

**FINAL DRAINAGE REPORT FOR
HOMESTEAD AT STERLING RANCH FILING
NO. 1 & AMENDMENT TO MASTER
DEVELOPMENT DRAINAGE REPORT
STERLING RANCH FILING NO. 1 & 2

EL PASO COUNTY, COLORADO**

November 2017

Prepared for:

**SR Land, LLC
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Colorado Springs, CO 80903**

Prepared by:



CIVIL CONSULTANTS, INC.

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Project #09-005
DSD Project # **SF-17-025**

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HOMESTEAD AT STERLING RANCH FILING NO. 1 &
AMENDMENT TO MASTER DEVELOPMENT DRAINAGE REPORT FOR
STERLING RANCH FILING NO. 1 & 2**

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was 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 master plan of the drainage basin.

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 F Morley

TITLE: _____

DATE: _____

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

**FINAL DRAINAGE REPORT FOR
HOMESTEAD AT STERLING RANCH FILING NO. 1 & AMENDMENT
TO MASTER DEVELOPMENT DRAINAGE REPORT
FOR STERLING RANCH FILING NO. 1 & 2**

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PURPOSE

This document is the Final Drainage Report for Homestead at Sterling Ranch Filing No. 1 & Amendment to Master Development Drainage Report for Sterling Ranch Filing No. 1 & 2. This site was previously discussed, in the “Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1” (henceforth referred to as MDDPSR) prepared by M&S 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. In addition to the drainage analysis presented for Homestead at Sterling Ranch Filing No. 1, this report also evaluates an alternative for the collection and treatment of offsite flows reaching the western boundary of this filing.

GENERAL LOCATION AND DESCRIPTION

Homestead at Sterling Ranch Filing No. 1 is located in the NE ¼ of the NW ¼ of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian, and the SE ¼ of the NW 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 by Dines Boulevard and platted Tract C (within the Sterling Ranch development). The property is bound to the east by Dines Boulevard and to the west by existing Vollmer Road. On the south the property is bound by Barbarick Subdivision and Tract BB (within the Sterling Ranch development). Sterling Ranch lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

Homestead at Sterling Ranch Filing No. 1 consists of 19.574 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to south at grade rates that vary between 2% and 4%.

Homestead at Sterling Ranch Filing No. 1 is currently zoned “RS-5000 for single family development. Improvements proposed for the site include paved streets, trails, utilities, and storm drainage improvements, as normally constructed for a residential development. As an alternative to the offsite pond W-2 an offsite Full Spectrum Sand Filter Pond is proposed to be constructed to provide water quality treatment for the off-site improvements to Vollmer Road. Onsite water quality is provided by the existing Pond 4 constructed with Sterling Ranch Filing No.1 (see MDDHSR).

**Revise to state that Filing 1 is
constructing pond W-9.**

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 are included 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. 08041C0535 F, effective date March 17, 1997 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.

EXISTING DRAINAGE CONDITIONS

Homestead at Sterling Ranch Filing No. 1 site consists of 19.574 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. Homestead at Sterling Ranch Filing No. 1 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 MDDPSR and Sterling Ranch Early Onsite Grading Plan 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 Homestead at Sterling Ranch Filing No. 1 and the Amendment to Master Development Drainage Report for Sterling Ranch Filing No. 1 & 2. The development of Homestead at Sterling Ranch Filing No. 1 consists only of the two cul-de-sacs, an eyebrow, roadways, and lots located within the filing boundary. The proposed development drainage patterns and flow values

Address overall Sterling Ranch
MDDP (provide) and add reference.

report was revised to discuss MDDP and provide a reference. Any text regarding the amendment or alternative was removed as the MDDPSR was updated.

are generally the same as those recommended within the MDDPSR. The following design points and basin results were determined using the Rational Method. 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. Surface flow is designated as Design Points (DP) and flow within the storm sewer as (Pipe Run (PR)).

Detailed Drainage Discussion (Design Points)

DP1, 2.79 acres, consists of Basin A 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 $Q_5=3.6$ cfs and $Q_{100}=8.7$ cfs has been calculated for DP1. The surface runoff is routed via overlot grading and curb and gutter to a proposed 15' CDOT type R at-grade inlet. The intercepted flow (PR1, $Q_5=3.6$ cfs and $Q_{100}=8.6$ cfs) will be routed via a 30" RCP under Wheatland Drive to DP2. There is flowby of 0.1 cfs in the 100 year event which is negligible and will not adversely affect the downstream infrastructure.

DP2, 2.70 acres, consists of Basin B 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 $Q_5=3.6$ cfs and $Q_{100}=8.6$ cfs has been calculated for DP2. The surface runoff is routed via overlot grading and curb and gutter to a proposed 15' CDOT type R at-grade inlet. The intercepted flow ($Q_5=3.6$ cfs and $Q_{100}=8.5$ cfs) will combine with flows from PR1 be routed via a 36" RCP to an existing stub. The cumulative flows in PR2 ($Q_5=7.1$ cfs and $Q_{100}=17.2$ cfs) are less than the flows documented in the MDDPSR report ($Q_5=8.0$ cfs and $Q_{100}=19.3$ cfs). There is flowby of 0.1 cfs in the 100 year event which is negligible and will not adversely affect the downstream infrastructure.

DP3, 2.92 acres, consists of Basin C 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 $Q_5=4.2$ cfs and $Q_{100}=10.1$ cfs has been calculated for DP3. The surface runoff is routed via overlot grading and curb and gutter to a proposed 10' CDOT type R sump inlet. The intercepted flow (PR3, $Q_5=4.2$ cfs and $Q_{100}=10.1$ cfs) will be routed via an 18" RCP to an existing stub. The flows in PR3 are equivalent to the flows documented in the MDDPSR report ($Q_5=4.2$ cfs and $Q_{100}=10.1$ cfs). The flows will not adversely affect the downstream infrastructure.

DP4, 9.36 acres, consists of Basin D (2.9 ac) and Basin E (5.34 ac) proposed residential lots and Basin F (1.12 ac) streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year and Basin F (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of $Q_5=16.1$ cfs and $Q_{100}=36.7$ cfs has been calculated for DP4. The surface runoff is routed via overlot grading and curb and gutter to DP4 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow ($Q_5=13.3$ cfs and $Q_{100}=20.0$ cfs) will combine with flows from PR3 and be routed east via an existing 30" RCP to existing Detention Pond 4. The flows in DP4 are equivalent to the flows documented in the MDDPSR report ($Q_5=16.1$ cfs and $Q_{100}=36.7$ cfs). Flowby from DP4 will be routed to DP5. The flows will not adversely affect the downstream infrastructure.

DP5, consists of Basin G (0.61 ac) proposed backyards of residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin H (0.19 ac, Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP4. Developed runoff of $Q_5=4.2$ and $Q_{100}=19.7$ cfs has been calculated for DP5. The surface runoff is routed via overlot grading and curb and gutter to DP5 which will be collected by an existing 15' CDOT type R at-grade inlet. DP5 has an intercepted flow of ($Q_5=4.2$ cfs and $Q_{100}=14.7$ cfs). The flows in DP5 are equivalent to the flows documented in the MDDPSR report ($Q_5=4.2$ cfs and $Q_{100}=19.7$ cfs). Flowby from DP4 will be routed to DP5. The flows will not adversely affect the downstream infrastructure.

DP6, 4.68 acres, consists of Basin OS3 (0.43 ac) and Basin OS4 backyards of residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin OS2 (2.1 ac, Wheatland Drive) and

revise

DP5

verify

Design Point and Basin references have been corrected
Missing Basin ID was added to Plan (Map) as necessary

not on plan?

Discussion regarding condition has been added.

Address WQCV (maintenance of vegetated buffer/ swale if deviation is requested?)

Basin OS5 (1.54 ac, Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of $Q_5=14.1$ cfs and $Q_{100}=26.7$ cfs has been calculated for DP6. The surface runoff is routed via overlot grading and curb and gutter to DP6 which will be collected by an existing 15' CDOT type R at-grade inlet. The basins and flows shown for the east half of Dines Boulevard are only for reference. The proposed develop shall not adversely affect the downstream infrastructure.

Basin N 2.08 acres, consists of proposed residential backyard lots and part of Tract L located along the south boundary of Homestead at Sterling Ranch Filing No. 1 with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of, $Q_5=1.6$ cfs and $Q_{100}=5.7$ cfs have been calculated for the Basin. Runoff from the proposed residential backyard lots sheet flows to the Barbarick Subdivision development south as discussed in the MDDPSR. Basin N was part of a larger Basin YY. Coefficients and flows were calculated in a similar fashion as the MDDPSR, hence flows are equivalent to the flows calculated in the MDDPSR. The proposed develop shall not adversely affect the downstream infrastructure.

Basin O 0.57 acres, consists of planned residential backyard lots located along the south boundary of Homestead at Sterling Ranch Filing No. 1 with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of, $Q_5=0.5$ cfs and $Q_{100}=1.8$ cfs have been calculated for the Basin. Runoff from the proposed residential backyard lots sheet flows to the Branding Iron at Sterling Ranch Filing No. 1 south as discussed in the MDDPSR. Basin O was part of a larger Basin GG. Coefficients and flows were calculated in a similar fashion as the MDDPSR, hence flows are equivalent to the flows calculated in the MDDPSR. The proposed develop shall not adversely affect the downstream infrastructure.

Detailed Drainage Discussion (Amendment to MDDPSR)

As discussed this report also functions to provide an alternative recommendation for the collection and treatment of runoff from offsite watersheds located to the north and west of the subject site as well as those flows generated by the improved portions of Vollmer rights of ways as compared to the design presented within the MDDPSR.

The design initially presented in the MDDPSR recommends the construction of a large permanent erosion control fabric lined drainage channel along the west side of the improved Vollmer Road as well as a small drainage collection systems to convey the runoff from the improved roadway sections to the channel and to a large proposed Extended Detention Basin (EDB) full spectrum detention pond (FSD) known as Pond W2 (also located along the west side of Vollmer Road). A large 48-54" RCP storm sewer conveyance main was planned to direct the discharge from the proposed pond, across the Homestead at Sterling Ranch residential development (and other future SR tracts) to the east across to existing Sand Creek Channel. However, in order to construct these aforementioned improvements both temporary construction and permanent public improvement and drainage easements are required from multiple property owners along the Vollmer Roadway corridor.

The purpose of the alternative design presented by this report was to determine if a system could be constructed within the existing rights of way and within the Sterling Ranch properties which would not require the need for offsite easements and/or property acquisition. The following paragraphs outline this system. It should be noted that at the time of the writing of this report it is unclear which alternative is to be constructed but in either case the offsite runoff and runoff from planned improvements can be collected in a manner that protects the public and is in accordance with the design guidelines and recommendations presented within the various drainage criteria manuals.

Basin M 1.15 acres, consists of planned residential backyard lots located along the west boundary of Homestead at Sterling Ranch Filing No. 1 with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of, $Q_5=1.0$ cfs and $Q_{100}=3.6$ cfs have been calculated for the Basin. Runoff from the proposed residential backyard lots sheet flows to the Basin M2 (Sand Filter Pond W-9, Full

Spectrum Detention (FSD)). Basin M is comprised of Basin M and Basin T as discussed in the MDDPSR. Basin M will be treated for water quality when previously it was collected by the 48" RCP and released untreated to Sand Creek. Coefficients and flows were calculated in a similar fashion as the MDDPSR, hence flows are equivalent to the flows calculated in the MDDPSR. The proposed develop shall not adversely affect the downstream infrastructure.

Basin RP-2B 2.04 acres, consists of paved Vollmer Road (east half) and landscape area with runoff coefficients of 0.63 for the 5-year and 0.76 for the 100-year. Developed runoff of Q5=4.9 cfs and Q100=9.9 cfs has been calculated for this basin. In the interim the surface runoff is routed via curb and gutter to a proposed type 5 embankment protector and outfall to Basin M2 (FSD Pond W-9). In the future, upon full build out of Vollmer Road, the surface runoff will combine with Basin RP-2C and be routed via curb and gutter to a proposed type 5 embankment protector and outfall to Basin M2 (FSD Pond W-9). Coefficients and flows were calculated using the full build out of Vollmer Road. This alternative will consist of build out of the east half of Vollmer Road which will tie into existing Vollmer Road. The proposed develop shall not adversely affect the downstream infrastructure.

Basin RP-2C 1.28 acres, consists of paved Vollmer Road and landscape area with runoff coefficients of 0.74 for the 5-year and 0.84 for the 100-year. Developed runoff of Q5=4.3 cfs and Q100=8.2 cfs has been calculated for this basin. In the interim the surface runoff will sheet flow and outfall to Basin M2 (FSD Pond W-9). In the future, upon full build out of Vollmer Road, the surface runoff will combine with Basin RP-2B and be routed via curb and gutter to a proposed type 5 embankment protector and outfall to Basin M2 (FSD Pond W-9). Coefficients and flows were calculated using the full build of Vollmer Road. This alternative will consist of build out of the east half of Vollmer Road which will tie into existing Vollmer Road. The proposed develop shall not adversely affect the downstream infrastructure.

Basin M2 1.60 acres, consists of FSD Sand Filter Pond W-9 and landscape area with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. Developed runoff of Q5=0.4 cfs and Q100=3.2 cfs has been calculated for this basin. The cumulative upstream runoff of Q5=8.9 cfs and Q100=21.2 cfs has been calculated for DP13. The proposed FSD Pond W-9 functions to provide water quality and full spectrum detention for runoff calculated off and on-site. The pond is designed to treat approximately 6.07 acres, and provide 0.092 ac-ft of water quality storage and 0.638 ac-ft of 100-year storage. The outlet structure and pipe have been designed to release the required rates per the UDFCD manual and per the Detention Design-UD-Detention v3.07 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention pond. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP13 will over top the emergency spillway, with erosion control measures, and outfall south along Vollmer Road. The peak release rate from pond W-9 (PR9, Q5=0.6 cfs and Q100=8.7 cfs ~18" RCP) will combine with offsite flows from PR7. The summed flows (PR10, Q5=7.6 cfs and Q100=47.2 cfs) will outfall into a manhole and combine with flows from PR 8 (Q5=18.9 cfs and Q100=133.7 cfs). The combined flows shall be routed east via a proposed 54" RCP, PR 11 (Q5=23.8 cfs and Q100=164.1 cfs) into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

The water quality volume and 100-year volume required for the site has been determined using the guidelines set forth in the City of Colorado Springs/El Paso County Drainage Criteria Manual - Volume II. Refer to the Detention Basin Design sheets located within the appendix of this report.

Vollmer Road. The proposed develop shall not adversely affect the downstream infrastructure.

DP7, 3.01 acres, consists of Sub-Basin OS1A (2.7 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1A (0.31 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Calculated runoff of Q5=1.6 cfs and Q100=7.0 cfs has been calculated for DP7. The flow will be routed south via an an

existing 12" CMP (PR4) under an access road. The surface runoff shall be routed via historic drainage patterns and an existing road side swale to DP8.

DP8, 9.35 acres, consists of Sub-Basin OS1B (9.09 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1B (0.31 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flows from DP7. Calculated runoff of Q5=4.8 cfs and Q100=26.3 cfs has been calculated for DP8. The flow will be captured by a 2.9'x5.7' CDOT type D inlet and be routed, under Vollmer Road, south via a 24" RCP (PR5). Minimal grading, within DP8, will be provided within the Vollmer Road ROW. In the event of clogging, runoff will overtop the sump condition and the surface runoff shall be routed via historic drainage patterns and an existing road side swale to DP9.

DP9, 5.85 acres, consists of Sub-Basin OS1C (5.64 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1C (0.21 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Calculated runoff of Q5=2.2 cfs and Q100=12.3 cfs has been calculated for DP9. The flow will be captured by a 2.9'x2.9' CDOT type C inlet and be routed, under Vollmer Road, via an 18" RCP (PR6). These flows will be combined with flows from PR5 and be routed south via a 30" RCP, PR7 (Q5=7.0 cfs and Q100=38.6 cfs). These flows will combine with flows from PR9 and be routed south to a manhole via a 30" RCP, PR10 (Q5=7.6 cfs and Q100=47.2 cfs). Minimal grading, at DP9, will be provided within the Vollmer Road ROW. In the event of clogging, runoff will overtop the sump condition and the surface runoff shall be routed via historic drainage patterns and an existing road side swale to DP10.

DP10, 104.75 acres, consists of Sub-Basin OS1D (94.3 ac) and Basin W-2 (10.0 ac), existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1D (0.13 ac) and Basin V2 (0.32 ac), existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Calculated runoff of Q5=18.9 cfs and Q100=133.7 cfs has been calculated for DP10. The flow will be captured by a 4.0'x14.0' modified CDOT type D inlet and be routed, under Vollmer Road, via a 54" RCP (PR8) to a manhole. These flows will be combined with flows from PR10 and be routed east, within the Homestead Sterling Ranch Filing No. 1 subdivision, via a 54" RCP, PR11 (Q5=23.8 cfs and Q100=164.1 cfs). These flows will combine with flows from PR12 (Q5=2.7 cfs and Q100=36.2 cfs, release rate Pond 4) and be routed south via a 60" RCP, PR13 (Q5=26.5 cfs and Q100=200.3 cfs). These flows will outfall into a low tailwater riprap basin and into Sand Creek. Minimal grading, at DP10, will be provided within the Vollmer Road ROW. In the event of clogging, runoff will overtop the sump condition and the surface runoff shall be routed via historic drainage patterns and an existing road side swale south along Vollmer Road. The majority of improvements to Vollmer Road will drain to the east and be captured by FSD Pond W-9. No developed flows will be introduced to the westside of Vollmer Road.

Discussion was added throughout report to discuss adequacy of the facilities

DETENTION PONDS

Detention Pond W-9, has combined upstream developed runoff of Q5=8.9 cfs and Q100=21.2 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approximately 6.07 acres, and provide 0.092 ac-ft of water quality storage and 0.638 ac-ft of 100-year storage. The sand filter, underdrain, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.07 workbook.

The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention ponds. A private maintenance agreement documents shall accompany the submittal. In the event of clogging or total inlet failure, flows will over top the emergency spillway and outfall into a swale and will outlet along the eastside of Vollmer Road.

9
Provide statement confirming pond design sizing and attributes provided with S.R. Filing 1, and/or any revisions necessary.

The water quality volume and 100-year volume required for the site has been determined using the guidelines set forth in the City of Colorado Springs/El Paso County Drainage Criteria Manual Chapter 6 - Volume II. Refer to the Detention Basin Design sheets located within the appendix of this report.

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.

CONSTRUCTION COST OPINION – HOMESTEAD AT STERLING RANCH FILING NO. 1

Drainage Facilities:

Item	Description	Quantity	Unit Cost	Cost
1	18" RCP	10	\$40 /LF	\$400.00
2	30" RCP	34	\$65 /LF	\$2,210.00
3	36" RCP	36	\$75 /LF	\$2,700.00
4	15' CDOT Type R At-Grade	2	\$6000 /EA	\$12,000.00
5	8' CDOT Type R Sump Inlet	1	\$4700 /EA	<u>\$4,700.00</u>
Total				\$22,010.00

See Construction Cost Opinion for Alternative Sterling Ranch Filing No. 1 MDDP on the next page following the Summary paragraph.

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2017.

DRAINAGE & BRIDGE FEES – HOMESTEAD AT STERLING RANCH FILING NO. 1

This site is within the Sand Creek Drainage Basin. The 2017 Drainage and Bridge Fees per El Paso County for the Homestead at Sterling Ranch Filing No. 1 site are as follows:

Per Homestead at Sterling Ranch Filing No.1 Plat –	Total Area	19.574 Acres
FILING NO. 1 FEES:		
Drainage Fees:	19.574 x 46% \$ 16,270.00 =	\$ 146,495.73
Bridge Fees:	19.574 x 46% \$ 4,929.00 =	<u>\$ 44,380.91</u>
	Total	\$ 190,876.64

Revised

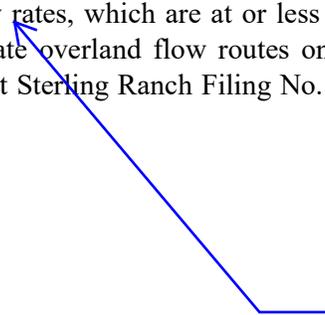
This could be 42% based on average lot size.

