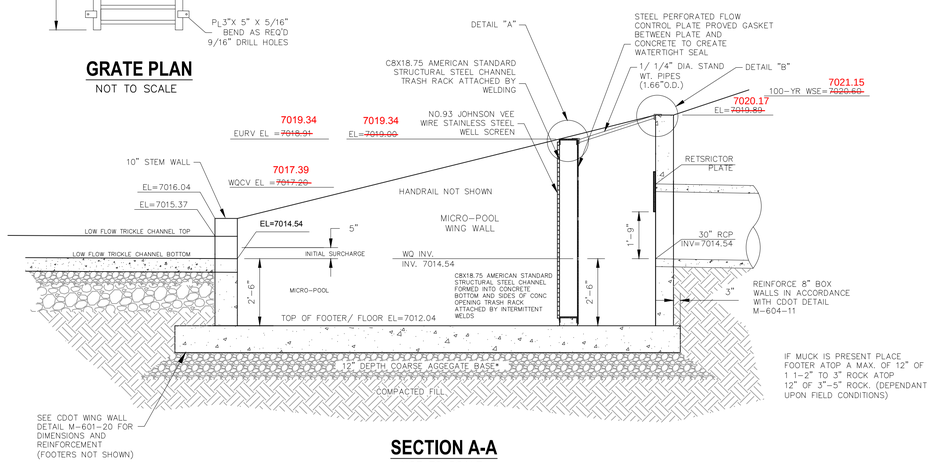
HANDRAIL ASSEMBLY DETAILS
NOT TO SCALE





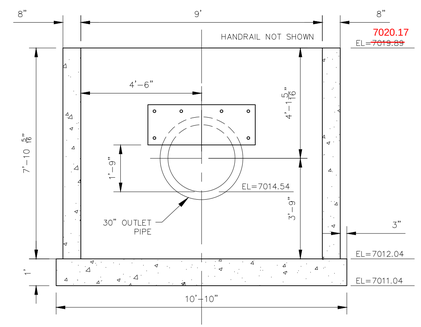
GRATE DETAIL "A"

GRATE DETAIL "B"

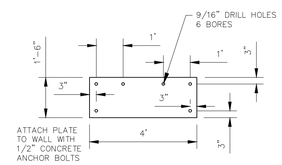


IF MUCK IS PRESENT PLACE FOOTER ATOP A MAX. OF 12" OF 1 1-2" TO 3" ROCK ATOP 12" OF 3"-5" ROCK. (DEPENDANT UPON FIELD CONDITIONS)

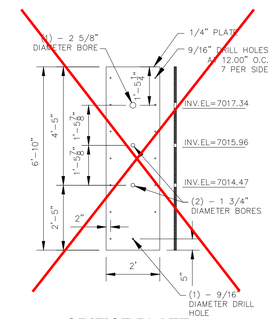
SECTION A-A
NOT TO SCALE



REAR WALL
NOT TO SCALE

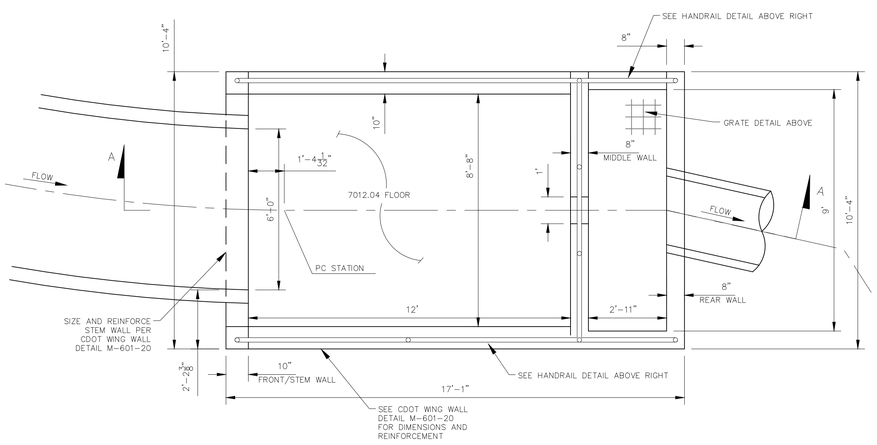


RESTRICTOR PLATE
NOT TO SCALE

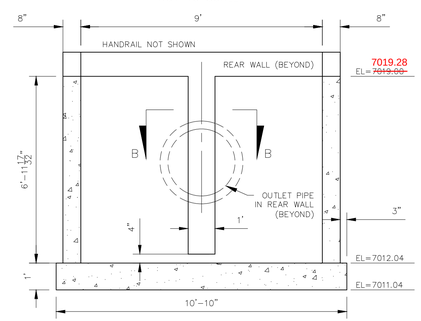


ORIFICE PLATE
NOT TO SCALE

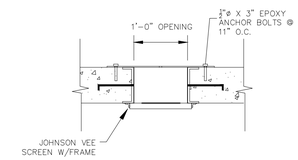
SEE UPDATED ORIFICE PLATE DETAIL ON NEXT PAGE SHEET ST20A



POND 8 WATER QUALITY OUTLET STRUCTURE
NOT TO SCALE



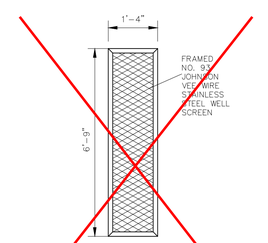
MIDDLE WALL
NOT TO SCALE



SECTION B-B
NOT TO SCALE

NOTE:
ALL GRATES, IMBEDS, AND FASTENERS SHALL BE FABRICATED USING GALVANIZED STEEL, UNLESS OTHERWSE NOTED.

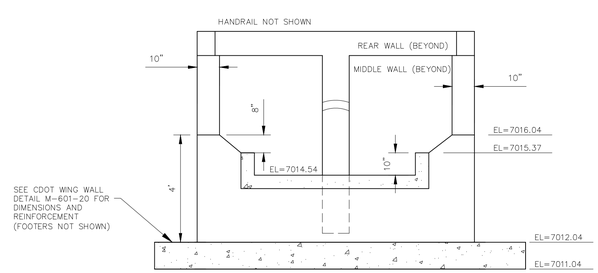
ALL GRATE DIMENSIONS TO BE FIELD VERIFIED PRIOR TO FABRICATION. ALL GRATE MATERIAL SHALL BE GALVANIZED.



