MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT FOR STERLING RANCH

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Project No. 25188.04

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ENGINEER'S STATEMENT:
The attached drainage plan amendment was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said drainage plan amendment has been prepared according to the criteria established by El Paso County for drainage plans and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____
Mike Bramlett, Colorado P.E. # 32314 Date
For and On Behalf of JR Engineering, LLC

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: _____

By: _____

Title: _____
Address: _____
_____

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

Joshua Palmer

_____ _____
Jennifer Irvine, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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PURPOSE

This document is an amendment to the approved Master Development Drainage Plan (MDDP) for Sterling Ranch. The purpose of this MDDP Amendment report is to:

1. Amend the approved MDDP to account for completed and planned on-site development within Sterling Ranch, including detention from completed filings.
2. Document all differences between the analysis and conclusions reached in the MDDP and this Amendment.
3. Provide analysis and conceptual design information for the on-line Detention Pond at Sterling Ranch Road (PNDW3).
4. This amendment is not intended to address drainage and bridge fees or credits for DBPS improvements. Subsequent submittals will address this.

GENERAL LOCATION AND DESCRIPTION

Location

Sterling Ranch, known as "the site" from herein, is a parcel of land located in Section 27, 28, 33 and 34, Township 12 South, and Section 4, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. To the west the site is bound by Vollmer Road. To the north and east, the site is bounded by undeveloped land. To the south, the site is bound by the Pawnee Rancheros and Woodmen Heights developments. A vicinity map is presented in Appendix A.

Description of Property

Sterling Ranch is 1444 acres and is a Planned Unit Development to be built in multiple phases. The site is currently in various stages of development, with portions already in construction, with others unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, the site slopes from north to south and the existing drainageways follow this topography.

Per a NRCS web soil survey of the area, the site is made up of Type A and B soils. Type A soils cover roughly 65% of the site while Type B soils cover the remaining 35% of the site. Group A soils have a high infiltration rate when thoroughly wet. Type B soils have a moderate infiltration when thoroughly wet. Type D soils have a very slow infiltration rate when thoroughly wet and have a high shrink-swell potential. A NRCS soil survey map has been presented in Appendix A.

Floodplain Statement

Based on the FEMA FIRM Map numbers 08041C0533G and 08041C0535G, dated December 7, 2018, the site lies within Zone AE and Zone X of the Sand Creek floodplain. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. All proposed development within the site occurs in Zone X. The current FIRM Map has been presented in Appendix A.

DRAINAGE BASINS AND SUBBASINS

Major Basin Descriptions

The site lies within two major drainage basins: the Sand Creek Drainage Basin and the East Fork of Sand Creek Drainage Basin. Both Basins have been previously studied firstly in the 1996 Drainage Basin Planning Study (DBPS) and again in the 2018 Sterling Ranch MDDP by M&S, and finally in the 2021 DBPS by Stantec which has not been adopted by the El Paso County.

The Sand Creek Drainage Basin covers approximately 22 square miles and begins approximately five miles northeast of the Town of Falcon and travels approximately 15 miles to the southeast. The majority of the area within the basin is undeveloped and is characterized as rolling range land typically associated with Colorado's semi-arid climates. Anticipated land use for the basin includes residential, industrial, agricultural and commercial development. Residential developments will range from 0.125 – 5 acre lots with a mix of low, medium and high density developments.

As part of its drainage research, JR Engineering reviewed the following drainage studies and reports:

- Sand Creek Drainage Basin Study prepared by Kiowa in 1996
- Upper Sand Creek Basin Drainage Study prepared by Wilson in 2011
- Sand Creek Drainage Basin Study prepared by Stantec in 2021
- Sterling Ranch Master Development Drainage Plan prepared by M&S in 2018
- Sterling Ranch Filing 1 Final Drainage report prepared by M&S in 2016
- Upper Sand Creek Basin Detention Evaluation Report by Wilson in 2009
- Branding Iron at Sterling Ranch Filing 1 Drainage Report prepared by M&S in 2018
- Branding Iron at Sterling Ranch Filing 2 Drainage Report prepared by M&S in 2020
- Sterling Ranch East Preliminary Drainage Report prepared by Classic Consultants in 2022

- Sterling Ranch Filing 2 Final Drainage Report prepared by JR Engineering in 2021
- Homestead North at Sterling Ranch Preliminary Drainage Report prepared by JR Engineering in 2021
- Aspen Meadows Final Drainage Report prepared by Matrix Design Group in 2019
- Homestead at Sterling Ranch Filing 1 Final Drainage Report prepared by M&S in 2018
- Homestead at Sterling Ranch Filing 2 Final Drainage Report prepared by M&S in 2020

Existing Sub-basin Drainage

The existing conditions sub-basins remain unchanged from the 2018 MDDP.

Proposed Sub-basin Drainage

The proposed basins remain unchanged from the MDDP, except where stated below:

SC3-6B is approximately 30.9 acres. It is composed of a portion of the Sterling Ranch Filing 2 Development. The basin is comprised of single-family housing, open space, and a future school site. The basin drains south via curb and gutter and storm sewer to Pond W-5. Flows from Pond W-5 (FSD6) discharge directly into Sand Creek at design point 61.

SC3-6C is approximately 62.1 acres. It is composed of a portion of the Sterling Ranch Filing 2 Development. The basin is comprised of single-family housing, open space, and a future school site. The basin drains southwest via curb and gutter and storm sewer to Pond W-5. Flows from Pond W-5 (FSD6) discharge directly into Sand Creek at design point 61.

SC3-11A is approximately 7.73 acres. It is composed entirely of the Sand Creek channel adjacent to the Sterling Ranch Filing 2. The basin drains south directly into Sand Creek at design point 63.

SC3-11B is approximately 64.5 acres. It is composed of a portion of the Sterling Ranch East Development. The basin is comprised of single-family housing, open space, and a future school site. The basin drains to the southwest via on-site curb and gutter and storm sewer to Pond FSD11B. Pond FSD11B outfalls directly into Sand Creek downstream of Sterling Ranch Road.

SC3-11C is approximately 8.2 acres. It is composed of a portion of the Sterling Ranch East development. The basin is comprised entirely of single-family housing. The basin drains off-site to the south into the Bar J-B Acres development via level-spreader.

SC3-12 is approximately 54.9 acres. It is composed of a portion of the Sterling Ranch Filing 1 Development. The basin is comprised of single-family housing and open space. The basin drains southwest via future on-site curb and gutter and storm sewer to Pond FSD12. Pond FSD12 outfalls directly into Sand Creek upstream of Sterling Ranch Road.

SC3-12A is approximately 16.9 acres. It is composed of a portion of the Sterling Ranch Filing 1 Development. The basin is comprised of single-family housing and open space. The basin drains southwest via future on-site curb and gutter and storm sewer to Pond FSD12A. Pond FS12A outfalls directly into Sand Creek upstream of Sterling Ranch Road.

SC3-12B is approximately 22.8 acres. It is composed entirely of the Sand Creek channel adjacent to the Homestead Filing 2 development. The basin drains north to south via the Sand Creek channel and outfalls at design point 87.

SC3-13 is approximately 41.0 acres. It is composed of Branding Iron at Sterling Ranch Filings 1 and 2, which is a portion of Sterling Ranch Filing 1. The basin is comprised of single-family housing and open space. The basin drains north to south via curb and gutter and storm sewer to Pond FSD13.Pond FSD13 outfall directly into Sand Creek.

SC3-13A is approximately 28.1 acres. It is composed entirely of the Sand Creek channel adjacent to the Branding Iron development. The basin drains north to south via the Sand Creek channel and outfalls at design point 68.

SC3-14A is approximately 130.9 acres. It is composed of a portion of the Sterling Ranch East Development east of Sand Creek. The basin is comprised of single-family housing and open space. The basin drains southwest via future on-site curb and gutter and storm sewer to Pond FSD14A. Pond FS14A outfalls directly into Sand Creek upstream of Sterling Ranch Road.

SC3-14B is approximately 63.1 acres. It is composed of a portion of the Sterling Ranch East Development east of the Sterling Ranch Road alignment. The basin is comprised of single-family housing and open space. The basin drains southwest via future on-site curb and gutter and storm sewer to Pond FSD14B. Pond FS14B's flows are routed south to the property line where it drains off-site to the south into the Bar J-B Acres development via level-spreader.

SC3-15A is approximately 128.7 acres. It is currently composed of low density housing and undeveloped land. The basin drains to the south to FSD15B at design point 26. The pond ultimately outfalls in Sand Creek at design point 87.

SC3-16 is approximately 245.0 acres. It is the combined basin of Basins SC316A and SC3B from the 2018 MDDP. It is composed of a portion of the Sterling Ranch East Development. The

basin is comprised of single-family housing and open space. The basin drains south via future on-site curb and gutter and storm sewer to Pond FSD16. Pond FSD16's flows down Sterling Ranch Road via storm sewer where it outfalls into Pond W-3.

SC3-17B is approximately 30.3 acres. It is composed of a portion of the Homestead North development. The basin is comprised of single-family housing and open space. The basin drains north to south via curb and gutter and storm sewer into Pond A, previously a part of FSD17 in the MDDP. Flows from Pond A discharge east directly in Sand Creek at design point 71.

SC3-17A is approximately 27.8 acres. It is composed of a portion of the Homestead North development. The basin is comprised of single-family housing and open space. The basin drains west to east via curb and gutter and storm sewer into Pond B, previously a part of FSD17 and FSD18 in the MDDP. Flows from Pond B discharge east directly in Sand Creek at design point 70.

SC3-18 is approximately 22.7 acres. It is composed of a portion of the Homestead North development. The basin is comprised of single-family housing and open space. The basin drains north to south via curb and gutter and storm sewer into Pond C, previously a part of FSD18 in the MDDP. Flows from Pond C discharge east directly in Sand Creek at design point 69.

SC3-18B is approximately 19.4 acres. It is composed entirely of the Sand Creek channel adjacent to the Homestead North development. The basin drains north to south via the Sand Creek channel and outfalls at design point 69.

SC3-19 is approximately 201.6 acres. It is currently composed of low density housing and undeveloped land. The basin drains to the south where is crosses Vollmer Rd and is conveyed to Homestead North Pond C (FSD18) before ultimately outfalling in Sand Creek at design point 69.

SC3-20 is approximately 37.1 acres. It is currently undeveloped with any future development required to route drainage through a future pond FSD20 and release at the current rate.

SC3-22 is approximately 28.9 acres. It is composed of a portion of the Retreat at Timber Ridge Filing 1 development. The basin is comprised of rural (or large lot) single-family housing. The basin is comprised of single-family housing and open space. The basin drains from northwest to southeast via drainage swale, curb and gutter, and storm sewer into the proposed full spectrum detention pond, Pond 1, labeled FSD22 in the MDDP. Flows from Pond 1 discharge east into Sand Creek at design point 71.

SC3-23 is approximately 28.0 acres. It is composed of a future filing of the Retreat at Timber Ridge development. The basin is comprised of urban density single-family housing. The basin

drains from north to southwest via curb and gutter and storm sewer into the proposed full spectrum detention pond, Pond 2, labeled FSD27 in the MDDP. Flows from Pond 2 discharge west into Sand Creek at design point 71.

SC3-24A is approximately 36.0 acres. It is comprised of a portion of a future filing of the Retreat at Timber Ridge development and Sand Creek floodplain. The drains north to south directly into Sand Creek at design point 73.

SC3-24B is approximately 10.6 acres. It is composed of a portion of the Retreat at Timber Ridge Filing 1 development and Sand Creek floodplain. The basin is comprised of single-family housing and open space. The basin drains from northwest to southeast via drainage swale, curb and gutter, and storm sewer directly into Sand Creek at design point 72.

SC3-27 is approximately 65.0 acres. It is composed of a portion of the Retreat at Timber Ridge Filing 1 development. The basin is comprised of urban density single-family housing. The basin drains from north to southwest via curb and gutter and storm sewer into the proposed full spectrum detention pond, Pond 2, labeled FSD27 in the MDDP. Flows from Pond 2 discharge west into Sand Creek at design point 71.

SCE-5 is approximately 74.8 acres. It is composed of undeveloped land. The basin drains to the east to FSDE3 before being conveyed to Pond E7 then discharging into the East Fork of Sand Creek.

SCE-7 is approximately 23.7 acres. It is composed of undeveloped land. The basin drains to the east to FSDE4 before being conveyed to Pond E7 then discharging into the East Fork of Sand Creek.

SCE-10 is approximately 163.0 acres. It is composed of undeveloped land. The basin drains to the east to FSDE6 before being conveyed to Pond E7 then discharging into the East Fork of Sand Creek.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the "*City of Colorado Spring/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual"* Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "Colorado Springs Drainage Criteria Manual (CCSDCM),

dated May 2014, as adopted by El Paso County, as well as the July 2019 El Paso County Engineering Criteria Manual update.

Hydrologic Criteria

Previously, the MDDP used HEC-HMS to model hydrologic conditions. With all of the on- and off-line detention present along Sand Creek, it was decided that CUHP-SWMM would be a more appropriate way to model the hydrologic conditions. All hydrologic data was obtained from NOAA Atlas 2 isopluvial maps found in the EPCDCM. Runoff was calculated using CUHP Version 2.0.0, developed by Urban Drainage and Flood Control District. The model utilizes the raingauge classified as "a 24-Hr Type II Storm" to simulate a long duration front storm common to the area, which is the same rain gauge used in the original MDDP. The following rainfall depths were utilized in the model: 2.1 inches for the 2 year storm, 2.5 inches for the 5 year storm, 3.0 inches for the 10 year storm, 3.6 inches for the 25 year storm, 4.1 inches for the 50 year storm, and 4.6 inches for the 100 year storm, which are the same point precipitation values used in the original MDDP. Using Table 5.2 from the EPCDCM, a distribution curve was created for each of the design storms to be used in CUHP. EPA SWMM 5.1 was utilized to route runoff flow rates for the sizing of stormwater storage facilities. The CUHP calculations and SWMM model are presented in Appendices B and C.

Urban Drainage and Flood Control District's UD-Detention, Version 3.07 workbook was used for in the original MDDP for preliminary pond sizing. Various other versions of UD-Detention were used in the different filings for final design of the full spectrum detention ponds. Required detention volumes and allowable release rates were designed per USDCM and CCS/EPCDCM. Pond sizing spreadsheets from the original MDDP and approved drainage reports are presented in Appendix D.

HYDROLOGIC RESULTS

General Concept

The general procedure for this MDDP Amendment is as follows. First the hydrology was evaluated to determine the most accurate way to model it using either SWMM internal hydrology or CUHP compared to the original HEC-HMS model. Next, the existing conditions were re-evaluated to determine the new baseline hydrology which would then determine the amount of detention required in Pond W-3 at Sterling Ranch Road. The third model was the proposed conditions model that updates the basins and various on-site ponds in the adjacent developments, as well as includes the preliminary design of the proposed Pond W-3 with the goal of reducing flows downstream to below historic levels

2018 MDDP Comparison to 2021 City DBPS

Comparing the 2018 MDDP hydrology with the City DBPS hydrology the main difference between the two is imperviousness. The City DBPS shows imperviousness values with the current undeveloped conditions of basins, regardless of future development plans. The adopted 1996 DBPS assumed low density development in this area. The 2018 MDDP accounts for future development within Sterling Ranch, as well as upstream and offsite basins that are still tributary to Sand Creek. With the intent of accounting for all possible future flows, as to avoid having to possibly improve the channel again in the future, it was decided that the 2018 MDDP hydrology would be what was used for the baseline of this study, rather than the City DBPS hydrology.

CUHP-SWMM Comparison to HEC-HMS

The first hydrologic analysis done was to verify the validity of using CUHP-SWMM instead of the previously used HEC-HMS. A technical memo summarizing the results of this analysis can be found in **Appendix B.**

Existing Conditions

The second model was a re-evaluation of the existing conditions along Sand Creek. Basic basin parameters (area, imperviousness, slope, routing parameters) were taken from the MDDP HEC-HMS model to create a model as close the previous one as possible, with the only difference being the software used to model the hydrology. With no detention present in the existing conditions model, the CUHP-SWMM model was able to produce numbers that were an average of 15% different from the HEC-RAS model, despite being functionally different in how they calculate runoff. The most critical values obtained from the model are at design points 63, 60A, and 53A, which are along Sand Creek downstream of the project. DP63, located at Sterling Ranch Road, saw an increase in flows from 1911.5 cfs to 1980.7 cfs compared to the previous model. DP60A, located along Sand Creek adjacent to the Aspen Meadows subdivision saw flows increase from 1913.5 cfs to 1969.2 cfs. DP53A, located along Sand Creek at Detention Basin #3 saw flows increase from 2061.5 cfs to 2197.7 cfs. Tables summarizing the comparison between the CUHP-SWMM model and the HEC-HMS model can be found in **Appendix B**.

Proposed Conditions

One of the purposes of this MDDP Amendment is to account for completed and planned development. The third model was a re-evaluation of the proposed conditions along Sand Creek.

The model was built using basic basin parameters (area, imperviousness, slope, routing parameters) taken from the MDDP for the basins that remain unchanged from the MDDP. For the rest of the basins, updates were made based on either preliminary or final designs taken from various Approved Drainage Reports. After re-evaluating the existing and proposed conditions of Sterling Ranch, it was determined that an on-line detention pond upstream of Sterling Ranch Road was still necessary in order to attenuate proposed flowrates below existing conditions flow rates. The following is a list of all the updates from the previous Proposed Conditions model:

- Pond W-3 has been updated based on preliminary designs proposed with this MDDP Amendment.

- The existing stock pond located approximately 600 feet upstream of Sterling Ranch Road has been included in the model. Previously, the pond was excluded from the MDDP model since the thalweg of the channel did not go through the pond. Based on preliminary designs with this MDDP Amendment, the pond will remain in place, but flows instead pass directly through it and outfall downstream via outlet structure.

- The larger stock pond located north of Briargate Parkway has been included in the model. Previously, the pond was excluded from the model since the thalweg of the channel did not go through the pond. Based on preliminary designs with this MDDP Amendment, the pond will remain in place, but flows instead pass directly through it and outfall downstream via outlet structure. The smaller stock pond in this area is being removed from the channel, and thus wis not need to be included in the model.

- With Sterling Ranch East progressing to preliminary design, a 20.84 acre portion of Sub-Basin SCE-7 and a 9.80 acre portion of SCE-10 has been shifted to basin SC3-14B based on the proposed storm layout.

- As part of Sterling Ranch Filing 2, Pond 11A proved to be unnecessary as hypothesized in the MDDP. Pond 11A was proposed to be located on the east side of the development and drain to the east in directly into Sand Creek. Sub-Basin 11A now drains to Pond FSD6.

- Sub-Basin SC3-7 still drains to FSD6 based on Pond W5 sizing. JR Engineering is currently coordinating with Matrix about the future routing of the flows from the Barbarick detention pond and rain garden through Sterling Ranch East, but for the purposes of this MDDP Amendment, flows from Sub-Basin SC3-7 have been accounted for in the design of Pond W-5 in Sterling Ranch Filing 2.

- Sub-Basin SC3-19 was previously proposed to release undetained into Sand Creek via outfall channel. The basin is now proposed to be routed through Pond FSD18 in the Homestead North development.

- The previous MDDP showed a discrepancy between the map and model for Basin SC3-15A. The approved map showed the basin being routed undetained around Pond FSD15B and combining with the outfall of Pond FSD15B at DP 26, then outfalling in Sand Creek. The results summary from the approved MDDP shows that at DP 26, only the discharge from FSD15B appears to be at the design point with the flows from SC3-15A unaccounted for. Based on as-built information from previous Sterling Ranch filings, Basin SC3-15A is shown draining to DP 26 undetained then discharging directly into Sand Creek. via storm drain through Homestead Filing 1

- Ponds 16A and 16B have been consolidated into Pond FSD16 for Sterling Ranch East. Sterling Ranch East is being designed by Classic Engineering. The storage and outfall curves were modeled based off the Sterling Ranch East Preliminary Design Report by Classic.

- Sterling Ranch East is being designed by Classic Engineering. Storage and outfall curves for Ponds 11B, 14A, and 14B were updated based on their preliminary drainage report.

- Sub-Basin SC311B has been broken up into 2 separate basins. Sub-Basin SC311B still flows to FSD11B, while SC311C flows offsite to the south via a level spreader along the property line. Sub-Basin SC314B still flows to FSD14B, which is conveyed south and outfalls along the level spreader in Basin SC311C.

- Pond FSD12 has been designed as Pond 4 from Sterling Ranch Filing 1 by M&S dated 7/16. The pond was modeled using the storage and outfall curves from the 2018 MDDP.

- Pond FSD12A has been added to the model, which is Pond 1 from Homestead Filing 2 by M&S, dated 7/18. The sub-basin hydrologic values for Sub-Basin SC3-12A were taken from the Homestead Filing 2 Final Drainage Report's UD-Detention spreadsheet, while the pond was also modeled using the UD-Detention spreadsheet's stage-area and stage-discharge curves. The previous MDDP considered this pond to be temporary, but it is now permanent.

- Sub-Basin SC312B was added to account for the runoff outside of the development, in the channel area from Sub-Basins SC3-12 and SC3-12A that were unaccounted for in the Homestead Filing 2 detention ponds.

- Sub-Basin SC313A was added to account for the runoff outside of the development, in the channel area from Sub-Basins SC3-13 and SC3-14A that were unaccounted for in the onsite detention ponds.

- Pond FSD13 has been designed as Pond 8 from Sterling Ranch Filing 1 by M&S dated 7/16 and modified for the Branding Iron Filing 2 development by M&S dated 1/20. The pond was modeled using the UD-Detention spreadsheet's stage-area and stage-discharge curves from the Branding Iron at Sterling Ranch Filing 2 Final Drainage Report.

- Pond FSD18 has been designed as Pond A from Homestead North by JR Engineering. The sub-basin hydrologic values for Sub-Basin SC3-18 were taken from the UD-Detention spreadsheet, while the pond was also modeled using the UD-Detention spreadsheet's stage-area and stage-discharge curves from the Homestead North Final Drainage Report.

- Pond FSD17A has been designed as Pond B from Homestead North by JR Engineering. The sub-basin hydrologic values for Sub-Basin SC3-17A were taken from the UD-Detention spreadsheet, while the pond was also modeled using the UD-Detention spreadsheet's stage-area and stage-discharge curves from the Homestead North Final Drainage Report.

- Pond FSD17B has been designed as Pond C from Homestead North by JR Engineering. The sub-basin hydrologic values for Sub-Basin SC3-17B were taken from the UD-Detention spreadsheet, while the pond was also modeled using the UD-Detention spreadsheet's stage-area and stage-discharge curves from the Homestead North Final Drainage Report.

- Sub-Basin SC318B was added to account for the runoff outside of the development, in the channel area from Sub-Basins SC3-17 and SC3-18 that were unaccounted for in the Homestead North detention ponds.

- Pond FSD22 has been designed as Pond 1 from Retreat at Timber Ridge Filing 1 by Classic Engineering. The sub-basin hydrologic values for Sub-Basin SC3-22 were taken from the UD-Detention spreadsheet, while the pond was also modeled using the UD-Detention spreadsheet's stage-area and stage-discharge curves from the Retreat at Timber Ridge Filing 1 Final Drainage Report.

- Pond FSD27 has been designed as Pond 2 from Retreat at Timber Ridge Filing 1 by Classic Engineering. The sub-basin hydrologic values for Sub-Basin SC3-27 were taken from the UD-Detention spreadsheet, while the pond was also modeled using the UD-

Detention spreadsheet's stage-area and stage-discharge curves from the Retreat at Timber Ridge Filing 1 Final Drainage Report.

- Pond FSD21 now outfalls directly into DP-73 instead of going through Pond FSD27. Based on the Drainage Report for The Retreat at Timber Ridge, flows from Sub-Basin SC3-21 drain to a future full spectrum detention pond that outfalls directly into Sand Creek.

  A table summarizing the changes in the Full Spectrum Detention Pond's sizing and release rates can be found in **Appendix C**.

The second stated purpose of this MDDP Amendment is to document the differences between the MDDP and this MDDP Amendment. Comparing the MDDP Amendment's proposed conditions model to the MDDP, the median difference in Sub-basin peak flow rates between the two is a 6% decrease in the basin runoff. With the basin parameters carried over as much as possible, some of the differences is due to how the hydrographs were generated in HEC-HMS and SWMM respectively. The MDDP used curve number while the MDDP Amendment used CUHP. The MDDP Amendment also took into account changes basin parameters based on the various accepted Final Drainage Reports. The differences in Sub-basin peak flow rates were not universally higher in CUHP-SWMM, with there being a range from 100% higher to 100% lower. A table comparing the peak flow rates of the Sub-basins can be found in **Appendix C**.