SUMMARY

Development of this site will not adversely affect the surrounding development per this final drainage report with no negative impact of the neighboring developments. The proposed drainage facilities will adequately convey, detain and route runoff from the tributary and onsite flows to the Sand Creek Drainage channel. Full Spectrum Detention and Water Quality Pond 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. The development of the Homestead at Sterling Ranch Filing No. 1 project shall not adversely affect adjacent or downstream property.

Summary Revised

see redline on
output sheet



 Sheet removed as these items were discussed in revised MDDPSR

CONSTRUCTION COST OPINION– STERLING RANCH FILING NO. 1 (ALTERNATIVE#1)

Drainage Facilities:

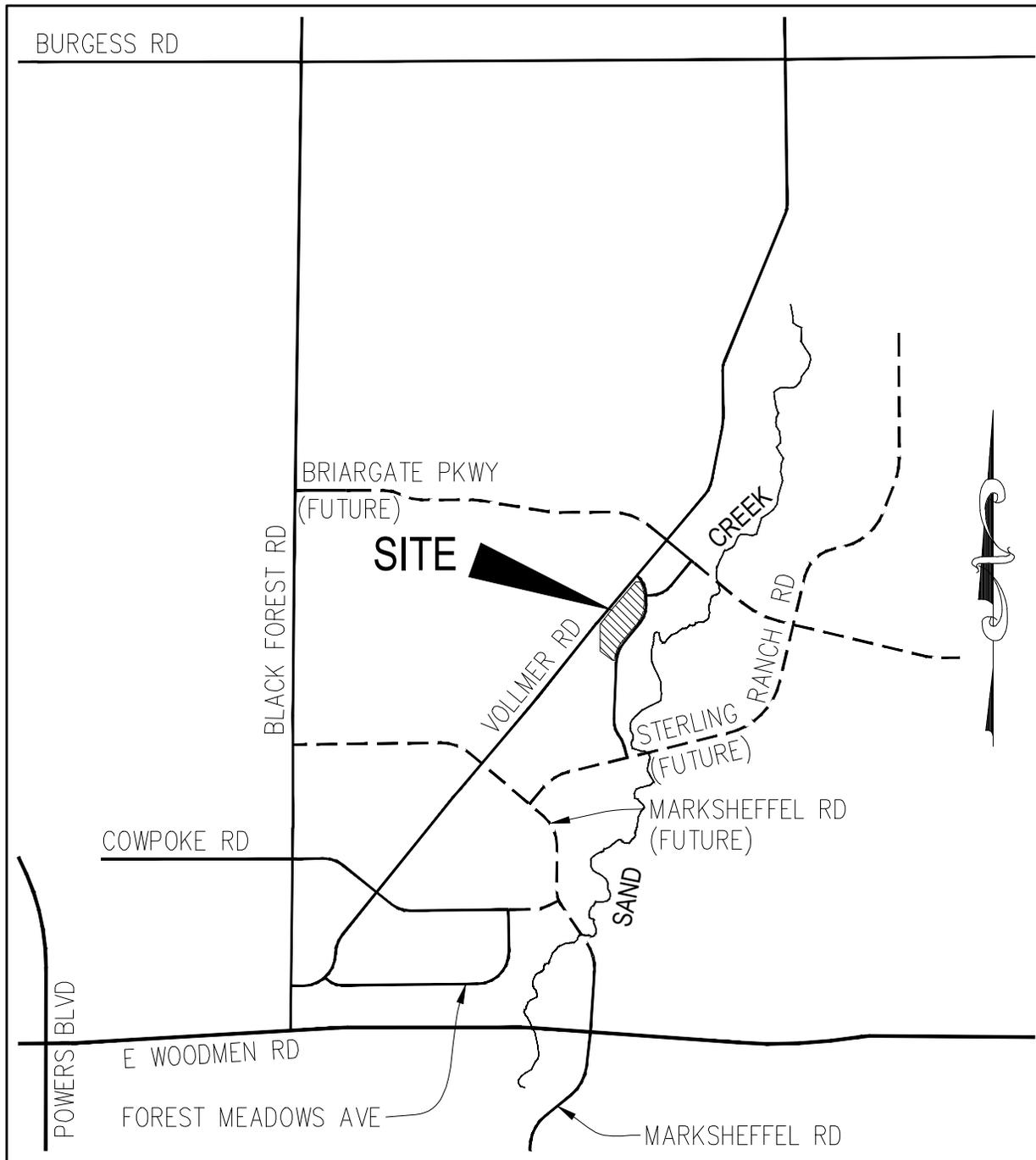
Item	Description	Quantity	Unit Cost	Cost
1	18" RCP	362	\$40 /LF	\$14,480.00
2	24" RCP	770	\$50 /LF	\$38,500.00
3	30" RCP	1952	\$65 /LF	\$58,560.00
4	36" RCP	615	\$75 /LF	\$46,125.00
5	42" RCP	385	\$85 /LF	\$32,725.00
6	54" RCP	1265	\$200 /LF	\$253,000.00
7	60" RCP	254	\$250 /LF	\$63,500.00
8	18" CMP	55	\$30 /LF	\$1,650.00
9	18" FES	3	\$245 /LF	\$735.00
10	24" FES	2	\$350 /EA	\$700.00
11	30" FES	4	\$475 /EA	\$1,900.00
12	36" FES	4	\$775 /EA	\$3,100.00
13	42" FES	1	\$895 /EA	\$895.00
14	18" CMP	1	\$150 /EA	\$150.00
15	60" End Treatment Headwall/Wing walls	1	\$17000 /EA	\$17,000.00
16	15' CDOT Type R At-Grade	7	\$6000 /EA	\$42,000.00
17	10' CDOT Type R Sump Inlet	2	\$4700 /EA	\$9,400.00
18	6.83'x6.33' MH	1	\$6500 /EA	\$6,500.00
19	7.83'x6.33" MH	2	\$6750 /EA	\$13,500.00
20	8.0'x8.0' MH	5	\$7000 /EA	\$35,000.00
21	8.0'x8.3' MH	1	\$8000 /EA	\$8,000.00
21	Type II MH	1	\$6000 /EA	\$36,000.00
22	Type III MH	1	\$6000 /EA	\$6,000.00
23	*Detention Pond 4	1	\$40000 /EA	\$40,000.00
24	*Detention Pond 8	1	\$40000 /EA	\$40,000.00
25	*Detention Pond W-9	1	\$20500 /EA	\$20,500.00
26	* Detention Pond BB	1	\$25000 /EA	\$25,000.00
27	Fabricated 36" Riser w/Trash rack	1	\$5000 /EA	\$5,000.00
27	CDOT Type C Area Inlet	1	\$5000 /EA	\$5,000.00
27	CDOT Type D Area Inlet	1	\$6000 /EA	\$5,000.00
28	Mod CDOT Outlet Structure	3	\$15000 /EA	\$45,000.00
29	Mod CDOT Type D Area Inlet	3	\$6000 /EA	\$18,000.00
Total				\$892,920.00

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 March 17, 1997.
- 5.) "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996
- 6.) "Preliminary Drainage Report for Sterling Ranch-Phase 1", dated May 2015, by M&S Civil Consultants, Inc.
- 7.) "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 8.) "Sterling Ranch-Phase 1 Onsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 9.) "Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3 & 4, by Matrix Design Group, dated June 2016.
- 10.) "Preliminary and Final Drainage Report, Barbarick Subdivision, A Replat of Lot "D", McClintock Subdivision", El Paso County, Revised August 15, 2007, prepared by Oliver E. Watts, Consulting Engineer, Inc.
- 11.) "Master Development Drainage Plan For Sterling Ranch", prepared by M&S Civil Consultants, Inc., dated July 2010 (Draft not approved)
- 12.) "Technical Memorandum Sand Creek Channel Study (North of Woodmen Road) Hydrologic Analysis" (TM-SCCS) prepared by M&S Civil Consultants, Inc., dated July 2016
- 13.) "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

APPENDIX

VICINITY MAP

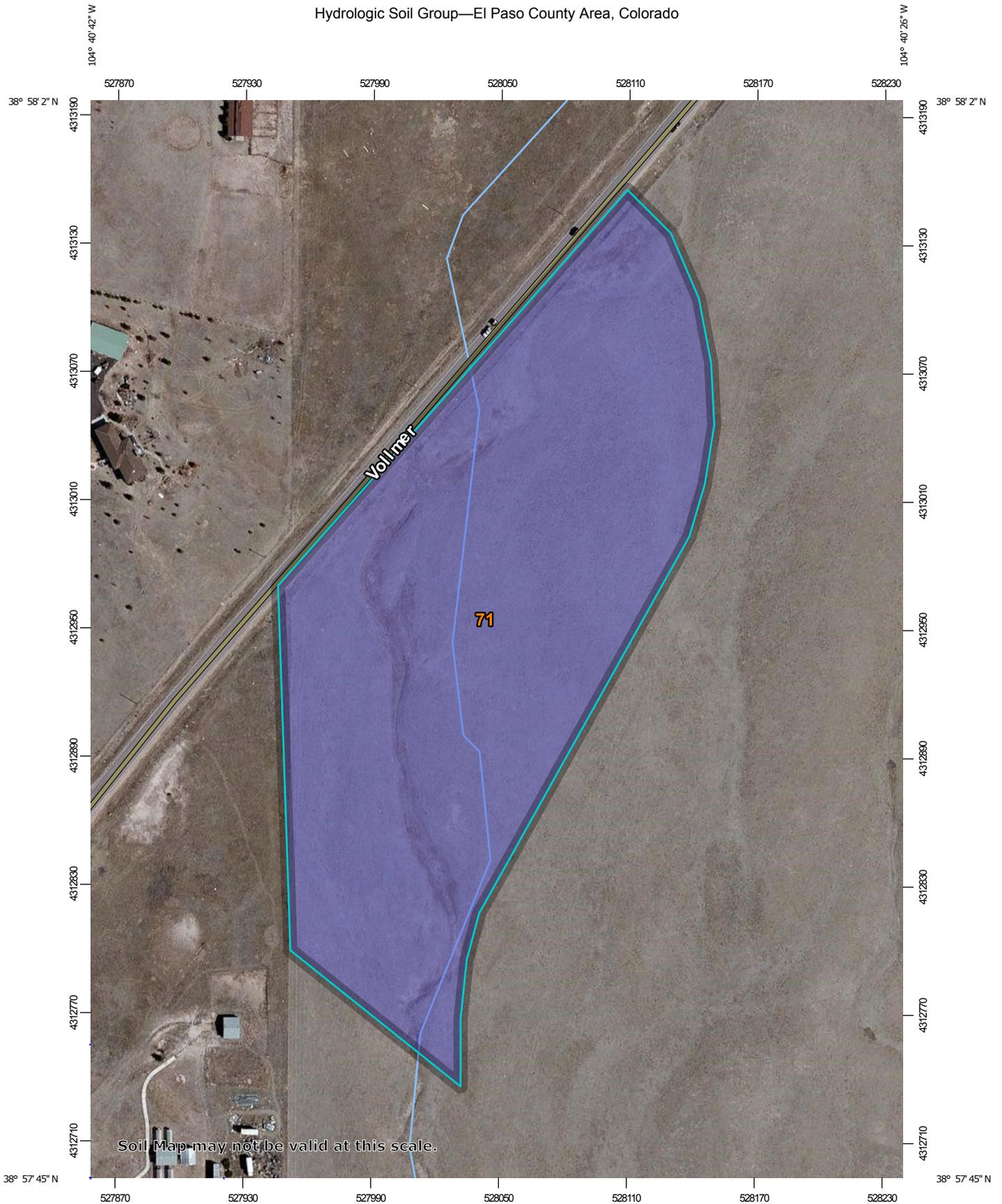


VICINITY MAP

N.T.S.

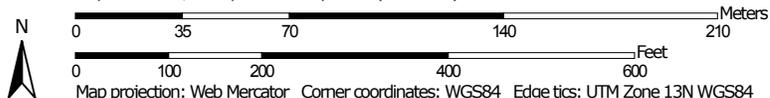
SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.

Map Scale: 1:2,460 if printed on A portrait (8.5" x 11") sheet.



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



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil 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 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	11.3	100.0%
Totals for Area of Interest			11.3	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.

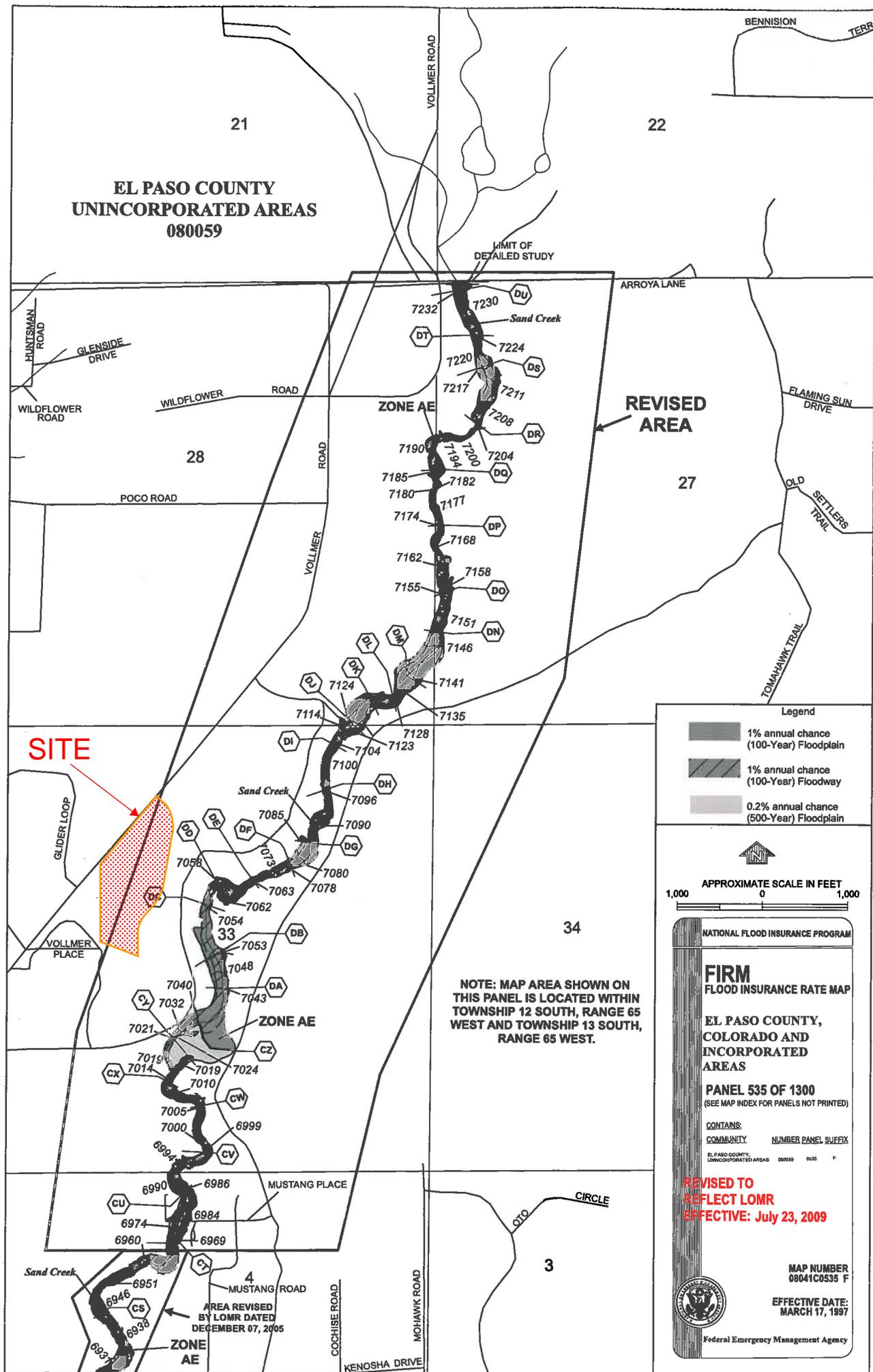
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

FIRM PANEL W/ REVISED LOMR

**EL PASO COUNTY
UNINCORPORATED AREAS
080059**



Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

1,000 0 1,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED
AREAS

PANEL 535 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0335 F

**REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009**

MAP NUMBER
08041C0535 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

21

22

28

27

34

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

AREA REVISED BY LOMR DATED DECEMBER 07, 2005

3

HYDROLOGIC CALCULATIONS

Calculation Sheets have been updated accordingly

HOMESTEAD AT STERLING RANCH FILING NO.1 AMENDED STERLING RANCH FILING NO.1 MDDP FINAL DRAINAGE REPORT (Area Drainage Summary)

BASIN	From Area Runoff Coefficient Summary		OVERLAND			STREET / CHANNEL FLOW			Time of Travel (T _t)		INTENSITY *			TOTAL FLOWS	#REF!	Basin	#REF!		
	AREA TOTAL (Acres)	C _s	C ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)					I _s (in/hr)	I ₁₀₀ (in/hr)
Proposed Area Drainage Summary																			
OS2	2.1	0.90	0.96	0.90	10	0.2	0.9	1082	2.5%	3.0	5.9	6.9	16.1	4.7	7.9	8.9	15.9	OS2	2.02
OS3	0.43	0.22	0.46	0.22	90	1.8	12.0	0	0.0%	0.0	0.0	12.0	10.5	4.1	6.8	0.4	7.3	OS3	0.20
OS4	0.61	0.22	0.46	0.22	75	1.5	10.9	0	0.0%	0.0	0.0	10.9	10.4	4.1	6.8	0.5	7.9	OS4	0.28
OS5	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	OS5	1.48
A	2.79	0.38	0.55	0.38	65	1.3	8.3	1449	2.8%	3.0	8.0	16.3	18.4	3.4	5.7	3.6	8.7	A	1.53
B	2.70	0.38	0.55	0.38	60	1.2	8.0	1381	2.8%	3.0	7.6	15.6	18.0	3.5	5.8	3.6	8.6	B	1.49
C	2.82	0.38	0.55	0.38	100	1.2	12.2	411	3.0%	3.0	2.3	14.5	12.8	3.8	6.3	4.2	10.1	C	1.61
D	2.9	0.38	0.55	0.38	100	2	10.3	245	2.1%	3.0	1.3	11.7	11.9	3.9	6.5	4.3	10.4	D	1.60
E	5.34	0.38	0.55	0.38	100	2	10.3	61	3.3%	3.0	0.3	10.7	10.9	4.0	6.8	8.2	19.9	E	2.94
F	1.12	0.90	0.96	0.90	10	0.2	0.9	1525	2.8%	3.0	8.4	9.3	18.5	4.2	7.1	4.3	7.7	F	1.08
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	7.9	G	0.28
EX-H	0.19	0.90	0.96	0.90	10	0.2	0.9	280	2.1%	3.0	1.5	5.0	11.6	5.2	8.7	0.9	1.6	EX-H	0.18
M	1.15	0.22	0.46	0.22	100	2	12.6					12.6	10.6	4.0	6.8	1.0	3.6	M	0.53
M2	1.6	0.08	0.35	0.08	100	2	14.7	1015	2.4%	2.3	7.4	22.1	16.2	3.4	5.7	0.4	3.2	M2	0.56
N	2.08	0.22	0.46	0.22	75	1.5	10.9	818	2.9%	3.0	4.5	15.4	15.0	3.5	5.9	1.6	5.7	N	0.96
O	0.57	0.22	0.46	0.22	100	4	10.1	0	2.7%	3.0	0.0	10.1	10.6	4.1	6.9	0.5	1.8	O	0.26
W-2	10	0.08	0.35	0.08	100	2	14.7	1113	4.0%	2.3	8.2	22.8	16.7	3.4	5.6	2.7	19.7	W-2	3.50
FROM HISTORIC MDDP CALC AREA WEST OF VOLLMER ROAD																			
OS1 Historic	111.7	0.08	0.35	0.08	100	0.57	22.2	1174	2.5%	1.5	12.9	35.1	17.1	3.3	5.6	0.7	5.3	OS1 Historic	39.10
SUB-BASIN OS1A	2.7	0.08	0.35	0.08	100	0.57	22.2	1174	2.5%	2.3	8.6	30.8	17.1	3.3	5.6	2.4	17.8	SUB-BASIN OS1A	0.95
SUB-BASIN OS1B	9.09	0.08	0.35	0.08	300	9	22.2	907	3.3%	2.3	6.6	28.8	16.7	3.4	5.6	1.5	11.1	SUB-BASIN OS1B	3.18
SUB-BASIN OS1C	5.84	0.08	0.35	0.08	100	0.57	22.2	4800	3.0%	2.3	35.2	57.3	37.2	2.2	3.6	16.3	119.5	SUB-BASIN OS1C	1.97
SUB-BASIN OS1D	94.3	0.08	0.35	0.08	20	0.4	1.3					5.0	10.1	5.2	8.7	1.4	2.6	SUB-BASIN OS1D	33.01
V1A	0.26	0.90	0.96	0.90	20	0.4	1.3					5.0	10.1	5.2	8.7	1.2	2.2	V1A	0.30
V1B	0.21	0.90	0.96	0.90	20	0.4	1.3					5.0	10.1	5.2	8.7	1.0	1.7	V1B	0.25
V1C	0.13	0.90	0.96	0.90	20	0.4	1.3					5.0	10.1	5.2	8.7	0.6	1.1	V1C	0.20
V1D	0.32	0.90	0.96	0.90	20	0.4	1.3					5.0	10.1	5.2	8.7	1.5	2.7	V1D	0.12
V2	2.04	0.63	0.76	0.63	50	1	4.8	1380	2.2%	3.0	7.6	12.4	17.9	3.8	6.4	4.9	9.9	V2	0.31
RP-2B	1.28	0.74	0.84	0.74	50	1	3.7	692	2.2%	3.0	3.8	7.5	14.1	4.6	7.7	4.3	8.2	RP-2B	1.55
RP-2C																		RP-2C	1.08