TRASH SCREEN DETAIL
NOT TO SCALE

NOTE:
CENTER ORIFICE PLATE AND TRASH SCREEN HORIZONTALLY ACROSS 1'-0" OPENING IN STRUCTURE

SEE UPDATED TRASH SCREEN DETAIL ON NEXT PAGE SHEET ST20A



FRONT/STEM WALL
NOT TO SCALE

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

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STERLING RANCH FILING NO. 1
FULL SPECTRUM DET. POND 8 DETAILS

PROJECT NO. 09-002	FILE: \dwg\Const Dwg\Storm - District\ST20.dwg	DATE: 01/02/2018	ST20
DESIGNED BY: ET	SCALE		SHEET 24 OF 28
DRAWN BY: ELY	HORIZ: N/A		
CHECKED BY: VAS	VERT: N/A		

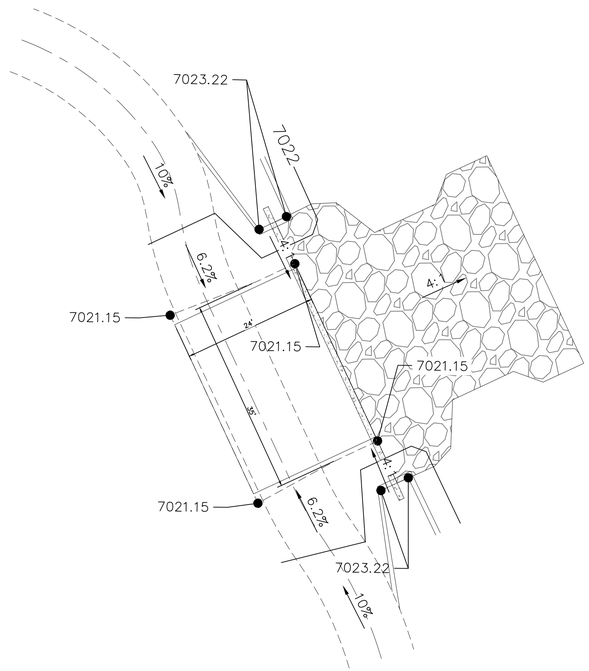
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160
FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.
COLORADO REGISTERED PROFESSIONAL ENGINEER 37160

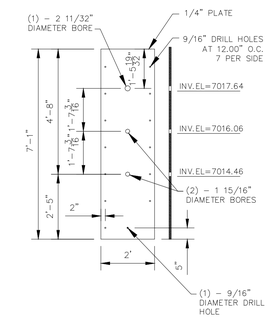
REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APPV'D:	BY:	DATE:

File: O:\09002A\Sterling Ranch District\dwg\Const Dwg\Storm - District\ST20.dwg Plotstamp: 2/7/2017 1:22 PM

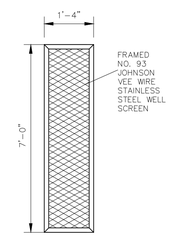


UPDATED SPILLWAY DETAILS



UPDATED ORIFICE PLATE

NOT TO SCALE



UPDATED TRASH SCREEN DETAIL

NOT TO SCALE

NOTE:
CENTER ORIFICE PLATE AND TRASH SCREEN HORIZONTALLY ACROSS 1'–0" OPENING IN STRUCTURE

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

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CALL 1–800–922–1987

STERLING RANCH FILING NO. 1

UPDATED FULL SPEC. DET. POND 8 DETAILS

PROJECT NO. 09-002 | FILE: \dwg\Const Dwg\Storm - District\ST20A.dwg

DESIGNED BY: ET
DRAWN BY: ELY
CHECKED BY: VAS

SCALE
HORIZ: N/A
VERT: N/A

DATE: 01/02/2018

SHEET 20 OF 28

ST20A

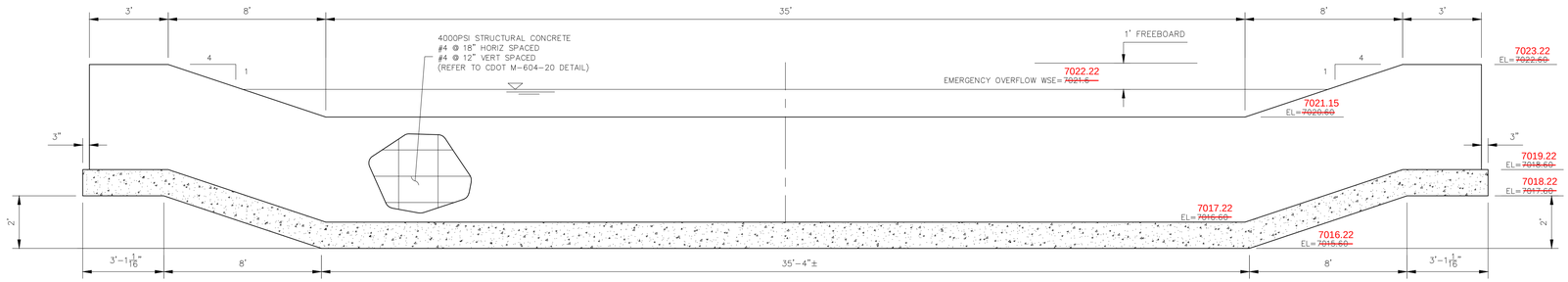
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

FOR AND ON BEHALF OF MVS CIVIL CONSULTANTS, INC.

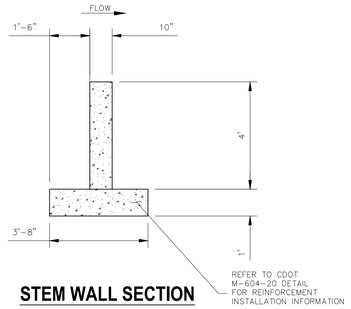
REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D.	BY:	DATE:



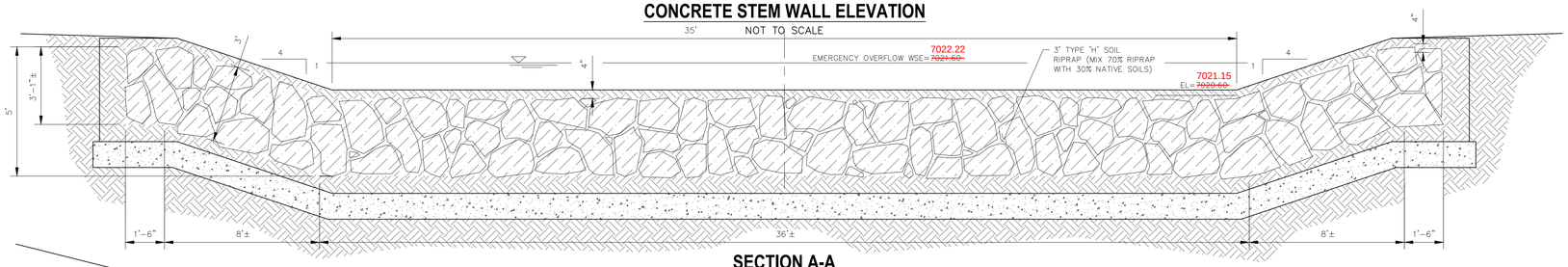
CONCRETE STEM WALL ELEVATION

NOT TO SCALE



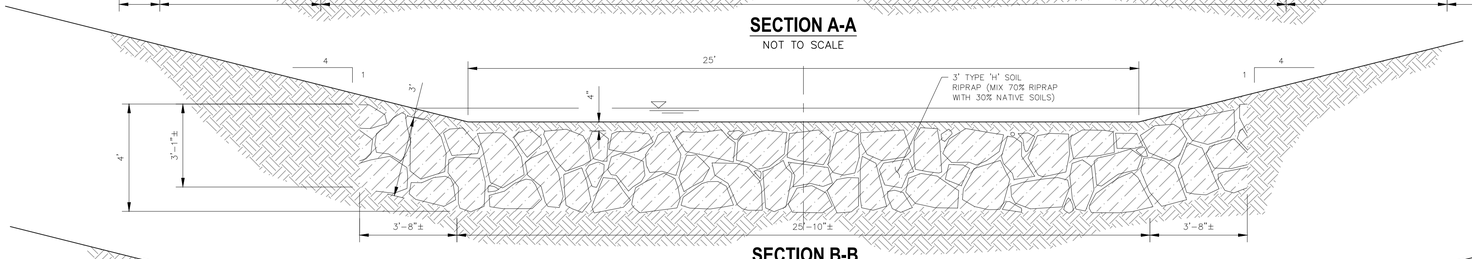
STEM WALL SECTION

NOT TO SCALE



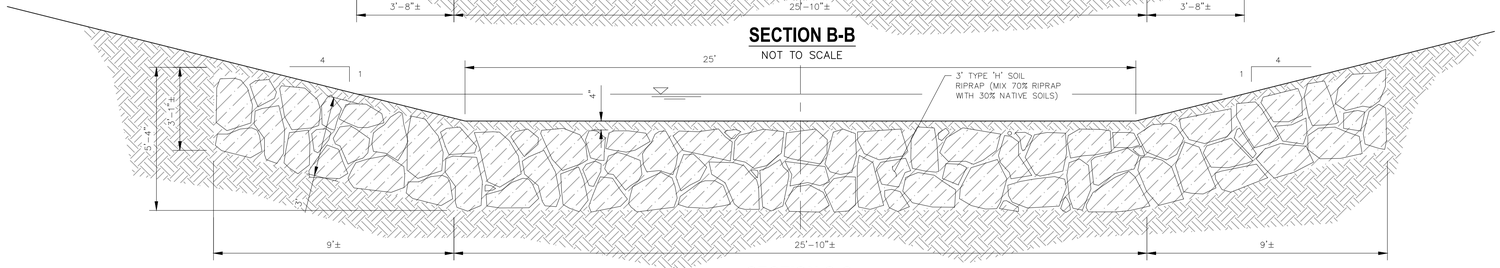
SECTION A-A

NOT TO SCALE



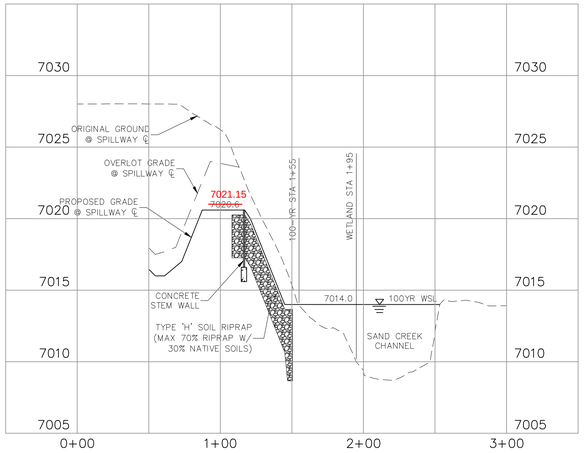
SECTION B-B

NOT TO SCALE



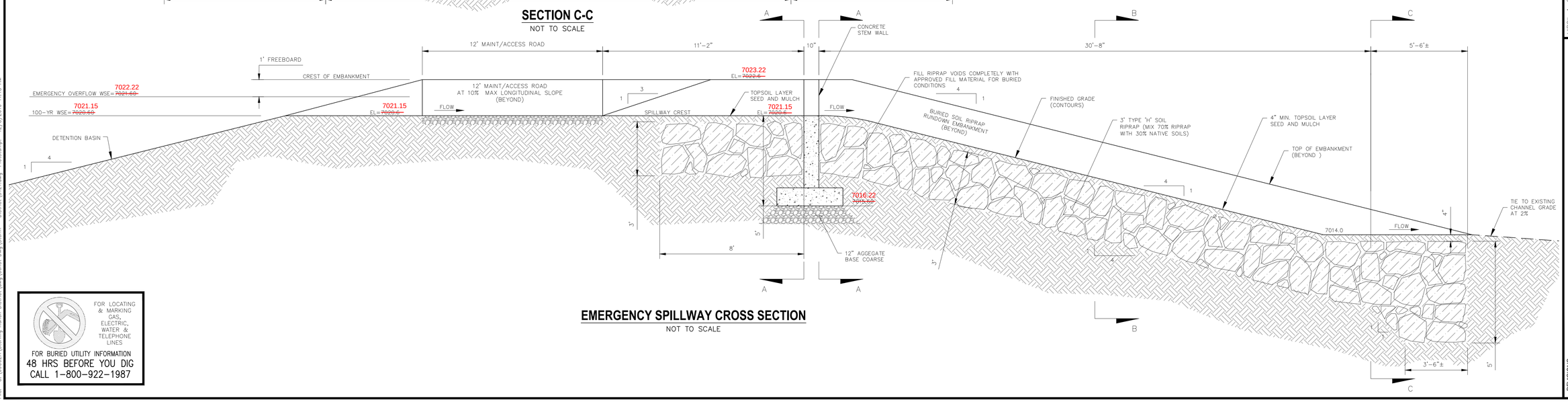
SECTION C-C

NOT TO SCALE



EMERGENCY SPILLWAY PROFILE

HORZ. SCALE: 1"=50'
VERT. SCALE: 1"=5'



EMERGENCY SPILLWAY CROSS SECTION

NOT TO SCALE

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
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File: Q:\09002A\Sterling Ranch District\dwg\Const Dwg\Storm - District\ST21.dwg Plotstamp: 12/5/2016 11:18 AM

STERLING RANCH FILING NO. 1
FULL SPECTRUM DET. POND 8 DETAILS

PROJECT NO. 09-002	FILE: \dwg\Const Dwg\Storm - District\ST21.dwg	DATE: 01/02/2018	SHEET 25 OF 28
DESIGNED BY: ET	SCALE		ST21
DRAWN BY: ELY	HORIZ: AS NOTED		
CHECKED BY: VAS	VERT: AS NOTED		

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

FOR AND ON BEHALF OF MCES CIVIL CONSULTANTS, INC.