The comparison between the routed hydrographs at the design points of the MDDP Amendment proposed conditions model and MDDP proposed conditions model shows a more consistent change. Peak runoff rates along the main fork are mostly a few percent higher, with a handful further downstream the reach 14 to 16% higher. The East Fork saw a reduction of peak runoff rates around 60% from the previous model. The total volume of water is consistently 10 to 25% lower than the previous model with a exception of a few places. This is due in part to the changes in detention release rates as well as the previously mentioned differences in how the hydrographs were created. The differences between the two models of when peak runoff occurs were typically within 10 to 15 minutes in each basin and at each node. Tables comparing the MDDP Amendment proposed conditions model with the previous one from the MDDP can be found in **Appendix C.**

The last and most crucial comparison is between the updated existing conditions model and the updated proposed conditions model. As seen in Table 1, all of the online and offline detention shows a clear reduction in flows along Sand Creek. The total volume of runoff is very similar in the undeveloped upper portion of the reach at Design Points 74, 75, and 78. As runoff accumulates downstream at Design Points 73, 71, 69, and 63 the volume of runoff drastically increases due to the increased imperviousness of the adjacent developments, but the peak flow rates remain lower than existing due to all of the full spectrum detention ponds along the reach.

As seen in Table 1, Pond W-3 reduces peak flow rates downstream of it at Design Points 60A and 53A to below the pre-development rates seen in the updated existing conditions model. Flows have been reduced from 1969.2 and 2197.2 cfs, respectively, to 1882.2 and 1887.5 cfs. A table comparing the peak runoff rates and the total volume of runoff at the design points can be found in **Appendix C**.

DRAINAGE FACILITY DESIGN

General Concept

The third stated purpose of this MDDP Amendment is an evaluation of the required volume for on-line detention at Sterling Ranch Road (Pond W-3). Along with an on-line detention pond, new culverts are proposed at Sterling Ranch Road and Briargate Parkway being designed by others. The amendment also includes revisions to the existing stock pond north of Sterling Ranch Road, the stock ponds north of Briargate Parkway, and improvements to Sand Creek channel.

Specific Details

Compared to the previous preliminary design of Pond W-3 from the 2018 MDDP, the amount of storage volume has decreased from 78.2 ac-ft. to 50.5 ac-ft. In order to avoid classification as a jurisdictional dam, the maximum ponding depth is 10 feet. The peak release rate has been increased from 1350.6 cfs to 1585.2 cfs. Despite the increase in release rate, peak flow rates along Sand Creek downstream of the pond are lower than existing. The previous MDDP model outfalls at DP 53A, which is defined as the Full Spectrum Pond at Woodmen Drive, and so does the MDDP Amendment SWMM model. The MDDP model over-detains at Pond W-3 in order to reduce flows downstream well below those in the existing conditions. With the goal being to simply reduce flows to less than predevelopment rates, this amount of detention is unnecessary, hence the reduced storage volume and the increased release rate. A complete comparison between existing and proposed conditions of design flows along Sand Creek can be seen below.

Staff is still awaiting City concurrence that this is an acceptable flow rate.

Table 1.

Design Point Comparison Summary						
Location	Design Point ID	Existing (Updated)	Proposed (MDDP)	Proposed (Amendment)	% Difference Amend vs. MDDP	% Difference Amend vs. EX
		Q100 (cfs)				
	DP-74	352.3	262.8	293.8	12%	-17%
	DP-75	970.5	950.5	887.9	-7%	-9%
	DP-78	497.7	385.3	422.1	10%	-15%
	DP-73	1672	1506.7	1497.1	-1%	-10%
Sterling Ranch N BNDY	DP-71	1734.9	1612.2	1644.1	2%	-5%
Briargate Pkwy X'ing	DP-69	1988.4	1775.7	1763.9	-1%	-11%
Sterling Ranch S BNDY	DP-63	1980.7	1385.1	1585.2	14%	-20%
Marksheffel X'ing	DP-60A	1969.2	1661.8	1882.2	13%	-4%
Sand Creek and Pond 3	DP-53A	2197.7	1668.9	1887.5	13%	-14%
Near SE Prop Corner	DP-56	242.9	196.4	136.2	-31%	-44%

Conceptually, the current preliminary design for Pond W-3 is similar to what was previously shown in the MDDP. Ponding occurs adjacent to Sterling Ranch Road and pass through a 3 barrel box culvert before entering the roadway culvert and continuing downstream. The Sterling Ranch Road culvert is currently proposed to be a Bridgecor arch with a 38'-1" span x 11'x11" rise (by others).

The existing stock pond upstream of Sterling Ranch Road will remain in place, with flows passing through the pond and leaving through an outlet structure. The major change in how the pond functions is the new design does not have a diversion structure along Sand Creek that routes flows around the existing pond. Due the narrow space between the proposed development and the existing stock pond, this portion of channel would require extensive reinforcement due to high shears and velocities. In order to maintain the water right for the pond, an outlet orifice structure maintains a static water surface of 7038 ft and all flows above that elevation pass undetained through the orifice structure and outfall into Pond W-3. An Agridrain system adjacent to the outlet structure controls flows below the static water surface and allow flows to be impounded or released as needed. Adding the existing stock pond as online storage directly upstream of Pond W-3 made a drastic difference in peak flows. The time of peak concentration at Sterling Ranch Road was only about 20 minutes greater, but the additional storage volume attributed to the stock ponds reduced peak flows by 160 cfs and reduced the maximum volume of runoff flowing into Pond W-3 by 1.3 ac-ft.

The proposed channel improvements begin just north of the Sterling Ranch southern property boundary and run north roughly two miles to the northern property boundary. The horizontal

alignment of the new channel is a meandering bankfull channel set inside of a flood terrace. The straight sections of channel are rock riffles, while the curves are scour pools. The channel features a 4 stage cross section with a low flow section, bankfull, flood terrace, and floodplain. The low flow section is a 7.6 feet wide, 0.8 feet deep trapezoidal section. The bankfull section is a 12.8 feet wide, 0.7 feet deep trapezoidal section with a flat inner berm between the low flow extents and the bankfull toe of slope. The flood terrace is a 57.1 feet wide, 1 foot deep trapezoidal section with 1% slopes between the bankfull section and the flood terrace toe of slopes. Above the flood terrace along the east side is a 1% floodplain that ranges from 80 feet to 120 feet wide. Along the west side exists the majority of the existing wetlands. Efforts have been made to preserve as much of them possible, while improving and mitigating areas where preservation is not possible. The channel has been broken up into three separate sections; Reach 1 is the portion between the southern boundary and Sterling Ranch Road, Reach 2 is the portion between Sterling Ranch Road and Briargate Parkway, and Reach 3 is the portion from Briargate Parkway to the northern boundary. A 15' maintenance trail runs the length of the channel on both sides of it, sitting several feet above the 100 year water surface, while access points from the proposed adjacent developments are be provided.

Reach 1 of the channel is approximately 900 feet long. Upstream, it ties in directly to the downstream grading of the proposed BridgeCor steel box, 38'-1"x11'x11" (designed by others) culvert at Sterling Ranch Road. The culvert was designed to pass the full 100-year FIS flow rate of 2600 cfs while still providing 1 foot of freeboard within the culvert. In the amended MDDP hydrology, the peak 100-year release from Pond W-3 is 1585 cfs. There are 8 riffle sections, with an average slope of approximately 0.40%, while the slope through the scour pools is flat. There are two grouted boulder drops structures along this reach, one approximately 1.5 feet tall and the other approximately 3.5 feet tall. Due to the development on both sides of the channel, the flood terrace is at its narrowest width of 50 feet along this section. As the channel moves downstream it eventually widens to a maximum flood terrace width of approximately 240 feet, before tying into the existing channel upstream of the property boundary.

Reach 2 of the channel is approximately 5,030 feet long. Upstream, there is the proposed BridgeCor steel box, Type 58S (designed by others) culvert at Briargate Parkway. The channel improvements begin downstream of the proposed concrete check structure by others. The culvert was designed to pass the full 100-year FIS flow rate of 2600 cfs while still providing 1 foot of freeboard within the culvert. In the amended MDDP hydrology, the peak 100-year flow at DP 69, located at Briargate Parkway, is 1764 cfs. There are 38 riffle sections with slopes ranging from 0.30% to 3.18%, while the slope through the scour pools is flat. There are three grouted boulder drops structures along this reach with heights of 6 feet, 4 feet, and 5 feet tall. The flood terrace varies in width along this reach from approximately 160 feet up to 330 feet wide. The channel ends at the existing stock pond upstream of Sterling Ranch Road. Flows accumulate in the stock pond until they reach the static water surface and then overtop the orifice of the outlet

structure and then outfall directly into Pond W-3. An Agridrain system controls flows below the static water surface. In the event of flow above the 100-year storm, an emergency spillway conveys flows into Pond W-3. With development currently happening on both sides of the channel, especially on the west side, retaining walls are used extensively to grade in the maintenance trail along this reach. The channel through Pond W-3 is not the 4 stage section used through the rest of the reach, but rather a 2 stage section with a 17 foot wide, 0.71 feet deep bankfull with a 1% flood terrace extending out to the extents of the pond bottom.

Reach 3 of the channel is approximately 2,807 feet long. In the amended MDDP hydrology, the peak 100-year flow at DP 71, located at the northern boundary of Sterling Ranch, is 1,644 cfs. There are 19 riffle sections with slopes ranging from 1.47% to 3.04%, while the slope through the eddy pools is flat. There is two grouted boulder drops structure along this reach, one 6 feet and the other 4.3 feet tall. The flood terrace varies in width along this reach from approximately 180 feet up to 260 feet wide. The larger of the two existing stock ponds on this reach will remain in place, approximately 900 feet upstream of the Briargate Parkway culvert. It functions similarly to the one just north of Sterling Ranch Road. Flows enter the pond directly, and an orifice structure maintains a static water surface in the pond. An Agridrain control structure maintains flows below the static water surface. During larger events, flows overtop the orifice structure and outfall downstream of the pond. In the event of flows above the 100-year event, an emergency spillway conveys flows downstream. A second stretch of channel approximately 550 feet long connects the pond outfall with the proposed drop structure associated with the Bridgecor steel box, Type 58S (designed by others) culvert at Briargate Parkway.

Address bank stabilization along the west side of the channel in the Homestead North development (from the Wheatland Drive cul-de-sac to Poco Road) and along Filing 3 at the south end.

SUMMARY

The proposed development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements, including ditches, culverts, detention ponds and drainage channel improvements. The proposed development will not adversely affect the offsite major drainageways or surrounding development. This report meets the latest El Paso County Drainage Criteria requirements for this site.

REFERENCES:

1. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.

2. Final Drainage Report for Aspen Meadows, Matrix Design Group, January 2019.

3. Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 2, M&S Civil Consultants, January 2020.

4. Final Drainage Report for Homestead at Sterling Ranch Filing No. 1, M&S Civil Consultants, July 2018.

5. Final Drainage Report for Homestead at Sterling Ranch Filing No. 2, M&S Civil Consultants, January 2020.

6. Final Drainage Report for Retreat at Timberridge Filing No. 1, Classic Consulting, June 2019.

7. Master Development Drainage Plan for Sterling Ranch, M&S Civil Consultants, October 2018.

8. Master Development Drainage Plan for Sterling Ranch Filing Nos. 1&2 and Final Drainage Report for Sterling Ranch Filing No. 1, M&S Civil Consultants, December 2017.

9. Preliminary Drainage Report and MDDP Addendum for Homestead North at Sterling Ranch Preliminary Plan, JR Engineering, February 2021.

10. Sand Creek Drainage Basin Planning Study, Kiowa, March 1996. (Adopted by El Paso County)

11. Sand Creek Drainage Basin Planning Study, Stantec, January 2021. (Not Adopted by El Paso County)

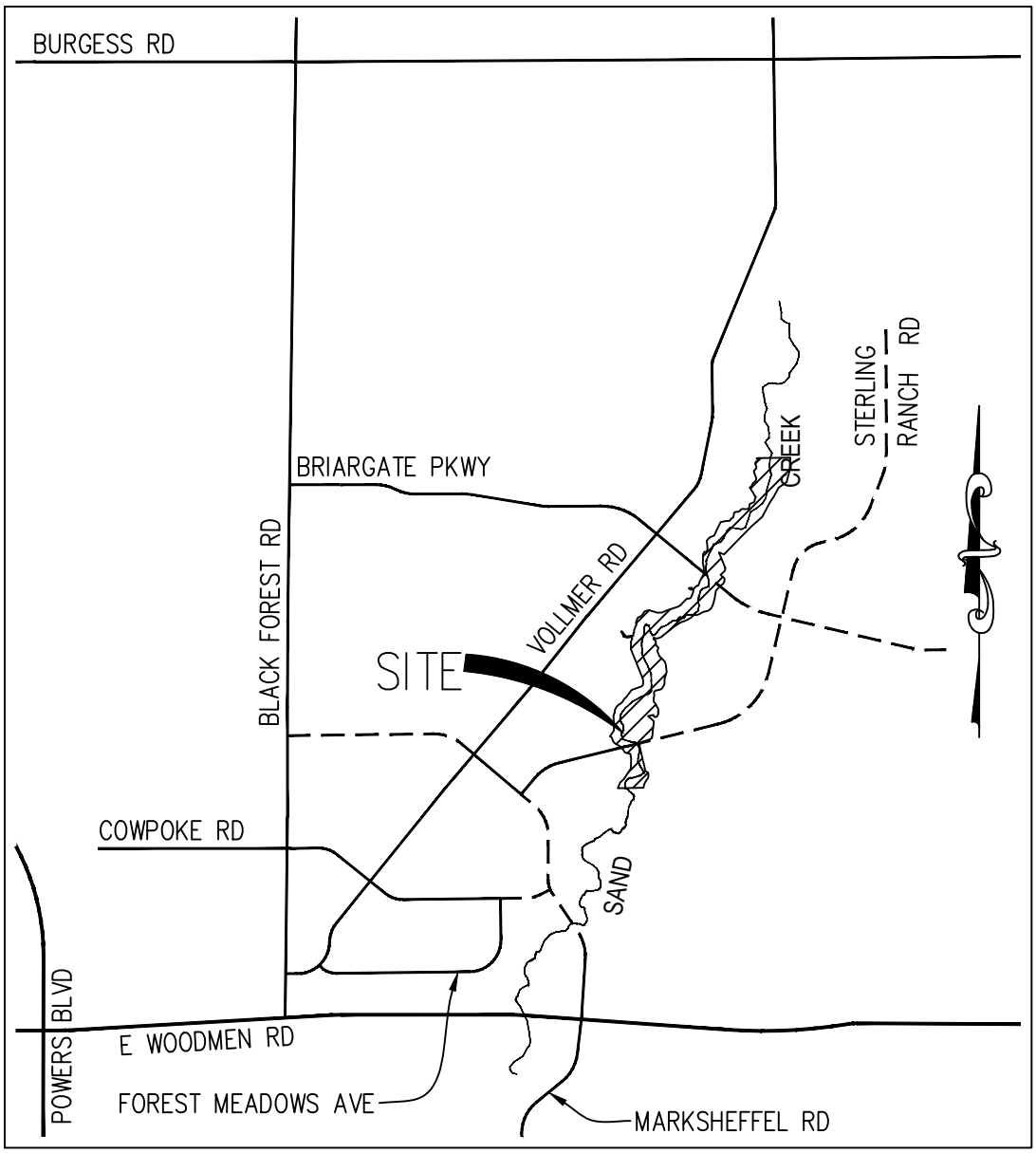
12. Sterling Ranch Filing 2 Final Drainage Report, JR Engineering, June 2021.

13. Sterling Ranch MDDP Amendment No. 2 & Preliminary Drainage Report for Sterling Ranch East Preliminary Plan No. 1, Classic Consulting, May 2022.

14. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.

APPENDIX A

FIGURES AND EXHIBITS



KEY MAP

N.T.S.

VICINITY MAP
STERLING RANCH
JOB NO. 25188.03
10/21/2021
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

X:\2510000.all\2518804\Drawings\Vicinity Map.dwg, 8.5x11 Portrait, 10/18/2021 2:40:40 PM, vaughtd

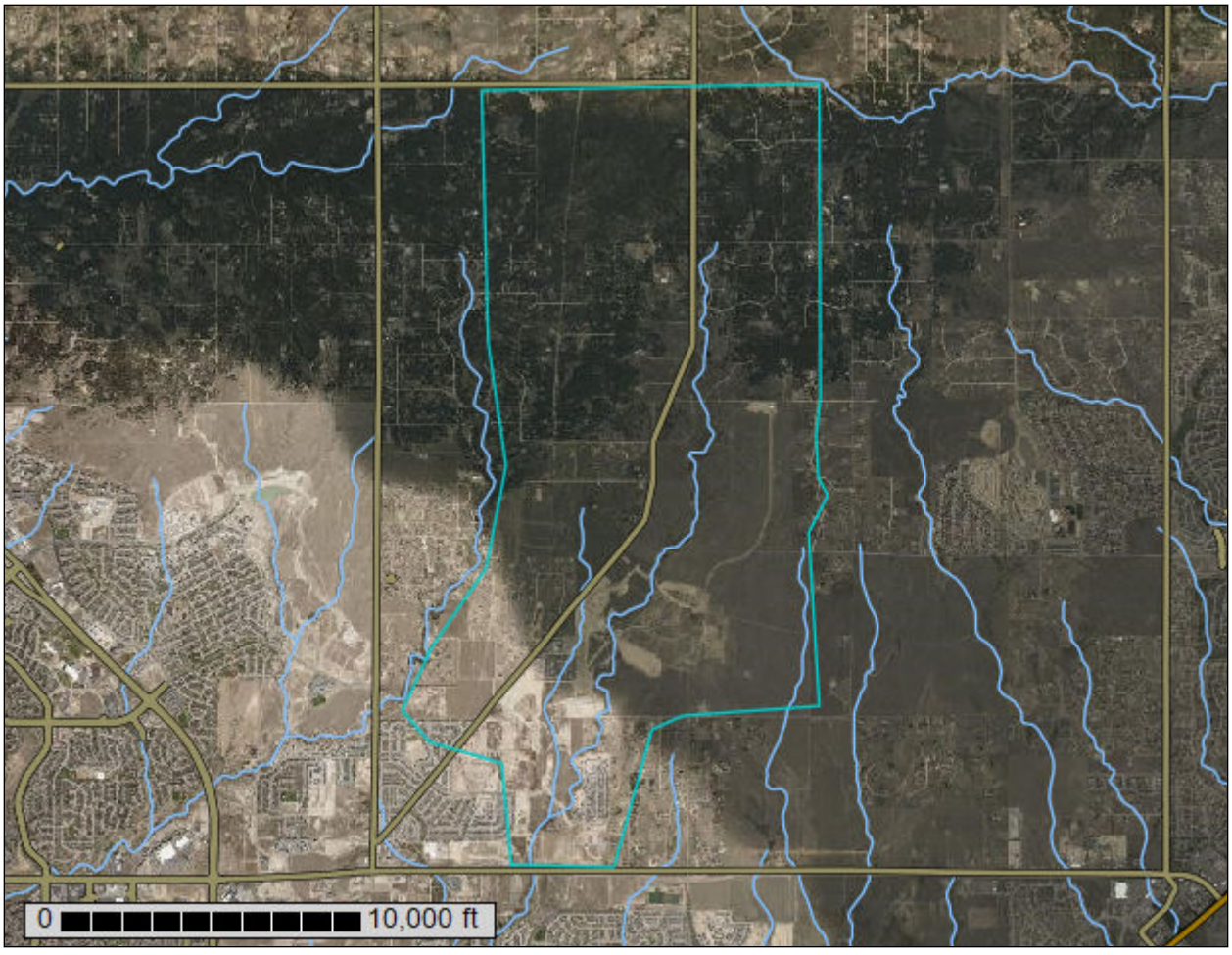
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

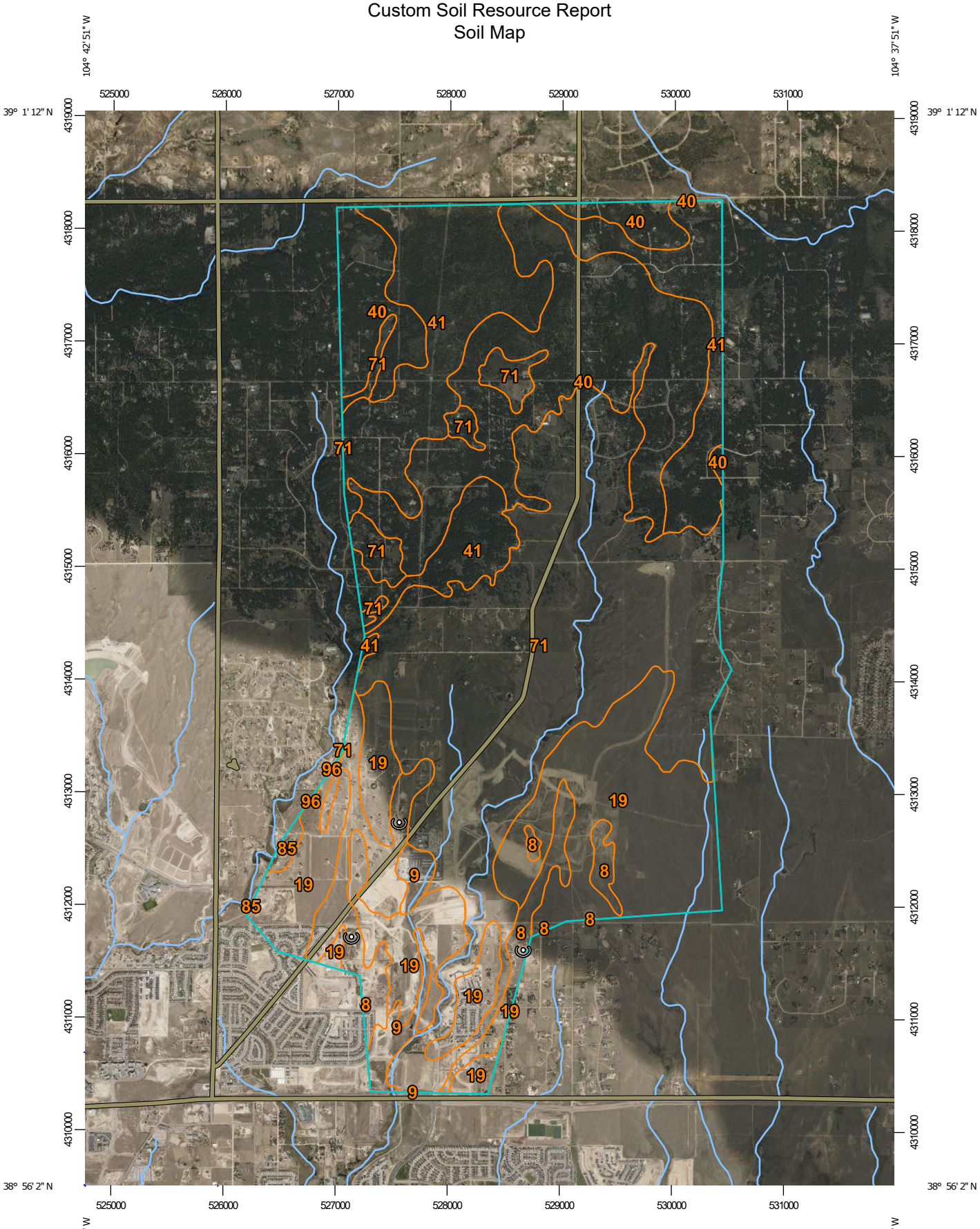
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



January 24, 2022

Custom Soil Resource Report
Soil Map



Map Scale: 1:46,500 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2000 4000 8000 12000

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	385.1	6.4%
9	Blakeland-Fluvaquentic Haplaquolls	91.2	1.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	1,196.8	19.9%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	1,190.9	19.8%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	1,028.9	17.1%
71	Pring coarse sandy loam, 3 to 8 percent slopes	2,108.3	35.0%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	16.9	0.3%
96	Truckton sandy loam, 0 to 3 percent slopes	2.2	0.0%
Totals for Area of Interest		**6,020.4**	**100.0%**