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

Calculated by: ET

Date: 11/7/2017

Checked by: VAS

HOMESTEAD AT STERLING RANCH FILING NO.1 AMENDED STERLING RANCH FILING NO.1 MDDP FINAL DRAINAGE REPORT (Basin Routing Summary)

DESIGN POINT	From Area Runoff Coefficient Summary		OVERLAND			PIPE / CHANNEL FLOW			Time of Travel (T _i)		INTENSITY *		TOTAL FLOWS		COMMENTS		
	CONTRIBUTING BASINS	CAs	CA ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _i (min)	TOTAL (min)	I _s (in/hr)	I ₁₀₀ (in/hr)		Q _s (c.f.s.)	Q ₁₀₀ (c.f.s.)
PROPOSED DRAINAGE BASIN ROUTING SUMMARY																	
1	A	1.06	1.53									16.3	3.4	5.7	3.6	8.7	15' AT-GRADE INLET
2	B	1.03	1.49									15.6	3.5	5.8	3.6	8.6	15' AT-GRADE INLET
3	C	1.11	1.61									12.8	3.8	6.3	4.2	10.1	6' SUMP INLET
4	D, E, F	4.14	5.61									11.7	3.9	6.5	16.1	36.7	EX 15' AT-GRADE INLET
5	G, EX-H, FLOWBY DP4	1.07	3.02									11.7	3.9	6.5	4.2	19.7	EX 15' AT-GRADE INLET
6	OS2, OS3, OS4, OS5	3.50	3.97									10.8	4.0	6.7	14.1	26.7	EX 15' AT-GRADE INLET
7	OS1A, VIA	0.50	1.24									17.1	3.3	5.6	1.6	7.0	EX 12" CMP CULVERT
8	OS1B,V1B, DP6	1.46	4.67									17.1	3.3	5.6	4.8	26.3	2.9x5.7' CDOT TYPE D INLET
9	OS1C, VIC	0.64	2.18									16.7	3.4	5.6	2.2	12.3	2.9x2.9' CDOT TYPE C INLET
10	OS1D, V1D, W-2, V2	8.75	36.94									37.2	2.2	3.6	18.9	133.7	4x14' MOD CDOT TYPE D INLET
12	RP-2B	1.29	1.55									12.4	2.2	3.6	2.8	5.6	CDOT EMBANKMENT PROTECTOR TYPE 5
13	M, M2, RP2C, DP10	2.61	3.71									16.2	3.4	5.7	8.9	21.2	WQCV SAND FILTER POND W-9

Calculated by: ET
Date: 11/7/2017
Checked by: VAS

Calculation Sheets have been updated accordingly

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

HOMESTEAD AT STERLING RANCH FILING NO.1 FINAL DRAINAGE REPORT

(CDOT Type R Inlet Calculations - Sump Condition)

Urban Local Roadway-50' ROW-30' Pavement-6" Vertical Curb Maximum allowable depth for MINOR (0.43') & MAJOR (0.66') storm						
Inlet Length	Storm	Depth	Eqn. 7-31 $Q_w = C_w N_w L_e D^{3/2}$	Eqn. 7-32 $Q_o = C_o N_o (L_e H_c) (2g(D - 0.5H_c))^{1/2}$	Eqn. 7-29 $Q_m = C_m (Q_w Q_o)^{1/2}$	
5	Q5	0.43	5.1	5.7	5.0	
5	Q100	0.66	9.7	8.6	8.5	
6	Q5	0.43	6.1	6.8	6.0	
6	Q100	0.66	11.6	10.3	10.2	
8	Q5	0.43	8.1	9.1	8.0	
8	Q100	0.66	15.4	13.8	13.6	
10	Q5	0.43	10.2	11.4	10.0	
10	Q100	0.66	19.3	17.2	17.0	
12	Q5	0.43	12.2	13.7	12.0	
12	Q100	0.66	23.2	20.7	20.3	
14	Q5	0.43	14.2	16.0	14.0	
14	Q100	0.66	27.0	24.1	23.7	
15	Q5	0.43	15.2	17.1	15.0	
15	Q100	0.66	29.0	25.8	25.4	
16	Q5	0.43	16.2	18.2	16.0	
16	Q100	0.66	30.9	27.5	27.1	

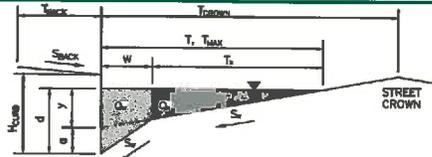
Table 7-7. Coefficients for various inlets in sumps

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

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

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

Project: Homestead at Sterling Ranch Filing No. 1
 Inlet ID: Inlet DP1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

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

MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

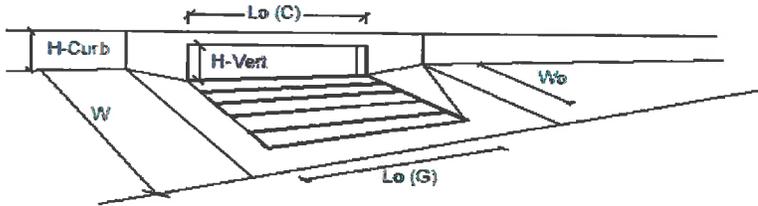
T_{BACK}	8.0	ft
S_{BACK}	0.020	ft/ft
n_{BACK}	0.020	
H_{CURB}	6.00	inches
T_{CROWN}	17.0	ft
W	2.00	ft
S_X	0.020	ft/ft
S_W	0.083	ft/ft
S_O	0.022	ft/ft
n_{STREET}	0.020	

	Minor Storm	Major Storm	
T_{MAX}	17.0	17.0	ft
d_{MAX}	5.1	7.8	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

	Minor Storm	Major Storm	
Q_{allow}	8.4	28.1	cfs

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a')				
Total Number of Units in the Inlet (Grate or Curb Opening)				
Length of a Single Unit Inlet (Grate or Curb Opening)				
Width of a Unit Grate (cannot be greater than W, Gutter Width)				
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)				
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)				
Street Hydraulics: OK - Q < Allowable Street Capacity				
Total Inlet Interception Capacity	MINOR		MAJOR	
Total Inlet Carry-Over Flow (flow bypassing Inlet)				
Capture Percentage = Q_a/Q_b				
Type =	CDOT Type R Curb Opening			
a_{LOCAL} =	3.0	3.0	inches	
N_u =	3	3		
L_u =	5.00	5.00	ft	
W_u =	N/A	N/A	ft	
C_{r-G} =	N/A	N/A		
C_{r-C} =	0.10	0.10		
Q =	3.6	8.8	cfs	
Q_b =	0.0	0.1	cfs	
C% =	100	89	%	

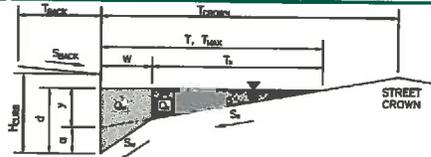
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project:
Inlet ID:

Homestead at Sterling Ranch Filing No. 1

Inlet DP2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 8.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.022$ ft/ft
 $n_{STREET} = 0.020$

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

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.1	7.8	Inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

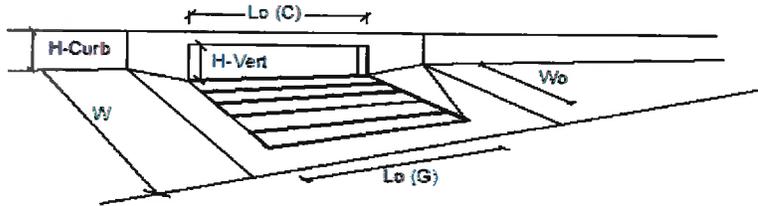
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	9.4	29.1	cfs

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a')				
Total Number of Units in the Inlet (Grate or Curb Opening)				
Length of a Single Unit Inlet (Grate or Curb Opening)				
Width of a Unit Grate (cannot be greater than W, Gutter Width)				
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)				
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)				
Street Hydraulics: OK - Q < Allowable Street Capacity				
Total Inlet Interception Capacity	MINOR		MAJOR	
Total Inlet Carry-Over Flow (flow bypassing Inlet)				
Capture Percentage = Q_c/Q_o				
Type =	CDOT Type R Curb Opening			
a_{LOCAL} =	3.0	3.0	inches	
No =	3	3		
L_o =	5.00	5.00	ft	
W_o =	N/A	N/A	ft	
C_{r-G} =	N/A	N/A		
C_{r-C} =	0.10	0.10		
Q =	3.6	8.5	cfs	
Q_b =	0.0	0.1	cfs	
C% =	100	99	%	

width	2.91	area	8.4681	open area x 70%	2.963835
length	2.91	blockage	0.5		
perimeter	11.64	blockage	4	avail perm.	7.64
				Orifice	Weir
12	0			0	0
12.1	0.1			4.512822	0.748954
12.2	0.2			6.382094	2.118361
12.3	0.3			7.816437	3.891678
12.4	0.4			9.025644	5.991631
12.5	0.5			10.09098	8.373559
12.6	0.6			11.05411	11.00733
12.7	0.7			11.9398	13.87082
12.8	0.8			12.76419	16.94689
12.9	0.9			13.53847	20.22175
13	1			14.2708	23.684
13.1	1.1			14.96734	27.32399
13.2	1.2			15.63287	31.13343
13.3	1.3			16.27121	35.10509
13.4	1.4			16.88543	39.2326
13.5	1.5			17.47808	43.51029
13.6	1.6			18.05129	47.93305
13.7	1.7			18.60684	52.49627
13.8	1.8			19.14628	57.19576
13.9	1.9			19.67094	62.02767
14	2			20.18195	66.98847

DP3 $Q_{100} = 12.1 \text{ cfs}$
 CDOT TYPE C AREA INLET

Design of this facility
 was part of
 MDDPSR
 (Filing No.1)
 Improvements thus
 is not needed in this
 report

width	2.91	area	16.587	open area x 70%	5.80545
length	5.7	blockage	0.5		
perimeter	17.22	blockage	4	avail perm.	13.22
				Orifice	Weir
12	0			0	0
12.1	0.1			8.839548	1.295965
12.2	0.2			12.50101	3.665542
12.3	0.3			15.31055	6.73403
12.4	0.4			17.6791	10.36772
12.5	0.5			19.76583	14.48933
12.6	0.6			21.65238	19.04671
12.7	0.7			23.38725	24.0016
12.8	0.8			25.00202	29.32433
12.9	0.9			26.51864	34.99105
13	1			27.95311	40.982
13.1	1.1			29.31747	47.28051
13.2	1.2			30.62109	53.87224
13.3	1.3			31.87144	60.74467
13.4	1.4			33.07456	67.88678
13.5	1.5			34.23542	75.28874
13.6	1.6			35.35819	82.94174
13.7	1.7			36.44639	90.83778
13.8	1.8			37.50303	98.96962
13.9	1.9			38.5307	107.3306
14	2			39.53166	115.9146

DPZ $Q_{100} = 25.1$ cfs
 CDOT TYPE D AREA INLET

Design of this facility
 was part of
 MDDPSR
 (Filing No.1)
 Improvements thus
 is not needed in this
 report

width	4	area	56	open area x 76%	21.28
length	14	blockage	0.5		
perimeter	36	blockage	4	avail perm.	32
				Orifice	Weir
87	0			0	0
87.1	0.1			32.40155	3.136979
87.2	0.2			45.82271	8.872718
87.3	0.3			56.12113	16.30022
87.4	0.4			64.8031	25.09584
87.5	0.5			72.45207	35.0725
87.6	0.6			79.36727	46.10399
87.7	0.7			85.72645	58.09767
87.8	0.8			91.64543	70.98174
87.9	0.9			97.20465	84.69844
88	1			102.4627	99.2
88.1	1.1			107.4638	114.446
88.2	1.2			112.2423	130.4018
88.3	1.3			116.8255	147.037
88.4	1.4			121.2355	164.325
88.5	1.5			125.4907	182.242
88.6	1.6			129.6062	200.7667
88.7	1.7			133.595	219.8797
88.8	1.8			137.4681	239.5634
88.9	1.9			141.2351	259.8018
89	2			144.9041	280.58
89.1	2.1			148.4826	301.8844
89.2	2.2			151.9767	323.7022
89.3	2.3			155.3924	346.0218
89.4	2.4			158.7345	368.832
89.5	2.5			162.0078	392.1224
89.6	2.6			165.2161	415.8835
89.7	2.7			168.3634	440.106
89.8	2.8			171.4529	464.7814
89.9	2.9			174.4877	489.9014
90	3			177.4706	515.4583

Design of this facility was part of MDDPSR (Filing No.1) Improvements thus is not needed in this report

DP4 $Q_{100} = 133 \text{ cfs}$
 MOD. CDOT TYPE D AREA INLET.

HYDRAULIC CALCULATIONS

HOMESTEAD AT STERLING RANCH FILING NO.1
AMENDED STERLING RANCH FILING NO.1 MDDP
(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	DP1	1.06	1.53	16.3	3.4	5.7	3.6	8.7	30" RCP
2	DP2, PR1	2.09	3.02	16.3	3.4	5.7	7.1	17.2	36" RCP
3	DP3	1.11	1.61	12.8	3.8	6.3	4.2	10.1	18" RCP
4	DP7	0.50	1.24	17.1	3.3	5.6	1.6	7.0	EX 12" CMP
5	DP8	1.46	4.67	17.1	3.3	5.6	4.8	26.3	24" RCP
6	DP9	0.64	2.18	16.7	3.4	5.6	2.2	12.3	18" RCP
7	PR5, PR6	2.10	6.85	17.1	3.3	5.6	7.0	38.6	30" RCP
8	DP10	8.75	36.94	37.2	2.2	3.6	18.9	133.7	54" RCP
9	OUTFLOW EDB POND W-9	0.18	1.53	16.2	3.4	5.7	0.6	8.7	18" RCP
10	PR7, PR9	2.28	8.38	17.1	3.3	5.6	7.6	47.2	30" RCP
11	PR8, PR10	11.03	45.32	37.2	2.2	3.6	23.8	164.1	54" RCP
12	OUTFLOW EDB POND 4	PEAK OUTFLOW FROM POND 4 UD DET v3.04					2.7	36.2	30" RCP
13	PR11, PR12	SUMMATION OF PR11 & PR18					26.5	200.3	60" 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: ET

Date: 11/7/2017

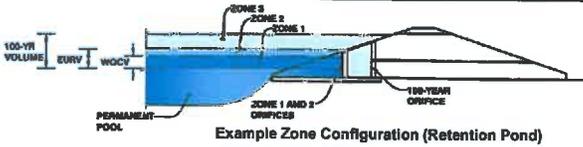
Checked by: VAS

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Revision to Pond W-2 Sterling Ranch Filling No.1 MDDP

Basin ID: East Vollmer Road, Homestead Backyards and Landscape area 3:1 Pond slope



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.69	0.108	Filtration Media
Zone 2 (EURV)	2.21	0.344	Circular Orifice
Zone 3 (100-year)	3.07	0.259	Weir&Pipe (Restrict)
	0.710	Total	

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

Underdrain Orifice Invert Depth = 3.30 ft (distance below the filtration media surface)
Underdrain Orifice Diameter = 1.49 Inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = 0.0 ft²
Underdrain Orifice Centroid = 0.06 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 = N/A ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = N/A ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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

	Row 1 (optional)	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)	N/A							
Orifice Area (sq. inches)	N/A							

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	0.69	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.21	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	3.92	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.08	N/A	ft ²
Vertical Orifice Centroid =	0.16	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir: Front Edge Height, Ho =	2.21	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.91	N/A	feet
Overflow Weir Slope =	0.00	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 _u =	2.21	N/A	feet
Over Flow Weir Slope Length =	2.91	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.08	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	5.93	N/A	ft ²
Overflow Grate Open Area w/ Debris =	2.96	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	3.55	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	7.80	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.73	N/A	ft ²
Outlet Orifice Centroid =	0.38	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.44	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	3.08	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	12.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	0.67	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.64	feet
Stage at Top of Freeboard =	4.39	feet
Basin Area at Top of Freeboard =	0.40	acres