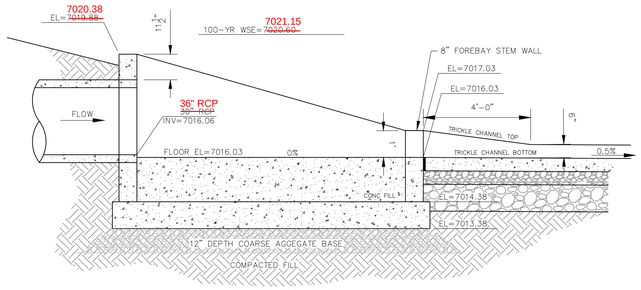
COLORADO REGISTERED 37160 PROFESSIONAL ENGINEER

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D. BY:	DATE:

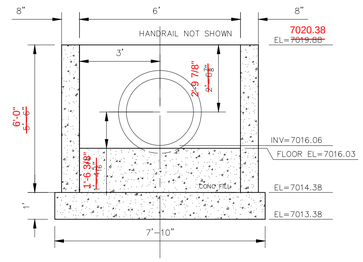
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR LIABILE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

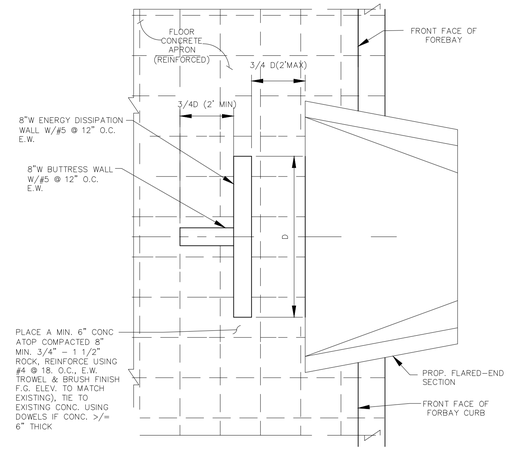


NOTE:
IF MUCK IS PRESENT PLACE FOOTER ATOP A MAX. OF 12" OF 1 1-2" TO 3" ROCK ATOP 12" OF 3"-5" ROCK (DEPENDANT UPON FIELD CONDITIONS)

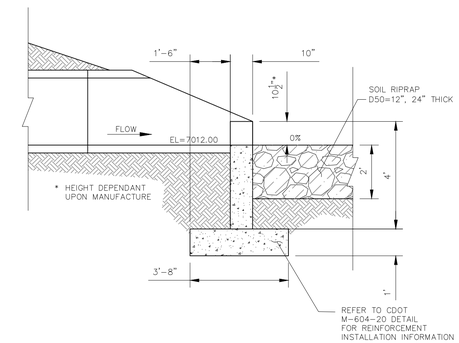
SECTION A-A
NOT TO SCALE



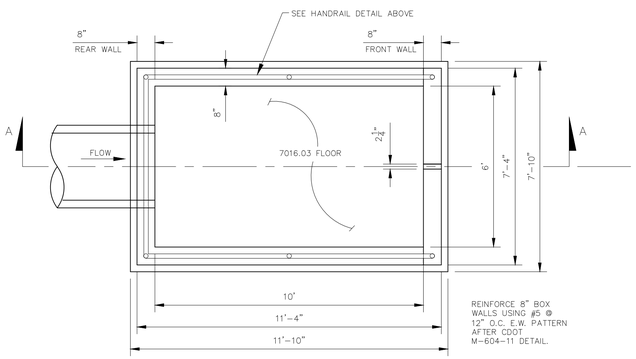
REAR WALL
NOT TO SCALE



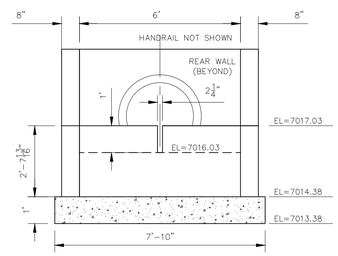
POND 8- ENERGY DISSIPATION WALL TYPICAL PLAN
NOT TO SCALE



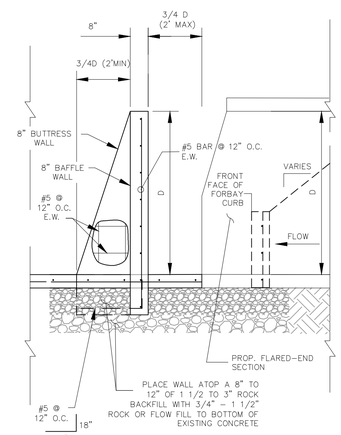
POND 8 - STORM 8 OUTFALL RIPRAP APRON W/HEADWALL SECTION (TYP.)
NOT TO SCALE



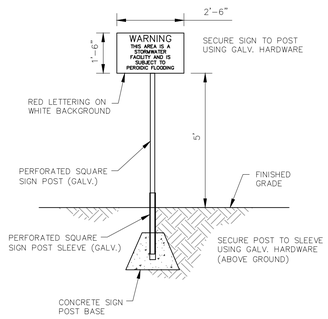
POND 8 - SOUTH FOREBAY PLAN
NOT TO SCALE



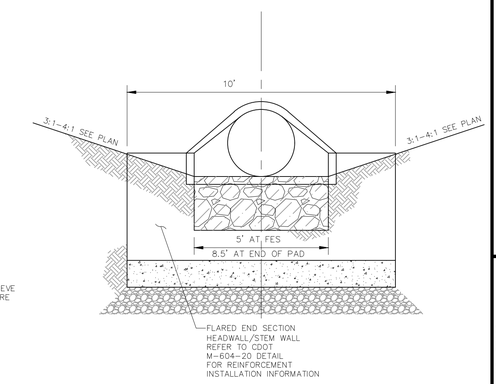
FRONT WALL
NOT TO SCALE



POND 8- ENERGY DISSIPATION WALL TYPICAL SECTION
NOT TO SCALE



POND WARNING SIGN
NOT TO SCALE

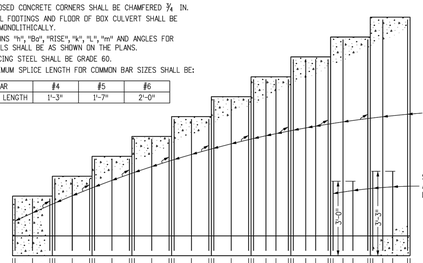


POND 8 - STORM 8 OUTFALL RIPRAP APRON W/HEADWALL ELEVATION (TYP.)
NOT TO SCALE

GENERAL NOTES

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
2. WINGWALL FOOTINGS AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
3. DIMENSIONS "H", "BW", "RISE", "K", "L", "m" AND ANGLES FOR WINGWALLS SHALL BE AS SHOWN ON THE PLANS.
4. REINFORCING STEEL SHALL BE GRADE 60.
5. THE MINIMUM SPLICE LENGTH FOR COMMON BAR SIZES SHALL BE:

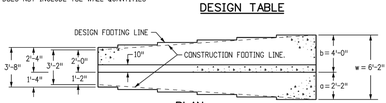
BAR	#4	#5	#6
SPLICE LENGTH	1'-3"	1'-7"	2'-0"



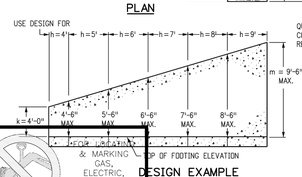
e =	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-4"	1'-3"	11"	9"	7"	CTRS.
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	
a =	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	
b =	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	
c & d BARS	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-4"	#5@1'-3"	#5@1'-1"	#6@9"	#6@7"	CTRS.
*CONC.CU.YD./L.F.	0.161	0.210	0.259	0.308	0.358	0.407	0.457	0.506	0.556	0.604	
REINF. LB./L.F.	8.0	9.3	10.7	12.1	14.3	16.4	23.0	28.6	41.8	54.6	