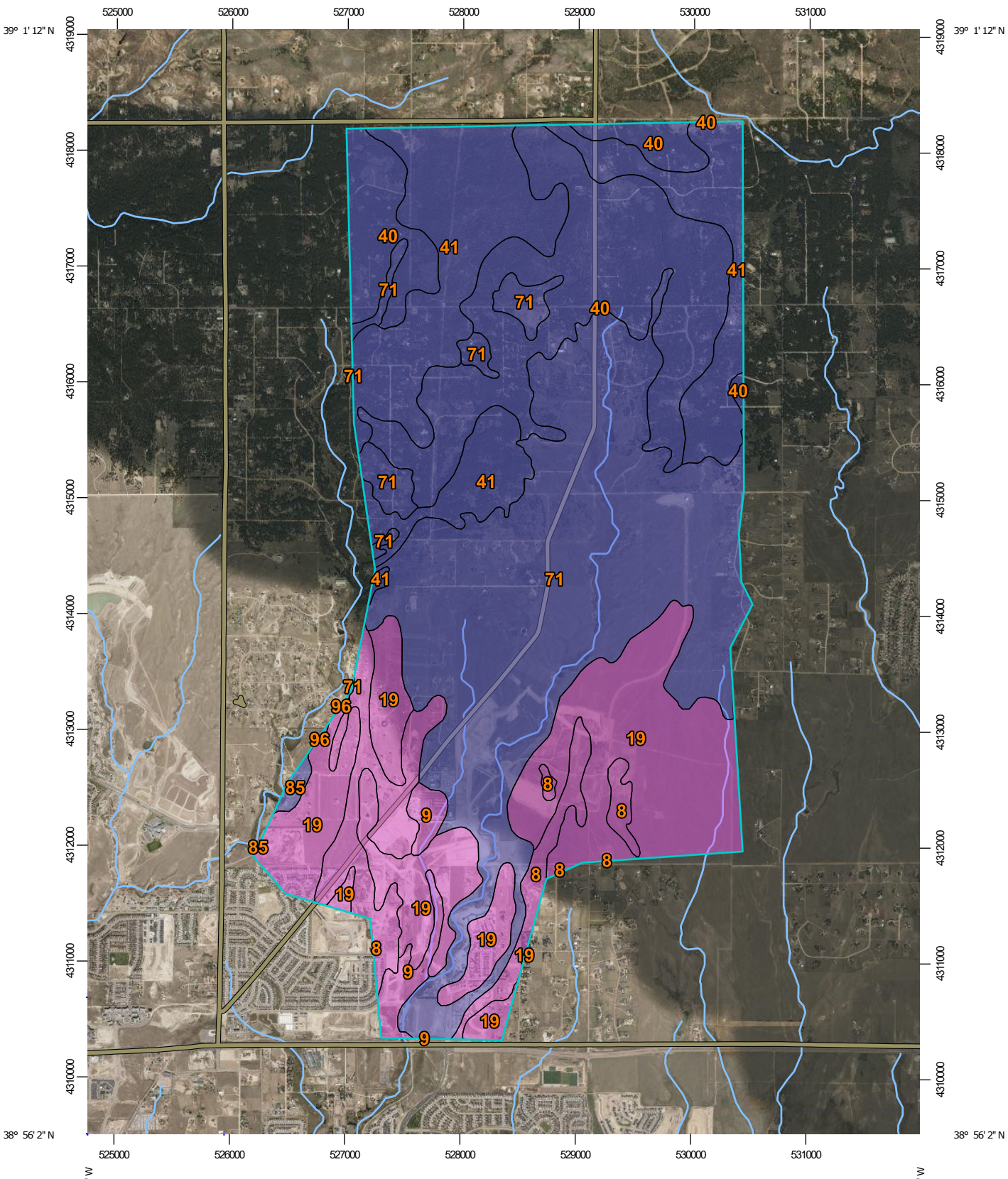
Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:46,500 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2000 4000 8000 12000

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	385.1	6.4%
9	Blakeland-Fluvaquentic Haplaquolls	A	91.2	1.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	1,196.8	19.9%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	B	1,190.9	19.8%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	1,028.9	17.1%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	2,108.3	35.0%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	16.9	0.3%
96	Truckton sandy loam, 0 to 3 percent slopes	A	2.2	0.0%
Totals for Area of Interest			**6,020.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

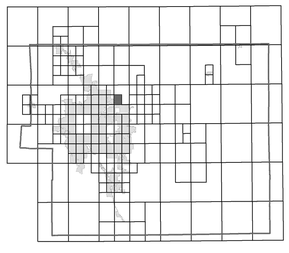
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

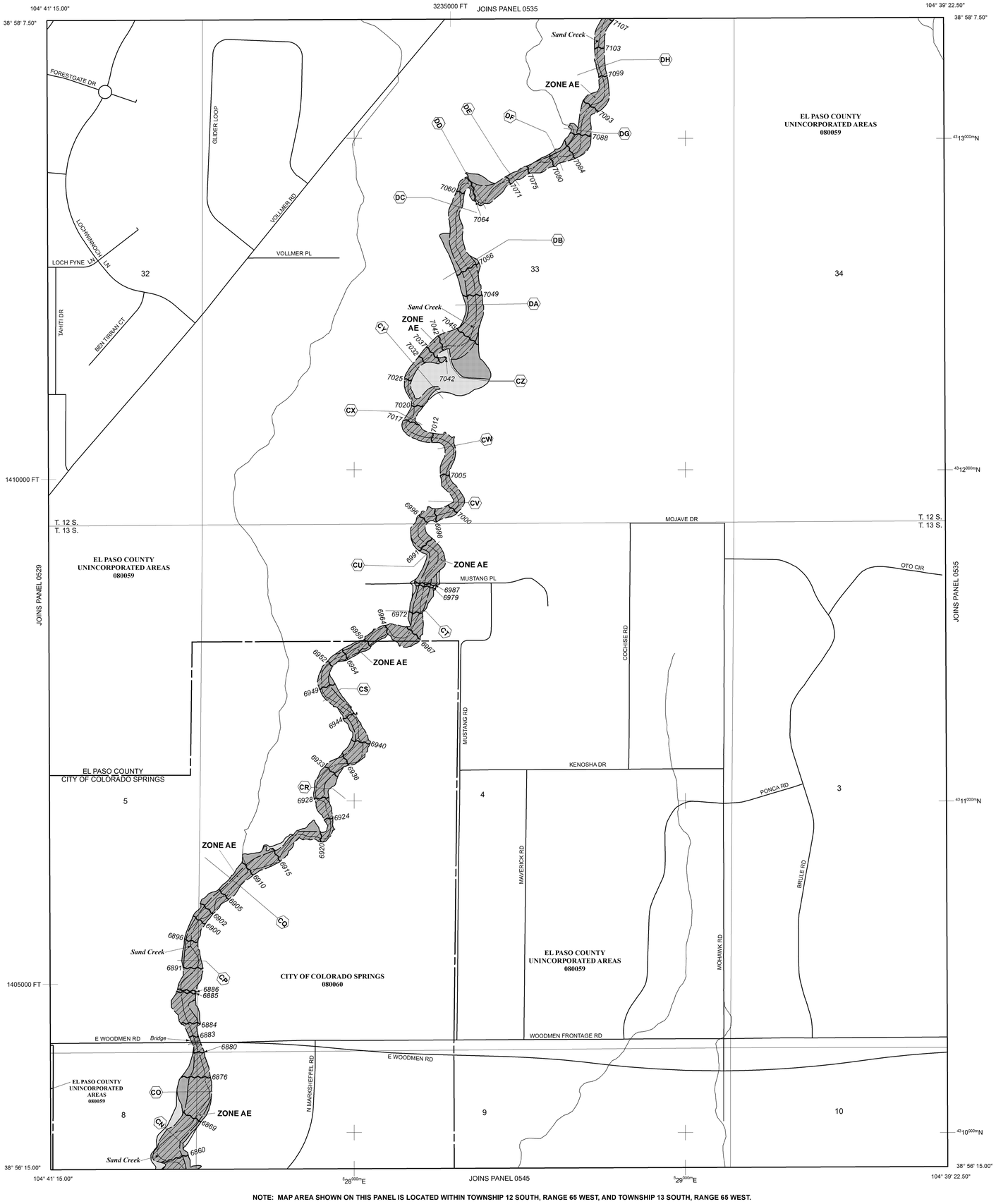
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A	Cross section line
23 — 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0533G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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

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

MAP NUMBER
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

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

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

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

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

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

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

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

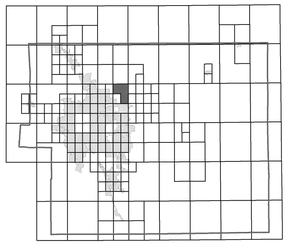
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

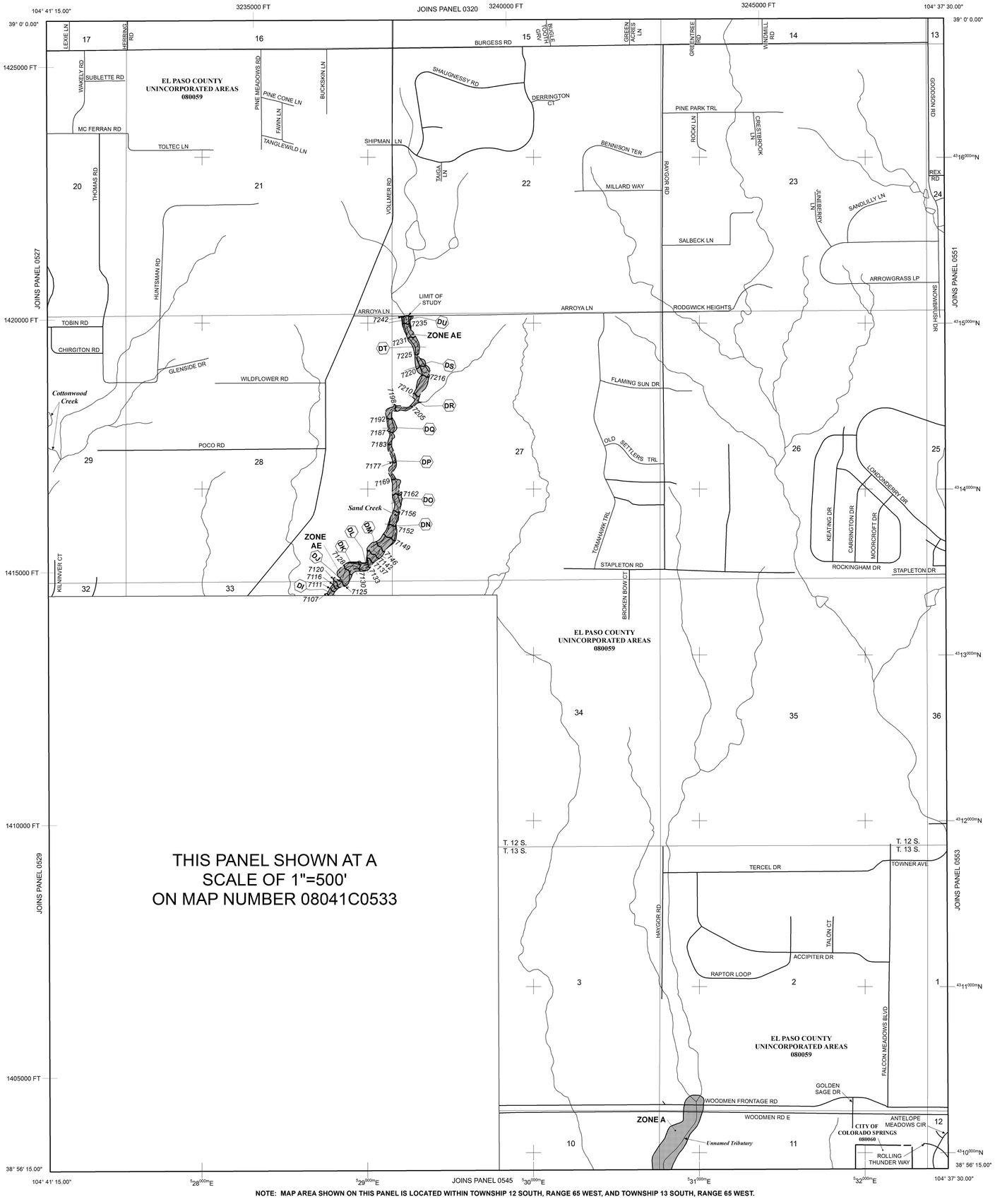
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



THIS PANEL SHOWN AT A SCALE OF 1"=500' ON MAP NUMBER 08041C0533

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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A — Cross section line
23 — 23 — Transect line
97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0535G

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

PANEL 535 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0535	G
EL PASO COUNTY	080059	0535	G

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

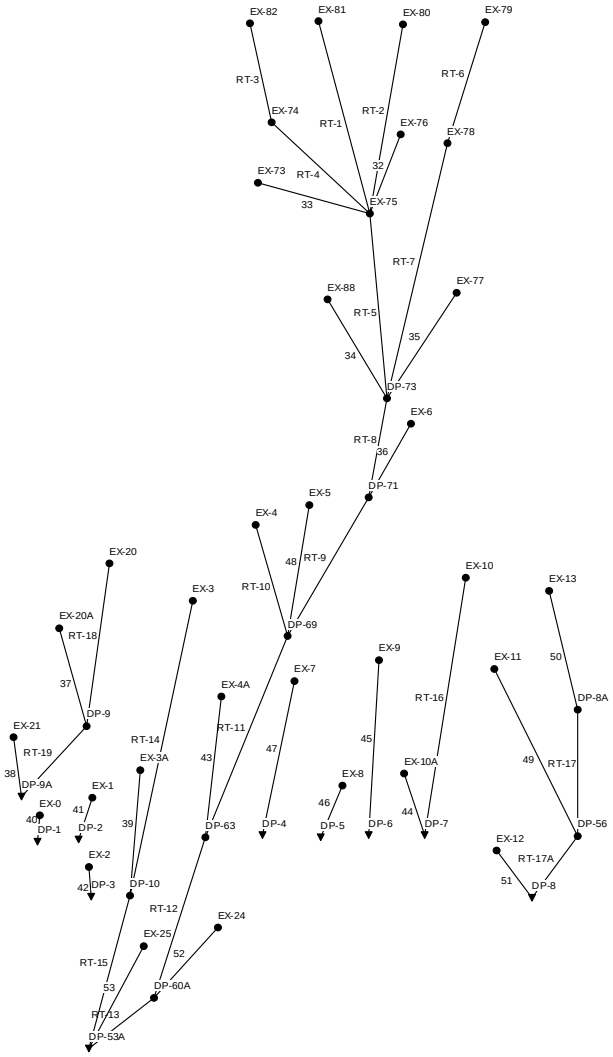
MAP NUMBER 08041C0535G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

APPENDIX B

EXISTING CONDITIONS HYDROLOGIC CALCULATIONS


EX-82
EX-81
EX-80
EX-79
RT-3
RT-6
EX-74
RT-1
RT-2
EX-76
EX-78
32
EX-73
RT-4
33
EX-75
RT-7
EX-88
EX-77
RT-5
35
34
DP-73
EX-6
RT-8
36
DP-71
EX-5
EX-4
48
RT-9
EX-20
RT-10
EX-10
EX-13
EX-3
EX-20A
DP-69
RT-18
EX-9
EX-11
50
EX-7
EX-4A
RT-16
DP-8A
37
DP-9
EX-21
RT-11
45
RT-14
47
EX-3A
43
EX-10A
49
RT-17
RT-19
EX-8
38
DP-9A
EX-1
46
DP-56
EX-0
41
44
DP-63
DP-4
DP-5
DP-6
DP-7
EX-12
40
DP-1
DP-2
39
EX-2
RT-17A
42
DP-3
DP-10
51
DP-8
RT-12
EX-24
EX-25
52
RT-15
53
DP-60A
RT-13
DP-53A

Sterling Ranch MDDP

Sand Creek and East Fork Sand Creek - Existing Condition Composite CN & Impervious % Table

6/21/2018

| Basin | Basin | Basin | Basin | Sub-Area 1 | | HSG | UA CN | CN | Sub-Area 2 | | HSG | UA CN | CN | Sub-Area 3 | | HSG | UA CN | CN | Sub-Area 4 | | HSG | UA CN | CN | Sub-Area 5 | | HSG | UA CN | CN | Sub-Area 6 | | HSG | UA CN | CN | Sub-Area 7 | | HSG | UA CN | CN | Sub-Area 8 | | HSG | UA CN | CN | Sub-Area 9 | | HSG | UA CN | CN | Sub-Areas | % HSG | % HSG | Weighted | Weighted |
|---|---|---

Sterling Ranch Master Development Drainage Plan
Hydrologic Study - Existing Conditions - Reach Data
6/20/2018

Reach ID	Reach Length L1 (ft)	Reach Vert. Drop H1 (ft)	Reach Slope S1 %	Mannings N Value n	Reach Side Slope SS (H/V)	Bottom Width BW (ft)	Diameter D (ft)
RT-1	3975	100	2.5%	0.05	10	6	N/A
RT-2	4570	120	2.6%	0.05	10	6	N/A
RT-3	2360	65	2.8%	0.05	10	6	N/A
RT-4	2695	65	2.4%	0.05	10	6	N/A
RT-5	4100	92	2.2%	0.05	6	10	N/A
RT-6	3030	100	3.3%	0.05	10	6	N/A
RT-7	6145	122	2.0%	0.05	10	6	N/A
RT-8	2160	42	1.9%	0.05	6	15	N/A
RT-9	3565	66	1.9%	0.05	6	30	N/A
RT-10	3165	68	2.1%	0.05	6	6	N/A
RT-11	6400	96	1.5%	0.05	4	40	N/A
RT-12	4375	74	1.7%	0.05	6	40	N/A
RT-13	1480	22	1.5%	0.05	6	40	N/A
RT-14	6365	136	2.1%	0.05	4	6	N/A
RT-15	3130	74	2.4%	0.05	4	8	N/A
RT-16	5575	138	2.5%	0.05	10	6	N/A
RT-17A	2675	72	2.7%	0.05	6	6	N/A
RT-17B	1300	32	2.5%	0.05	6	6	N/A
RT-18	3400	74	2.2%	0.05	10	6	N/A
RT-19	1670	22	1.3%	0.05	6	6	N/A

Sterling Ranch Master Development Drainage Plan

Sand Creek & East Sand Creek Basins - Existing Condition - Lag Time Calculations

6/21/2018

Basin	OVERLAND FLOW					SHALLOW GUTTER FLOW				SHALLOW CHANNEL FLOW				STORM SEWER FLOW				CHANNELIZED FLOW				Tc	TLag
ID	P2	n	Length	Slope	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Total	0.6*Tc
	(in)		(ft)	(%)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(min)	(min)
EX-0	2.1	0.15	160	2.5	16.1	0	0	0	0	1200	20	2.0	10.0	0	0	0	0.0	0	0.0	0.0	0.0	26.1	15.7
EX-1	2.1	0.15	200	2.0	21.1	0	0	0	0	1450	32	2.3	10.5	0	0	0	0.0	0	0.0	0.0	0.0	31.6	18.9
EX-2	2.1	0.15	200	1.5	23.6	0	0	0	0	1050	27	2.5	7.0	0	0	0	0.0	0	0.0	0.0	0.0	30.6	18.4
EX-3	2.1	0.15	300	5.3	19.7	0	0	0	0.0	1100	40	2.9	6.3	0	0	0	0.0	3540	2.7	4.1	14.4	40.4	24.2
EX-3A	2.1	0.15	200	3.0	17.9	0	0	0	0.0	1200	26	2.3	8.7	0	0	0	0.0	3360	2.1	4.5	12.4	39.0	23.4
EX-4	2.1	0.15	300	4.7	20.8	0	0	0	0.0	770	22	2.7	4.8	0	0	0	0.0	3900	3.0	4.0	16.3	41.8	25.1
EX-4A	2.1	0.15	200	3.0	17.9	0	0	0	0.0	250	8	2.8	1.5	0	0	0	0.0	5190	1.9	4.3	20.1	39.5	23.7
EX-5	2.1	0.15	200	4.0	16.0	0	0	0	0.0	1050	34	2.8	6.3	0	0	0	0.0	4425	2.3	3.8	19.4	41.6	25.0
EX-6	2.1	0.15	300	5.0	20.2	0	0	0	0.0	250	11	3.2	1.3	0	0	0	0.0	3490	2.3	3.8	15.3	36.8	22.1
EX-7	2.1	0.15	300	2.0	29.1	0	0	0	0.0	1650	42	2.4	11.5	0	0	0	0.0	3950	2.1	4.2	15.7	56.3	33.8
EX-8	2.1	0.15	200	2.0	21.1	0	0	0	0.0	1600	35	2.3	11.6	0	0	0	0.0	0	0.0	0.0	0.0	32.7	19.6
EX-9	2.1	0.15	200	2.0	21.1	0	0	0	0.0	800	26	2.8	4.8	0	0	0	0.0	3775	2.1	4.0	15.7	41.5	24.9
EX-10	2.1	0.15	300	5.3	19.7	0	0	0	0.0	880	32	2.9	5.1	0	0	0	0.0	6133	2.2	4.6	22.2	47.0	28.2
EX-10A	2.1	0.15	200	2.0	21.1	0	0	0	0.0	1440	35	2.4	10.0	0	0	0	0.0	5500	2.0	3.5	26.2	57.2	34.3
EX-11	2.1	0.15	200	4.0	16.0	0	0	0	0.0	1620	44	2.6	10.4	0	0	0	0.0	3000	2.7	4.0	12.5	38.8	23.3
EX-12	2.1	0.15	200	3.0	17.9	0	0	0	0.0	250	8	2.8	1.5	0	0	0	0.0	820	2.7	2.6	5.3	24.7	14.8
EX-13	2.1	0.15	200	9.0	11.5	0	0	0	0.0	250	12	3.4	1.2	0	0	0	0.0	4325	2.9	3.7	19.5	32.2	19.3
EX-20	2.1	0.15	300	3.8	22.5	0	0	0	0.0	730	40	3.5	3.5	0	0	0	0.0	2200	3.6	4.3	8.5	34.5	20.7
EX-20A	2.1	0.15	300	4.0	22.1	0	0	0	0.0	650	20	2.7	4.0	0	0	0	0.0	4450	1.8	4.2	17.7	43.7	26.2
EX-21	2.1	0.15	200	4.5	15.2	0	0	0	0.0	1175	42	2.9	6.8	0	0	0	0.0	915	1.7	2.5	6.1	28.1	16.8
EX-24	2.1	0.15	200	4.4	15.3	0	0	0	0.0	0	0	0.0	0.0	0	0	0	0.0	2400	2.3	3.1	12.9	28.2	16.9
EX-25	2.1	0.15	150	4.0	12.7	0	0	0	0.0	0	0	0.0	0.0	0	0	0	0.0	2700	1.6	3.1	14.5	27.2	16.3
EX-73	2.1	0.15	300	3.3	23.7	0	0	0	0.0	1650	3.3	2.9	9.5	0	0	0	0.0	1230	3.3	4.2	4.9	38.1	22.9
EX-74	2.1	0.15	300	4.7	20.8	0	0	0	0.0	2000	3.5	2.8	11.9	0	0	0	0.0	770	2.6	3.9	3.3	35.9	21.6
EX-75	2.1	0.15	300	3.3	23.7	0	0	0	0.0	1200	4.1	2.7	7.4	0	0	0	0.0	2300	2.8	3.1	12.4	43.5	26.1
EX-76	2.1	0.15	300	3.3	23.7	0	0	0	0.0	1160	3.4	3.1	6.2	0	0	0	0.0	3025	2.6	3.6	14.0	44.0	26.4
EX-77	2.1	0.15	300	4.7	20.8	0	0	0	0.0	1600	4.0	3.4	7.8	0	0	0	0.0	4850	2.1	5.1	15.8	44.4	26.7
EX-78	2.1	0.15	300	3.3	23.7	0	0	0	0.0	1560	4.1	3.3	7.9	0	0	0	0.0	1850	3.2	4.5	6.9	38.5	23.1
EX-79	2.1	0.15	300	4.0	22.1	0	0	0	0.0	1740	5.6	3.5	8.3	0	0	0	0.0	1100	1.8	3.0	6.1	36.5	21.9
EX-80	2.1	0.15	300	5.0	20.2	0	0	0	0.0	1625	4.9	3.4	8.0	0	0	0	0.0	2140	2.8	4.1	8.7	36.9	22.1
EX-81	2.1	0.15	300	6.7	18.0	0	0	0	0.0	2000	5.0	3.4	9.8	0	0	0	0.0	3600	3.1	4.9	12.2	40.0	24.0
EX-82	2.1	0.15	300	3.3	23.7	0	0	0	0.0	2000	4.7	3.3	10.1	0	0	0	0.0	625	3.2	4.1	2.5	36.4	21.8
EX-88	2.1	0.15	300	4.7	20.8	0	0	0	0.0	1750	4.1	3.4	8.6	0	0	0	0.0	2760	3.1	4.0	11.5	40.8	24.5