Routed Hydrograph Results

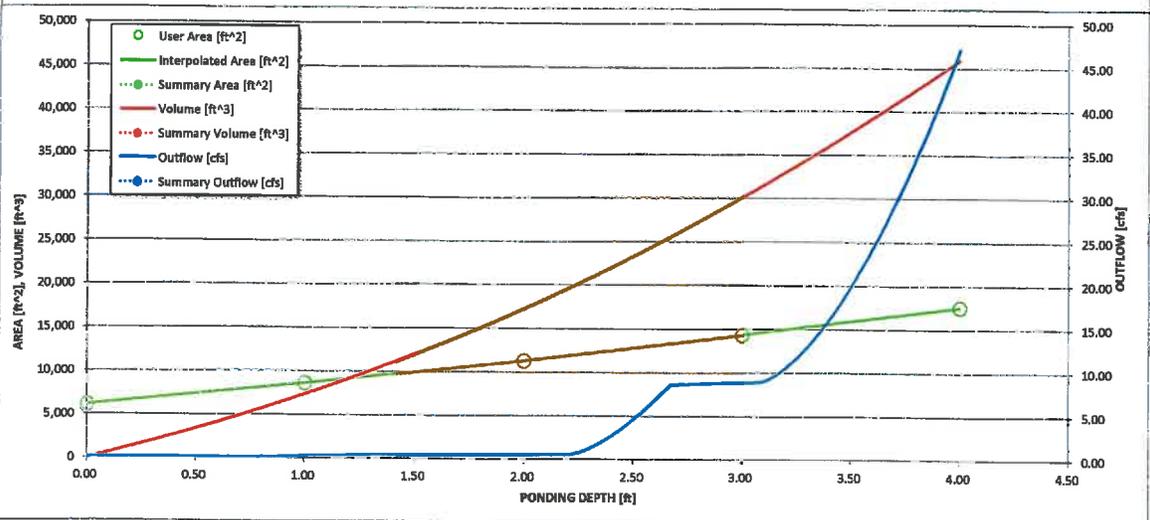
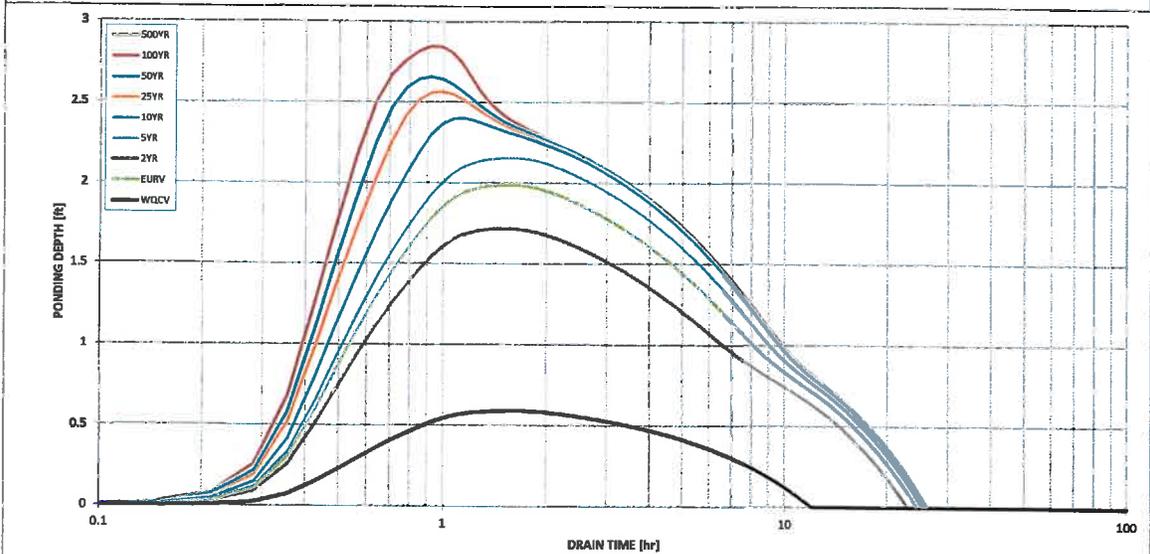
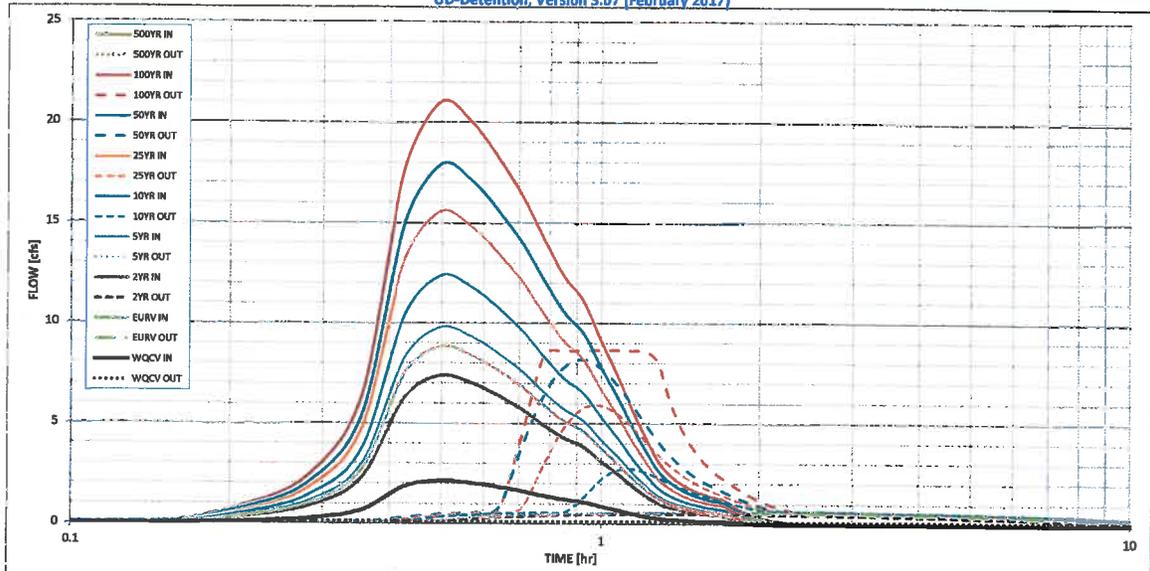
	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period									
One-Hour Rainfall Depth (in)	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft)	0.108	0.451	0.376	0.500	0.634	0.799	0.922	1.083	0.000
OPTIONAL Override Runoff Volume (acre-ft)									
Inflow Hydrograph Volume (acre-ft)	0.107	0.451	0.376	0.500	0.634	0.800	0.923	1.083	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre)	0.00	0.00	0.01	0.03	0.25	0.81	1.11	1.49	0.00
Predevelopment Peak Q (cfs)	0.0	0.0	0.1	0.2	1.5	4.7	6.5	8.7	0.0
Peak Inflow Q (cfs)	2.1	8.8	7.4	9.8	12.4	15.5	17.9	21.0	#N/A
Peak Outflow Q (cfs)	0.1	0.6	0.5	0.6	2.7	5.9	8.2	8.7	#N/A
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	4.0	1.8	1.3	1.2	1.0	#N/A
Structure Controlling Flow	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	N/A	0.4	0.9	1.3	1.3	#N/A
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)	12	23	22	24	24	23	23	23	#N/A
Time to Drain 99% of Inflow Volume (hours)	12	24	23	25	25	25	25	25	#N/A
Maximum Ponding Depth (ft)	0.59	1.99	1.72	2.15	2.40	2.56	2.66	2.84	#N/A
Area at Maximum Ponding Depth (acres)	0.17	0.26	0.24	0.27	0.29	0.30	0.30	0.32	#N/A
Maximum Volume Stored (acre-ft)	0.092	0.390	0.323	0.435	0.505	0.552	0.579	0.638	#N/A

In speaking with UDFCD they recognize that it often difficult to design an outfall structure that meets all discharge goals. Please look at the Predevelopment peak vs the outflow and not that the actual cfs difference is minimal although the ratio isn't the desired ration of 1.0.

Address these values meeting release requirements in the report. Revise if necessary.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Revision to Pond W-2 Sterling Ranch Filling No. 1 MIDDP

Basin ID: East Vollmer Road, Homestead backyards and Landscape area 3:1 Pond slope



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	SF
Watershed Area =	5.87 acres
Watershed Length =	575 ft
Watershed Slope =	0.024 ft/ft
Watershed Imperviousness =	70.00% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Group C/D =	0.0% percent
Desired WQCV Drain Time =	12.0 hours
Location for 1-hr Rainfall Depth =	User Input

Water Quality Capture Volume (WQCV) =	0.108 acre-feet
Excess Urban Runoff Volume (EURV) =	0.451 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.376 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.500 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.634 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.799 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.922 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.063 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.353 acre-feet
Approximate 5-yr Detention Volume =	0.470 acre-feet
Approximate 10-yr Detention Volume =	0.593 acre-feet
Approximate 25-yr Detention Volume =	0.637 acre-feet
Approximate 50-yr Detention Volume =	0.663 acre-feet
Approximate 100-yr Detention Volume =	0.710 acre-feet

Optional User Override

1-hr Precipitation

1.19 inches
1.50 inches
1.75 inches
2.00 inches
2.25 inches
2.52 inches

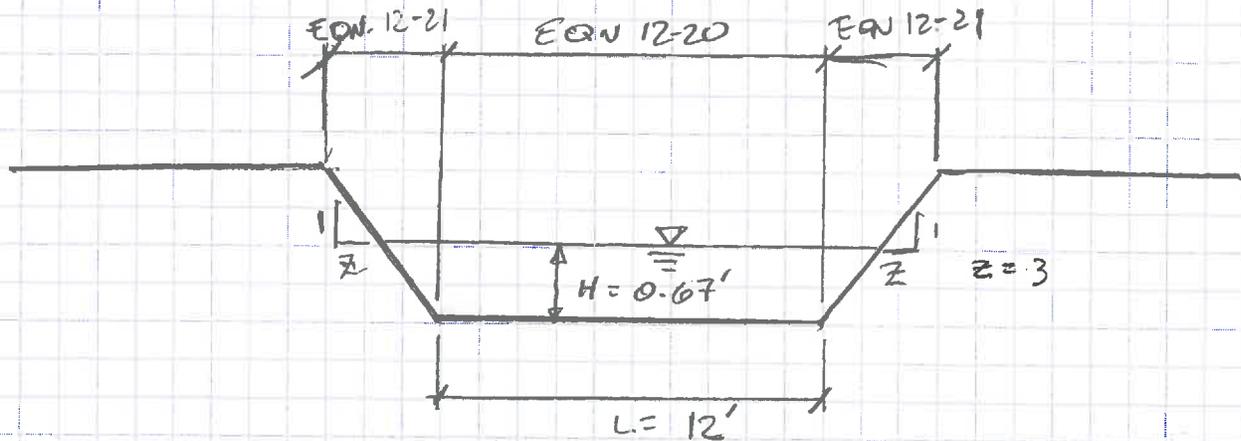
7086	7087	7088	7089	7090	ft		Optional Override Stage (ft)	Optional Override Area (ft ²)	Area (ft ²)	Width (ft)	Length (ft)	Volume (ft ³)	Volume (ac-ft)
					Depth Increment =	0.5							
Stage - Storage Description													
Media Surface													
							0.00						
							1.00	8,035	0.139				
							2.00	11,312	0.186			7,209	0.165
							3.00	14,295	0.260			17,115	0.393
							4.00	17,480	0.328			30,031	0.689
									0.401			45,918	1.054

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.108 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.344 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.259 acre-feet
Total Detention Basin Volume =	0.710 acre-feet
Initial Surcharge Volume (SV) =	N/A ft ³
Initial Surcharge Depth (ISD) =	N/A ft
Total Available Detention Depth (H _{total}) =	user ft
Depth of Trickle Channel (H _{trc}) =	N/A ft
Slope of Trickle Channel (S _{trc}) =	N/A ft/ft
Slope of Main Basin Sides (S _{main}) =	user ft/ft
Basin Length-to-Width Ratio (R _{L/W}) =	user

PROJECT: HOMESTEAD (STELLING RANCH)
DATE: 11/15/2017

SIZE SPILLWAY - POND W-2



From UDFCD 12-33 (STORAGE)

$$Q_{100} = 21 \text{ cfs (TOTAL INFLOW)}$$

$$\text{EQN 12-20 } Q = C_L H^{1.5} = 3.0$$

$$\text{EQN 12-21 } Q = \frac{2}{5} C_z H^{2.5} = \frac{4}{5} (3.0) (3) (0.67)^{2.5} = 1.32 \text{ cfs}$$

$$Q_{\text{TOTAL}} = 19.74 \text{ cfs} + (2) 1.32 \text{ cfs} = \underline{22.38 > 21 \text{ cfs}} \text{ OK}$$

SPILLWAY RUNOFF PROTECTION

RZPRAP SIZING (UDFCD 12-34)

$$Q_{100} = 21 \text{ cfs} \quad \text{SLOPE } 5.8\%$$

FIGURE 12-21

BASED ON SLOPE AND UNIT DISCHARGE

$$\text{UNIT DISCHARGE} = 21 \text{ cfs} / 12 \text{ ft} = 1.75 \text{ ft}^3/\text{s}$$

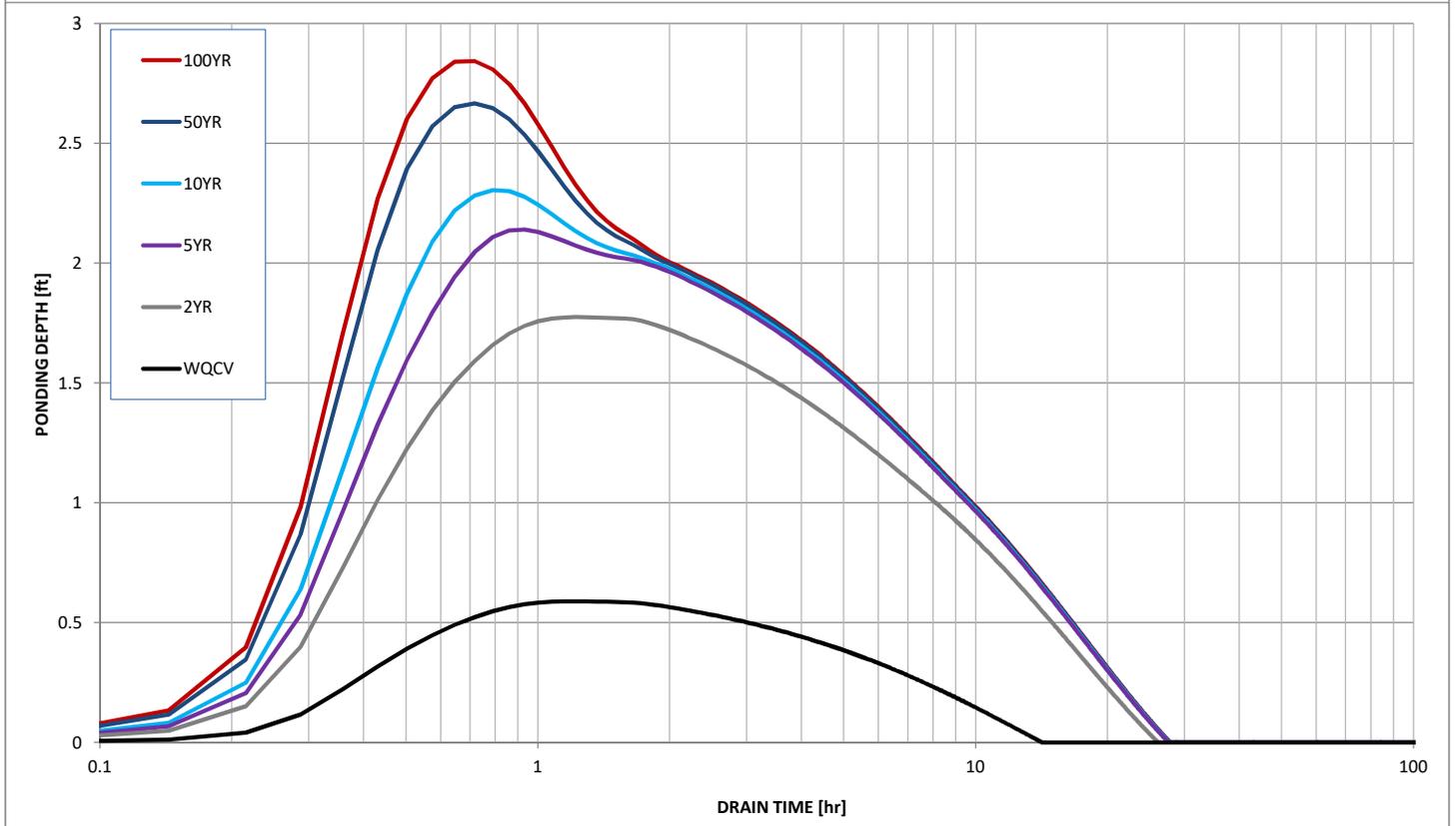
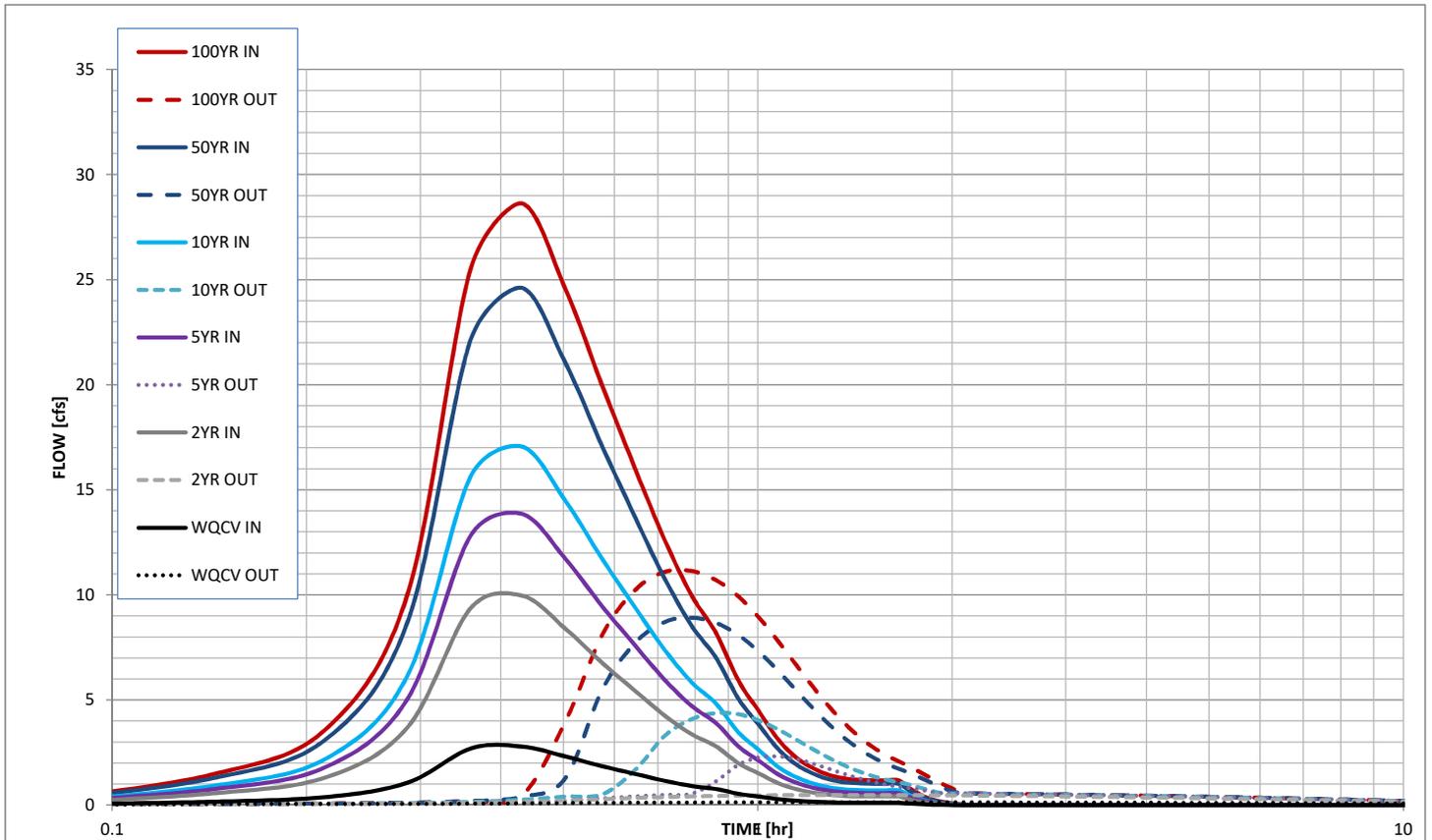
FROM FIGURE 12-21 ~ TYPE VL
RECOMMEND SIZE UP TO TYPE L