* DOES NOT INCLUDE TOE WALL QUANTITIES

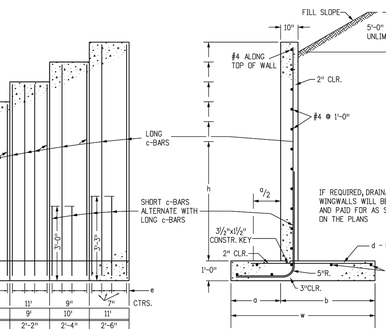
DESIGN TABLE



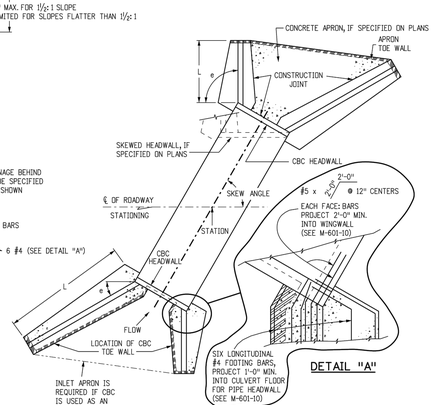
PLAN



DESIGN EXAMPLE

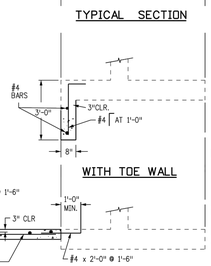


TYPICAL SECTION

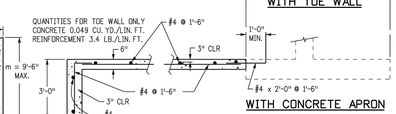


DETAIL "A"

TYPICAL CULVERT LAYOUT



WITH TOE WALL



APRON TOE WALL

WITH CONCRETE APRON
REINFORCEMENT 0.89 LB./SQ. FT.

DESIGN DATA:

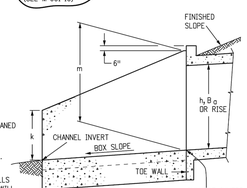
UNIT STRESSES: f_s=24,000 PSI
f_c=1,200 PSI
n = 9

EQUIVALENT FLUID PRESSURE = 36 LBS./CU. FT.
MAXIMUM TOE PRESSURE = 1 TON/SQ. FT.

ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE CONCRETE IS POURED.

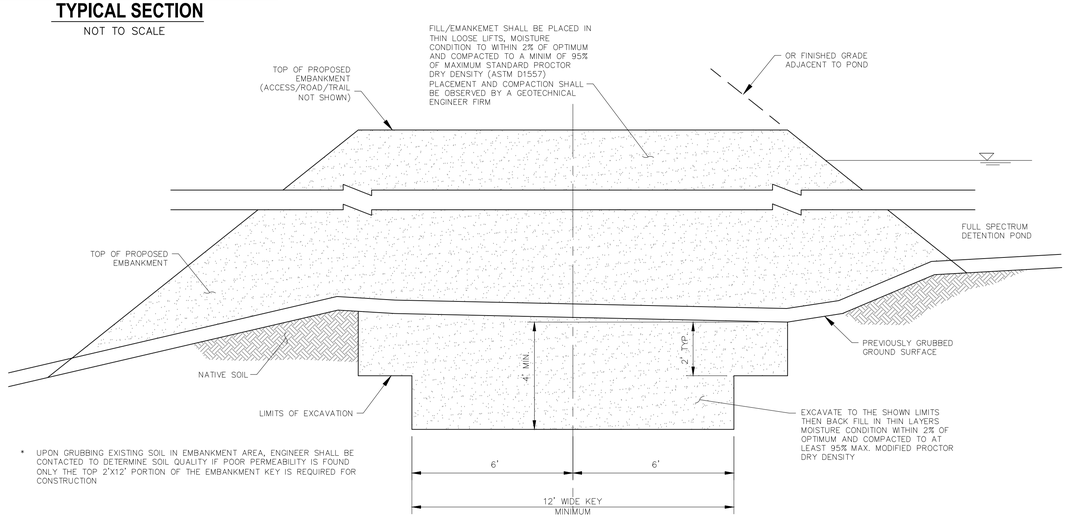
WINGWALL AND APRON CONCRETE SHALL BE:
CONCRETE CLASS B, OR D (BOX CULVERT) FOR CBC's.
CONCRETE CLASS B, OR D (WALL) FOR PIPES.

LIVE LOAD SURCHARGE HAS NOT BEEN CONSIDERED. WALLS WITHIN ⅔ OF THE EDGE OF THE ROADWAY SHOULDER WILL REQUIRE A SPECIAL DESIGN IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES.



BOX ELEVATION
m = h, B, a OR RISE + (1'-4")
UNLESS OTHERWISE SHOWN ON PLANS

OUTLET STRUCTURE WINGWALL REINFORCING DETAILS
CDOT M-601-20
NOT TO SCALE



* UPON GRUBBING EXISTING SOIL IN EMBANKMENT AREA, ENGINEER SHALL BE CONTACTED TO DETERMINE SOIL QUALITY IF POOR PERMEABILITY IS FOUND ONLY THE TOP 2'X12' PORTION OF THE EMBANKMENT KEY IS REQUIRED FOR CONSTRUCTION

TYPICAL EMBANKMENT WITH SOIL KEYWAY
NOT TO SCALE

STERLING RANCH FILING NO. 1
FULL SPECTRUM DET. POND 8 DETAILS

PROJECT NO. 09-002 | FILE: \dwg\Const Dwg\Storm - District\ST22.dwg | DATE: 01/02/2018 | SHEET 26 OF 28 | ST22
DESIGNED BY: ET | DRAWN BY: ELY | CHECKED BY: VAS | SCALE HORIZ: N/A VERT: N/A

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160
FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.
COLORADO REGISTERED PROFESSIONAL ENGINEER 37160

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APRV'D. BY:	DATE:

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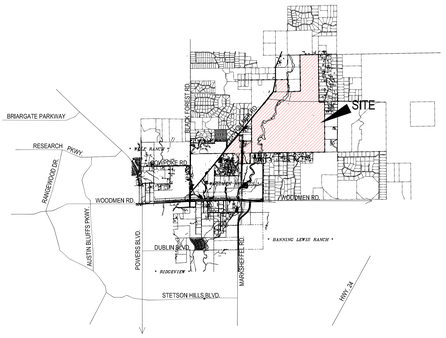
CAUTION

File: Q:\09002A\Sterling Ranch District\dwg\Const Dwg\Storm - District\ST22.dwg Plotstamp: 12/5/2016 11:19 AM