DCM TABLE 6-25 WAS USED FOR SHALLOW CONCENTRATED SWALE & GUTTER FLOW
N VALUE FOR OVERLAND FLOW WAS ASSUMED TO BE 0.15 FOR ALL BASINS
A ROUGHNESS COEFFICENT OF 0.050 WAS USED FOR EARTHEN CHANNEL BOTTOMS
A ROUGHNESS COEFFICENT OF 0.013 WAS USED FOR CONCRETE LINED CONVEYANCES

Basin Summary						
Basin	Peak Flow Rate					
	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
EX-0	0.0	4.9	11.8	17.6	26.0	31.5
EX-1	0.0	4.4	10.9	15.9	23.2	27.9
EX-2	0.0	0.7	1.7	2.5	3.7	4.5
EX-3	16.6	48.4	74.7	95.7	128.0	149.6
EX-3A	31.4	77.8	116.1	146.4	192.5	223.4
EX-4	24.5	71.7	110.6	141.7	189.4	221.2
EX-4A	10.1	32.1	50.4	65.5	89.0	104.8
EX-5	14.2	46.4	73.1	94.8	128.2	150.4
EX-6	10.1	30.5	47.3	60.8	81.5	95.3
EX-7	13.0	35.9	65.5	89.1	124.0	147.0
EX-8	1.2	9.4	20.8	29.8	42.6	50.9
EX-9	7.8	24.4	46.1	63.6	89.4	106.6
EX-10	28.2	79.8	122.7	157.6	211.7	247.9
EX-10A	0.0	18.2	45.7	67.6	100.1	121.6
EX-11	0.0	33.2	82.2	121.2	177.2	213.9
EX-12	2.0	17.0	29.4	39.3	53.7	63.4
EX-13	0.6	17.3	31.4	42.7	59.3	70.5
EX-20	22.9	69.9	108.7	138.8	184.5	215.0
EX-20A	13.9	40.9	75.9	103.9	144.8	171.9
EX-21	6.7	15.3	22.2	27.8	36.3	41.9
EX-24	1.0	15.4	27.3	36.7	50.9	60.4
EX-25	0.0	5.8	14.4	21.3	31.4	38.2
EX-73	12.6	34.1	51.7	65.8	87.5	102.0
EX-74	40.0	113.2	175.1	224.9	301.2	197.9
EX-75	104.1	300.6	468.8	607.4	824.6	85.8
EX-76	11.8	29.5	44.1	55.9	74.1	86.2
EX-77	19.7	59.7	92.7	120.0	162.2	190.5
EX-78	62.6	164.3	250.5	320.0	426.4	245.4
EX-79	40.3	104.1	156.4	197.0	258.6	299.7
EX-80	24.5	62.6	93.6	118.3	156.3	181.7
EX-81	28.0	84.9	131.6	169.3	228.0	267.2
EX-82	20.5	62.0	95.7	121.5	160.7	186.8
EX-88	16.6	50.3	77.9	100.0	134.0	156.6

Basin Summary						
Basin	Total Runoff Volume					
	V_2 (ac-ft)	V_5 (ac-ft)	V_{10} (ac-ft)	V_{25} (ac-ft)	V_{50} (ac-ft)	V_{100} (ac-ft)
EX-0	0.00	0.25	0.62	0.92	1.37	1.7
EX-1	0.00	0.27	0.67	1.00	1.48	1.8
EX-2	0.00	0.06	0.15	0.22	0.33	0.4
EX-3	1.38	3.99	6.20	8.04	10.99	13.0
EX-3A	3.87	7.89	11.29	14.02	18.20	21.1
EX-4	1.93	5.62	8.68	11.29	15.41	18.2
EX-4A	1.33	4.20	6.63	8.65	11.88	14.1
EX-5	1.26	4.17	6.60	8.65	11.91	14.1
EX-6	0.85	2.57	4.02	5.22	7.15	8.4
EX-7	1.59	3.74	6.48	8.68	12.03	14.2
EX-8	0.08	0.54	1.21	1.75	2.56	3.1
EX-9	0.99	2.65	4.82	6.54	9.18	10.9
EX-10	2.92	8.10	12.49	16.17	22.00	25.9
EX-10A	0.00	1.88	4.73	7.00	10.40	12.7
EX-11	0.00	2.20	5.49	8.16	12.12	14.8
EX-12	0.11	0.86	1.50	2.00	2.77	3.3
EX-13	0.06	1.73	3.16	4.27	5.98	7.1
EX-20	1.35	4.08	6.38	8.32	11.35	13.4
EX-20A	1.54	3.84	6.81	9.21	12.80	15.2
EX-21	0.59	1.26	1.83	2.30	3.06	3.6
EX-24	0.08	1.28	2.29	3.10	4.30	5.1
EX-25	0.00	0.57	1.43	2.12	3.16	3.8
EX-73	1.04	2.78	4.24	5.46	7.43	8.7
EX-74	3.04	7.67	11.57	14.85	20.04	23.5
EX-75	11.11	28.88	43.58	56.16	75.80	89.3
EX-76	1.21	2.90	4.33	5.52	7.43	8.7
EX-77	2.16	6.57	10.22	13.35	18.26	21.5
EX-78	4.91	11.72	17.43	22.28	29.89	35.0
EX-79	2.48	6.17	9.24	11.85	15.99	18.8
EX-80	1.94	4.82	7.24	9.27	12.52	14.7
EX-81	2.47	7.49	11.69	15.22	20.87	24.6
EX-82	1.10	3.35	5.25	6.81	9.33	11.0
EX-88	1.30	3.96	6.17	8.04	11.02	13.0

Existing Conditions Design Point Peak Flow Rate Summary

Design Point	MDDP						MDDP Amendment						% Difference					
	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}
DP-73	225.9	380.7	618	957	1260.4	1582.3	171.2	503.09	791.79	1033.04	1414.41	1672.0	-32%	24%	22%	7%	11%	5%
DP-71	229.3	388.9	629.7	978.8	1277.3	1637.9	175	518.37	818.24	1068.91	1466.2	1734.9	-31%	25%	23%	8%	13%	6%
DP-69	253	434.8	707.7	1100	1453.3	1870.4	189.69	579.88	923.83	1213.68	1675.53	1988.4	-33%	25%	23%	9%	13%	6%
DP-63	251.4	430.7	713.1	1113.2	1496.2	1911.5	175.18	557.4	899.71	1192.36	1661.58	1980.7	-44%	23%	21%	7%	10%	3%
DP-10	36.5	56	106.4	162.9	220.6	287.2	32.32	93.36	146.19	189.33	255.2	300.1	-13%	40%	27%	14%	14%	4%
DP-9A	55.3	94.3	150.3	227.7	299.5	380.5	31.89	101.87	173.68	232.21	321.39	381.1	-73%	7%	13%	2%	7%	0%
DP-9	52.8	88.8	142.1	214.2	281	351.4	28.73	93.68	160.49	215.19	297.14	351.7	-84%	5%	11%	0%	5%	0%
DP-8A	7.7	15.2	27.1	44.2	60.5	78.4	0.56	17.3	31.43	42.65	59.34	70.5	-1275%	12%	14%	-4%	-2%	-11%
DP-8	24.2	45.1	77.8	124.4	169.5	220.9	1.97	50.28	115.07	167.23	245.12	297.4	-1128%	10%	32%	26%	31%	26%
DP-7	32.4	57.1	97.3	156.1	213.8	277.9	22.38	82.23	143.62	194.75	273.43	326.3	-45%	31%	32%	20%	22%	15%
DP-6	12.2	23.9	43.1	70.9	97	125.2	7.82	24.38	46.12	63.58	89.43	106.6	-56%	2%	7%	-12%	-8%	-17%
DP-5	0.5	1.7	4.5	9.4	14.5	20.5	1.18	9.36	20.8	29.82	42.58	50.9	58%	82%	78%	68%	66%	60%
DP-4	11.6	21.5	37.5	60.9	83.1	107.4	12.95	35.87	65.46	89.09	123.98	147.0	10%	40%	43%	32%	33%	27%
DP-3	1.1	1.8	2.8	4.3	5.6	7.1	0.0	0.69	1.71	2.52	3.71	4.5	-10900%	-161%	-64%	-71%	-51%	-57%
DP-2	4.8	7.9	12.4	18.7	24.5	30.9	0.0	4.41	10.85	15.93	23.17	27.9	-47900%	-79%	-14%	-17%	-6%	-11%
DP-1	5	8.2	13	19.6	25.7	32.2	0.0	4.88	11.82	17.63	25.97	31.5	-49900%	-68%	-10%	-11%	1%	-2%
DP-60A	247.7	430.2	707.1	1113	1496.6	1913.5	167.91	546.35	886.79	1179	1649.04	1969.2	-48%	21%	20%	6%	9%	3%
DP-56	23.2	42.5	71.9	115.6	157.4	202.9	0.35	40.19	96.37	141.51	207.98	242.9	-6529%	-6%	25%	18%	24%	16%
DP-53A	262.1	454	763.2	1196.5	1609.8	2061.5	182.68	602.01	983.58	1311.23	1837.86	2197.7	-43%	25%	22%	9%	12%	6%

Existing Conditions Design Point Total Runoff Volume Summary

Design Point	MDDP						MDDP Amendment						% Difference					
	V_2 (ac-ft)	V_5 (ac-ft)	V_{10} (ac-ft)	V_{25} (ac-ft)	V_{50} (ac-ft)	V_{100} (ac-ft)	V_2 (ac-ft)	V_5 (ac-ft)	V_{10} (ac-ft)	V_{25} (ac-ft)	V_{50} (ac-ft)	V_{100} (ac-ft)	V_2	V_5	V_{10}	V_{25}	V_{50}	V_{100}
DP-73	40.4	61.5	92.1	134.3	173.1	214.9	19.9	51.9	78.6	101.0	136.3	159.9	-103%	-19%	-17%	-33%	-27%	-34%
DP-71	42.5	64.9	97.1	141.6	182.5	226.6	20.7	54.6	82.6	106.2	143.6	168.5	-105%	-19%	-18%	-33%	-27%	-34%
DP-69	50.7	77.4	116.1	169.4	218.6	271.4	24.0	64.4	98.2	126.4	171.2	201.0	-111%	-20%	-18%	-34%	-28%	-35%
DP-63	54.1	82.5	123.8	180.8	233.3	289.9	25.9	69.7	105.9	136.3	184.4	216.4	-109%	-18%	-17%	-33%	-26%	-34%
DP-10	7.6	11.7	17.6	25.8	33.4	41.6	5.4	12.2	17.9	22.5	29.6	34.4	-41%	4%	1%	-15%	-13%	-21%
DP-9A	9.3	14.1	21.1	30.7	39.4	48.8	3.6	9.4	15.2	20.0	27.5	32.5	-159%	-50%	-39%	-53%	-43%	-50%
DP-9	8.4	12.7	19	27.6	35.5	44	3.0	8.1	13.4	17.7	24.4	28.9	-181%	-56%	-42%	-56%	-45%	-52%
DP-8A	1.3	2.1	3.4	5.2	7	8.9	0.1	1.7	3.2	4.3	6.0	7.1	-2153%	-21%	-8%	-22%	-17%	-25%
DP-8	4.4	7	11.1	16.8	22.3	28.4	0.2	4.9	10.3	14.5	21.0	25.3	-2483%	-43%	-8%	-15%	-6%	-12%
DP-7	6.1	10	15.9	24.3	32.4	41.3	3.1	10.3	17.6	23.6	32.8	39.0	-99%	3%	10%	-3%	1%	-6%
DP-6	2.4	4	6.3	9.6	12.7	16	1.0	2.7	4.8	6.5	9.2	10.9	-142%	-51%	-31%	-47%	-38%	-46%
DP-5	0.2	0.4	0.8	1.4	1.9	2.6	0.1	0.5	1.2	1.7	2.6	3.1	-160%	26%	34%	20%	26%	16%
DP-4	2.6	4.2	6.7	10.2	13.5	17.2	1.6	3.7	6.5	8.7	12.0	14.2	-64%	-12%	-3%	-17%	-12%	-21%
DP-3	0.1	0.2	0.3	0.5	0.6	0.8	0.0	0.1	0.2	0.2	0.3	0.4	-9900%	-231%	-98%	-123%	-79%	-97%
DP-2	0.6	0.9	1.4	2.1	2.7	3.4	0.0	0.3	0.7	1.0	1.5	1.8	-59900%	-236%	-108%	-111%	-82%	-88%
DP-1	0.6	0.9	1.3	1.9	2.5	3.1	0.0	0.2	0.6	0.9	1.4	1.7	-59900%	-263%	-110%	-106%	-83%	-86%
DP-60A	55.3	84.4	126.4	184.8	238.5	296.6	26.1	71.2	108.6	139.6	189.0	221.9	-112%	-19%	-16%	-32%	-26%	-34%
DP-56	4	6.3	9.9	14.9	19.8	25.1	0.1	4.0	8.7	12.6	18.2	22.0	-6352%	-58%	-13%	-19%	-9%	-14%
DP-53A	63	96.4	144.7	211.8	273.9	340.9	31.6	84.1	128.0	164.5	221.9	260.5	-99%	-15%	-13%	-29%	-23%	-31%

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option            Value
FLOW_UNITS          CFS
INFILTRATION        HORTON
FLOW_ROUTING        KINWAVE
LINK_OFFSETS        DEPTH
MIN_SLOPE           0
ALLOW_PONDING       NO
SKIP_STEADY_STATE   NO

START_DATE          01/01/2005
START_TIME          00:00:00
REPORT_START_DATE   01/01/2005
REPORT_START_TIME   00:00:00
END_DATE            01/04/2005
END_TIME            06:00:00
SWEEP_START         01/01
SWEEP_END           12/31
DRY_DAYS            0
REPORT_STEP         00:05:00
WET_STEP            00:01:00
DRY_STEP            01:00:00
ROUTING_STEP        0:00:30

INERTIAL_DAMPING    PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP       0.75
LENGTHENING_STEP    0
MIN_SURFAREA        12.557
MAX_TRIALS          8
HEAD_TOLERANCE      0.005
SYS_FLOW_TOL        5
LAT_FLOW_TOL        5
MINIMUM_STEP        0.5
THREADS             1

[FILES]
;;Interfacing Files
USE INFLOWS "2518804 CUHP SWMM - EX Conditions 24hr Storm.txt"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------
CONSTANT        0.0
DRY_ONLY        NO