TYPE L $D_{50} = 9''$

SOIL RZPRAP DEPTH $2D_{50} = 2 \times 9'' = 18''$ THICK

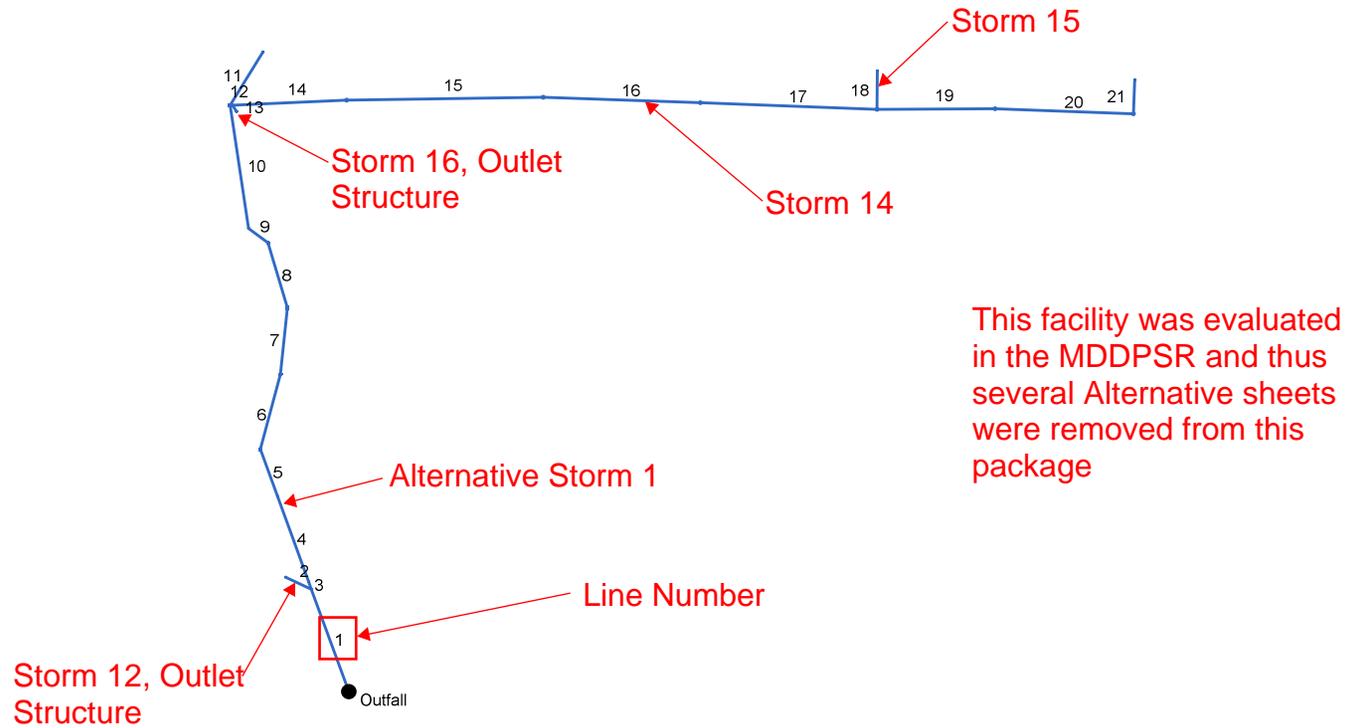
This facility was evaluated in the MDDPSR and thus the Alternative sheets were removed from this package

Stormwater Detention and Infiltration Design Data Sheet

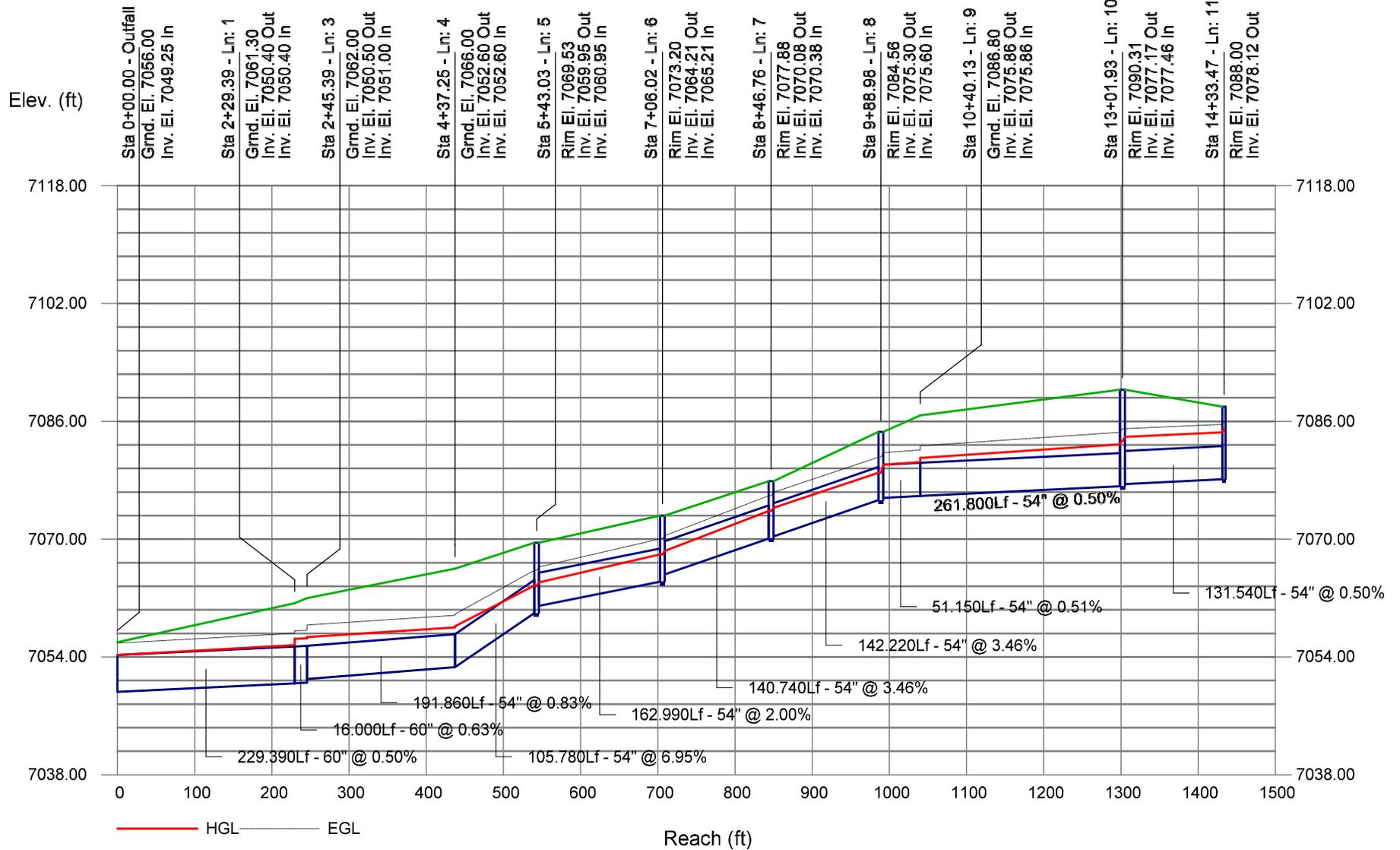


Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan

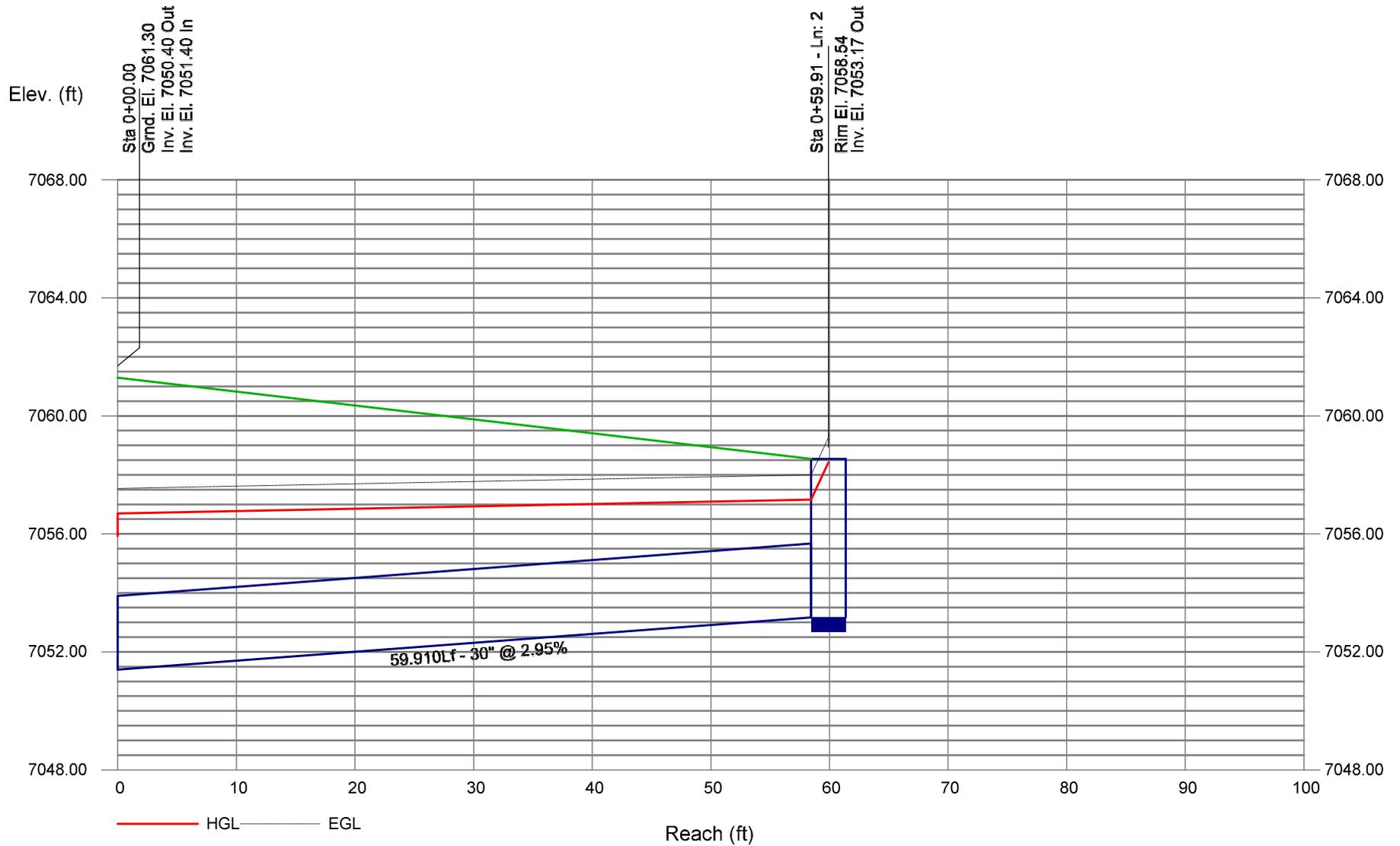
Alternative Storm 1 and Storms 12, 14, 15, 16 Plan View