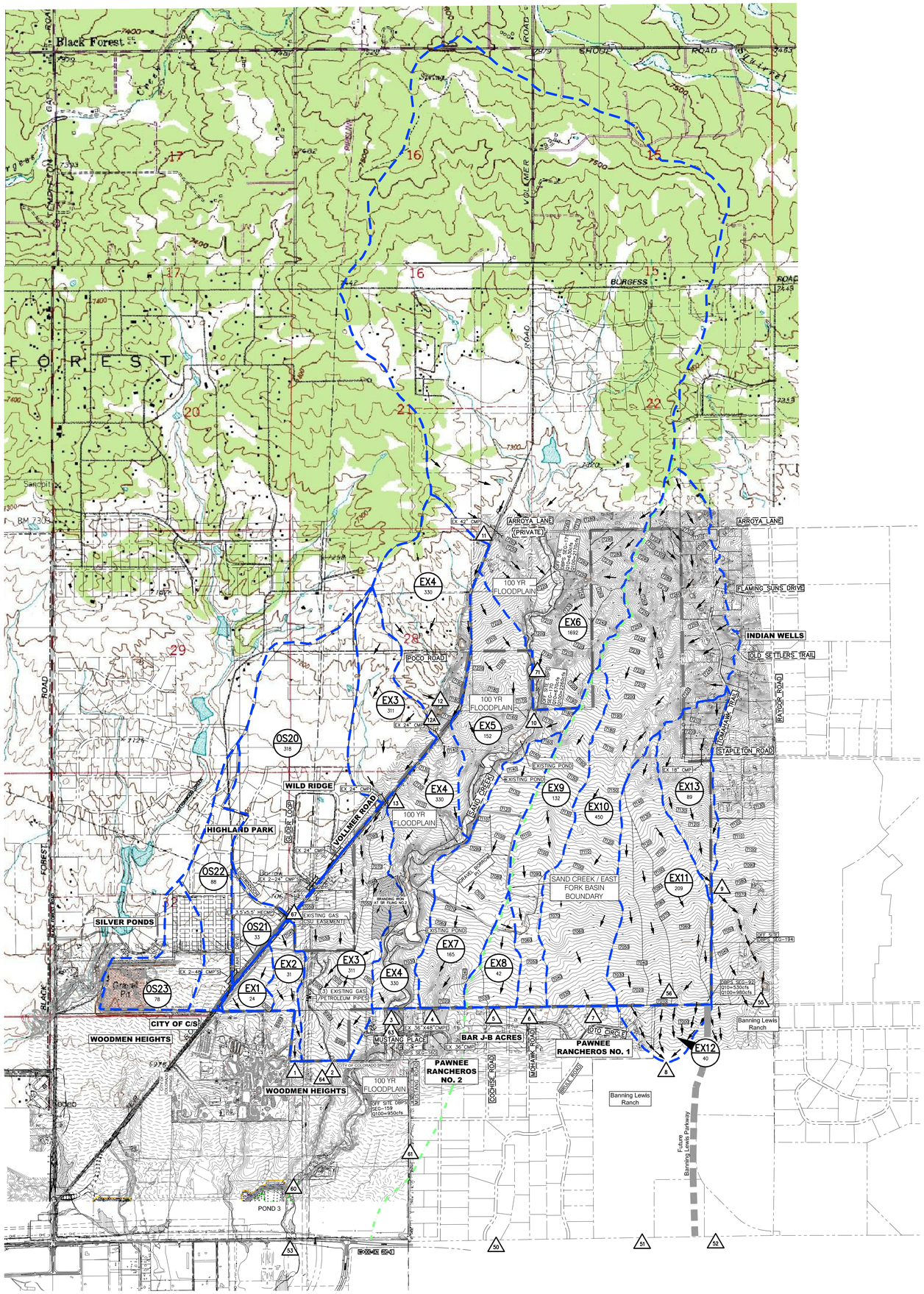
HISTORIC, EXISTING & PROPOSED

DRAINAGE MAP



STERLING RANCH

N.T.S.



HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5 (CFS)	Q_{100} (CFS)
EX-1	24	3	40
EX-2	31	3	45
EX-3	311	49	341
EX-4	330	71	352
EX-5	152	14	209
EX-6	1692	118	2168
EX-7	165	12	197
EX-8	42	4	64
EX-9	132	11	149
EX-10	450	48	474
EX-11	209	17	261
EX-12	40	5	65
EX-13	89	6	114
OS-20	318	61	310
OS-21	33	8	38
OS-22	88	18	91
OS-23	78	34	84

* NOTE: BASIN S OS-22 & OS-23 NOT PART OF THIS REPORT. FLOWS FOLLOW HISTORIC PATTERNS ON THE WEST SIDE OF VOLLMER ROAD.

HISTORIC CONDITION

DESIGN POINTS						
DESIGN POINT	SQ. MI.	Q_5 (CFS)	Q_{100} (CFS)	SQ. MI.	DBPS Q_{100}	DBPS DP /ID
1	0.09	5	84			
2	0.49	55	465	0.74	465	64
3	0.52	139	2610	4.33	2552	63
4	0.26	12	197			
5	0.07	4	64			
6	0.21	11	149			
7	0.70	48	474			
8	0.39	18	305			
9	0.14	6	114			
10	2.64	122	2245	3.27	2245	71
11	0.09	5	83			
12A	0.01	3	16			
12	0.27	10	200			
13	0.17	6	126			
				0.48	#	55
				0.53	1210	56
				5.38	2629	60

* NOTE: SQ. MI. ARE NOT CONSISTANT AT EACH DESIGN POINT DP-DBPS

1" = 1000'

0 250 500 1000 2000

Scale in Feet

LEGEND

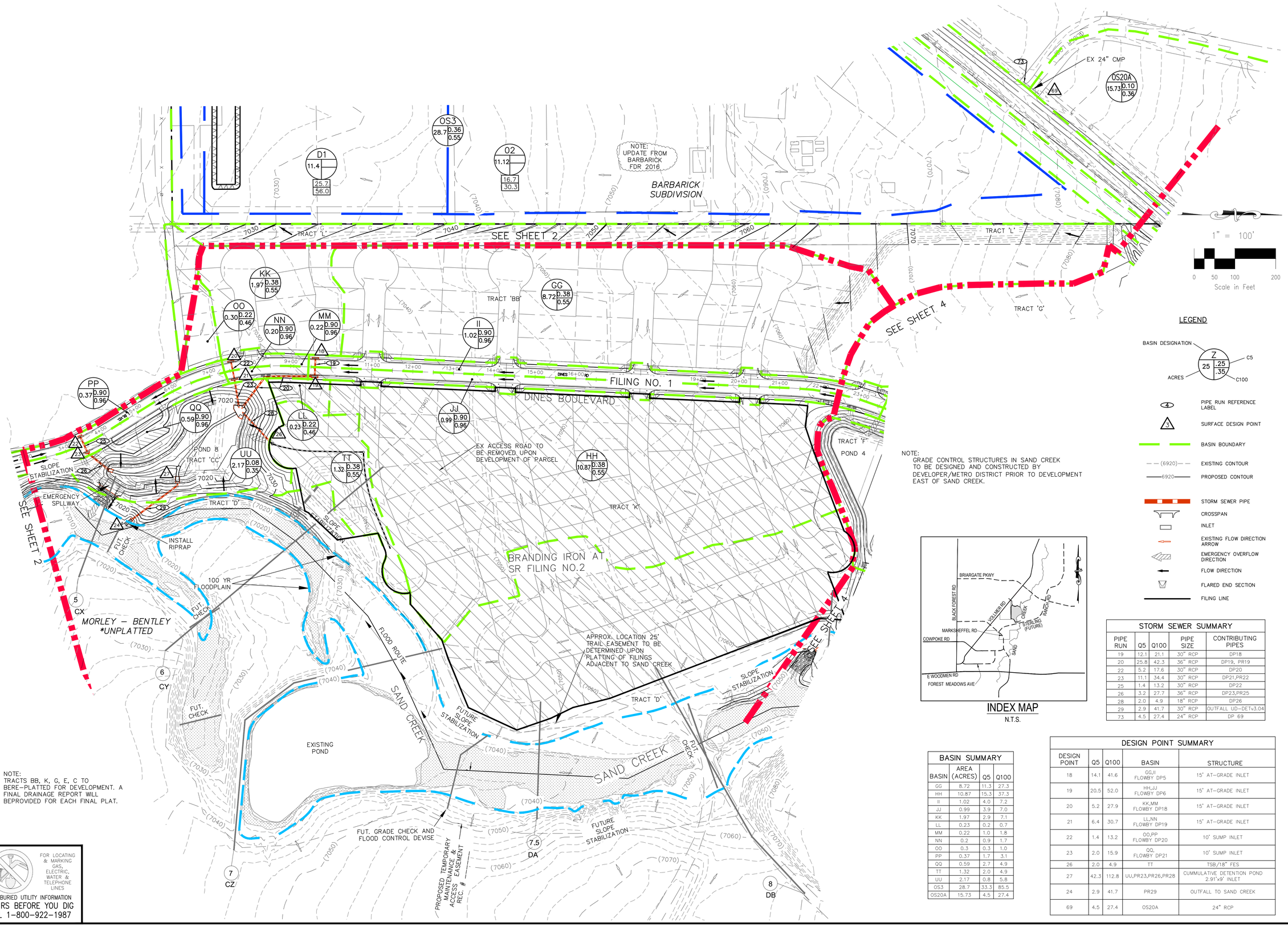
- EX1 / 23.2 — EXISTING MDDP BASIN / ACREAGE
- E1 — EXISTING FLOW RELEASE POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- PROPERTY BOUNDARY
- 6920 — EXISTING CONTOUR
- CULVERT PIPE