[JUNCTIONS]
;;Name          Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;--------------- ---------- ---------- ---------- ---------- ----------
```

EX-3 210 0 0 0 0
EX-4 260 0 0 0 0
EX-10 138 0 0 0 0
EX-20 96 0 0 0 0
EX-79 522 0 0 0 0
EX-80 512 0 0 0 0
EX-81 492 0 0 0 0
EX-82 522 0 0 0 0
DP-10 74 0 0 0 0
DP-56 72 0 0 0 0
DP-60A 22 0 0 0 0
DP-63 96 0 0 0 0
DP-69 192 0 0 0 0
DP-71 258 0 0 0 0
DP-73 300 0 0 0 0
EX-74 457 0 0 0 0
EX-75 392 0 0 0 0
EX-78 422 0 0 0 0
DP-8A 104 0 0 0 0
DP-9 22 0 0 0 0
EX-76 392 0 0 0 0
EX-73 392 0 0 0 0
EX-88 300 0 0 0 0
EX-77 300 0 0 0 0
EX-6 258 0 0 0 0
EX-20A 22 0 0 0 0
EX-21 0 0 0 0 0
EX-3A 74 0 0 0 0
EX-0 0 0 0 0 0
EX-1 0 0 0 0 0
EX-2 0 0 0 0 0
EX-4A 96 0 0 0 0
EX-10A 0 0 0 0 0
EX-9 0 0 0 0 0
EX-8 0 0 0 0 0
EX-7 0 0 0 0 0
EX-5 192 0 0 0 0
EX-12 0 0 0 0 0
EX-11 72 0 0 0 0
EX-13 104 0 0 0 0
EX-24 22 0 0 0 0
EX-25 0 0 0 0 0

[OUTFALLS]
;;Name Elevation Type Stage Data Gated Route To
;;---------- ---------- ---------- ---------- -------- ----------
DP-53A 0 FREE NO
DP-9A 0 FREE NO
DP-1 0 FREE NO
DP-2 0 FREE NO
DP-4 0 FREE NO
DP-5 0 FREE NO
DP-6 0 FREE NO

DP-7 0 FREE NO
DP-3 0 FREE NO
DP-8 0 FREE NO

[CONDUITS]
;;Name From Node To Node Length Roughness InOffset OutOffset InitFlow MaxFlow
;;---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
RT-4 EX-74 EX-75 2695 0.05 0 0 0 0
RT-1 EX-81 EX-75 3975 0.05 0 0 0 0
RT-3 EX-82 EX-74 2360 0.05 0 0 0 0
RT-2 EX-80 EX-75 4570 0.05 0 0 0 0
RT-6 EX-79 EX-78 3030 0.05 0 0 0 0
RT-5 EX-75 DP-73 4100 0.05 0 0 0 0
RT-7 EX-78 DP-73 6145 0.05 0 0 0 0
RT-10 EX-4 DP-69 3165 0.05 0 0 0 0
RT-9 DP-71 DP-69 3565 0.05 0 0 0 0
RT-14 EX-3 DP-10 6365 0.05 0 0 0 0
RT-13 DP-60A DP-53A 1480 0.05 0 0 0 0
RT-12 DP-63 DP-60A 4375 0.05 0 0 0 0
RT-18 EX-20 DP-9 3400 0.05 0 0 0 0
RT-19 DP-9 DP-9A 1670 0.05 0 0 0 0
RT-11 DP-69 DP-63 6400 0.05 0 0 0 0
RT-15 DP-10 DP-53A 3130 0.05 0 0 0 0
RT-8 DP-73 DP-71 2160 0.05 0 0 0 0
RT-16 EX-10 DP-7 5575 0.05 0 0 0 0
RT-17 DP-8A DP-56 2675 0.05 0 0 0 0
RT-17A DP-56 DP-8 1300 0.05 0 0 0 0
32 EX-76 EX-75 1 0.05 0 0 0 0
33 EX-73 EX-75 1 .05 0 0 0 0
34 EX-88 DP-73 1 0.05 0 0 0 0
35 EX-77 DP-73 1 .05 0 0 0 0
36 EX-6 DP-71 1 0.05 0 0 0 0
37 EX-20A DP-9 1 0.05 0 0 0 0
38 EX-21 DP-9A 1 0.05 0 0 0 0
39 EX-3A DP-10 1 .05 0 0 0 0
40 EX-0 DP-1 1 0.05 0 0 0 0
41 EX-1 DP-2 1 0.05 0 0 0 0
42 EX-2 DP-3 1 0.05 0 0 0 0
43 EX-4A DP-63 1 0.05 0 0 0 0
44 EX-10A DP-7 1 0.05 0 0 0 0
45 EX-9 DP-6 1 0.05 0 0 0 0
46 EX-8 DP-5 1 0.05 0 0 0 0
47 EX-7 DP-4 1 0.05 0 0 0 0
48 EX-5 DP-69 1 0.05 0 0 0 0
49 EX-11 DP-56 1 0.05 0 0 0 0
50 EX-13 DP-8A 1 0.05 0 0 0 0
51 EX-12 DP-8 1 0.05 0 0 0 0
52 EX-24 DP-60A 1 0.05 0 0 0 0
53 EX-25 DP-53A 400 0.05 0 0 0 0

[XSECTIONS]
;;Link Shape Geom1 Geom2 Geom3 Geom4 Barrels Culvert
;;---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------

RT-4 TRAPEZOIDAL 20 6 10 10 1
RT-1 TRAPEZOIDAL 20 6 10 10 1
RT-3 TRAPEZOIDAL 20 6 10 10 1
RT-2 TRAPEZOIDAL 20 6 10 10 1
RT-6 TRAPEZOIDAL 20 6 10 10 1
RT-5 TRAPEZOIDAL 20 10 6 6 1
RT-7 TRAPEZOIDAL 20 6 10 10 1
RT-10 TRAPEZOIDAL 20 6 6 6 1
RT-9 TRAPEZOIDAL 20 30 6 6 1
RT-14 TRAPEZOIDAL 20 6 4 4 1
RT-13 TRAPEZOIDAL 20 40 6 6 1
RT-12 TRAPEZOIDAL 20 40 6 6 1
RT-18 TRAPEZOIDAL 20 6 10 10 1
RT-19 TRAPEZOIDAL 20 6 6 6 1
RT-11 TRAPEZOIDAL 20 40 4 4 1
RT-15 TRAPEZOIDAL 20 8 4 4 1
RT-8 TRAPEZOIDAL 20 15 6 6 1
RT-16 TRAPEZOIDAL 20 6 10 10 1
RT-17 TRAPEZOIDAL 20 6 6 6 1
RT-17A TRAPEZOIDAL 20 6 6 6 1
32 DUMMY 0 0 0 0 1
33 DUMMY 0 0 0 0 1
34 DUMMY 0 0 0 0 1
35 DUMMY 0 0 0 0 1
36 DUMMY 0 0 0 0 1
37 DUMMY 0 0 0 0 1
38 DUMMY 0 0 0 0 1
39 DUMMY 0 0 0 0 1
40 DUMMY 0 0 0 0 1
41 DUMMY 0 0 0 0 1
42 DUMMY 0 0 0 0 1
43 DUMMY 0 0 0 0 1
44 DUMMY 0 0 0 0 1
45 DUMMY 0 0 0 0 1
46 DUMMY 0 0 0 0 1
47 DUMMY 0 0 0 0 1
48 DUMMY 0 0 0 0 1
49 DUMMY 0 0 0 0 1
50 DUMMY 0 0 0 0 1
51 DUMMY 0 0 0 0 1
52 DUMMY 0 0 0 0 1
53 DUMMY 0 0 0 0 1

[REPORT]
;;Reporting Options
INPUT NO
CONTROLS NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -2500.000 0.000 12500.000 10000.000
Units None

[COORDINATES]
;;Node X-Coord Y-Coord
;;---------- ---------- ----------
EX-3 2152.842 3756.835
EX-4 2571.814 4278.574
EX-10 3957.520 3914.976
EX-20 1604.854 4007.997
EX-79 4085.424 7724.977
EX-80 3542.799 7709.473
EX-81 2988.547 7728.853
EX-82 2531.192 7717.225
DP-10 1741.775 1729.169
DP-56 4701.691 2139.818
DP-60A 1895.925 1029.565
DP-63 2235.846 2136.283
DP-69 2781.300 3511.776
DP-71 3318.849 4464.344
DP-73 3437.426 5140.233
EX-74 2674.581 7037.464
EX-75 3322.017 6408.826
EX-78 3840.587 6895.172
DP-8A 4697.815 3008.018
DP-9 1457.570 2891.741
EX-76 3525.759 6956.775
EX-73 2765.778 6674.792
EX-88 3047.762 5818.523
EX-77 3900.591 5866.667
EX-6 3597.974 4972.571
EX-20A 1273.326 3569.530
EX-21 1084.191 2819.865
EX-3A 1806.345 2589.463
EX-0 1146.090 2286.847
EX-1 1493.411 2403.767
EX-2 1465.901 1931.593
EX-4A 2346.241 3097.356
EX-10A 3553.270 2571.215
EX-9 3388.206 3344.952
EX-8 3144.049 2488.683
EX-7 2824.238 3203.960
EX-5 2989.302 4355.967
EX-12 4302.934 1931.593
EX-11 4251.352 3327.758
EX-13 4509.264 3819.510
EX-24 1916.387 1518.934
EX-25 1710.057 1199.123
DP-53A 1469.048 685.692
DP-9A 1023.470 2411.130
DP-1 1128.119 2101.059
DP-2 1403.308 2116.563

DP-4 2616.461 2151.446
DP-5 3000.175 2135.942
DP-6 3317.998 2147.570
DP-7 3686.207 2151.446
DP-3 1480.825 1725.098
DP-8 4399.371 1721.222

[VERTICES]
;;Link X-Coord Y-Coord
;;---------- ---------- ----------

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

SAND CREEK 2021 MDDP AMENDMENT
EXISTING CONDITIONS
2-YR 100YR TYPE II STORM

WARNING 04: minimum elevation drop used for Conduit 32
WARNING 04: minimum elevation drop used for Conduit 33
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 35
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 41
WARNING 04: minimum elevation drop used for Conduit 42
WARNING 04: minimum elevation drop used for Conduit 43
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 49
WARNING 04: minimum elevation drop used for Conduit 50
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 52
WARNING 04: minimum elevation drop used for Conduit 53

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	39.199	12.774
External Outflow	41.031	13.371
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-4.672	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	: 30.00 sec
Average Time Step	: 30.00 sec
Maximum Time Step	: 30.00 sec
Percent in Steady State	: 0.00
Average Iterations per Step	: 1.00
Percent Not Converging	: 0.00

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
EX-3	JUNCTION	0.02	0.68	210.68	0 12:25	0.68
EX-4	JUNCTION	0.02	0.79	260.79	0 12:25	0.78
EX-10	JUNCTION	0.02	0.74	138.74	0 12:30	0.74
EX-20	JUNCTION	0.01	0.69	96.69	0 12:25	0.69
EX-79	JUNCTION	0.02	0.82	522.82	0 12:20	0.81
EX-80	JUNCTION	0.02	0.68	512.68	0 12:25	0.68
EX-81	JUNCTION	0.02	0.73	492.73	0 12:30	0.73
EX-82	JUNCTION	0.01	0.62	522.62	0 12:20	0.61
DP-10	JUNCTION	0.04	0.84	74.84	0 12:38	0.84
DP-56	JUNCTION	0.00	0.09	72.09	0 13:10	0.09
DP-60A	JUNCTION	0.04	1.05	23.05	0 13:48	1.05
DP-63	JUNCTION	0.04	1.07	97.07	0 13:33	1.07
DP-69	JUNCTION	0.04	1.16	193.16	0 13:11	1.16
DP-71	JUNCTION	0.05	1.56	259.56	0 13:00	1.56

DP-73	JUNCTION	0.05	1.57	301.57	0	12:53	1.57
EX-74	JUNCTION	0.03	0.88	457.88	0	12:28	0.87
EX-75	JUNCTION	0.04	1.36	393.36	0	12:42	1.35
EX-78	JUNCTION	0.03	1.12	423.12	0	12:31	1.12
DP-8A	JUNCTION	0.01	0.12	104.12	0	12:25	0.12
DP-9	JUNCTION	0.04	0.96	22.96	0	12:36	0.96
EX-76	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-73	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-88	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-77	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-6	JUNCTION	0.00	0.00	258.00	0	00:00	0.00
EX-20A	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-21	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-3A	JUNCTION	0.00	0.00	74.00	0	00:00	0.00
EX-0	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-4A	JUNCTION	0.00	0.00	96.00	0	00:00	0.00
EX-10A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-9	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-8	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-5	JUNCTION	0.00	0.00	192.00	0	00:00	0.00
EX-12	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-11	JUNCTION	0.00	0.00	72.00	0	00:00	0.00
EX-13	JUNCTION	0.00	0.00	104.00	0	00:00	0.00
EX-24	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-25	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
DP-53A	OUTFALL	0.07	1.05	1.05	0	13:53	1.05
DP-9A	OUTFALL	0.03	0.95	0.95	0	12:47	0.94
DP-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-7	OUTFALL	0.02	0.66	0.66	0	12:59	0.66
DP-3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-8	OUTFALL	0.00	0.06	0.06	0	13:51	0.06

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
EX-3	JUNCTION	16.58	16.58	0	12:25	0.449	0.449	0.000
EX-4	JUNCTION	24.48	24.48	0	12:25	0.629	0.629	0.000
EX-10	JUNCTION	28.19	28.19	0	12:30	0.95	0.95	0.000
EX-20	JUNCTION	22.91	22.91	0	12:25	0.439	0.439	0.000
EX-79	JUNCTION	40.26	40.26	0	12:20	0.807	0.807	0.000
EX-80	JUNCTION	24.46	24.46	0	12:25	0.631	0.631	0.000
EX-81	JUNCTION	28.03	28.03	0	12:30	0.805	0.805	0.000

EX-82	JUNCTION	20.51	20.51	0	12:20	0.36	0.36	0.000
DP-10	JUNCTION	0.00	32.32	0	12:38	0	1.76	0.000
DP-56	JUNCTION	0.00	0.35	0	13:10	0	0.0202	0.000
DP-60A	JUNCTION	0.00	167.91	0	13:48	0	8.51	0.000
DP-63	JUNCTION	0.00	175.18	0	13:33	0	8.43	0.000
DP-69	JUNCTION	0.00	189.69	0	13:10	0	7.83	0.000
DP-71	JUNCTION	0.00	175.00	0	12:59	0	6.75	0.000
DP-73	JUNCTION	0.00	171.20	0	12:53	0	6.47	0.000
EX-74	JUNCTION	30.47	40.00	0	12:28	0.615	0.99	0.000
EX-75	JUNCTION	12.76	104.13	0	12:42	0.408	3.62	-0.000
EX-78	JUNCTION	37.10	62.60	0	12:31	0.801	1.6	0.000
DP-8A	JUNCTION	0.00	0.56	0	12:25	0	0.0188	0.000
DP-9	JUNCTION	0.00	28.73	0	12:36	0	0.975	0.000
EX-76	JUNCTION	11.84	11.84	0	12:25	0.393	0.393	0.000
EX-73	JUNCTION	12.58	12.58	0	12:25	0.338	0.338	0.000
EX-88	JUNCTION	16.59	16.59	0	12:25	0.425	0.425	0.000
EX-77	JUNCTION	19.74	19.74	0	12:35	0.705	0.705	0.000
EX-6	JUNCTION	10.10	10.10	0	12:25	0.276	0.276	0.000
EX-20A	JUNCTION	13.87	13.87	0	12:25	0.501	0.501	0.000
EX-21	JUNCTION	6.72	6.72	0	12:20	0.193	0.193	0.000
EX-3A	JUNCTION	31.40	31.40	0	12:20	1.26	1.26	0.000
EX-0	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
EX-1	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
EX-2	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
EX-4A	JUNCTION	10.14	10.14	0	12:35	0.433	0.433	0.000
EX-10A	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
EX-9	JUNCTION	7.82	7.82	0	12:25	0.323	0.323	0.000
EX-8	JUNCTION	1.18	1.18	0	12:20	0.0251	0.0251	0.000
EX-7	JUNCTION	12.95	12.95	0	12:25	0.518	0.518	0.000
EX-5	JUNCTION	14.15	14.15	0	12:30	0.409	0.409	0.000
EX-12	JUNCTION	1.97	1.97	0	12:15	0.0366	0.0366	0.000
EX-11	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
EX-13	JUNCTION	0.56	0.56	0	12:25	0.0188	0.0188	0.000
EX-24	JUNCTION	0.95	0.95	0	12:20	0.0276	0.0276	0.000
EX-25	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
DP-53A	OUTFALL	0.00	182.68	0	13:52	0	10.3	0.000
DP-9A	OUTFALL	0.00	31.89	0	12:46	0	1.17	0.000
DP-1	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 gal
DP-2	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 gal
DP-4	OUTFALL	0.00	12.95	0	12:25	0	0.518	0.000
DP-5	OUTFALL	0.00	1.18	0	12:20	0	0.0251	0.000
DP-6	OUTFALL	0.00	7.82	0	12:25	0	0.323	0.000
DP-7	OUTFALL	0.00	22.38	0	12:59	0	1	0.000
DP-3	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 gal
DP-8	OUTFALL	0.00	1.97	0	12:15	0	0.0555	0.000

****

Node Flooding Summary

****

No nodes were flooded.

****

Outfall Loading Summary

****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP-53A	46.55	10.51	182.68	10.277
DP-9A	30.10	1.85	31.89	1.167
DP-1	0.00	0.00	0.00	0.000
DP-2	0.00	0.00	0.00	0.000
DP-4	31.22	0.79	12.95	0.518
DP-5	27.68	0.04	1.18	0.025
DP-6	31.32	0.49	7.82	0.323
DP-7	8.99	5.32	22.38	1.003
DP-3	0.00	0.00	0.00	0.000
DP-8	28.18	0.09	1.97	0.055
System	20.40	19.09	210.85	13.370

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-4	CONDUIT	36.75	0 12:40	3.23	0.00	0.04
RT-1	CONDUIT	23.44	0 12:50	2.97	0.00	0.03
RT-3	CONDUIT	16.88	0 12:35	2.80	0.00	0.03
RT-2	CONDUIT	18.48	0 12:48	2.90	0.00	0.03
RT-6	CONDUIT	34.05	0 12:35	3.59	0.00	0.04
RT-5	CONDUIT	98.66	0 12:56	4.36	0.00	0.07
RT-7	CONDUIT	47.85	0 12:55	3.58	0.00	0.05
RT-10	CONDUIT	20.95	0 12:43	2.97	0.00	0.04
RT-9	CONDUIT	169.23	0 13:11	4.07	0.00	0.06
RT-14	CONDUIT	11.77	0 12:58	2.86	0.00	0.03
RT-13	CONDUIT	167.31	0 13:53	3.45	0.00	0.05
RT-12	CONDUIT	167.73	0 13:48	3.70	0.00	0.05
RT-18	CONDUIT	17.45	0 12:41	2.99	0.00	0.03
RT-19	CONDUIT	27.73	0 12:47	2.59	0.00	0.05
RT-11	CONDUIT	170.01	0 13:33	3.79	0.00	0.05
RT-15	CONDUIT	32.10	0 12:50	3.45	0.00	0.04
RT-8	CONDUIT	169.61	0 13:00	4.52	0.00	0.08
RT-16	CONDUIT	22.38	0 12:59	2.97	0.00	0.03
RT-17	CONDUIT	0.35	0 13:10	0.73	0.00	0.00
RT-17A	CONDUIT	0.35	0 13:51	1.06	0.00	0.00
32	DUMMY	11.84	0 12:25			
33	DUMMY	12.58	0 12:25			
34	DUMMY	16.59	0 12:25			
35	DUMMY	19.74	0 12:35			
36	DUMMY	10.10	0 12:25			
37	DUMMY	13.87	0 12:25			
38	DUMMY	6.72	0 12:20			
39	DUMMY	31.40	0 12:20			

40	DUMMY	0.00	0	00:00
41	DUMMY	0.00	0	00:00
42	DUMMY	0.00	0	00:00
43	DUMMY	10.14	0	12:35
44	DUMMY	0.00	0	00:00
45	DUMMY	7.82	0	12:25
46	DUMMY	1.18	0	12:20
47	DUMMY	12.95	0	12:25
48	DUMMY	14.15	0	12:30
49	DUMMY	0.00	0	00:00
50	DUMMY	0.56	0	12:25
51	DUMMY	1.97	0	12:15
52	DUMMY	0.95	0	12:20
53	DUMMY	0.00	0	00:00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Sep 02 14:55:57 2021
Analysis ended on: Thu Sep 02 14:55:58 2021
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

SAND CREEK 2021 MDDP AMENDMENT
EXISTING CONDITIONS
5-YR 100YR TYPE II STORM

WARNING 04: minimum elevation drop used for Conduit 32
WARNING 04: minimum elevation drop used for Conduit 33
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 35
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 41
WARNING 04: minimum elevation drop used for Conduit 42
WARNING 04: minimum elevation drop used for Conduit 43
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 49
WARNING 04: minimum elevation drop used for Conduit 50
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 52
WARNING 04: minimum elevation drop used for Conduit 53

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

**************************	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	112.441	36.641
External Outflow	116.156	37.851
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-3.303	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
EX-3	JUNCTION	0.03	1.19	211.19	0 12:25	1.19
EX-4	JUNCTION	0.03	1.33	261.33	0 12:25	1.32
EX-10	JUNCTION	0.04	1.19	139.19	0 12:30	1.19
EX-20	JUNCTION	0.02	1.16	97.16	0 12:20	1.14
EX-79	JUNCTION	0.03	1.26	523.26	0 12:20	1.25
EX-80	JUNCTION	0.03	1.05	513.05	0 12:25	1.05
EX-81	JUNCTION	0.03	1.22	493.22	0 12:30	1.22
EX-82	JUNCTION	0.02	1.04	523.04	0 12:20	1.03
DP-10	JUNCTION	0.06	1.46	75.46	0 12:36	1.46
DP-56	JUNCTION	0.02	0.80	72.80	0 12:33	0.80
DP-60A	JUNCTION	0.07	2.06	24.06	0 13:25	2.06
DP-63	JUNCTION	0.07	2.09	98.09	0 13:14	2.09
DP-69	JUNCTION	0.06	2.18	194.18	0 12:58	2.18
DP-71	JUNCTION	0.08	2.67	260.67	0 12:51	2.67

DP-73	JUNCTION	0.08	2.68	302.68	0	12:47	2.68
EX-74	JUNCTION	0.04	1.40	458.40	0	12:27	1.39
EX-75	JUNCTION	0.06	2.26	394.26	0	12:38	2.26
EX-78	JUNCTION	0.05	1.72	423.72	0	12:28	1.71
DP-8A	JUNCTION	0.02	0.77	104.77	0	12:25	0.77
DP-9	JUNCTION	0.05	1.68	23.68	0	12:34	1.68
EX-76	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-73	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-88	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-77	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-6	JUNCTION	0.00	0.00	258.00	0	00:00	0.00
EX-20A	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-21	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-3A	JUNCTION	0.00	0.00	74.00	0	00:00	0.00
EX-0	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-4A	JUNCTION	0.00	0.00	96.00	0	00:00	0.00
EX-10A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-9	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-8	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-5	JUNCTION	0.00	0.00	192.00	0	00:00	0.00
EX-12	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-11	JUNCTION	0.00	0.00	72.00	0	00:00	0.00
EX-13	JUNCTION	0.00	0.00	104.00	0	00:00	0.00
EX-24	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-25	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
DP-53A	OUTFALL	0.10	2.05	2.05	0	13:28	2.05
DP-9A	OUTFALL	0.05	1.66	1.66	0	12:40	1.66