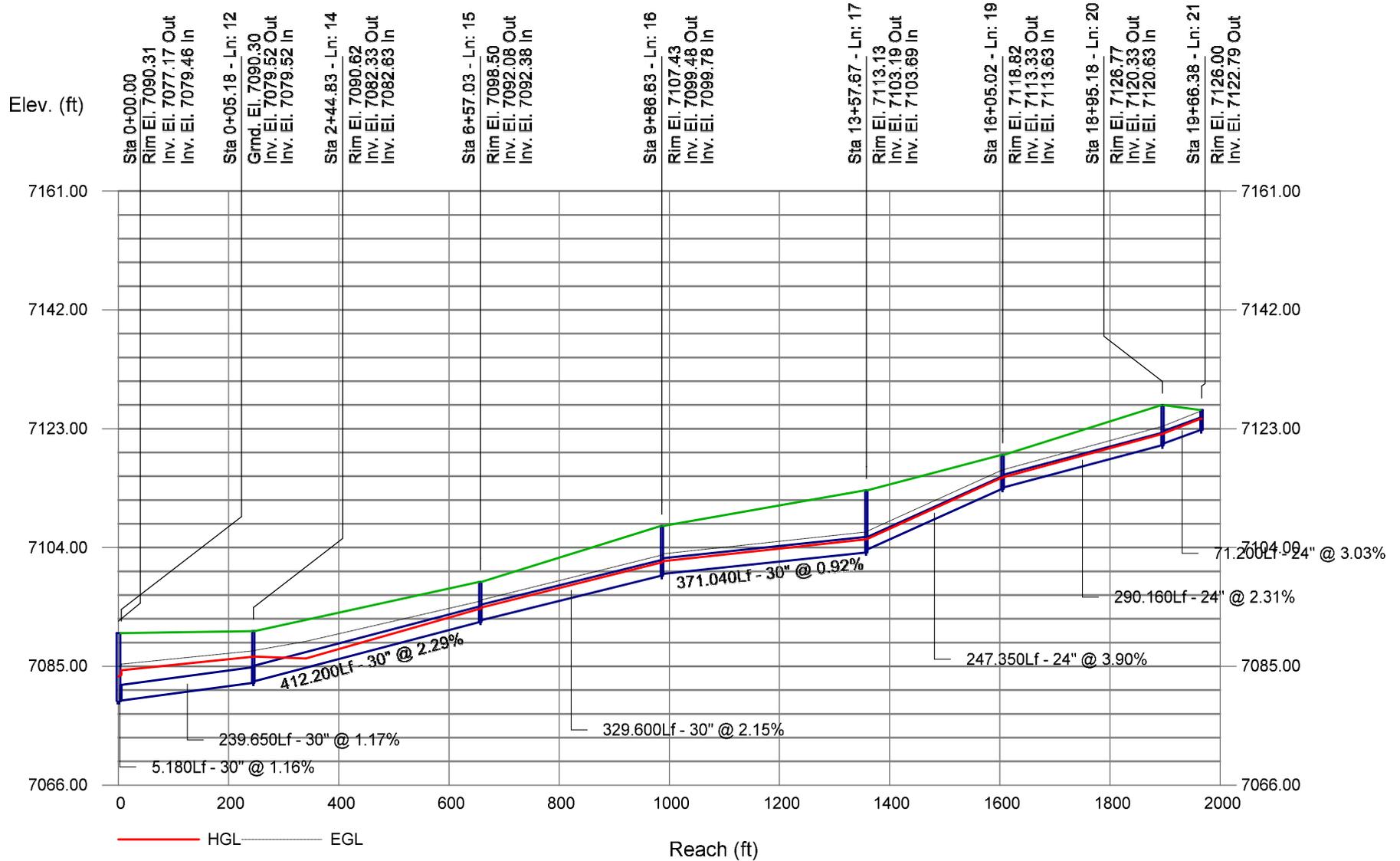
Alternative Storm 1 Profile



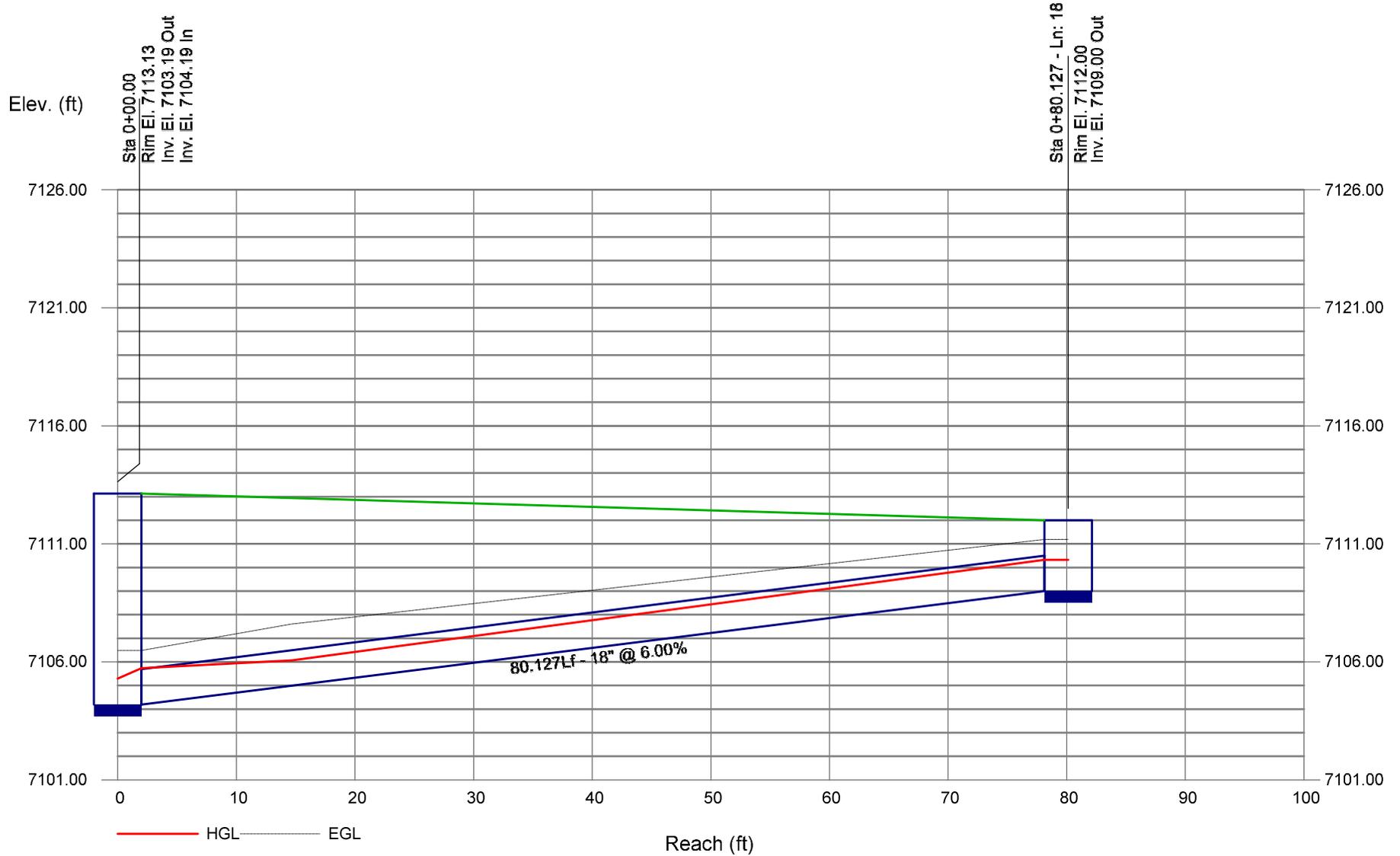
Storm 12 Outlet Structure Profile



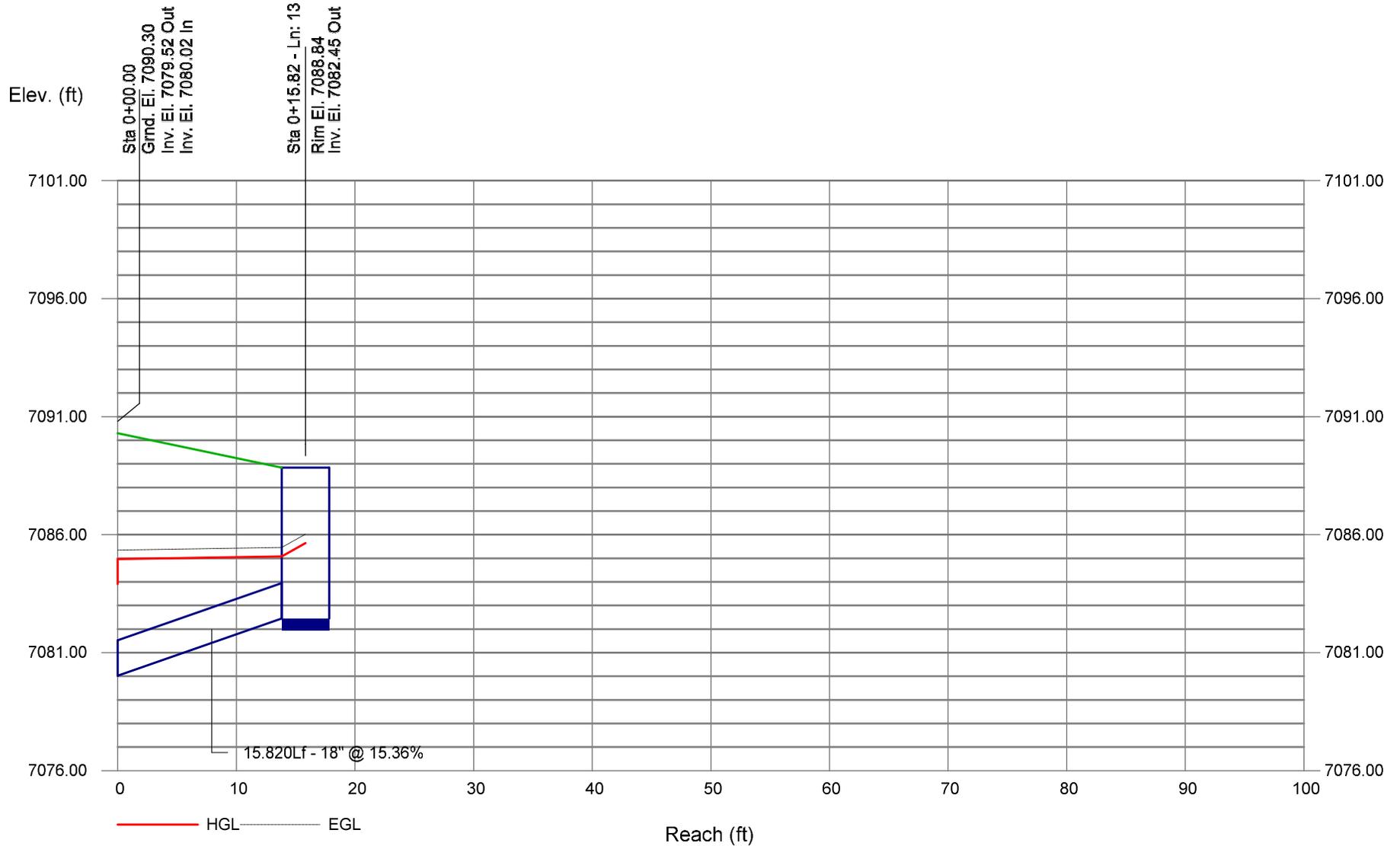
Storm 14 Profile



Storm 15 Profile



Storm 16 Outlet Structure Profile



Line No.	Line ID	Line Size (in)	Line Type	Junct Type	J-Loss Coeff	n-val Pipe	Flow Rate (cfs)	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	HGL Dn (ft)	HGL Up (ft)	Minor Loss (ft)	HGL Jnct (ft)	Vel Ave (ft/s)
1	Storm 1	60	Cir	None	0.20	0.013	199.90	7049.25	7050.40	0.50	7054.25	7055.60	0.32	7055.93	10.18
2	Storm 12 , Out. Struct.	30	Cir	Generic	1.50	0.013	36.20	7051.40	7053.17	2.95	7056.69	7057.16	1.27	7058.43	7.38
3	Storm 1, Typ 3 MH	60	Cir	None	0.15	0.013	163.70	7050.40	7050.50	0.63	7056.46	7056.52	0.16	7056.68	8.34
4	Storm 1	54	Cir	None	0.10	0.013	163.70	7051.00	7052.60	0.83	7056.68	7058.01	0.16	7058.18	10.29
5	Storm 1	54	Cir	MH	0.28 z	0.013	163.70	7052.60	7059.95	6.95	7058.18	7063.68	n/a	7063.68	10.95
6	Storm 1	54	Cir	MH	0.05 z	0.013	163.70	7060.95	7064.21	2.00	7064.13	7067.94	n/a	7067.94	12.62
7	Storm 1	54	Cir	MH	0.10 z	0.013	163.70	7065.21	7070.08	3.46	7068.39	7073.81	n/a	7073.81	12.62
8	Storm 1	54	Cir	MH	0.60 z	0.013	163.70	7070.38	7075.30	3.46	7074.26	7079.03	n/a	7079.03	11.42
9	Storm 1	54	Cir	None	0.35	0.013	163.70	7075.60	7075.86	0.51	7080.10	7080.46	0.58	7081.03	10.29
10	Storm 1	54	Cir	MH	0.30	0.013	163.70	7075.86	7077.17	0.50	7081.03	7082.85	0.49	7083.34	10.29
11	Storm 1, Type D Mod. In.	54	Cir	Generic	0.40	0.013	133.70	7077.46	7078.12	0.50	7083.89	7084.50	0.44	7084.94	8.41
12	Storm 14	30	Cir	None	0.20	0.013	47.20	7079.46	7079.52	1.16	7083.55	7083.62	0.29	7083.91	9.62
13	Storm 16, Out. Struct.	18	Cir	Generic	1.50	0.013	8.70	7080.02	7082.45	15.36	7084.97	7085.08	0.57	7085.64	4.92
14	Storm 14	30	Cir	MH	0.05	0.013	38.60	7079.52	7082.33	1.17	7084.38	7086.51	0.05	7086.56	7.86
15	Storm 14	30	Cir	MH	0.05 z	0.013	38.60	7082.63	7092.08	2.29	7086.56	7094.18 j	n/a	7094.18	8.32
16	Storm 14	30	Cir	MH	0.05 z	0.013	38.60	7092.38	7099.48	2.15	7094.41	7101.58	n/a	7101.58	8.90
17	Storm 14	30	Cir	MH	0.25 z	0.013	38.60	7099.78	7103.19	0.92	7101.81	7105.29	n/a	7105.29	8.90
18	Storm 15, Type C In.	18	Cir	Generic	1.50 z	0.013	12.30	7104.19	7109.00	6.00	7105.73	7110.33 j	n/a	7110.33	7.20
19	Storm 14	24	Cir	MH	0.05 z	0.013	26.30	7103.69	7113.33	3.90	7105.40	7115.12	n/a	7115.12	9.04
20	Storm 14	24	Cir	MH	1.00 z	0.013	26.30	7113.63	7120.33	2.31	7115.25	7122.12	n/a	7122.12	9.25
21	Storm 14, Type D In.	24	Cir	Generic	1.50 z	0.013	26.30	7120.63	7122.79	3.03	7122.25	7124.58	n/a	7124.58	9.25

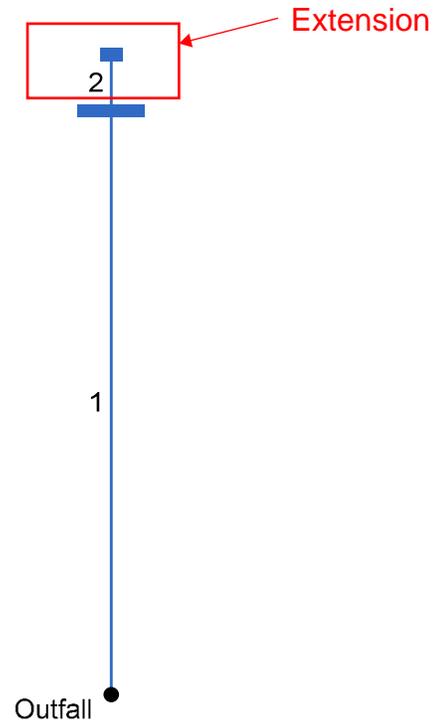
Project File: Sterling Ranch Storms 1, 14, 15, 16 - 11-08-17.stm

Number of lines: 21

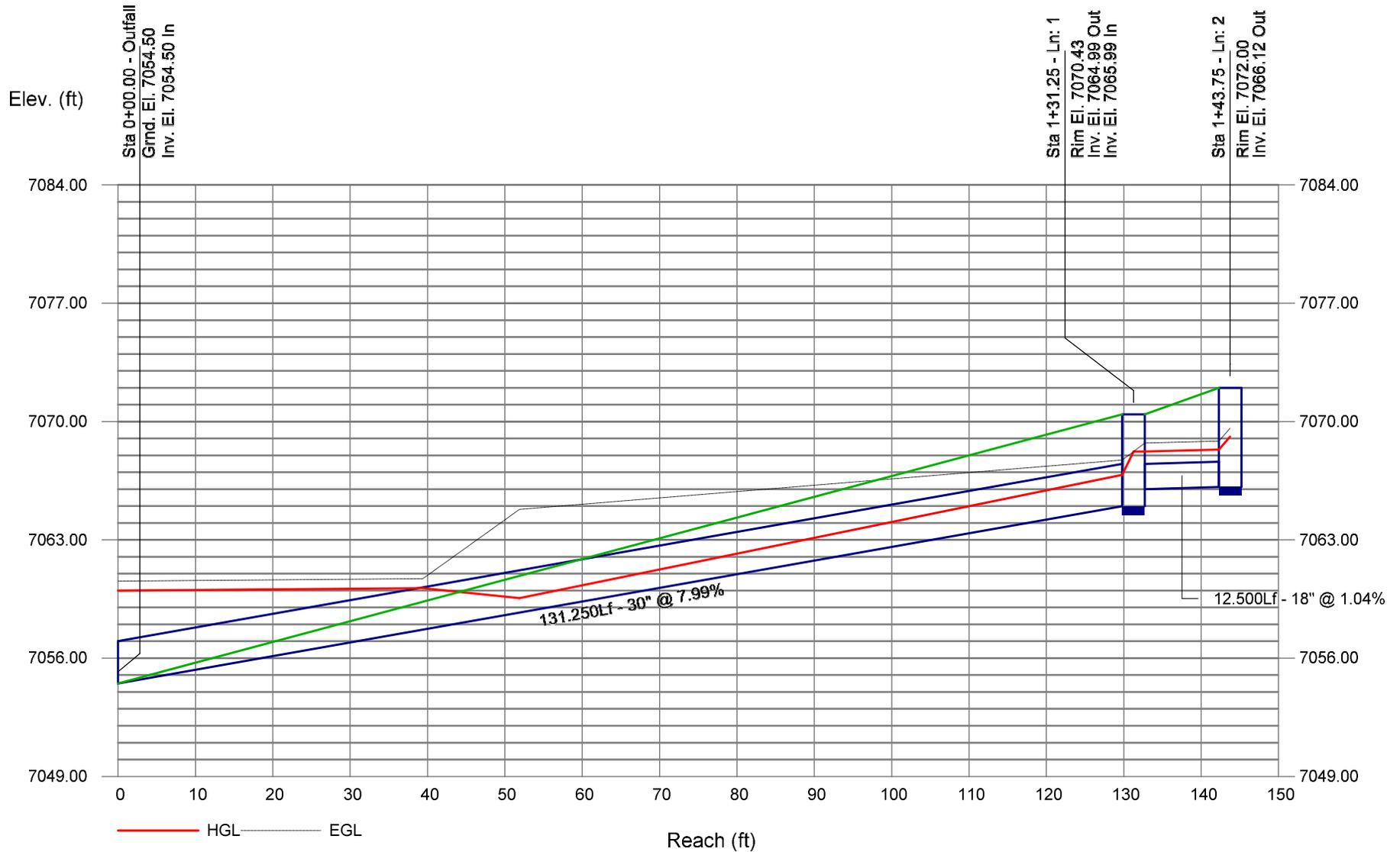
Date: 11/9/2017

NOTES: ** Critical depth

Storm 3 Extension Plan View



Storm 3 Extension Profile



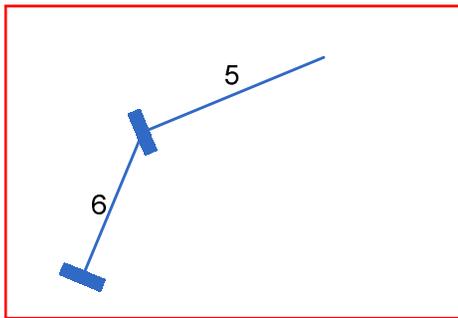
Line No.	Line ID	Line Size (in)	Line Type	Junct Type	J-Loss Coeff	n-val Pipe	Flow Rate (cfs)	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	HGL Dn (ft)	HGL Up (ft)	Minor Loss (ft)	HGL Jnct (ft)	Vel Ave (ft/s)
1	Storm 3	30	Cir	Curb	1.50	0.013	29.40	7054.50	7064.99	7.99	7060.00	7066.84 j	n/a	7068.23 i	6.78
2	Storm 3	18	Cir	Curb	1.50	0.013	10.10	7065.99	7066.12	1.04	7068.23	7068.34	0.76	7069.10	5.72

Project File: Sterling Ranch Storm 3 - 7-27-16.stm Number of lines: 2 Date: 11/9/2017

NOTES: i Inlet control; ** Critical depth

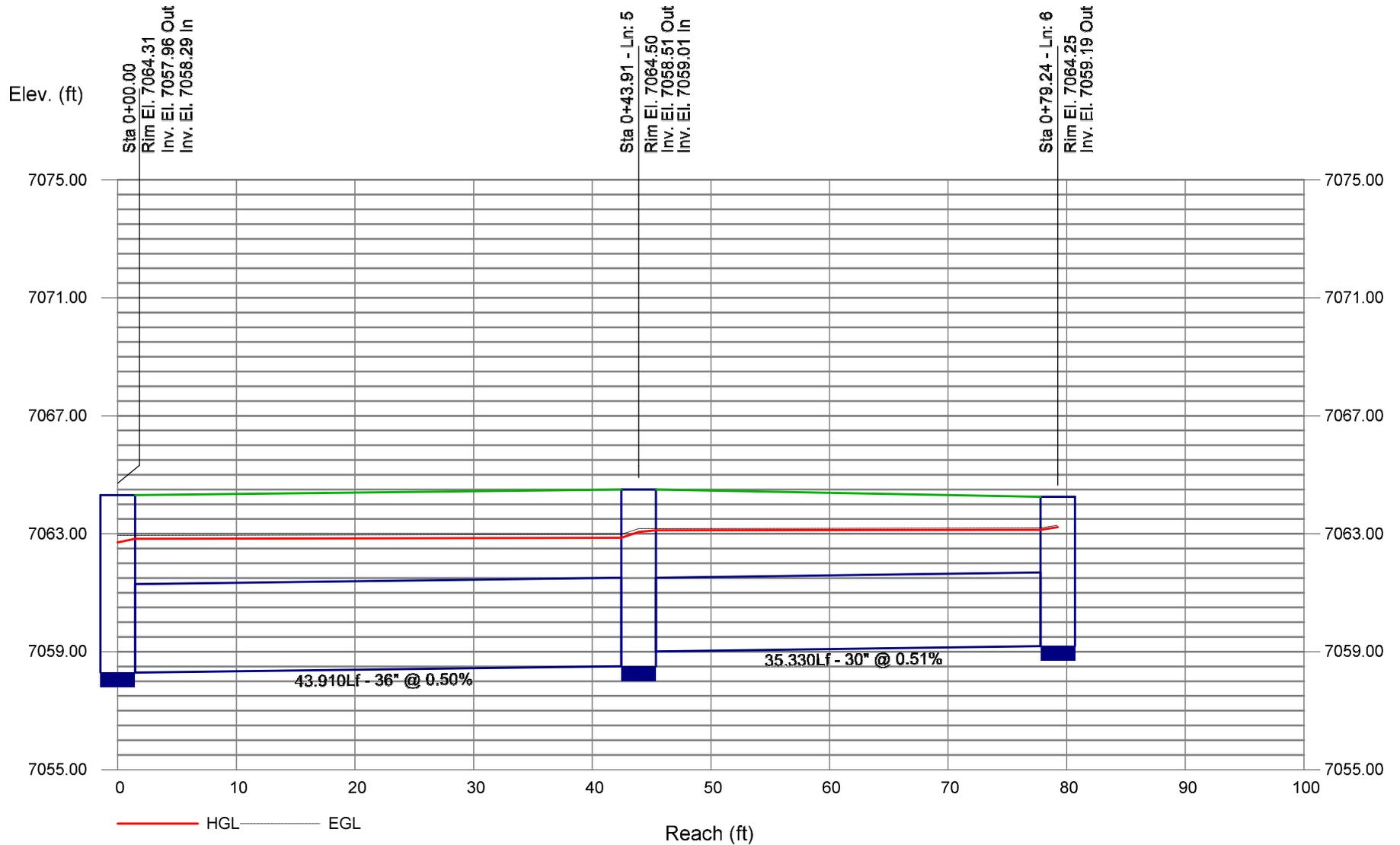
Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan

Storm 4 Extension Plan View



Extension

Storm 4 Extension Profile



Line No.	Line ID	Line Size (in)	Line Type	Junct Type	J-Loss Coeff	n-val Pipe	Flow Rate (cfs)	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	HGL Dn (ft)	HGL Up (ft)	Minor Loss (ft)	HGL Jnct (ft)	Vel Ave (ft/s)
1		36	Cir	None	0.40	0.013	42.10	7054.50	7054.83	1.46	7060.00	7060.09	0.22	7060.31	5.96
2		36	Cir	None	0.40	0.013	42.10	7054.83	7056.81	1.46	7060.31	7060.85	0.22	7061.07	5.96
3		36	Cir	Curb	1.50	0.013	42.10	7056.81	7057.05	1.50	7061.07	7061.14	0.83	7061.97	5.96
4		36	Cir	Curb	1.50	0.013	27.60	7057.55	7057.96	0.99	7062.28	7062.35	0.36	7062.71	3.90
5	Homestead, Storm 4 Extension	36	Cir	Curb	1.70	0.013	19.30	7058.29	7058.51	0.50	7062.83	7062.86	0.20	7063.06	2.73
6	Homestead, Storm 4 Extension	30	Cir	Curb	1.50	0.013	9.70	7059.01	7059.19	0.51	7063.12	7063.14	0.09	7063.23	1.98

Project File: Sterling Ranch Storm 4 - 7-27-16.stm	Number of lines: 6	Date: 11/9/2017
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NOTES: i Inlet control; ** Critical depth

DRAINAGE MAP

HOMESTEAD AT STERLING RANCH FILING NO. 1

COUNTY OF EL PASO, STATE OF COLORADO

FINAL DRAINAGE MAP

NOVEMBER 2017

LEGEND

- BASIN DESIGNATION: Z, C5, C100
- ACRES: 25, .25
- PIPE RUN REFERENCE LABEL: 4
- SURFACE DESIGN POINT: 6
- BASIN BOUNDARY: Dashed green line
- EXISTING CONTOUR: Dashed black line (6920)
- PROP CONTOUR: Solid black line (6920)
- FILING NO. 4 BOUNDARY: Solid black line
- EXISTING STORM SEWER PIPE: Dashed black line
- EXISTING STORM SEWER PIPE: Solid black line
- CROSSSPAN: Inverted U-shape
- INLET: Square symbol
- EXISTING FLOW DIRECTION: Arrow
- FLOW DIRECTION: Arrow
- FLARED END SECTION: Tapered shape
- HIGH POINT: H.P. X
- LOW POINT: L.P. X

BASIN SUMMARY

BASIN	AREA (ACRES)	Q ₅	Q ₁₀₀
OS2	2.10	8.9	15.9
OS3	0.43	0.4	1.3
OS4	0.61	0.5	1.9
OS5	1.54	5.6	10.0
A	2.79	3.6	8.7
B	2.70	3.6	8.6
C	2.92	4.2	10.1
D	2.90	4.3	10.4
E	5.34	8.2	19.9
F	1.12	4.3	7.7
G	0.61	0.5	1.9
EX-H	0.19	0.9	1.6
M	1.15	1.0	3.6
M2	1.60	0.4	3.2
N	2.08	1.6	5.7
O	0.57	0.5	1.8
W-2	10.00	2.7	19.7
OS1 HISTORIC	111.70	18.9	136.8
SUB-BASIN OS1A	2.70	0.7	5.3
SUB-BASIN OS1B	9.09	2.4	17.8
SUB-BASIN OS1C	5.64	1.5	11.1
SUB-BASIN OS1D	94.3	16.3	119.5
V1A	0.31	1.4	2.6
V1B	0.26	1.2	2.2
V1C	0.21	1.0	1.7
V1D	0.13	0.6	1.1
V2	0.32	1.5	2.7
RP-2B	2.04	4.9	9.9
RP-2C	1.28	4.3	8.2