M&S CIVIL CONSULTANTS, INC.
15 NORTH NEVADA AVENUE
COLORADO SPRINGS, CO 80903
(719) 955-5485, FAX (719) 471-4812

STERLING RANCH

HISTORIC – DRAINAGE MAP

PROJECT NO. 09-002		FILE: O:\\dwg\Eng Exhibits\MDDP HISTORIC	
DESIGNED BY: VAS	SCALE	DATE: 09/19/16	
DRAWN BY: VAS	HORIZ: 1"=1000'	SHEET 1 OF 1	
CHECKED BY: VAS	VERT: N/A		



NOTE:
GRADE CONTROL STRUCTURES IN SAND CREEK TO BE DESIGNED AND CONSTRUCTED BY DEVELOPER/METRO DISTRICT PRIOR TO DEVELOPMENT EAST OF SAND CREEK.

NOTE:
TRACTS BB, K, G, E, C TO BERE-PLATTED FOR DEVELOPMENT. A FINAL DRAINAGE REPORT WILL BEPROVIDED FOR EACH FINAL PLAT.

LEGEND

- BASIN DESIGNATION — Z; 25; .25 / .35; C5; C100; ACRES
- PIPE RUN REFERENCE LABEL
- SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) EXISTING CONTOUR
- 6920 PROPOSED CONTOUR
- STORM SEWER PIPE
- CROSSPAN
- INLET
- EXISTING FLOW DIRECTION ARROW
- EMERGENCY OVERFLOW DIRECTION
- FLOW DIRECTION
- FLARED END SECTION
- FILING LINE

INDEX MAP
N.T.S.

STORM SEWER SUMMARY

PIPE RUN	Q5	Q100	PIPE SIZE	CONTRIBUTING PIPES
19	12.1	21.1	30" RCP	DP18
20	25.8	42.3	36" RCP	DP19, PR19
22	5.2	17.6	30" RCP	DP20
23	11.1	34.4	30" RCP	DP21,PR22
25	1.4	13.2	30" RCP	DP22
26	3.2	27.7	36" RCP	DP23,PR25
28	2.0	4.9	18" RCP	DP26
29	2.9	41.7	30" RCP	OUTFALL UD-DETv3.04
73	4.5	27.4	24" RCP	DP 69

BASIN SUMMARY

BASIN	AREA (ACRES)	Q5	Q100
GG	8.72	11.3	27.3
HH	10.87	15.3	37.3
II	1.02	4.0	7.2
JJ	0.99	3.9	7.0
KK	1.97	2.9	7.1
LL	0.23	0.2	0.7
MM	0.22	1.0	1.8
NN	0.2	0.9	1.7
OO	0.3	0.3	1.0
PP	0.37	1.7	3.1
QQ	0.59	2.7	4.9
TT	1.32	2.0	4.9
UU	2.17	0.8	5.8
OS3	28.7	33.3	85.5
OS20A	15.73	4.5	27.4

DESIGN POINT SUMMARY

DESIGN POINT	Q5	Q100	BASIN	STRUCTURE
18	14.1	41.6	GG,II FLOWBY DP5	15' AT-GRADE INLET
19	20.5	52.0	HH,JJ FLOWBY DP6	15' AT-GRADE INLET
20	5.2	27.9	KK,MM FLOWBY DP18	15' AT-GRADE INLET
21	6.4	30.7	LL,NN FLOWBY DP19	15' AT-GRADE INLET
22	1.4	13.2	OO,PP FLOWBY DP20	10' SUMP INLET
23	2.0	15.9	QQ, FLOWBY DP21	10' SUMP INLET
26	2.0	4.9	TT	TSB/18" FES
27	42.3	112.8	UU,PR23,PR26,PR28	CUMMULATIVE DETENTION POND 2.91'x9' INLET
24	2.9	41.7	PR29	OUTFALL TO SAND CREEK
69	4.5	27.4	OS20A	24" RCP

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

STERLING RANCH FILING NO.1
PROPOSED FINAL DRAINAGE MAP

PROJECT NO. 09-002
DESIGNED BY: ET
DRAWN BY: BB
CHECKED BY: GT
SCALE: HORIZONTAL: 1"=100' VERTICAL: N/A
DATE: 6/1/2017
SHEET 3 OF 4
SHEET 3

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160
FOR AND ON BEHALF OF MCS CIVIL CONSULTANTS, INC.