DP-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-7	OUTFALL	0.03	1.11	1.11	0	12:52	1.11
DP-3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-8	OUTFALL	0.02	0.80	0.80	0	12:37	0.79

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
EX-3	JUNCTION	48.44	48.44	0 12:25	1.3	1.3	0.000
EX-4	JUNCTION	71.69	71.69	0 12:25	1.83	1.83	0.000
EX-10	JUNCTION	79.81	79.81	0 12:30	2.64	2.64	0.000
EX-20	JUNCTION	69.92	69.92	0 12:20	1.33	1.33	0.000
EX-79	JUNCTION	104.12	104.12	0 12:20	2.01	2.01	0.000
EX-80	JUNCTION	62.55	62.55	0 12:25	1.57	1.57	0.000
EX-81	JUNCTION	84.86	84.86	0 12:30	2.44	2.44	0.000

EX-82	JUNCTION	62.03	62.03	0	12:20	1.09	1.09	0.000
DP-10	JUNCTION	0.00	93.36	0	12:36	0	3.98	0.000
DP-56	JUNCTION	0.00	40.19	0	12:33	0	1.3	0.000
DP-60A	JUNCTION	0.00	546.35	0	13:25	0	23.2	0.000
DP-63	JUNCTION	0.00	557.40	0	13:14	0	22.7	0.000
DP-69	JUNCTION	0.00	579.88	0	12:58	0	21	0.000
DP-71	JUNCTION	0.00	518.37	0	12:51	0	17.8	0.000
DP-73	JUNCTION	0.00	503.09	0	12:47	0	16.9	0.000
EX-74	JUNCTION	72.28	113.19	0	12:27	1.39	2.5	0.000
EX-75	JUNCTION	30.23	300.63	0	12:38	0.922	9.41	-0.000
EX-78	JUNCTION	88.40	164.33	0	12:28	1.81	3.82	0.000
DP-8A	JUNCTION	0.00	17.30	0	12:25	0	0.565	0.000
DP-9	JUNCTION	0.00	93.68	0	12:34	0	2.65	0.000
EX-76	JUNCTION	29.53	29.53	0	12:25	0.944	0.944	0.000
EX-73	JUNCTION	34.11	34.11	0	12:25	0.905	0.905	0.000
EX-88	JUNCTION	50.26	50.26	0	12:25	1.29	1.29	0.000
EX-77	JUNCTION	59.73	59.73	0	12:35	2.14	2.14	0.000
EX-6	JUNCTION	30.54	30.54	0	12:25	0.837	0.837	0.000
EX-20A	JUNCTION	40.88	40.88	0	12:25	1.25	1.25	0.000
EX-21	JUNCTION	15.25	15.25	0	12:20	0.411	0.411	0.000
EX-3A	JUNCTION	77.80	77.80	0	12:25	2.57	2.57	0.000
EX-0	JUNCTION	4.88	4.88	0	12:20	0.0807	0.0807	0.000
EX-1	JUNCTION	4.41	4.41	0	12:20	0.0874	0.0874	0.000
EX-2	JUNCTION	0.69	0.69	0	12:20	0.0197	0.0197	0.000
EX-4A	JUNCTION	32.14	32.14	0	12:35	1.37	1.37	0.000
EX-10A	JUNCTION	18.21	18.21	0	12:30	0.613	0.613	0.000
EX-9	JUNCTION	24.38	24.38	0	12:25	0.865	0.865	0.000
EX-8	JUNCTION	9.36	9.36	0	12:20	0.176	0.176	0.000
EX-7	JUNCTION	35.87	35.87	0	12:25	1.22	1.22	0.000
EX-5	JUNCTION	46.44	46.44	0	12:30	1.36	1.36	0.000
EX-12	JUNCTION	17.03	17.03	0	12:20	0.281	0.281	0.000
EX-11	JUNCTION	33.15	33.15	0	12:25	0.716	0.716	0.000
EX-13	JUNCTION	17.30	17.30	0	12:25	0.565	0.565	0.000
EX-24	JUNCTION	15.37	15.37	0	12:25	0.418	0.418	0.000
EX-25	JUNCTION	5.78	5.78	0	12:25	0.186	0.186	0.000
DP-53A	OUTFALL	0.00	602.01	0	13:27	0	27.4	0.000
DP-9A	OUTFALL	0.00	101.87	0	12:39	0	3.06	0.000
DP-1	OUTFALL	0.00	4.88	0	12:20	0	0.0807	0.000
DP-2	OUTFALL	0.00	4.41	0	12:20	0	0.0874	0.000
DP-4	OUTFALL	0.00	35.87	0	12:25	0	1.22	0.000
DP-5	OUTFALL	0.00	9.36	0	12:20	0	0.176	0.000
DP-6	OUTFALL	0.00	24.38	0	12:25	0	0.865	0.000
DP-7	OUTFALL	0.00	82.23	0	12:50	0	3.36	0.000
DP-3	OUTFALL	0.00	0.69	0	12:20	0	0.0197	0.000
DP-8	OUTFALL	0.00	50.28	0	12:33	0	1.59	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP-53A	48.54	26.87	602.01	27.393
DP-9A	30.77	4.73	101.87	3.057
DP-1	2.34	1.64	4.88	0.081
DP-2	2.77	1.50	4.41	0.087
DP-4	31.88	1.82	35.87	1.219
DP-5	28.56	0.29	9.36	0.176
DP-6	31.97	1.29	24.38	0.865
DP-7	10.35	15.46	82.23	3.362
DP-3	4.01	0.23	0.69	0.020
DP-8	28.94	2.61	50.28	1.588
System	22.01	56.46	744.77	37.848

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-4	CONDUIT	105.39	0 12:36	4.20	0.00	0.07
RT-1	CONDUIT	75.57	0 12:45	4.03	0.00	0.06
RT-3	CONDUIT	54.00	0 12:30	3.76	0.00	0.05
RT-2	CONDUIT	50.88	0 12:41	3.71	0.00	0.05
RT-6	CONDUIT	91.46	0 12:31	4.61	0.00	0.06
RT-5	CONDUIT	287.83	0 12:48	5.78	0.01	0.11
RT-7	CONDUIT	130.49	0 12:48	4.44	0.00	0.08
RT-10	CONDUIT	64.67	0 12:39	3.99	0.00	0.06
RT-9	CONDUIT	505.82	0 12:59	5.71	0.01	0.11
RT-14	CONDUIT	37.24	0 12:49	3.88	0.00	0.05
RT-13	CONDUIT	545.00	0 13:28	5.09	0.01	0.10
RT-12	CONDUIT	541.38	0 13:25	5.41	0.01	0.10
RT-18	CONDUIT	57.33	0 12:35	4.00	0.00	0.05
RT-19	CONDUIT	91.21	0 12:40	3.53	0.00	0.08
RT-11	CONDUIT	536.57	0 13:14	5.54	0.01	0.10
RT-15	CONDUIT	91.96	0 12:46	4.68	0.00	0.07
RT-8	CONDUIT	499.30	0 12:51	6.08	0.01	0.13
RT-16	CONDUIT	67.70	0 12:52	3.87	0.00	0.05
RT-17	CONDUIT	15.11	0 12:48	2.18	0.00	0.04
RT-17A	CONDUIT	40.06	0 12:37	4.72	0.00	0.04
32	DUMMY	29.53	0 12:25			
33	DUMMY	34.11	0 12:25			
34	DUMMY	50.26	0 12:25			
35	DUMMY	59.73	0 12:35			
36	DUMMY	30.54	0 12:25			
37	DUMMY	40.88	0 12:25			
38	DUMMY	15.25	0 12:20			
39	DUMMY	77.80	0 12:25			

40	DUMMY	4.88	0	12:20
41	DUMMY	4.41	0	12:20
42	DUMMY	0.69	0	12:20
43	DUMMY	32.14	0	12:35
44	DUMMY	18.21	0	12:30
45	DUMMY	24.38	0	12:25
46	DUMMY	9.36	0	12:20
47	DUMMY	35.87	0	12:25
48	DUMMY	46.44	0	12:30
49	DUMMY	33.15	0	12:25
50	DUMMY	17.30	0	12:25
51	DUMMY	17.03	0	12:20
52	DUMMY	15.37	0	12:25
53	DUMMY	5.78	0	12:25

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Sep 02 14:55:27 2021
Analysis ended on: Thu Sep 02 14:55:27 2021
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

SAND CREEK 2021 MDDP AMENDMENT
EXISTING CONDITIONS
10-YR 100YR TYPE II STORM

WARNING 04: minimum elevation drop used for Conduit 32
WARNING 04: minimum elevation drop used for Conduit 33
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 35
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 41
WARNING 04: minimum elevation drop used for Conduit 42
WARNING 04: minimum elevation drop used for Conduit 43
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 49
WARNING 04: minimum elevation drop used for Conduit 50
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 52
WARNING 04: minimum elevation drop used for Conduit 53

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	180.323	58.761
External Outflow	184.936	60.264
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-2.558	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
EX-3	JUNCTION	0.03	1.48	211.48	0 12:25	1.47
EX-4	JUNCTION	0.04	1.62	261.62	0 12:25	1.62
EX-10	JUNCTION	0.04	1.44	139.44	0 12:30	1.44
EX-20	JUNCTION	0.03	1.41	97.41	0 12:20	1.39
EX-79	JUNCTION	0.03	1.51	523.51	0 12:20	1.49
EX-80	JUNCTION	0.03	1.26	513.26	0 12:25	1.26
EX-81	JUNCTION	0.04	1.48	493.48	0 12:30	1.48
EX-82	JUNCTION	0.02	1.26	523.26	0 12:20	1.25
DP-10	JUNCTION	0.07	1.83	75.83	0 12:36	1.83
DP-56	JUNCTION	0.03	1.22	73.22	0 12:30	1.22
DP-60A	JUNCTION	0.09	2.68	24.68	0 13:17	2.68
DP-63	JUNCTION	0.08	2.73	98.73	0 13:07	2.73
DP-69	JUNCTION	0.08	2.84	194.84	0 12:54	2.84
DP-71	JUNCTION	0.10	3.32	261.32	0 12:48	3.32

DP-73	JUNCTION	0.09	3.33	303.33	0	12:44	3.33
EX-74	JUNCTION	0.04	1.69	458.69	0	12:25	1.69
EX-75	JUNCTION	0.08	2.78	394.78	0	12:36	2.77
EX-78	JUNCTION	0.05	2.05	424.05	0	12:27	2.04
DP-8A	JUNCTION	0.03	1.03	105.03	0	12:25	1.03
DP-9	JUNCTION	0.06	2.14	24.14	0	12:31	2.13
EX-76	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-73	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-88	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-77	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-6	JUNCTION	0.00	0.00	258.00	0	00:00	0.00
EX-20A	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-21	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-3A	JUNCTION	0.00	0.00	74.00	0	00:00	0.00
EX-0	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-4A	JUNCTION	0.00	0.00	96.00	0	00:00	0.00
EX-10A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-9	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-8	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-5	JUNCTION	0.00	0.00	192.00	0	00:00	0.00
EX-12	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-11	JUNCTION	0.00	0.00	72.00	0	00:00	0.00
EX-13	JUNCTION	0.00	0.00	104.00	0	00:00	0.00
EX-24	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-25	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
DP-53A	OUTFALL	0.12	2.68	2.68	0	13:20	2.68
DP-9A	OUTFALL	0.06	2.12	2.12	0	12:37	2.11
DP-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-7	OUTFALL	0.04	1.36	1.36	0	12:50	1.36
DP-3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-8	OUTFALL	0.03	1.22	1.22	0	12:33	1.21

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
EX-3	JUNCTION	74.70	74.70	0 12:25	2.02	2.02	0.000
EX-4	JUNCTION	110.61	110.61	0 12:25	2.83	2.83	0.000
EX-10	JUNCTION	122.69	122.69	0 12:30	4.07	4.07	0.000
EX-20	JUNCTION	108.71	108.71	0 12:20	2.08	2.08	0.000
EX-79	JUNCTION	156.40	156.40	0 12:20	3.01	3.01	0.000
EX-80	JUNCTION	93.62	93.62	0 12:25	2.36	2.36	0.000
EX-81	JUNCTION	131.58	131.58	0 12:30	3.81	3.81	0.000

EX-82	JUNCTION	95.70	95.70	0	12:20	1.71	1.71	-0.000
DP-10	JUNCTION	0.00	146.19	0	12:36	0	5.82	0.000
DP-56	JUNCTION	0.00	96.37	0	12:30	0	2.85	0.000
DP-60A	JUNCTION	0.00	886.79	0	13:17	0	35.4	0.000
DP-63	JUNCTION	0.00	899.71	0	13:07	0	34.5	0.000
DP-69	JUNCTION	0.00	923.83	0	12:54	0	32	0.000
DP-71	JUNCTION	0.00	818.24	0	12:48	0	26.9	0.000
DP-73	JUNCTION	0.00	791.79	0	12:44	0	25.6	0.000
EX-74	JUNCTION	106.02	175.09	0	12:25	2.04	3.77	0.000
EX-75	JUNCTION	44.57	468.77	0	12:36	1.35	14.2	0.000
EX-78	JUNCTION	130.23	250.53	0	12:27	2.65	5.68	0.000
DP-8A	JUNCTION	0.00	31.43	0	12:25	0	1.03	0.000
DP-9	JUNCTION	0.00	160.49	0	12:31	0	4.37	0.000
EX-76	JUNCTION	44.13	44.13	0	12:25	1.41	1.41	0.000
EX-73	JUNCTION	51.72	51.72	0	12:25	1.38	1.38	0.000
EX-88	JUNCTION	77.94	77.94	0	12:25	2.01	2.01	0.000
EX-77	JUNCTION	92.70	92.70	0	12:35	3.33	3.33	0.000
EX-6	JUNCTION	47.33	47.33	0	12:25	1.31	1.31	0.000
EX-20A	JUNCTION	75.91	75.91	0	12:25	2.22	2.22	0.000
EX-21	JUNCTION	22.24	22.24	0	12:20	0.595	0.595	0.000
EX-3A	JUNCTION	116.10	116.10	0	12:25	3.68	3.68	0.000
EX-0	JUNCTION	11.82	11.82	0	12:15	0.202	0.202	0.000
EX-1	JUNCTION	10.85	10.85	0	12:20	0.219	0.219	0.000
EX-2	JUNCTION	1.71	1.71	0	12:20	0.0493	0.0493	0.000
EX-4A	JUNCTION	50.39	50.39	0	12:35	2.16	2.16	0.000
EX-10A	JUNCTION	45.66	45.66	0	12:30	1.54	1.54	0.000
EX-9	JUNCTION	46.12	46.12	0	12:25	1.57	1.57	0.000
EX-8	JUNCTION	20.80	20.80	0	12:20	0.395	0.395	0.000
EX-7	JUNCTION	65.46	65.46	0	12:25	2.11	2.11	0.000
EX-5	JUNCTION	73.05	73.05	0	12:25	2.15	2.15	0.000
EX-12	JUNCTION	29.37	29.37	0	12:15	0.488	0.488	0.000
EX-11	JUNCTION	82.24	82.24	0	12:25	1.79	1.79	0.000
EX-13	JUNCTION	31.43	31.43	0	12:25	1.03	1.03	0.000
EX-24	JUNCTION	27.26	27.26	0	12:25	0.746	0.746	0.000
EX-25	JUNCTION	14.41	14.41	0	12:25	0.467	0.467	0.000
DP-53A	OUTFALL	0.00	983.58	0	13:19	0	41.7	0.000
DP-9A	OUTFALL	0.00	173.68	0	12:37	0	4.96	0.000
DP-1	OUTFALL	0.00	11.82	0	12:15	0	0.202	0.000
DP-2	OUTFALL	0.00	10.85	0	12:20	0	0.219	0.000
DP-4	OUTFALL	0.00	65.46	0	12:25	0	2.11	0.000
DP-5	OUTFALL	0.00	20.80	0	12:20	0	0.395	0.000
DP-6	OUTFALL	0.00	46.12	0	12:25	0	1.57	0.000
DP-7	OUTFALL	0.00	143.62	0	12:47	0	5.73	0.000
DP-3	OUTFALL	0.00	1.71	0	12:20	0	0.0493	0.000
DP-8	OUTFALL	0.00	115.07	0	12:31	0	3.34	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP-53A	49.33	40.23	983.58	41.681
DP-9A	31.25	7.56	173.68	4.960
DP-1	2.45	3.94	11.82	0.202
DP-2	2.87	3.63	10.85	0.219
DP-4	32.22	3.12	65.46	2.112
DP-5	29.06	0.65	20.80	0.395
DP-6	32.34	2.30	46.12	1.565
DP-7	11.40	23.95	143.62	5.734
DP-3	4.13	0.57	1.71	0.049
DP-8	29.37	5.42	115.07	3.342
System	22.44	91.36	1270.10	60.260

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-4	CONDUIT	164.54	0 12:34	4.68	0.00	0.08
RT-1	CONDUIT	119.66	0 12:43	4.46	0.00	0.07
RT-3	CONDUIT	85.36	0 12:29	4.19	0.00	0.06
RT-2	CONDUIT	78.68	0 12:40	4.12	0.00	0.06
RT-6	CONDUIT	140.15	0 12:30	5.11	0.00	0.07
RT-5	CONDUIT	451.23	0 12:45	6.48	0.01	0.14
RT-7	CONDUIT	203.01	0 12:45	4.86	0.00	0.09
RT-10	CONDUIT	101.36	0 12:37	4.47	0.00	0.08
RT-9	CONDUIT	801.27	0 12:55	6.53	0.01	0.13
RT-14	CONDUIT	59.61	0 12:45	4.37	0.00	0.07
RT-13	CONDUIT	884.79	0 13:20	5.91	0.02	0.13
RT-12	CONDUIT	876.50	0 13:17	6.27	0.01	0.13
RT-18	CONDUIT	91.02	0 12:34	4.41	0.00	0.06
RT-19	CONDUIT	157.38	0 12:37	4.05	0.00	0.11
RT-11	CONDUIT	864.66	0 13:07	6.44	0.02	0.14
RT-15	CONDUIT	144.19	0 12:43	5.30	0.00	0.09
RT-8	CONDUIT	786.90	0 12:48	6.85	0.01	0.17
RT-16	CONDUIT	106.83	0 12:50	4.31	0.00	0.07
RT-17	CONDUIT	28.18	0 12:45	2.58	0.00	0.05
RT-17A	CONDUIT	95.73	0 12:33	5.96	0.00	0.06
32	DUMMY	44.13	0 12:25			
33	DUMMY	51.72	0 12:25			
34	DUMMY	77.94	0 12:25			
35	DUMMY	92.70	0 12:35			
36	DUMMY	47.33	0 12:25			
37	DUMMY	75.91	0 12:25			
38	DUMMY	22.24	0 12:20			
39	DUMMY	116.10	0 12:25			

40	DUMMY	11.82	0	12:15
41	DUMMY	10.85	0	12:20
42	DUMMY	1.71	0	12:20
43	DUMMY	50.39	0	12:35
44	DUMMY	45.66	0	12:30
45	DUMMY	46.12	0	12:25
46	DUMMY	20.80	0	12:20
47	DUMMY	65.46	0	12:25
48	DUMMY	73.05	0	12:25
49	DUMMY	82.24	0	12:25
50	DUMMY	31.43	0	12:25
51	DUMMY	29.37	0	12:15
52	DUMMY	27.26	0	12:25
53	DUMMY	14.41	0	12:25

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Sep 02 14:54:53 2021
Analysis ended on: Thu Sep 02 14:54:53 2021
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

SAND CREEK 2021 MDDP AMENDMENT
EXISTING CONDITIONS
25-YR 100YR TYPE II STORM

WARNING 04: minimum elevation drop used for Conduit 32
WARNING 04: minimum elevation drop used for Conduit 33
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 35
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 41
WARNING 04: minimum elevation drop used for Conduit 42
WARNING 04: minimum elevation drop used for Conduit 43
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 49
WARNING 04: minimum elevation drop used for Conduit 50
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 52
WARNING 04: minimum elevation drop used for Conduit 53

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

**************************	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	236.756	77.150
External Outflow	241.696	78.760
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-2.086	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
EX-3	JUNCTION	0.04	1.67	211.67	0 12:25	1.66
EX-4	JUNCTION	0.04	1.82	261.82	0 12:25	1.81
EX-10	JUNCTION	0.05	1.61	139.61	0 12:30	1.60
EX-20	JUNCTION	0.03	1.56	97.56	0 12:20	1.55
EX-79	JUNCTION	0.04	1.66	523.66	0 12:20	1.65
EX-80	JUNCTION	0.04	1.40	513.40	0 12:25	1.40
EX-81	JUNCTION	0.04	1.65	493.65	0 12:30	1.65
EX-82	JUNCTION	0.02	1.40	523.40	0 12:20	1.39
DP-10	JUNCTION	0.08	2.08	76.08	0 12:34	2.08
DP-56	JUNCTION	0.04	1.46	73.46	0 12:30	1.46
DP-60A	JUNCTION	0.10	3.13	25.13	0 13:12	3.12
DP-63	JUNCTION	0.10	3.20	99.20	0 13:04	3.20
DP-69	JUNCTION	0.09	3.30	195.30	0 12:52	3.29
DP-71	JUNCTION	0.11	3.76	261.76	0 12:46	3.75

DP-73	JUNCTION	0.11	3.77	303.77	0	12:42	3.76
EX-74	JUNCTION	0.05	1.88	458.88	0	12:25	1.88
EX-75	JUNCTION	0.09	3.12	395.12	0	12:35	3.12
EX-78	JUNCTION	0.06	2.27	424.27	0	12:26	2.27
DP-8A	JUNCTION	0.03	1.19	105.19	0	12:25	1.19
DP-9	JUNCTION	0.07	2.44	24.44	0	12:30	2.43
EX-76	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-73	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-88	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-77	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-6	JUNCTION	0.00	0.00	258.00	0	00:00	0.00
EX-20A	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-21	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-3A	JUNCTION	0.00	0.00	74.00	0	00:00	0.00
EX-0	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-4A	JUNCTION	0.00	0.00	96.00	0	00:00	0.00
EX-10A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-9	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-8	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-5	JUNCTION	0.00	0.00	192.00	0	00:00	0.00
EX-12	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-11	JUNCTION	0.00	0.00	72.00	0	00:00	0.00
EX-13	JUNCTION	0.00	0.00	104.00	0	00:00	0.00
EX-24	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-25	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
DP-53A	OUTFALL	0.13	3.12	3.12	0	13:15	3.12
DP-9A	OUTFALL	0.07	2.42	2.42	0	12:36	2.41
DP-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-7	OUTFALL	0.05	1.52	1.52	0	12:49	1.52
DP-3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-8	OUTFALL	0.03	1.46	1.46	0	12:32	1.45

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
EX-3	JUNCTION	95.73	95.73	0 12:25	2.62	2.62	0.000
EX-4	JUNCTION	141.70	141.70	0 12:25	3.68	3.68	0.000
EX-10	JUNCTION	157.63	157.63	0 12:30	5.27	5.27	0.000
EX-20	JUNCTION	138.82	138.82	0 12:20	2.71	2.71	0.000
EX-79	JUNCTION	197.01	197.01	0 12:20	3.86	3.86	0.000
EX-80	JUNCTION	118.31	118.31	0 12:25	3.02	3.02	0.000
EX-81	JUNCTION	169.33	169.33	0 12:30	4.96	4.96	0.000

EX-82	JUNCTION	121.49	121.49	0	12:20	2.22	2.22	0.000
DP-10	JUNCTION	0.00	189.33	0	12:34	0	7.33	0.000
DP-56	JUNCTION	0.00	141.51	0	12:30	0	4.09	0.000
DP-60A	JUNCTION	0.00	1179.00	0	13:12	0	45.5	0.000
DP-63	JUNCTION	0.00	1192.36	0	13:04	0	44.4	0.000
DP-69	JUNCTION	0.00	1213.68	0	12:52	0	41.2	0.000
DP-71	JUNCTION	0.00	1068.91	0	12:46	0	34.6	0.000