DESIGN POINT SUMMARY

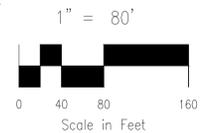
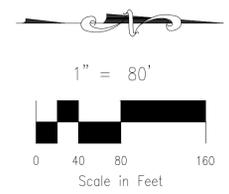
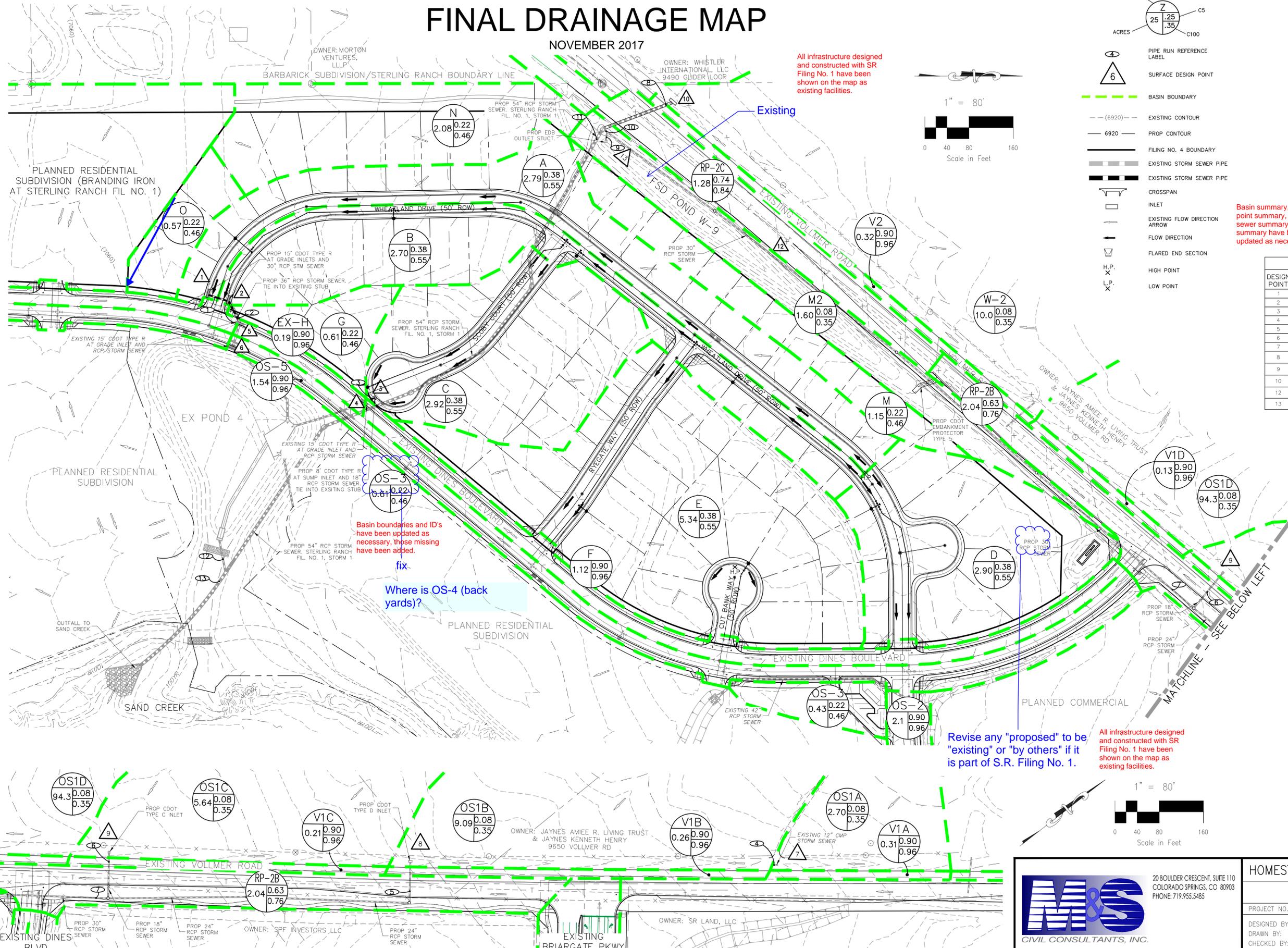
DESIGN POINT	Q ₅	Q ₁₀₀	BASIN	STRUCTURE
1	3.6	8.7	A	15' AT-GRADE INLET
2	3.6	8.6	B	15' AT-GRADE INLET
3	4.2	10.1	C	8' SUMP INLET
4	16.1	36.7	D, E, F	15' AT-GRADE INLET
5	4.2	19.7	G, EX-H, FLOWBY DP4	EX 15' AT-GRADE INLET
6	14.1	26.7	OS2, OS3, OS4, OS5	EX 15' AT-GRADE INLET
7	1.6	7.0	OS1A, V1A	EX 12" CMP CULVERT
8	4.8	26.3	OS1B, V1B, DP6	2.9'x5.7' CDDT TYPE D INLET
9	2.2	12.3	OS1C, V1C	2.9'x2.9' CDDT TYPE C INLET
10	18.9	133.7	OS1D, V1D, W-2, V2	4'x14' MOD CDDT TYPE D INLET
12	2.8	5.6	RP-2B	CDDT EMBANKMENT PROTECTOR TYPE 5
13	8.9	21.2	M, M2, RP2C, DP10	FSD WCVV POND W-9

STORM SEWER SUMMARY

PIPE RUN	Q ₅	Q ₁₀₀	PIPE SIZE	CONTRIBUTING PIPES
1	3.6	8.7	30" RCP	DP1
2	7.1	17.2	36" RCP	DP2, PR1
3	4.2	10.1	18" RCP	DP3
4	1.6	7.0	EX 12" CMP	DP7
5	4.8	26.3	24" RCP	DP8
6	2.2	12.3	18" RCP	DP9
7	7.0	38.6	30" RCP	PR5, PR6
8	18.9	133.7	54" RCP	DP10
9	0.6	8.7	18" RCP	OUTFLOW EDB POND W-9
10	7.6	47.2	30" RCP	PR7, PR9
11	23.8	164.1	54" RCP	PR8, PR10
12	2.7	36.2	30" RCP	OUTFLOW EDB POND 4
13	26.5	200.3	60" RCP	PR11, PR12

REVISED POND W-8 FSD BASIN DATA

WQ WATER SURFACE EL = 7086.59
 WQ VOLUME = 0.092 AC-FT
 EURV WATER SURFACE EL = 7087.99
 EURV VOLUME = 0.390 AC-FT
 100-YR WATER SURFACE EL = 7088.84
 SPILLWAY CREST EL = 7088.84
 TOP OF EMBANKMENT EL = 7090.5
 100-YR VOLUME = 0.635 AC-FT
 100-YR INFLOW = 21.2 CFS
 100-YR RELEASE = 8.7 CFS



HOMESTEAD AT STERLING RANCH FIL NO. 1

FINAL DRAINAGE MAP

PROJECT NO. 09-005
 DESIGNED BY: CMN
 DRAWN BY: CMN
 CHECKED BY: VAS

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

DATE: 11/09/2017
 SHEET 1 OF 1
FDM01

File: 0:\00005A\Sterling Ranch No 2\Map\Eng Exhibit\Proposed Drainage Map.dwg Plotstamp: 11/10/2017 9:51 AM

Markup Summary

dsdrice (20)

155-5485

#09-005
SF-17-025

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SF-17-025



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Revise to state that Filing 1 is constructing pond W-9.

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1 and the /
2. The de

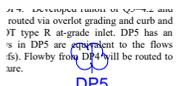
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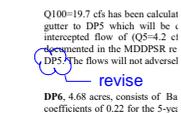
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Address overall Sterling Ranch MDDP (provide) and add reference.



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DP5



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revise

every station are recommended to be replaced per the same message and lighting development. The proposed change includes all all items for change and needs done in the Street Curb Through Water Quality Pond will be used to discharge. Avoid and from this this from the pond as a new drain for storm flow. Care considered to avoid this area, water and temporary discharge around the pond. Refer to the 10 project sheet for an alternative.

see redline on output sheet

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see redline on output sheet

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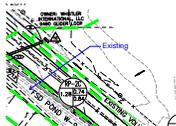
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Address these values meeting release requirements in the report. Revise if necessary.

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Existing



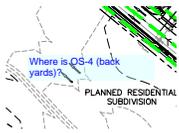
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Revise any "proposed" to be "existing" or "by others" if it is part of S.R. Filing No. 1.



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fix



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Where is OS-4 (back yards)?



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show rear lot swale

cneises (35)



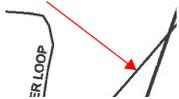
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SITE



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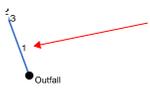


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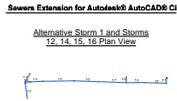


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Storm 14

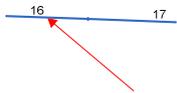


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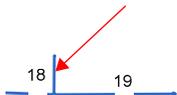


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Alternative Storm 1 and Storms 12, 14, 15, 16 Plan View



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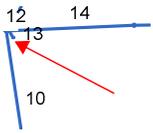
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Date: 11/9/2017 4:27:32 PM
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Line Number

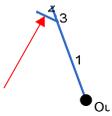


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Storm 15



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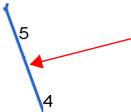


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Alternative Storm 1

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Date: 11/9/2017 4:23:37 PM
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Alternative Storm 1



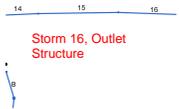
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Storm 12, Outlet Structure



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Storm 12, Outlet Structure



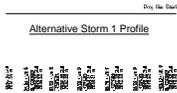
Storm 16, Outlet Structure

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Storm 16, Outlet Structure



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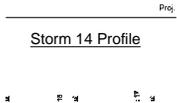
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Alternative Storm 1 Profile



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Storm 12 Outlet Structure Profile



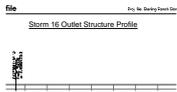
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Storm 14 Profile



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Storm 15 Profile



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Storm 16 Outlet Structure Profile

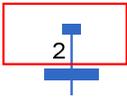
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Alternative Storm 1 and Storms 12, 14, 15, 16 Summary



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ms Extension for Autodesk® AutoCAD® City

Storm 3 Extension Plan View



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Author: cneises
Date: 11/9/2017 4:15:52 PM
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Storm 3 Extension Plan View

Extension

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Extension

Storm 3 Extension Profile



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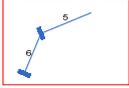
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Storm 3 Extension Summary

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2	2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
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Date: 11/9/2017 4:16:19 PM
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Storm 3 Extension Summary



Subject: Rectangle
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Date: 11/9/2017 4:20:20 PM
Color: ■

Extension

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Page Label: 50
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Author: cneises
Date: 11/9/2017 4:20:29 PM
Color: ■

Extension



Subject: Arrow
Page Label: 50
Lock: Unlocked
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vere Extension for Autodesk® AutoCAD® C

Storm 4 Extension Plan View

Subject: Text Box
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Date: 11/9/2017 4:16:44 PM
Color: ■

Storm 4 Extension Plan View

Storm 4 Extension Profile



Subject: Text Box
Page Label: 51
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Status:
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Date: 11/9/2017 4:17:00 PM
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Storm 4 Extension Profile

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0+200	100	100	100	100	100	100	100	100	100	100	100
0+300	100	100	100	100	100	100	100	100	100	100	100
0+400	100	100	100	100	100	100	100	100	100	100	100
0+500	100	100	100	100	100	100	100	100	100	100	100
0+600	100	100	100	100	100	100	100	100	100	100	100
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0+800	100	100	100	100	100	100	100	100	100	100	100
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Subject: Text Box

Storm 4 Extension Summary

Page Label: 52

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Author: cneises

Date: 11/9/2017 4:17:22 PM

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AutoCAD SHX Text (550)



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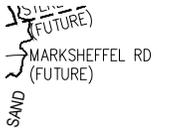
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VIC



Subject:

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Lock: Unlocked

Status:

Checkmark: Unchecked

Author: AutoCAD SHX Text

Date:

Color: □



Subject:

(FUTURE)

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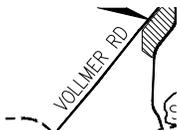
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Author: AutoCAD SHX Text

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Color: □



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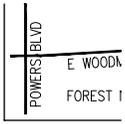
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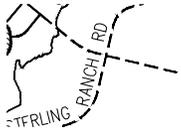
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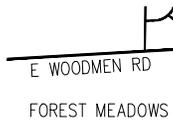
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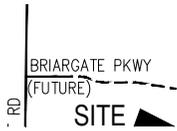
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Date:
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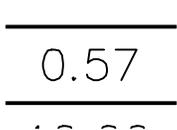
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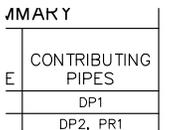
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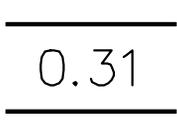
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9

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OS1A, V1A
OS1B, V1B, DP6
OS1C, V1C,

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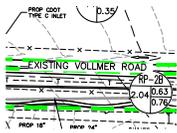
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Date:
Color:

EXISTING VOLLMER ROAD



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DESIGN POINT

V1B

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V1B

8

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8



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164.1



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7



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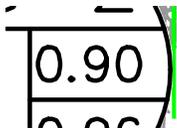
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OWNER: JAYNES AMIEE R. LIVING TRUST &
JAYNES KENNETH HENRY 9650 VOLLMER RD

V1C

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3.6

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FDM01

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OS1D

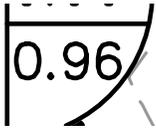
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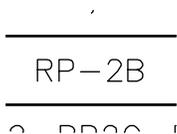
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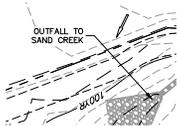
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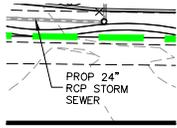


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12

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12



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PROP 24" RCP STORM SEWER

1.60

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Status:
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Author: AutoCAD SHX Text
Date:
Color:

1.60



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Lock: Unlocked
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Date:
Color:

PROP 36" RCP STORM SEWER. TIE INTO EXSITING STUB

10.0

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10.0

94.3

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94.3

6

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6

E

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1.5

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Date:
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1.5

13

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Color:

13

VAS

Subject:
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Status:
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Author: AutoCAD SHX Text
Date:
Color:

VAS

18" RCP
EX 12" CMP
24" RCP
12" RCP

Subject:
Page Label: [1] Filing No. 3
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Status:
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Author: AutoCAD SHX Text
Date:
Color:

EX 12" CMP

30" RCP	Subject:	54" RCP
54" RCP	Page Label: [1] Filing No. 3	
18" RCP	Lock: Unlocked	
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EX-H

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0.22

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Color:

30" RCP
36" RCP
18" RCP

Subject:
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Author: AutoCAD SHX Text
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2.2

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SCALE:
HORIZONTAL:

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19.9

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V1D

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Color:

26.3

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38.6

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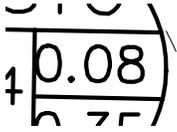
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OWNER: JAYNES AMIEE R. LIVING TRUST &
JAYNES KENNETH HENRY 9650 VOLLMER RD



Subject:
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0.08

15' AT-GRADE INLET
8' SUMP INLET
15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 12" CMP CULVERT
2.9'x5.7' CDOT TYPE D INLET

Subject:
Page Label: [1] Filing No. 3
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EX 15' AT-GRADE INLET

- 24" RCP
- 18" RCP
- 30" RCP

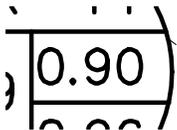
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18" RCP



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4.3



Subject:
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Date:
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0.90



Subject:
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PROP 54" RCP STORM SEWER. STERLING RANCH FIL. NO. 1, STORM 1

SUB-BASIN OS1A
SUB-BASIN OS1B
SUB-BASIN OS1C
SUB-BASIN OS1D
V1A

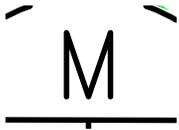
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SUB-BASIN OS1C



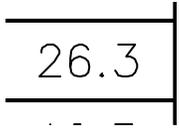
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6



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Color:

M



Subject:
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Date:
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26.3



Subject:
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Color:

PROP 30" RCP STORM SEWER

OUTFLOW EDD
POND W-9
PR7, PR9
PR8, PR10

Subject:
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Author: AutoCAD SHX Text
Date:
Color:

1.7

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0.19

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5

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200.3

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7

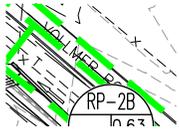
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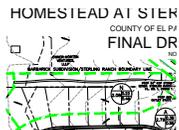
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Subject: BARBARICK SUBDIVISION/STERLING RANCH
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2.2

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Color:

OS3

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0.38

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A

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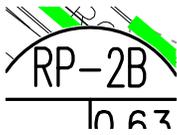
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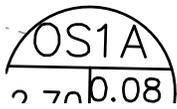
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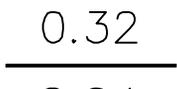
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RP-2B



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OS1A



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Subject:
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A



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36.2

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8

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Q100

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9

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11

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-(7060)-

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47.2

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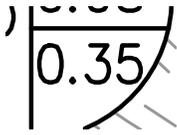
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U
W-2
OS1 HISTORIC
SUB-BASIN OS1A
SUB-BASIN OS1B

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Z

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Subject:
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ACRES ↙

Subject:
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DP10
TFI OW F

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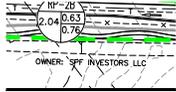
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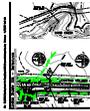
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Color:

OWNER: SPF INVESTORS LLC



Subject:
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File: O:\09005A\Sterling Ranch No 2\dwg\Eng Exhibits\Proposed Drainage Map.dwg Plotstamp: 11/10/2017 9:51 AM

PIPE RUN

1

Subject:
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Author: AutoCAD SHX Text
Date:
Color:

PIPE RUN

EA 12 LMF CULVERT
2.9'x5.7' CDOT TYPE D INLET
2.9'x2.9' CDOT TYPE C INLET
4'x14' MOD CDOT TYPE D INLET
CDOT EMBANKMENT PROTECTOR TYPE 5
FSD WQCV POND W-9

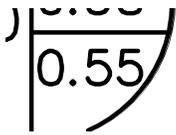
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4'x14' MOD CDOT TYPE D INLET

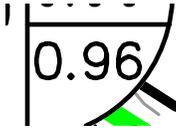
- FILING NO. 4 BOUNDARY
- EXISTING STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- CROSSSPAN
- INLET

Subject:
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EXISTING STORM SEWER PIPE



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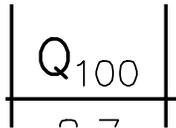
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Subject: PROP 18" RCP STORM SEWER
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EX 15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 12" CMP CULVERT
2.9'x5.7' CDOT TYPE D INLET
2.9'x2.9' CDOT TYPE C INLET
4'x14' MOD CDOT TYPE D INLET

Subject: 2.9'x5.7' CDOT TYPE D INLET
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Subject: PLANNED RESIDENTIAL SUBDIVISION
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09-005

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EX POND 4

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E

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Date:
Color:

PIPE SIZE
30" RCP

Subject:
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Author: AutoCAD SHX Text
Date:
Color:

SURFACE DESIGN POI
BASIN BOUNDARY
EXISTING CONTOUR

Subject:
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Lock: Unlocked
Status:
Checkmark: Unchecked
Author: AutoCAD SHX Text
Date:
Color:

40 80
Scale in Feet

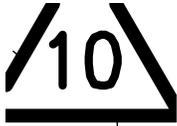
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Scale in Feet

CROSSSPAN
INLET
EXISTING FLOW DIRECTION
ARROW
FLOW DIRECTION
FLARED END SECTION

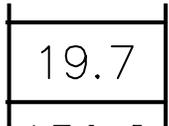
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EXISTING FLOW DIRECTION ARROW



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10



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19.7



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M



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OS1B, V1B, DP6
OS1C, V1C,
OS1D, V1D, W-2, V2
RP-2B
M, M2, RP2C, DP10

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OS1D, V1D, W-2, V2

OS5

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OS5

0.90

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1.3

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0.26

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2, OS3, OS4, C
OS1A, V1A
OS1B, V1B, DP6

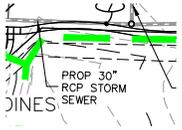
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OS1A, V1A

2

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2



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PROP 30" RCP STORM SEWER

2.8

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C

2.70 C C

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3 RANCH FIL NO. 1

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BASIN

A

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BASIN

L.P.
X

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L.P.