REVISIONS: NO. DATE: BY: DESCRIPTION: APPV'D BY: DATE:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

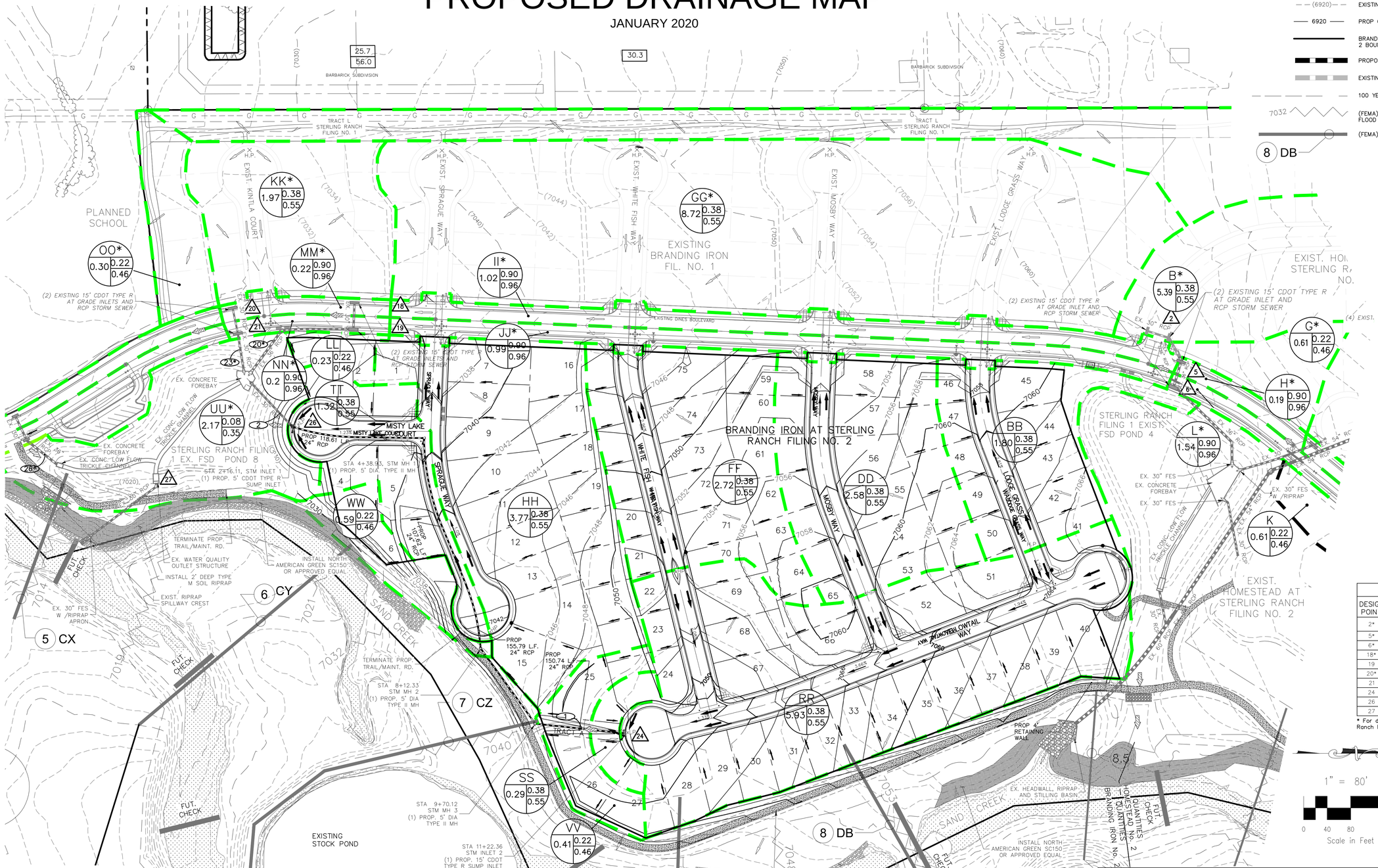
File: O:\09002A\Challenger East\dwg\Eng Exhibits\SR Filing 1-Drainage Map SHEET 3.dwg Plotstamp: 1/24/2020 11:57 AM

BRANDING IRON AT STERLING RANCH FILING NO. 2

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

JANUARY 2020



LEGEND

- FUTURE CHANNEL RIP RAP CHECK DAM
- BASIN BOUNDARY
- (6920) EXISTING CONTOUR
- 6920 PROP CONTOUR
- BRANDING IRON FILING NO. 2 BOUNDARY
- PROPOSED STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- 100 YEAR FLOODPLAIN
- 7032 (FEMA) BASE FLOOD ELEVATION
- (FEMA) CROSS SECTION
- 8 DB
- BASIN DESIGNATION: Z, 25, .25, .35, C5, C100, ACRES
- 4 PIPE RUN REFERENCE LABEL
- 6 SURFACE DESIGN POINT
- CROSSPAN
- INLET
- EXISTING FLOW DIRECTION ARROW
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- FLARED END SECTION
- HIGH POINT
- LOW POINT
- EXISTING WETLANDS

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
ONSITE BASINS			
BB	1.80	2.6	6.4
DD	2.58	3.7	9.0
FF	2.72	3.9	9.6
HH	3.77	5.3	12.9
LL	0.23	0.2	0.7
RR	5.93	7.9	19.2
SS	0.29	0.1	0.9
TT	1.32	2.0	4.9
VV	0.41	0.4	1.3
WW	0.59	0.5	1.8
OFFSITE BASINS			
B*	5.39	8.0	19.3
G*	0.61	0.5	1.9
H*	0.19	0.9	1.6
K*	0.61	0.5	1.9
L*	1.54	5.6	10.0
GG*	8.72	11.3	27.3
II*	1.02	4.0	7.2
JJ*	0.99	3.9	7.0
KK*	1.97	2.9	7.1
MM*	0.22	1.0	1.8
NN*	0.20	0.9	1.7
OO*	0.30	0.3	1.0
PP*	0.37	1.7	3.1
UU*	2.17	0.8	5.8

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
2*	8.0	19.3	B*	(2) EX. 15' AT-GRADE INLETS
5*	4.2	19.7	G*, H*, FLOWBY DP4*	EX. 15' AT-GRADE INLET
6*	14.1	26.7	I*, J*, K*,L*	EX. 15' AT-GRADE INLET
18*	14.1	41.6	GG*, II*, FLOWBY DP5*	EX. 15' AT-GRADE INLET
19	20.5	52.0	BB,DD,FF,HH,JJ*, FLOWBY DP6*	EX. 15' AT-GRADE INLET
20*	5.2	27.9	KK*,MM*,FLOWBY DP18*	EX. 15' AT-GRADE INLET
21	6.4	30.7	LL,NN*, FLOWBY DP19*	EX. 15' AT-GRADE INLET
24	8.0	19.8	RR,SS	PROP. 15' SUMP INLET
26	2.0	4.9	TT	PROP. 5' SUMP INLET
27	50.0	132.0	UU*, PR2, PR20*, PR23*, PR26*	CUMULATIVE DET. POND 8

* For detailed information on Desing Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
1	8.0	19.8	24" RCP	DP24
2	9.5	23.5	24" RCP	DP26, PR1
20*	25.8	42.3	36" RCP	SEE MDDP*
23*	11.1	34.4	30" RCP	SEE MDDP*
26*	3.2	27.7	36" RCP	SEE MDDP*

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

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M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

BRANDING IRON AT SR FIL. NO. 2

PROPOSED DRAINAGE MAP

PROJECT NO. 09-012

DESIGNED BY: CMN
DRAWN BY: CMN
CHECKED BY: VAS

SCALE: HORIZONTAL: 1"=80' VERTICAL: N/A

DATE: 01/27/2020

SHEET 1 OF 1

PDM