DP-73	JUNCTION	0.00	1033.04	0	12:42	0	32.9	0.000
EX-74	JUNCTION	132.02	224.86	0	12:25	2.59	4.84	0.000
EX-75	JUNCTION	56.20	607.40	0	12:35	1.72	18.3	0.000
EX-78	JUNCTION	162.88	319.95	0	12:26	3.37	7.26	0.000
DP-8A	JUNCTION	0.00	42.65	0	12:25	0	1.39	0.000
DP-9	JUNCTION	0.00	215.19	0	12:30	0	5.78	0.000
EX-76	JUNCTION	55.94	55.94	0	12:25	1.8	1.8	0.000
EX-73	JUNCTION	65.79	65.79	0	12:25	1.78	1.78	0.000
EX-88	JUNCTION	100.02	100.02	0	12:25	2.62	2.62	0.000
EX-77	JUNCTION	119.97	119.97	0	12:30	4.35	4.35	0.000
EX-6	JUNCTION	60.79	60.79	0	12:25	1.7	1.7	0.000
EX-20A	JUNCTION	103.86	103.86	0	12:25	3	3	0.000
EX-21	JUNCTION	27.80	27.80	0	12:20	0.75	0.75	0.000
EX-3A	JUNCTION	146.37	146.37	0	12:20	4.57	4.57	0.000
EX-0	JUNCTION	17.63	17.63	0	12:15	0.3	0.3	0.000
EX-1	JUNCTION	15.93	15.93	0	12:20	0.325	0.325	0.000
EX-2	JUNCTION	2.52	2.52	0	12:20	0.073	0.073	0.000
EX-4A	JUNCTION	65.45	65.45	0	12:35	2.82	2.82	0.000
EX-10A	JUNCTION	67.61	67.61	0	12:30	2.28	2.28	0.000
EX-9	JUNCTION	63.58	63.58	0	12:25	2.13	2.13	0.000
EX-8	JUNCTION	29.82	29.82	0	12:20	0.57	0.57	0.000
EX-7	JUNCTION	89.09	89.09	0	12:25	2.83	2.83	0.000
EX-5	JUNCTION	94.83	94.83	0	12:25	2.82	2.82	0.000
EX-12	JUNCTION	39.30	39.30	0	12:15	0.653	0.653	0.000
EX-11	JUNCTION	121.23	121.23	0	12:25	2.66	2.66	0.000
EX-13	JUNCTION	42.65	42.65	0	12:25	1.39	1.39	0.000
EX-24	JUNCTION	36.67	36.67	0	12:20	1.01	1.01	0.000
EX-25	JUNCTION	21.29	21.29	0	12:25	0.691	0.691	0.000
DP-53A	OUTFALL	0.00	1311.23	0	13:14	0	53.6	0.000
DP-9A	OUTFALL	0.00	232.21	0	12:36	0	6.53	0.000
DP-1	OUTFALL	0.00	17.63	0	12:15	0	0.3	0.000
DP-2	OUTFALL	0.00	15.93	0	12:20	0	0.325	0.000
DP-4	OUTFALL	0.00	89.09	0	12:25	0	2.83	0.000
DP-5	OUTFALL	0.00	29.82	0	12:20	0	0.57	0.000
DP-6	OUTFALL	0.00	63.58	0	12:25	0	2.13	0.000
DP-7	OUTFALL	0.00	194.75	0	12:46	0	7.69	0.000
DP-3	OUTFALL	0.00	2.52	0	12:20	0	0.073	0.000
DP-8	OUTFALL	0.00	167.23	0	12:31	0	4.74	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP-53A	50.10	50.90	1311.23	53.562
DP-9A	31.54	9.85	232.21	6.526
DP-1	2.45	5.83	17.63	0.300
DP-2	2.87	5.38	15.93	0.325
DP-4	32.40	4.16	89.09	2.833
DP-5	29.36	0.92	29.82	0.570
DP-6	32.56	3.12	63.58	2.134
DP-7	12.38	29.56	194.75	7.688
DP-3	4.13	0.84	2.52	0.073
DP-8	29.63	7.62	167.23	4.744
System	22.74	118.20	1725.18	78.754

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-4	CONDUIT	212.88	0 12:32	4.97	0.00	0.09
RT-1	CONDUIT	155.96	0 12:42	4.72	0.00	0.08
RT-3	CONDUIT	110.27	0 12:28	4.45	0.00	0.07
RT-2	CONDUIT	101.46	0 12:39	4.37	0.00	0.06
RT-6	CONDUIT	178.98	0 12:29	5.40	0.00	0.08
RT-5	CONDUIT	587.39	0 12:44	6.92	0.01	0.15
RT-7	CONDUIT	263.39	0 12:43	5.16	0.00	0.10
RT-10	CONDUIT	131.25	0 12:36	4.76	0.00	0.09
RT-9	CONDUIT	1049.57	0 12:53	7.05	0.02	0.16
RT-14	CONDUIT	78.22	0 12:45	4.68	0.00	0.07
RT-13	CONDUIT	1176.49	0 13:15	6.43	0.02	0.16
RT-12	CONDUIT	1164.03	0 13:12	6.82	0.02	0.15
RT-18	CONDUIT	118.47	0 12:33	4.31	0.00	0.07
RT-19	CONDUIT	211.25	0 12:36	4.36	0.01	0.12
RT-11	CONDUIT	1144.73	0 13:04	7.03	0.03	0.16
RT-15	CONDUIT	186.90	0 12:42	5.67	0.00	0.10
RT-8	CONDUIT	1027.18	0 12:46	7.35	0.02	0.19
RT-16	CONDUIT	139.19	0 12:49	4.60	0.00	0.08
RT-17	CONDUIT	38.62	0 12:43	2.79	0.00	0.06
RT-17A	CONDUIT	141.16	0 12:32	6.60	0.00	0.07
32	DUMMY	55.94	0 12:25			
33	DUMMY	65.79	0 12:25			
34	DUMMY	100.02	0 12:25			
35	DUMMY	119.97	0 12:30			
36	DUMMY	60.79	0 12:25			
37	DUMMY	103.86	0 12:25			
38	DUMMY	27.80	0 12:20			
39	DUMMY	146.37	0 12:20			

40	DUMMY	17.63	0	12:15
41	DUMMY	15.93	0	12:20
42	DUMMY	2.52	0	12:20
43	DUMMY	65.45	0	12:35
44	DUMMY	67.61	0	12:30
45	DUMMY	63.58	0	12:25
46	DUMMY	29.82	0	12:20
47	DUMMY	89.09	0	12:25
48	DUMMY	94.83	0	12:25
49	DUMMY	121.23	0	12:25
50	DUMMY	42.65	0	12:25
51	DUMMY	39.30	0	12:15
52	DUMMY	36.67	0	12:20
53	DUMMY	21.29	0	12:25

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Sep 02 14:53:56 2021
Analysis ended on: Thu Sep 02 14:53:56 2021
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

SAND CREEK 2021 MDDP AMENDMENT
EXISTING CONDITIONS
50-YR 100YR TYPE II STORM

WARNING 04: minimum elevation drop used for Conduit 32
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WARNING 04: minimum elevation drop used for Conduit 50
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 52
WARNING 04: minimum elevation drop used for Conduit 53

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	324.744	105.823
External Outflow	330.139	107.581
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-1.661	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	: 30.00 sec
Average Time Step	: 30.00 sec
Maximum Time Step	: 30.00 sec
Percent in Steady State	: 0.00
Average Iterations per Step	: 1.00
Percent Not Converging	: 0.00

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
EX-3	JUNCTION	0.04	1.91	211.91	0 12:25	1.91
EX-4	JUNCTION	0.05	2.07	262.07	0 12:25	2.06
EX-10	JUNCTION	0.06	1.82	139.82	0 12:30	1.82
EX-20	JUNCTION	0.03	1.77	97.77	0 12:20	1.76
EX-79	JUNCTION	0.04	1.87	523.87	0 12:20	1.86
EX-80	JUNCTION	0.04	1.58	513.58	0 12:25	1.58
EX-81	JUNCTION	0.05	1.88	493.88	0 12:30	1.87
EX-82	JUNCTION	0.03	1.58	523.58	0 12:20	1.58
DP-10	JUNCTION	0.09	2.40	76.40	0 12:34	2.40
DP-56	JUNCTION	0.04	1.74	73.74	0 12:28	1.74
DP-60A	JUNCTION	0.12	3.73	25.73	0 13:08	3.73
DP-63	JUNCTION	0.11	3.83	99.83	0 13:01	3.83
DP-69	JUNCTION	0.11	3.94	195.94	0 12:49	3.94
DP-71	JUNCTION	0.12	4.34	262.34	0 12:44	4.34

DP-73	JUNCTION	0.12	4.35	304.35	0	12:41	4.35
EX-74	JUNCTION	0.05	2.13	459.13	0	12:24	2.13
EX-75	JUNCTION	0.10	3.58	395.58	0	12:34	3.58
EX-78	JUNCTION	0.07	2.56	424.56	0	12:26	2.56
DP-8A	JUNCTION	0.04	1.39	105.39	0	12:25	1.39
DP-9	JUNCTION	0.08	2.80	24.80	0	12:30	2.80
EX-76	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-73	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-88	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-77	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-6	JUNCTION	0.00	0.00	258.00	0	00:00	0.00
EX-20A	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-21	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-3A	JUNCTION	0.00	0.00	74.00	0	00:00	0.00
EX-0	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-4A	JUNCTION	0.00	0.00	96.00	0	00:00	0.00
EX-10A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-9	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-8	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-5	JUNCTION	0.00	0.00	192.00	0	00:00	0.00
EX-12	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-11	JUNCTION	0.00	0.00	72.00	0	00:00	0.00
EX-13	JUNCTION	0.00	0.00	104.00	0	00:00	0.00
EX-24	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-25	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
DP-53A	OUTFALL	0.15	3.73	3.73	0	13:11	3.73
DP-9A	OUTFALL	0.08	2.78	2.78	0	12:35	2.78
DP-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-7	OUTFALL	0.05	1.74	1.74	0	12:48	1.74
DP-3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-8	OUTFALL	0.04	1.74	1.74	0	12:31	1.74

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
EX-3	JUNCTION	128.03	128.03	0 12:25	3.58	3.58	0.000
EX-4	JUNCTION	189.38	189.38	0 12:25	5.02	5.02	0.000
EX-10	JUNCTION	211.69	211.69	0 12:30	7.17	7.17	0.000
EX-20	JUNCTION	184.50	184.50	0 12:20	3.7	3.7	0.000
EX-79	JUNCTION	258.55	258.55	0 12:20	5.21	5.21	0.000
EX-80	JUNCTION	156.30	156.30	0 12:25	4.08	4.08	0.000
EX-81	JUNCTION	228.01	228.01	0 12:30	6.8	6.8	0.000

EX-82	JUNCTION	160.67	160.67	0	12:20	3.04	3.04	0.000
DP-10	JUNCTION	0.00	255.20	0	12:34	0	9.66	0.000
DP-56	JUNCTION	0.00	207.98	0	12:28	0	5.93	0.000
DP-60A	JUNCTION	0.00	1649.04	0	13:08	0	61.6	0.000
DP-63	JUNCTION	0.00	1661.58	0	13:00	0	60.1	0.000
DP-69	JUNCTION	0.00	1675.53	0	12:49	0	55.8	0.000
DP-71	JUNCTION	0.00	1466.20	0	12:44	0	46.8	0.000
DP-73	JUNCTION	0.00	1414.41	0	12:41	0	44.4	0.000
EX-74	JUNCTION	171.48	301.19	0	12:24	3.46	6.53	0.000
EX-75	JUNCTION	73.94	824.55	0	12:34	2.3	24.7	0.000
EX-78	JUNCTION	212.35	426.39	0	12:26	4.5	9.74	0.000
DP-8A	JUNCTION	0.00	59.34	0	12:25	0	1.95	0.000
DP-9	JUNCTION	0.00	297.14	0	12:30	0	7.96	0.000
EX-76	JUNCTION	74.06	74.06	0	12:25	2.42	2.42	0.000
EX-73	JUNCTION	87.48	87.48	0	12:25	2.42	2.42	0.000
EX-88	JUNCTION	133.97	133.97	0	12:25	3.59	3.59	0.000
EX-77	JUNCTION	162.20	162.20	0	12:35	5.95	5.95	0.000
EX-6	JUNCTION	81.51	81.51	0	12:25	2.33	2.33	0.000
EX-20A	JUNCTION	144.84	144.84	0	12:25	4.17	4.17	0.000
EX-21	JUNCTION	36.26	36.26	0	12:20	0.996	0.996	0.000
EX-3A	JUNCTION	192.52	192.52	0	12:20	5.93	5.93	0.000
EX-0	JUNCTION	25.97	25.97	0	12:15	0.446	0.446	0.000
EX-1	JUNCTION	23.17	23.17	0	12:20	0.483	0.483	0.000
EX-2	JUNCTION	3.71	3.71	0	12:15	0.109	0.109	0.000
EX-4A	JUNCTION	89.03	89.03	0	12:35	3.87	3.87	0.000
EX-10A	JUNCTION	100.09	100.09	0	12:30	3.39	3.39	0.000
EX-9	JUNCTION	89.43	89.43	0	12:25	2.99	2.99	0.000
EX-8	JUNCTION	42.58	42.58	0	12:20	0.833	0.833	0.000
EX-7	JUNCTION	123.98	123.98	0	12:25	3.92	3.92	0.000
EX-5	JUNCTION	128.18	128.18	0	12:25	3.88	3.88	0.000
EX-12	JUNCTION	53.72	53.72	0	12:15	0.902	0.902	0.000
EX-11	JUNCTION	177.16	177.16	0	12:25	3.95	3.95	0.000
EX-13	JUNCTION	59.34	59.34	0	12:25	1.95	1.95	0.000
EX-24	JUNCTION	50.91	50.91	0	12:20	1.4	1.4	0.000
EX-25	JUNCTION	31.44	31.44	0	12:25	1.03	1.03	0.000
DP-53A	OUTFALL	0.00	1837.86	0	13:10	0	72.3	0.000
DP-9A	OUTFALL	0.00	321.39	0	12:34	0	8.95	0.000
DP-1	OUTFALL	0.00	25.97	0	12:15	0	0.446	0.000
DP-2	OUTFALL	0.00	23.17	0	12:20	0	0.483	0.000
DP-4	OUTFALL	0.00	123.98	0	12:25	0	3.92	0.000
DP-5	OUTFALL	0.00	42.58	0	12:20	0	0.833	0.000
DP-6	OUTFALL	0.00	89.43	0	12:25	0	2.99	0.000
DP-7	OUTFALL	0.00	273.43	0	12:44	0	10.7	0.000
DP-3	OUTFALL	0.00	3.71	0	12:15	0	0.109	0.000
DP-8	OUTFALL	0.00	245.12	0	12:28	0	6.84	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP-53A	50.89	67.64	1837.86	72.290
DP-9A	31.90	13.36	321.39	8.952
DP-1	2.55	8.31	25.97	0.446
DP-2	2.98	7.71	23.17	0.483
DP-4	32.64	5.71	123.98	3.915
DP-5	29.70	1.33	42.58	0.833
DP-6	32.83	4.33	89.43	2.987
DP-7	14.07	36.27	273.43	10.719
DP-3	4.25	1.22	3.71	0.109
DP-8	29.93	10.88	245.12	6.840
System	23.17	156.77	2455.20	107.573

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-4	CONDUIT	287.68	0 12:31	5.34	0.00	0.10
RT-1	CONDUIT	212.94	0 12:41	5.08	0.00	0.09
RT-3	CONDUIT	148.46	0 12:27	4.76	0.00	0.08
RT-2	CONDUIT	137.30	0 12:38	4.70	0.00	0.07
RT-6	CONDUIT	238.46	0 12:28	5.76	0.00	0.09
RT-5	CONDUIT	801.60	0 12:42	7.47	0.01	0.18
RT-7	CONDUIT	358.68	0 12:42	5.54	0.00	0.12
RT-10	CONDUIT	177.88	0 12:34	5.12	0.00	0.10
RT-9	CONDUIT	1443.27	0 12:50	7.70	0.02	0.18
RT-14	CONDUIT	107.56	0 12:44	5.07	0.00	0.09
RT-13	CONDUIT	1645.84	0 13:11	7.10	0.03	0.19
RT-12	CONDUIT	1626.98	0 13:08	7.52	0.03	0.18
RT-18	CONDUIT	161.34	0 12:32	4.56	0.00	0.08
RT-19	CONDUIT	292.62	0 12:35	4.73	0.01	0.14
RT-11	CONDUIT	1593.34	0 13:01	7.77	0.04	0.19
RT-15	CONDUIT	252.44	0 12:40	6.13	0.01	0.12
RT-8	CONDUIT	1407.11	0 12:44	7.96	0.03	0.22
RT-16	CONDUIT	190.35	0 12:48	4.96	0.00	0.09
RT-17	CONDUIT	54.28	0 12:41	3.05	0.00	0.07
RT-17A	CONDUIT	207.70	0 12:31	7.29	0.00	0.09
32	DUMMY	74.06	0 12:25			
33	DUMMY	87.48	0 12:25			
34	DUMMY	133.97	0 12:25			
35	DUMMY	162.20	0 12:35			
36	DUMMY	81.51	0 12:25			
37	DUMMY	144.84	0 12:25			
38	DUMMY	36.26	0 12:20			
39	DUMMY	192.52	0 12:20			

40	DUMMY	25.97	0	12:15
41	DUMMY	23.17	0	12:20
42	DUMMY	3.71	0	12:15
43	DUMMY	89.03	0	12:35
44	DUMMY	100.09	0	12:30
45	DUMMY	89.43	0	12:25
46	DUMMY	42.58	0	12:20
47	DUMMY	123.98	0	12:25
48	DUMMY	128.18	0	12:25
49	DUMMY	177.16	0	12:25
50	DUMMY	59.34	0	12:25
51	DUMMY	53.72	0	12:15
52	DUMMY	50.91	0	12:20
53	DUMMY	31.44	0	12:25

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Sep 02 14:54:25 2021
Analysis ended on: Thu Sep 02 14:54:25 2021
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

WARNING 04: minimum elevation drop used for Conduit 32
WARNING 04: minimum elevation drop used for Conduit 33
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 35
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 41
WARNING 04: minimum elevation drop used for Conduit 42
WARNING 04: minimum elevation drop used for Conduit 43
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 49
WARNING 04: minimum elevation drop used for Conduit 50
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 52
WARNING 04: minimum elevation drop used for Conduit 53

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	383.667	125.024
External Outflow	389.413	126.896
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-1.498	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
EX-3	JUNCTION	0.05	2.06	212.06	0 12:25	2.05
EX-4	JUNCTION	0.05	2.21	262.21	0 12:25	2.21
EX-10	JUNCTION	0.06	1.95	139.95	0 12:30	1.95
EX-20	JUNCTION	0.03	1.89	97.89	0 12:20	1.88
EX-79	JUNCTION	0.05	1.99	523.99	0 12:20	1.98
EX-80	JUNCTION	0.05	1.69	513.69	0 12:25	1.69
EX-81	JUNCTION	0.05	2.01	494.01	0 12:30	2.00
EX-82	JUNCTION	0.03	1.69	523.69	0 12:20	1.68
DP-10	JUNCTION	0.10	2.59	76.59	0 12:34	2.59
DP-56	JUNCTION	0.05	1.90	73.90	0 12:27	1.90

DP-60A	JUNCTION	0.13	4.10	26.10	0	13:06	4.09
DP-63	JUNCTION	0.12	4.22	100.22	0	12:59	4.21
DP-69	JUNCTION	0.12	4.32	196.32	0	12:48	4.32
DP-71	JUNCTION	0.13	4.68	262.68	0	12:43	4.68
DP-73	JUNCTION	0.13	4.69	304.69	0	12:40	4.69
EX-74	JUNCTION	0.05	2.27	459.27	0	12:24	2.27
EX-75	JUNCTION	0.11	3.85	395.85	0	12:34	3.84
EX-78	JUNCTION	0.07	2.73	424.73	0	12:25	2.73
DP-8A	JUNCTION	0.04	1.51	105.51	0	12:25	1.50
DP-9	JUNCTION	0.09	3.01	25.01	0	12:29	3.01
EX-76	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-73	JUNCTION	0.00	0.00	392.00	0	00:00	0.00
EX-88	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-77	JUNCTION	0.00	0.00	300.00	0	00:00	0.00
EX-6	JUNCTION	0.00	0.00	258.00	0	00:00	0.00
EX-20A	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-21	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-3A	JUNCTION	0.00	0.00	74.00	0	00:00	0.00
EX-0	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-4A	JUNCTION	0.00	0.00	96.00	0	00:00	0.00
EX-10A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-9	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-8	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-5	JUNCTION	0.00	0.00	192.00	0	00:00	0.00
EX-12	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
EX-11	JUNCTION	0.00	0.00	72.00	0	00:00	0.00
EX-13	JUNCTION	0.00	0.00	104.00	0	00:00	0.00
EX-24	JUNCTION	0.00	0.00	22.00	0	00:00	0.00
EX-25	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
DP-53A	OUTFALL	0.16	4.09	4.09	0	13:09	4.09
DP-9A	OUTFALL	0.08	2.99	2.99	0	12:34	2.99
DP-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-7	OUTFALL	0.06	1.87	1.87	0	12:47	1.87
DP-3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DP-8	OUTFALL	0.04	1.90	1.90	0	12:29	1.90

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent

EX-3	JUNCTION	149.59	149.59	0	12:25	4.22	4.22	0.000
EX-4	JUNCTION	221.22	221.22	0	12:25	5.92	5.92	0.000
EX-10	JUNCTION	247.82	247.82	0	12:30	8.45	8.45	0.000
EX-20	JUNCTION	214.98	214.98	0	12:20	4.37	4.37	0.000
EX-79	JUNCTION	299.69	299.69	0	12:20	6.12	6.12	0.000
EX-80	JUNCTION	181.71	181.71	0	12:25	4.79	4.79	-0.000
EX-81	JUNCTION	267.18	267.18	0	12:30	8.02	8.02	0.000
EX-82	JUNCTION	186.82	186.82	0	12:20	3.59	3.59	0.000
DP-10	JUNCTION	0.00	300.10	0	12:34	0	11.2	0.000
DP-56	JUNCTION	0.00	252.85	0	12:27	0	7.17	0.000
DP-60A	JUNCTION	0.00	1969.24	0	13:06	0	72.3	0.000
DP-63	JUNCTION	0.00	1980.73	0	12:59	0	70.5	0.000
DP-69	JUNCTION	0.00	1988.41	0	12:48	0	65.5	0.000
DP-71	JUNCTION	0.00	1734.92	0	12:43	0	54.9	0.000
DP-73	JUNCTION	0.00	1672.02	0	12:40	0	52.1	0.000
EX-74	JUNCTION	197.86	352.34	0	12:24	4.05	7.67	-0.000
EX-75	JUNCTION	85.81	970.48	0	12:34	2.68	29.1	0.000
EX-78	JUNCTION	245.43	497.68	0	12:25	5.27	11.4	0.000
DP-8A	JUNCTION	0.00	70.54	0	12:25	0	2.32	0.000
DP-9	JUNCTION	0.00	351.65	0	12:29	0	9.41	0.000
EX-76	JUNCTION	86.18	86.18	0	12:25	2.84	2.84	0.000
EX-73	JUNCTION	101.98	101.98	0	12:25	2.85	2.85	0.000
EX-88	JUNCTION	156.62	156.62	0	12:25	4.23	4.23	0.000
EX-77	JUNCTION	190.53	190.53	0	12:35	7.02	7.02	0.000
EX-6	JUNCTION	95.34	95.34	0	12:25	2.75	2.75	0.000
EX-20A	JUNCTION	171.92	171.92	0	12:25	4.95	4.95	0.000
EX-21	JUNCTION	41.94	41.94	0	12:20	1.16	1.16	0.000
EX-3A	JUNCTION	223.40	223.40	0	12:20	6.86	6.86	0.000
EX-0	JUNCTION	31.45	31.45	0	12:15	0.543	0.543	0.000
EX-1	JUNCTION	27.93	27.93	0	12:20	0.588	0.588	0.000
EX-2	JUNCTION	4.52	4.52	0	12:15	0.132	0.132	0.000
EX-4A	JUNCTION	104.76	104.76	0	12:35	4.58	4.58	0.000
EX-10A	JUNCTION	121.64	121.64	0	12:30	4.13	4.13	0.000
EX-9	JUNCTION	106.57	106.57	0	12:25	3.56	3.56	0.000
EX-8	JUNCTION	50.92	50.92	0	12:20	1.01	1.01	0.000
EX-7	JUNCTION	147.04	147.04	0	12:25	4.64	4.64	0.000
EX-5	JUNCTION	150.41	150.41	0	12:25	4.59	4.59	0.000