5

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2.7

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2.7

13

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13

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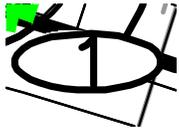
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PROP EDB OUTLET STUCT.

W-2	
OS1 HISTORIC	1
SUB-BASIN OS1A	
SUB-BASIN OS1B	
SUB-BASIN OS1C	

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SUB-BASIN OS1A



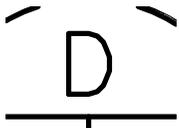
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5.64

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D

2.1

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0.5

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2.90

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STRUCTURE
15' AT-GRADE INLET
15' AT-GRADE INLET
8" SUMP INLET
15' AT-GRADE INLET
EX 15' AT-GRADE INLET

Subject: 15' AT-GRADE INLET
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E MAP
11/09/2017

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Color:

V2

Subject:
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Date:
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V2

2.08

Subject:
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2.08

D

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D

STORM SEWER SUMMARY			
E. RUN	Q ₁₀₀	PIPE SIZE	CONTRIBUTOR PIPES
1	3.6	8" 30' RCP	SP1
2	7.1	12" 30' RCP	DP2, PR1

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STORM SEWER SUMMARY

19.7

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19.7



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OWNER: SR LAND, LLC

2.6

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2.6

LEGEN

BASIN DESIGNATION

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BASIN DESIGNATION

0

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18.9

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5.6

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9.09

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9.09

17.2

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2.7

10	22.2	27.2	30' RSP	PR7, PR8
11	23.8	28.1	30' RSP	PR8, PR9
12	25.1	28.2	30' RSP	OUTFLOW EDB
13	26.5	29.3	40' RSP	PR9, PR10

REVISED POND W-8 FSD	
BASIN DATA	
NO WATER SURFACE EL. = 7086.59	
NO VOLUME = 0.092 AC-FT	
EURV WATER SURFACE EL. = 7087.59	
EURV VOLUME = 0.280 AC-FT	
100-YR WATER SURFACE EL. = 7088.84	
SPILLWAY CREST EL. = 7088.84	

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REVISED POND W-8 FSD BASIN DATA



Subject:
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CUT BANK WAY (50' ROW)

PR9, PR10	
DP10	
OUTFLOW EDB	
POND W-9	
PR7, PR9	
PR8 PR10	

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OUTFLOW EDB POND W-9

C

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Date:
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H.P.

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V1A

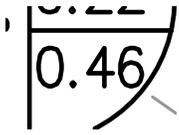
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30" RCP
54" RCP
30" RCP

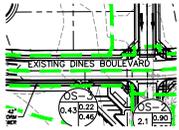
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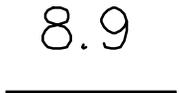
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15' AT-GRADE INLET
15' AT-GRADE INLET
8' SUMP INLET
15' AT-GRADE INLET
< 15' AT-GRADE INLE

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Subject: 8.9
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Subject: F
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Subject: PLANNED RESIDENTIAL SUBDIVISION
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Color:



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EXISTING 15' CDOT TYPE R AT GRADE INLET
AND RCP STORM SEWER



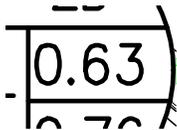
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MATCHLINE - SEE ABOVE RIGHT

EXISTING CONTOUR
PROP CONTOUR
FILING NO. 4 BOUN

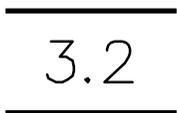
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PROP CONTOUR



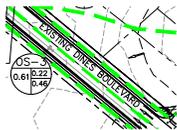
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3.2



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EXISTING DINES BOULEVARD



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PROP 15' CDOT TYPE R AT GRADE INLETS
AND 30' RCP STM SEWER

36" RCP
18" RCP
EX 12" CMP

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Date:
Color:

18" RCP

11.1

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DP1
DP2, PR1
DP3

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Color:

DP2, PR1

0.08

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0.7

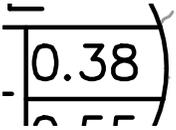
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PROP 8' CDOT TYPE R AT SUMP INLET AND
 18" RCP STORM SEWER. TIE INTO EXSITING
 STUB



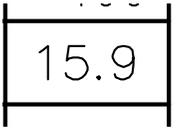
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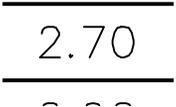
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15.9



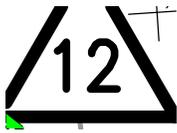
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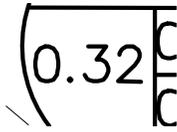
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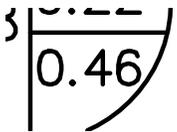
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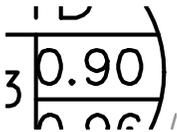
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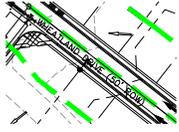
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4.2

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Subject: WHEATLAND DRIVE (50' ROW)
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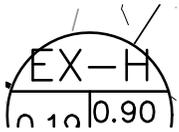
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80

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2.2

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OS1 HISTORIC
SUB-BASIN OS1A
SUB-BASIN OS1B
SUB-BASIN OS1C
SUB-BASIN OS1D

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4.2

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AD
RP-2B
10 6 3

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0.46

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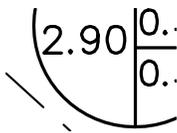
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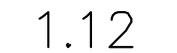
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4.8



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MATCHLINE - SEE BELOW LEFT

5.7

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5.7

PR7, PR9
PR8, PR10
OUTFLOW EDB
POND 4

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PR8, PR10

2.92

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RP-2B
RP-2C

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RP-2C

OS1B, V1B, DP6
OS1C, V1C,
1D, V1D, W-2,

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OS1C, V1C,

DP7

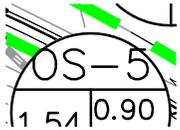
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3

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3



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OS-5

PROJECT NO. 09

DESIGNED BY:
DRAWN BY:
CHECKED BY:

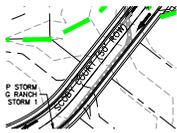
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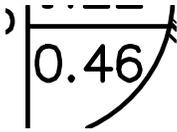
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Color:

SCOBY COURT (50' ROW)



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Author: AutoCAD SHX Text
Date:
Color:

8.7



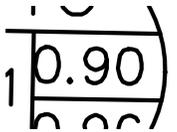
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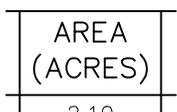
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Color:

0.90



Subject:
Page Label: [1] Filing No. 3
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Date:
Color:

AREA (ACRES)

STRUCTURE
5' AT-GRADE INLET
5' AT-GRADF INLFT

Subject:
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Lock: Unlocked
Status:
Checkmark: Unchecked
Author: AutoCAD SHX Text
Date:
Color:

STRUCTURE

CMN

Subject:
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Status:
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Date:
Color:

CMN

B
C
D, E, F
G, EX-H, FLOWBY DP4
OS2, OS3, OS4, OS5
OS1A, VIA
OS1B, V1B, DP6

Subject:
Page Label: [1] Filing No. 3
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Color:

G, EX-H, FLOWBY DP4

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OWNER: SPF INVESTORS LLC

2.92

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2.92

9

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9

10

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4.9

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4.9

G

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G

0.6

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1.6

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OS2

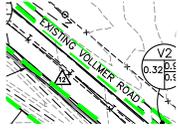
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OS2

EXISTING STR
CROSSSPAN
INLET

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Date:
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CROSSSPAN



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EXISTING VOLLMER ROAD



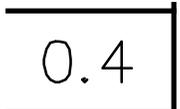
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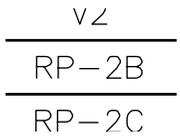
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0.4



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RP-2B

DP9

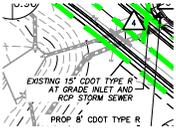
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DP9

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0.19



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Author: AutoCAD SHX Text
Date:
Color:

EXISTING 15' CDOT TYPE R AT GRADE INLET
AND RCP STORM SEWER



Subject:
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Date:
Color:

PROP 24" RCP STORM SEWER

3.6

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3.6

DP8

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DP8

B

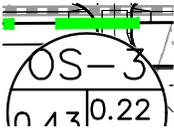
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B

V1C

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Color:

V1C



Subject:
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Date:
Color:

OS-3

8' SUMP INLET
15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 12" CMP CULVERT
2.9'x5.7' CDOT TYPE D INLET
2.9'x2.9' CDOT TYPE C

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EX 15' AT-GRADE INLET

2.10

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2.10



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1.12

DATE: 11/09/201

SHEET 1 OF 1

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SHEET 1 OF 1

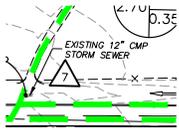
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270

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111.70



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Color:

EXISTING 12" CMP STORM SEWER

4'x14' MOD CDOT TYPE D
INLET
CDOT EMBANKMENT
PROTECTOR TYPE 5
FSD WQCV POND W-9

R SUMMARY

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FSD WQCV POND W-9

0.5

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0.5

14.1

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14.1

48 HRS BEFORE
CALL 1-800-
EAD AT STERLING RANCH FII

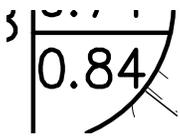
FINAL DRAINAGE MAP

38-025	SCALE:	DATE: 11/09/2017
DATE:	HORIZONTAL:	
CAD:	1"=60'	
WAS:	VERTICAL:	SHEET 1 OF 1
	N/A	

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Color:

OSID, VID, W-2, V2
RP-2B
M, M2, RP2C, DP10
STORM SFWI

Subject: M, M2, RP2C, DP10
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REAR END

HIGH POINT

LOW POINT

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3
0.35

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10.00

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INLET

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133.7

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9.9

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5.34

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DP9
PR5, PR6
DP10

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PR5, PR6

23.8

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0.96

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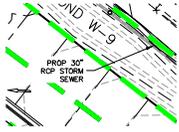
C

D, E, F

H, FLOWBY

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D, E, F



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PROP 30" RCP STORM SEWER

8.2

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8.2

10.1

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10.1

ARROW
FLOW DIRECTION
FLARED END SECTION
HIGH POINT

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FLARED END SECTION

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F

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(1.15)

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Date:
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2.70

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7.0

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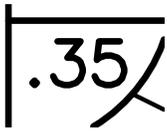
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Date:
Color:

SUB-BASIN OS1B
SUB-BASIN OS1C
SUB-BASIN OS1D
V1A
V1B

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1.0

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36.7

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0.08

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16.1

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40 80
Scale in Feet

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Scale in Feet

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4.2

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4.2

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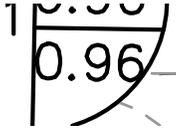
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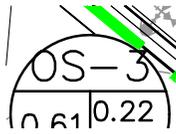
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LOW POINT



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OS-3

80'

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80'

1" =

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CALL 1-800-922-1987

8.6

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8.6

1.60

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1.60

CMN

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CMN

PIPE RUN REFERENCE LABEL
SURFACE DESIGN POINT
BASIN BOUNDARY

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SURFACE DESIGN POINT

Q5

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Q 5

PROJECT NO. 0'
DESIGNED BY:

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Date:
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PROJECT NO.

4.8

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0.22

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EX 12" CMP
24" RCP
18" RCP

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24" RCP

0.43

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1.1

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1.1

54" RCP
30" RCP
60" RCP

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30" RCP

1.4

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1.4

6

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6

H.P.
X

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26.7

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15' AT-GRADE INLET
15' AT-GRADE INLET
8' SUMP INLET
15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 12" CMP CULVERT

Subject: 15' AT-GRADE INLET
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- C5

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G

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C

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OS1D
0.08

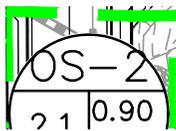
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W-2

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2.90

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EX 12" A1-URADE INLET
EX 12" CMP CULVERT
2.9'x5.7' CDOT TYPE D INLET
2.9'x2.9' CDOT TYPE C INLET
4'x14' MOD CDOT TYPE D INLET
CDOT EMBANKMENT PROTECTOR TYPE 5

Subject: 2.9'x2.9' CDOT TYPE C INLET
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9

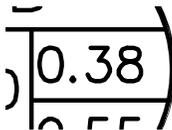
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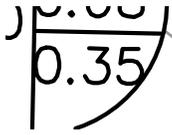
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LEGEND

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BASIN
 OS2

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PR8, PR10
OUTFLOW EDB
POND 4
PR11, PR12

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.38

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4.2

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4.2



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PROP 18" RCP STORM SEWER

1

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1

119.5

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119.5



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OWNER:MORTON VENTURES, LLLP



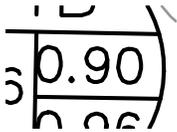
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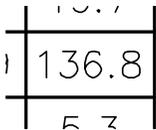
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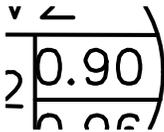
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15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 15' AT-GRADE INLET
EX 12" CMP CULVERT
2.9'x5.7' CDOT TYPE D INLET
2.9'x2.9' CDOT TYPE C INLET

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12

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4

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PIPE SIZE

30" RCP

36" RCP

Subject: 30" RCP
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2.9x2.9 CDOT TYPE C
INLET
4'x14' MOD CDOT TYPE D
INLET
CDOT EMBANKMENT
PROTECTOR TYPE 5
FSD WQCV POND W-9

Subject: CDOT EMBANKMENT PROTECTOR TYPE 5
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Date:
Color:

C
D, E, F
G, EX-H, FLOWBY DP4
OS2, OS3, OS4, OS5
OS1A, V1A
OS1B, V1B, DP6

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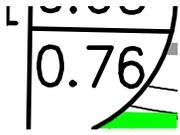
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7.1

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ORIZONIAL
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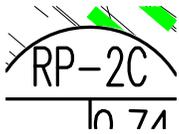
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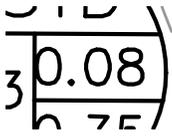
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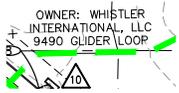
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V1A

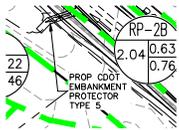
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18" RCP

30" RCP

54" RCP

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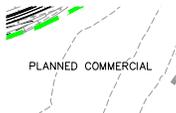
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RP-2B	2.04	4.9	9.9
RP-2C	1.28	4.3	8.2

DESIGN POINT SUMMARY		
Q ₁₀₀	BASIN	STF
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5.6	B	15' AT
10.1	C	15' AT

Subject: DESIGN POINT SUMMARY
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Color:



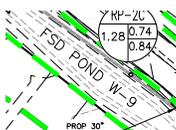
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8.6

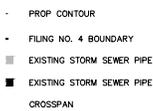
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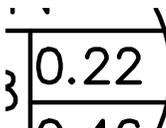
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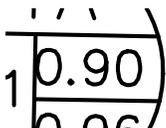
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Subject: 0.90
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Date:
Color:

2

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2

0.96

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0.96

26.5

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26.5

1.28

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1.28

54" RCP

18" RCP

30" RCP

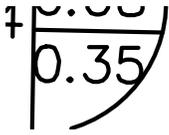
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18" RCP

OS1B
0.08

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OS1B



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13

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30" RCP

60" RCP

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REVISED POND W-8 FSD
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WQ VOLUME=0.092 AC-FT
EURV WATER SURFACE EL = 7087.99
EURV VOLUME=0.390 AC-FT
100-YR WATER SURFACE EL=7088.84
SPILLWAY CREST EL=7088.84
TOP OF EMBANKMENT EL=7090.5
100-YR VOLUME=0.638 AC-FT
100-YR INFLOW = 21.2 CFS
100-YR RELEASE = 8.7 CFS

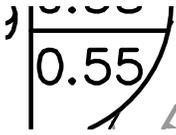
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 Status: 100-YR WATER SURFACE EL=7088.84
 Checkmark: Unchecked SPILLWAY CREST EL=7088.84 TOP OF
 Author: AutoCAD SHX Text EMBANKMENT EL=7090.5 100-YR
 Date: VOLUME=0.638 AC-FT 100-YR INFLOW = 21.2
 Color: CFS 100-YR RELEASE = 8.7 CFS



Subject: 4
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BASIN SUMMARY			
BASIN	AREA (ACRES)	Q _s	Q _t
052	2.10	8.9	11

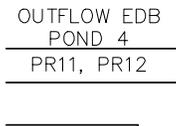
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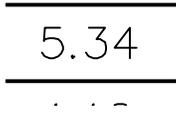
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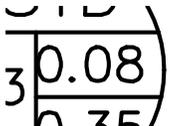
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5.6

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5.6

12.3

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12.3

1.28

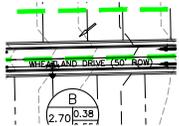
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2.70

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2.70



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WHEATLAND DRIVE (50' ROW)

2.04

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2.04

7

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7

2.08

Subject:
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Date:
Color:

2.08

0.96

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Date:
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0.96

0.22

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0.22

0.35

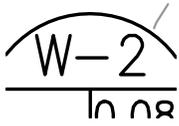
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0.35

Q100

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Checkmark: Unchecked
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Date:
Color:

Q 100



Subject:
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Date:
Color:

W-2



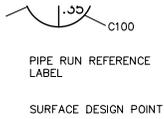
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4



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5



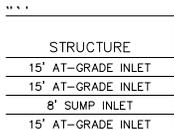
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PIPE RUN REFERENCE LABEL



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V1D



Subject:
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15' AT-GRADE INLET

0.08

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Date:
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M2

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3

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10

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21.2

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6920 -

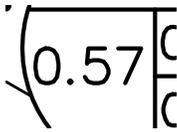
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EXISTING 42" RCP STORM SEWER



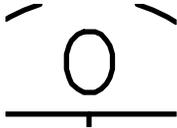
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12

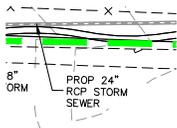
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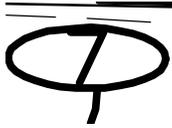


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PROP 24" RCP STORM SEWER

3.6

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18.9

Subject:
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9

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Color:

SCALE:
HORIZONTAL:
1"=80'
VERTICAL:

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Color:

BASIN BOUNDARY
EXISTING CONTOUR
PROP CONTOUR

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Author: AutoCAD SHX Text
Date:
Color:

EXISTING FLOW DIRE
ARROW
FLOW DIRECTION
FLARED END SECTI

Subject:
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Date:
Color:

FLOW DIRECTION

V2

Subject:
Page Label: [1] Filing No. 3
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V2

2.90 | 0.38
0.55

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Color:

0.38

1.0

Subject:
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Date:
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HOMESTEAD AT STERLING RANCH FIL NO. 1

133.7

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Author: AutoCAD SHX Text
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Color:

133.7

B

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Date:
Color:

B

DESIGNED BY
DRAWN BY:
CHECKED BY:

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Color:

DRAWN BY:

0.5

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0.5

.25

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M2

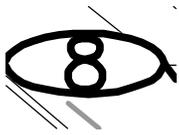
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M2

8

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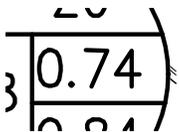
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