EX-12	JUNCTION	63.35	63.35	0	12:15	1.07	1.07	0.000
EX-11	JUNCTION	213.92	213.92	0	12:25	4.82	4.82	0.000
EX-13	JUNCTION	70.54	70.54	0	12:25	2.32	2.32	0.000
EX-24	JUNCTION	60.43	60.43	0	12:20	1.67	1.67	0.000
EX-25	JUNCTION	38.17	38.17	0	12:25	1.25	1.25	0.000
DP-53A	OUTFALL	0.00	2197.66	0	13:08	0	84.9	0.000
DP-9A	OUTFALL	0.00	381.11	0	12:33	0	10.6	0.000
DP-1	OUTFALL	0.00	31.45	0	12:15	0	0.543	0.000
DP-2	OUTFALL	0.00	27.93	0	12:20	0	0.588	0.000
DP-4	OUTFALL	0.00	147.04	0	12:25	0	4.64	0.000
DP-5	OUTFALL	0.00	50.92	0	12:20	0	1.01	0.000
DP-6	OUTFALL	0.00	106.57	0	12:25	0	3.56	0.000
DP-7	OUTFALL	0.00	326.28	0	12:44	0	12.7	0.000
DP-3	OUTFALL	0.00	4.52	0	12:15	0	0.132	0.000
DP-8	OUTFALL	0.00	297.43	0	12:28	0	8.25	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP-53A	51.14	78.99	2197.66	84.854
DP-9A	32.08	15.69	381.11	10.572
DP-1	2.55	10.13	31.45	0.543
DP-2	2.98	9.40	27.93	0.588
DP-4	32.77	6.74	147.04	4.637
DP-5	29.89	1.61	50.92	1.008
DP-6	32.96	5.14	106.57	3.555
DP-7	15.14	40.08	326.28	12.745
DP-3	4.25	1.48	4.52	0.132
DP-8	30.10	13.05	297.43	8.251
System	23.39	182.30	2955.71	126.887

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-4	CONDUIT	337.89	0 12:31	5.55	0.00	0.11
RT-1	CONDUIT	251.20	0 12:40	5.29	0.00	0.10
RT-3	CONDUIT	173.98	0 12:27	4.94	0.00	0.08
RT-2	CONDUIT	161.46	0 12:38	4.88	0.00	0.08
RT-6	CONDUIT	278.31	0 12:28	5.97	0.00	0.10
RT-5	CONDUIT	945.90	0 12:41	7.78	0.02	0.19
RT-7	CONDUIT	423.39	0 12:41	5.75	0.01	0.13
RT-10	CONDUIT	209.08	0 12:34	5.32	0.00	0.11
RT-9	CONDUIT	1709.59	0 12:49	8.06	0.03	0.20
RT-14	CONDUIT	127.38	0 12:43	5.28	0.00	0.09
RT-13	CONDUIT	1965.55	0 13:09	7.47	0.03	0.20
RT-12	CONDUIT	1942.19	0 13:06	7.91	0.03	0.20

RT-18	CONDUIT	190.02	0	12:32	4.74	0.00	0.09
RT-19	CONDUIT	347.12	0	12:34	4.93	0.01	0.15
RT-11	CONDUIT	1898.12	0	12:59	8.18	0.04	0.21
RT-15	CONDUIT	297.12	0	12:40	6.39	0.01	0.13
RT-8	CONDUIT	1663.86	0	12:43	8.31	0.03	0.23
RT-16	CONDUIT	224.77	0	12:47	5.16	0.00	0.09
RT-17	CONDUIT	64.98	0	12:40	3.19	0.00	0.07
RT-17A	CONDUIT	252.10	0	12:29	7.66	0.00	0.10
32	DUMMY	86.18	0	12:25			
33	DUMMY	101.98	0	12:25			
34	DUMMY	156.62	0	12:25			
35	DUMMY	190.53	0	12:35			
36	DUMMY	95.34	0	12:25			
37	DUMMY	171.92	0	12:25			
38	DUMMY	41.94	0	12:20			
39	DUMMY	223.40	0	12:20			
40	DUMMY	31.45	0	12:15			
41	DUMMY	27.93	0	12:20			
42	DUMMY	4.52	0	12:15			
43	DUMMY	104.76	0	12:35			
44	DUMMY	121.64	0	12:30			
45	DUMMY	106.57	0	12:25			
46	DUMMY	50.92	0	12:20			
47	DUMMY	147.04	0	12:25			
48	DUMMY	150.41	0	12:25			
49	DUMMY	213.92	0	12:25			
50	DUMMY	70.54	0	12:25			
51	DUMMY	63.35	0	12:15			
52	DUMMY	60.43	0	12:20			
53	DUMMY	38.17	0	12:25			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

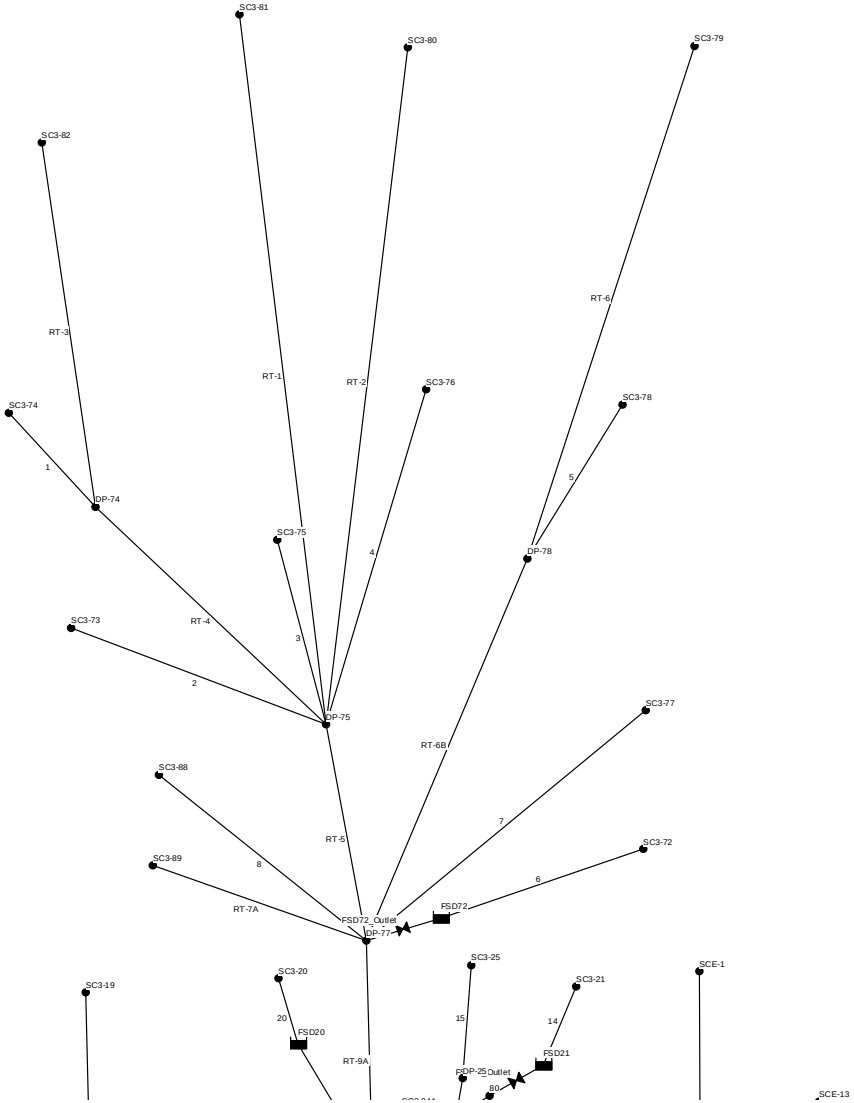
Analysis begun on: Thu Aug 12 12:23:21 2021
Analysis ended on: Thu Aug 12 12:23:21 2021
Total elapsed time: < 1 sec

APPENDIX C

PROPOSED CONDITIONS HYDRAULIC CALCULATIONS

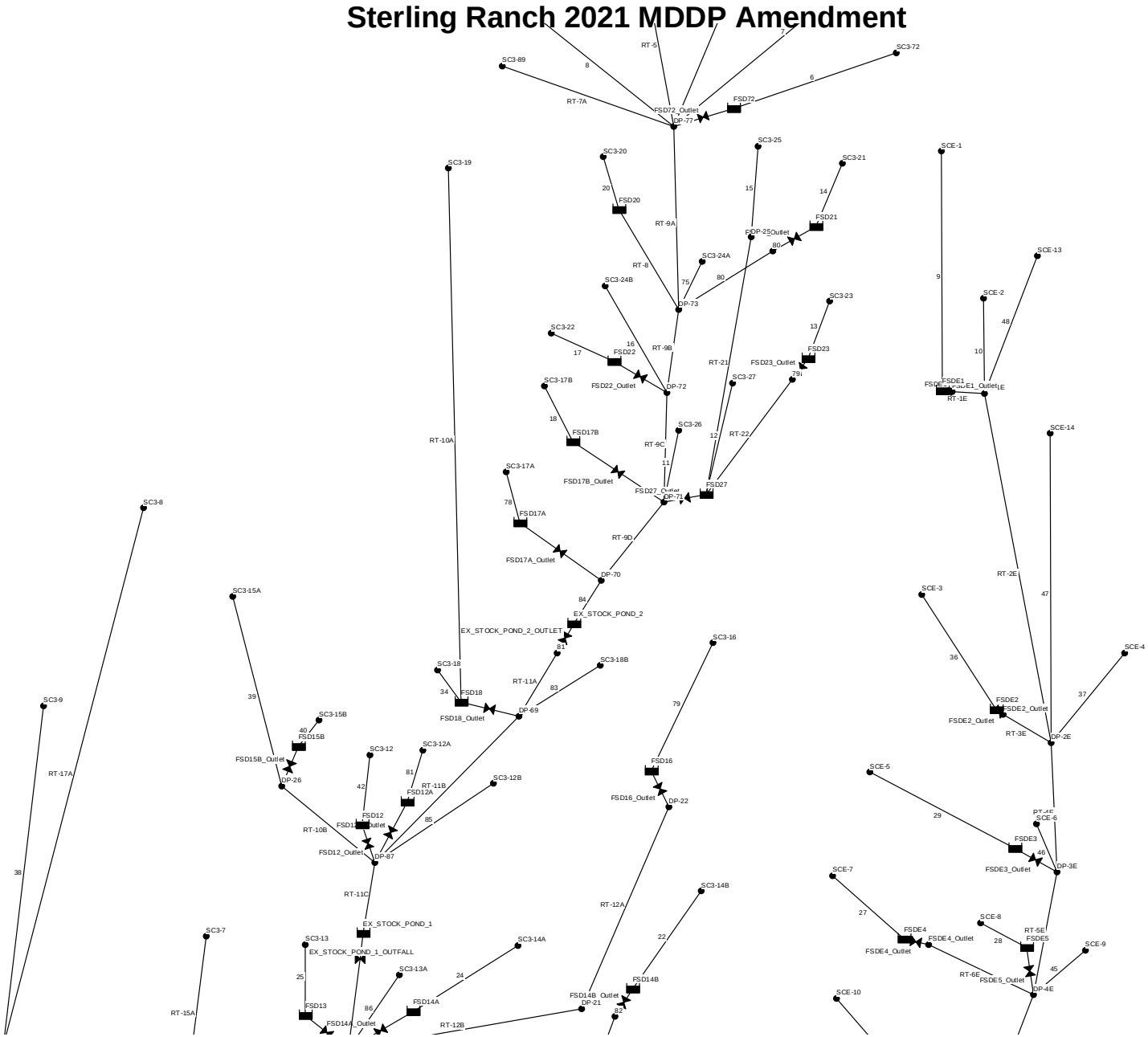
Basin Update Summary				
	MDDP (2018)		Updated (2022)	
Basin	Area (ac)	Imperv. %	Area (ac)	Imperv. %
SC3-1A	27.8	32%	27.8	32%
SC3-5A	39.1	61%	39.1	61%
SC3-5B	63.0	54%	63.0	54%
SC3-6A	49.3	71%	49.3	71%
SC3-6B	30.9	58%	29.6	58%
SC3-6C	58.0	46%	62.1	47%
SC3-7	45.7	72%	45.7	72%
SC3-8	143.4	2%	143.4	2%
SC3-9	217.4	15%	217.4	15%
SC3-10	36.0	8%	36.0	8%
SC3-11A	10.7	17%	7.7	5%
SC3-11B	76.6	39%	64.5	66%
SC3-11C			8.3	10%
SC3-12	88.2	55%	54.9	55%
SC3-12A			16.9	44%
SC3-12B			22.8	3%
SC3-13	41.0	65%	41.0	65%
SC3-13A			28.1	3%
SC3-14A	164.9	40%	130.8	65%
SC3-14B	34.7	65%	63.1	65%
SC3-15A	139.7	3%	128.7	3%
SC3-15B	7.9	60%	7.9	60%
SC3-16			245.0	60%
SC3-16A	168.1	51%		
SC3-16B	50.7	67%		
SC3-17	70.6	29%		
SC3-17A			27.9	50%
SC3-17B			30.3	62%
SC3-18	53.8	44%	22.7	3%
SC3-18B			19.4	3%
SC3-19	184.0	4%	201.6	4%
SC3-20	34.2	12%	37.1	12%
SC3-21	23.3	16%	23.7	16%
SC3-22	33.9	12%	28.9	12%
SC3-23	14.5	19%	28.0	19%
SC3-24A	35.7	10%	36.0	10%
SC3-24B	12.2	9%	10.6	9%
SC3-25	19.0	15%	14.9	15%
SC3-26	10.0	3%	12.7	6%
SC3-27	70.0	28%	65.0	22%
SC3-61	65.5	10%	65.5	10%
SC3-72	56.2	8%	56.2	8%
SC3-73	90.0	5%	90.0	5%
SC3-74	119.7	10%	119.7	10%
SC3-75	79.3	10%	79.3	10%
SC3-76	86.4	8%	86.4	8%
SC3-77	106.9	2%	106.9	2%
SC3-78	155.6	10%	155.6	10%
SC3-79	189.0	7%	189.0	7%
SC3-80	147.7	7%	147.7	7%
SC3-81	262.9	2%	262.9	2%
SC3-82	117.8	2%	117.8	2%
SC3-88	60.2	2%	60.2	2%
SC3-89	27.5	2%	23.3	2%
SCE-1	64.4	14%	64.4	14%
SCE-2	15	10%	15.0	10%
SCE-3	67.5	25%	61.6	25%
SCE-4	29.5	25%	29.5	25%
SCE-5	85.5	70%	74.8	70%
SCE-6	3.8	10%	4.2	10%
SCE-7	44.9	76%	23.7	76%
SCE-8	25.5	95%	25.5	95%
SCE-9	4	10%	4.2	10%
SCE-10	174.3	45%	163.0	45%
SCE-11	5.8	10%	5.8	10%
SCE-13	78.6	10%	78.6	10%
SCE-14	52.5	10%	52.5	10%
SCE-15	39.7	20%	39.7	20%

Sterling Ranch 2021 MDDP Amendment



Sterling Ranch 2021 MDDP Amendment

01/01/2005 00:05:00



Sterling Ranch Master Development Drainage Plan

Sand Creek - Developed Conditions Composite CN & Impervious % Table

8/21/2018

| Basin | Basin | Basin | Basin | Sub-Area 1 | | HSG | UA CN | CN | Sub-Area 2 | | HSG | UA CN | CN | Sub-Area 3 | | HSG | UA CN | CN | Sub-Area 4 | | HSG | UA CN | CN | Sub-Area 5 | | HSG | UA CN | CN | Sub-Area 6 | | HSG | UA CN | CN | Sub-Area 7 | | HSG | UA CN | CN | Sub-Area 8 | | HSG | UA CN | CN | Sub-Area 9 | | HSG | UA CN | CN | Sub-Areas | % HSG | % HSG | Weighted | Weighted |
|---|---|---

Sterling Ranch Master Development Drainage Plan

Sand Creek Basin - Developed Condition - Lag Time Calculations

8/21/2018

Basin	OVERLAND FLOW					SHALLOW GUTTER FLOW				SHALLOW CHANNEL FLOW				STORM SEWER FLOW				CHANNELIZED FLOW				Tc	TLag
ID	P2	n	Length	Slope	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Total	0.6*Tc
	(in)		(ft)	(%)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(min)	(min)
SC3-1A	2.1	0.15	100	1.5	13.6	200	1	0.5	1.5	0	0	0	0	800	2.3	8	1.7	0	0	0	0	16.7	10.0
SC3-5A	2.1	0.15	100	2.0	12.1	900	2.0	2.0	2.9	0	0	0	0	600	1.7	8	1.3	0	0	0	0	16.2	9.7
SC3-5B	2.1	0.15	100	2.0	12.1	975	2.5	2.5	3.1	0	0	0	0	1250	1.0	6	3.5	0	0	0	0	18.7	11.2
SC3-6A	2.1	0.15	100	2.0	12.1	1250	2.2	2.2	2.9	0	0	0	0	1030	1.9	8	2.1	0	0	0	0	17.1	10.3
SC3-6B	2.1	0.15	100	2.0	12.1	300	2.0	2.0	2.8	0	0	0	0	1300	2.2	8	2.7	0	0	0	0	17.6	10.6
SC3-6C	2.1	0.15	100	2.0	12.1	950	1.9	1.9	2.8	0	0	0	0	1195	1.7	8	2.5	0	0	0	0	17.4	10.4
SC3-7	2.1	0.15	100	3.0	10.3	0	0	0	0	1175	28	3.0	6.5	0	0	0	0	730	2.7	4.1	3.0	19.8	11.9
SC3-8	2.1	0.15	300	3.8	22.5	0	0	0	0	730	40	3.5	3.5	0	0	0	0	2200	3.6	4.3	8.5	34.5	20.7
SC3-9	2.1	0.15	300	4.0	22.1	0	0	0	0	650	20	2.7	4.0	0	0	0	0	4450	1.8	4.2	17.7	43.7	26.2
SC3-10	2.1	0.15	250	3.2	20.9	0	0	0	0	400	20	3.5	1.9	0	0	0	0	1150	2.0	3.0	6.4	29.2	17.5
SC3-11A	2.1	0.15	100	2.0	12.1	280	10	3.6	3.7	0	0	0	0	100	2.0	8	0.2	0	0	0	0	16.0	9.6
SC3-11B	2.1	0.15	100	2.0	12.1	550	12	2.2	2.9	0	0	0	0	2700	1.6	8	5.6	0	0	0	0	20.6	12.4
SC3-12	2.1	0.15	100	2.0	12.1	1000	30	3.0	3.5	0	0	0	0	400	3.0	10	0.7	0	0	0	0	16.3	9.8
SC3-13	2.1	0.15	100	2.0	12.1	820	18	2.2	3.0	0	0	0	0	1025	1.8	8	2.1	0	0	0	0	17.2	10.6
SC3-14A	2.1	0.15	100	3.0	10.3	875	22	2.5	3.0	0	0	0	0	2575	1.8	8	5.4	0	0	0	0	18.6	11.2
SC3-14B	2.1	0.15	100	2.0	12.1	930	22	2.4	3.1	0	0	0	0	1050	2.3	8	2.2	0	0	0	0	17.4	10.4
SC3-15A	2.1	0.15	300	5.3	19.7	0	0	0	0	1100	40	2.9	6.3	0	0	0	0	4163	2.5	4.1	16.9	42.9	25.8
SC3-15B	2.1	0.15	50	2.0	6.9	1380	23	1.0	2.6	0	0	0	0	0	0	0	0	315	3.8	4.1	1.3	10.8	6.5
SC3-16A	2.1	0.15	100	2.0	12.1	900	28	3.1	3.5	0	0	0	0	4485	2.3	8	9.3	0	0	0	0	24.9	15.0
SC3-16B	2.1	0.15	100	3.0	10.3	0	0	2.4	0	700	20	3.4	3.4	1290	3.6	12	1.8	0	0	0	0	15.5	9.3
SC3-17	2.1	0.15	100	3.0	10.3	0	0	0	0	700	20	3.4	3.4	1290	3.6	12	1.8	0	0	0	0	15.5	8.5
SC3-18	2.1	0.15	100	3.0	10.3	0	0	0	0	800	22	3.4	3.9	200	4.0	12	0.3	0	0	0	0	14.5	8.6
SC3-19	2.1	0.15	300	4.7	20.8	0	0	0	0	770	22	2.7	4.8	0	0	0	0	3900	3.0	4.0	16.3	41.8	25.1
SC3-20	2.1	0.15	200	4.0	16.0	0	0	0	0	70	2	2.7	0.4	0	0	0	0	975	4.3	3.1	5.2	21.6	13.0
SC3-21	2.1	0.15	200	4.0	16.0	0	0	0	0	630	26	3.1	3.4	0	0	0	0	875	3.4	3.4	4.3	23.6	14.2
SC3-22	2.1	0.15	200	4.0	16.0	0	0	0	0	400	16	3.0	2.2	0	0	0	0	1350	2.8	3.4	6.6	24.8	14.9
SC3-23	2.1	0.15	200	5.0	14.6	0	0	0	0	275	12	3.3	1.4	200	4.0	12	0.3	450	3.5	2.8	2.7	18.9	11.4
SC3-24A	2.1	0.15	200	3.0	17.9	0	0	0	0	495	18	2.9	2.8	0	0	0	0	1780	1.6	2.9	10.2	31.0	18.6
SC3-24B	2.1	0.15	200	3.0	17.9	0	0	0	0	320	14	3.3	1.6	0	0	0	0	930	4.5	2.9	5.3	24.9	14.9
SC3-25	2.1	0.15	200	6.0	13.6	0	0	0	0	340	20	2.7	2.1	600	2.0	8	1.3	960	1.9	2.1	7.6	24.5	14.7
SC3-26	2.1	0.15	100	2.0	12.1	0	0	0	0	0	0	0	0	0	0	0	0	1300	1.7	2.0	10.8	22.9	13.8
SC3-27	2.1	0.15	100	3.0	10.3	900	28.0	3.1	3.5	0	0	0	0	1800	2.0	8	3.8	0	0	0	0	17.5	10.5
SC3-61	2.1	0.15	200	3.0	17.9	0	0	0	0	0	0	0	0	0	0	0	0	2500	1.8	3.4	12.3	30.2	18.1
SC3-72	2.1	0.15	250	4.0	19.1	0	0	0	0	1025	4.4	3.8	4.5	0	0	0	0	1595	4.4	4.0	6.6	30.2	18.1
SC3-73	2.1	0.15	300	3.3	23.7	0	0	0	0	1650	3.3	2.9	9.5	0	0	0	0	1230	3.3	4.2	4.9	38.1	22.9
SC3-74	2.1	0.15	300	4.7	20.8	0	0	0	0	2000	2.6	2.8	11.9	0	0	0	0	770	2.6	3.9	3.3	35.9	21.6
SC3-75	2.1	0.15	300	3.3	23.7	0	0	0	0	1200	2.8	2.7	7.4	0	0	0	0	2300	2.8	3.1	12.4	43.5	26.1
SC3-76	2.1	0.15	300	3.3	23.7	0	0	0	0	1160	2.6	3.1	6.2	0	0	0	0	3025	2.6	3.6	14.0	44.0	26.4
SC3-77	2.1	0.15	300	4.7	20.8	0	0	0	0	1250	2.7	2.7	7.7	0	0	0	0	3600	2.7	4.4	13.6	42.1	25.3
SC3-78	2.1	0.15	300	3.3	23.7	0	0	0	0	1560	3.2	3.3	7.9	0	0	0	0	1850	3.2	4.5	6.9	38.5	23.1
SC3-79	2.1	0.15	300	4.0	22.1	0	0	0	0	1740	1.8	3.5	8.3	0	0	0	0	1100	1.8	3.0	6.1	36.5	21.9
SC3-80	2.1	0.15	300	5.0	20.2	0	0	0	0	1625	2.8	3.4	8.0	0	0	0	0	2140	2.8	4.1	8.7	36.9	22.1
SC3-81	2.1	0.15	300	6.7	18.0	0	0	0	0	2000	3.1	3.4	9.8	0	0	0	0	3600	3.1	4.9	12.2	40.0	24.0
SC3-82	2.1	0.15	300	3.3	23.7	0	0	0	0	2000	3.2	3.3	10.1	0	0	0	0	625	3.2	4.1	2.5	36.4	21.8
SC3-88	2.1	0.15	300	4.7	20.8	0	0	0	0	825	3.8	3.3	4.2	0	0	0	0	2400	3.8	3.9	10.3	35.2	21.1
SC3-89	2.1	0.15	200	4.0	16.0	0	0	0	0	910	4.1	4.0	3.8	0	0	0	0	830	4.1	3.5	4.0	23.7	14.2

DCM TABLE 6-25 WAS USED FOR SHALLOW CONCENTRATED SWALE & GUTTER FLOW
N VALUE FOR OVERLAND FLOW WAS ASSUMED TO BE 0.15 FOR ALL BASINS
A ROUGHNESS COEFFICENT OF 0.050 WAS USED FOR EARTHEN CHANNEL BOTTOMS
A ROUGHNESS COEFFICENT OF 0.013 WAS USED FOR CONCRETE LINED CONVEYANCES

Sterling Ranch MDDP
Hydrologic Study -Developed Conditions - Reach Data
8/21/2018

Reach ID	Reach Length L1 (ft)	Reach Vert. Drop H1 (ft)	Reach Slope S1 %	Mannings N Value n	Reach Side Slope SS (H/V)	Bottom Width BW (ft)	Diameter D ft
RT-1	3975	100	2.5%	0.05	10	6	N/A
RT-2	4570	120	2.6%	0.05	10	6	N/A
RT-3	2360	65	2.8%	0.05	10	6	N/A
RT-4	2695	65	2.4%	0.05	10	6	N/A
RT-5	4100	92	2.2%	0.05	6	10	N/A
RT-6A	3030	100	3.3%	0.05	10	6	N/A
RT-6B	6145	122	2.0%	0.05	10	6	N/A
RT-7A	1050	35	3.3%	0.013			4
RT-8	625	24	3.8%	0.013			2
RT-9A	2600	40	1.5%	0.05	6	30	N/A
RT-9B	760	17	2.2%	0.05	6	30	N/A
RT-9C	1450	26	1.8%	0.05	6	30	N/A
RT-9D	1490	28	1.9%	0.05	6	30	N/A
RT-10A	1940	42	2.2%	0.013			5
RT-10B	1560	42	2.7%	0.013			5
RT-11A	1275	26	2.0%	0.05	6	30	N/A
RT-11B	2960	46	1.6%	0.05	6	30	N/A
RT-12A	2590	40	1.5%	0.05	6	40	
RT-12B	4200	66	1.6%	0.035	4	15	
RT-13	1550	20	1.3%	0.05	6	40	N/A
RT-14	1765	35	2.0%	0.05	6	40	N/A
RT-15A	900	24	2.7%	0.013			4
RT-15B	1450	30	2.1%	0.013			6
RT-16	1250	24	1.9%	0.013			3.5
RT-17A	5000	108	2.2%	0.04	4	4	N/A
RT-17B	3675	76	2.1%	0.013			4
RT-18	2500	41	1.6%	0.05	6	40	N/A
RT-19	1200	6	0.5%	0.013			6
RT-20	1480	22	1.5%	0.05	6	40	N/A
RT-21	3300	75	2.3%	0.013			3.5
RT-22	2000	38	1.9%	0.013			3

Sterling Ranch MDDP - East Fork Basin

Hydrologic Study - Developed Condition Composite CN & Impervious % Table

| Basin | Basin | Basin | Basin | Sub-Area 1 | | HSG | UA CN | CN | Sub-Area 2 | | HSG | UA CN | CN | Sub-Area 3 | | HSG | UA CN | CN | Sub-Area 4 | | HSG | UA CN | CN | Sub-Area 5 | | HSG | UA CN | CN | Sub-Area 6 | | HSG | UA CN | CN | Sub-Area 7 | | HSG | UA CN | CN | Sub-Area 8 | | HSG | UA CN | CN | Sub-Area 9 | | HSG | UA CN | CN | Sub-Areas | % HSG | % HSG | Weighted | Weighted |
|---|---|---

Sterling Ranch MDDP - East Fork Basin

Hydrologic Study - Developed Condition - Lag Time Calculations

Basin	OVERLAND FLOW					SHALLOW GUTTER FLOW				SHALLOW CHANNEL FLOW				STORM SEWER FLOW				CHANNELIZED FLOW				Tc	TLag
ID	P2	n	Length	Slope	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Length	Slope	Vel	Tt	Total	0.6*Tc
	(in)		(ft)	(%)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(ft)	(%)	(fps)	(min)	(min)	(min)
SCE-1	2.1	0.15	100	3.9	9.3	500	2.8	0.5	1.5	0	0	0.0	0.0	1500	1.2	8	3.1	0	0.0	0.0	0.0	13.9	8.3
SCE-2	2.1	0.15	100	2.0	12.1	50	3.0	2.0	2.9	0	0	0.0	0.0	1800	1.4	8	3.8	0	0.0	0.0	0.0	18.7	11.2
SCE-3	2.1	0.15	100	2.0	12.1	350	2.0	2.0	2.8	0	0	0.0	0.0	2000	1.4	8	4.2	0	0.0	0.0	0.0	19.1	11.4
SCE-4	2.1	0.15	75	2.0	9.6	25	3.3	1.9	2.8	0	0	0.0	0.0	3350	0.6	8	7.0	0	0.0	0.0	0.0	19.4	11.6
SCE-5	2.1	0.15	150	3.0	14.2	830	2.7	2.7	2.8	0	0	0.0	0.0	556	1.2	7	1.3	0	0.0	0.0	0.0	18.3	11.0
SCE-6	2.1	0.15	25	2.0	4.0	25	3.1	3.0	2.8	0	0	0.0	0.0	123	1.5	8	0.3	0	0.0	0.0	0.0	7.0	4.2
SCE-7	2.1	0.15	100	2.0	12.1	400	2.9	2.1	2.8	0	0	0.0	0.0	754	1.8	7	1.8	0	0.0	0.0	0.0	16.7	10.0
SCE-8	2.1	0.15	100	2.0	12.1	300	2.8	3.4	2.8	0	0	0.0	0.0	650	1.5	7	1.5	0	0.0	0.0	0.0	16.4	9.9
SCE-9	2.1	0.15	35	2.0	5.2	25	3.5	3.6	3.7	0	0	0.0	0.0	100	2.0	8	0.2	0	0.0	0.0	0.0	9.1	5.5
SCE-10	2.1	0.15	150	2.0	16.7	900	2.5	2.2	2.9	0	0	0.0	0.0	2700	1.6	8	5.6	0	0.0	0.0	0.0	25.3	15.2
SCE-11	2.1	0.15	25	2.0	4.0	25	3	3.0	3.5	0	0	0.0	0.0	400	3.0	7	1.0	0	0.0	0.0	0.0	8.4	5.1
SCE-13	2.1	0.15	160	2.0	17.6	500	2.5	2.5	3.1	0	0	0.0	0.0	500	2.4	6	1.4	0	0.0	0.0	0.0	22.1	13.3
SCE-14	2.1	0.15	160	2.0	17.6	450	2.5	2.2	2.9	0	0	0.0	0.0	500	2.0	8	1.0	0	0.0	0.0	0.0	21.6	12.9

DCM TABLE 6-25 WAS USED FOR SHALLOW CONCENTRATED SWALE & GUTTER FLOW
N VALUE FOR OVERLAND FLOW WAS ASSUMED TO BE 0.15 FOR ALL BASINS
A ROUGHNESS COEFFICENT OF 0.050 WAS USED FOR EARTHEN CHANNEL BOTTOMS
A ROUGHNESS COEFFICENT OF 0.013 WAS USED FOR CONCRETE LINED CONVEYANCES

Sterling Ranch - East Fork Basin
Hydrologic Study - Developed Conditions - Reach Data

Reach ID	Reach Length L1 (ft)	Reach Vert. Drop H1 (ft)	Reach Slope S1 %	Mannings N Value n	Reach Side Slope SS (H/V)	Bottom Width BW (ft)	Diameter D ft
RT-1E	300	6	2.0%	0.013	N/A	N/A	4
RT-2E	2000	40	2.0%	0.013	N/A	N/A	4
RT-3E	400	10	2.5%	0.013	N/A	N/A	4
RT-4E	3600	90	2.5%	0.013	N/A	N/A	4
RT-5E	1250	31	2.5%	0.013	N/A	N/A	5
RT-6E	1485	37	2.5%	0.013	N/A	N/A	4
RT-7E	1410	35	2.5%	0.013	N/A	N/A	6

CUHP SUBCATCHMENTS

CUHP SUBCATCHM

Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA	Directly Connected Impervious Fraction DCIF (Decimal)		Receiving Pervious Fraction RPF (Decimal)		Effective Imperviousness	C_T		C_p		Width of Unit (Min
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (acre)	Length to Centroid (ft)	Length (ft)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2	Override	Used	Override	Used	(Percent)	Override	Used	Override	Used	Override At 50%
SC3-1A	SC3-1A	2-YR 24HR	27.8	400	1200	0.0545	32	0.4	0.05	4.8	0.0012	0.8	0										
SC3-5A	SC3-5A	2-YR 24HR	39.1	498.96	1599.84	0.06	61	0.4	0.05	4.9	0.0009	0.9	0										
SC3-5B	SC3-5B	2-YR 24HR	63	1115.136	2324.784	0.06	54	0.4	0.05	4.7	0.0014	0.8	0										
SC3-6A	SC3-6A	2-YR 24HR	49.3	1252.944	2380.224	0.06	71	0.4	0.05	5	0.0007	1	0										
SC3-6B	SC3-6B	2-YR 24HR	29.591736	819.984	1700.16	0.06	58	0.4	0.05	4.8	0.0012	0.8	0										
SC3-6C	SC3-6C	2-YR 24HR	62.130533	709	2345	0.06	47	0.4	0.05	5	0.0007	1	0										
SC3-7	SC3-7	2-YR 24HR	45.7	1091.904	2004.816	0.06	72	0.4	0.05	4.7	0.0014	0.8	0										
SC3-8	SC3-8	2-YR 24HR	143.4	2293.104	3229.776	0.06	2	0.4	0.05	4.6	0.0016	0.7	0										
SC3-9	SC3-9	2-YR 24HR	217.4	3220.8	5399.856	0.0411	15	0.4	0.05	4.8	0.0012	0.8	0										
SC3-10	SC3-10	2-YR 24HR	36	1153.152	1799.952	0.06	8	0.4	0.05	4.7	0.0014	0.8	0										
SC3-11A	SC3-11A	2-YR 24HR	7.7275712	200	1226	0.06	5	0.4	0.05	4.5	0.0018	0.6	0										
SC3-11B	SC3-11B	2-YR 24HR	64.5	1250	2500	0.02	66	0.4	0.05	4.8	0.0012	0.8	0										
SC3-11C	SC3-11C	2-YR 24HR	8.3384757	100	965	0.02	10	0.4	0.05	4.8	0.0012	0.8	0										
SC3-12	SC3-12	2-YR 24HR	54.912006	1752.96	3073	0.06	55	0.4	0.05	4.5	0.0018	0.6	0										
SC3-12A	SC3-12A	2-YR 24HR	16.908953	450	875	0.02	44.1	0.4	0.05	4.5	0.0018	0.6	0										
SC3-12B	SC3-12B	2-YR 24HR	22.778788	1150	2292	0.02	3	0.4	0.05	4.5	0.0018	0.6	0										
SC3-13	SC3-13	2-YR 24HR	41	784.08	1945.152	0.06	65	0.4	0.05	4.5	0.0018	0.6	0										
SC3-13A	SC3-13A	2-YR 24HR	28.112948	1352	2479	0.02	3	0.4	0.05	4.5	0.0018	0.6	0										
SC3-14A	SC3-14A	2-YR 24HR	130.8	2250	4500	0.02	65	0.4	0.05	4.9	0.0009	0.9	0										
SC3-14B	SC3-14B	2-YR 24HR	63.1	1250	2500	0.02	65	0.4	0.05	5	0.0007	1	0										
SC3-15A	SC3-15A	2-YR 24HR	128.66731	3379.2	5563.008	0.06	3	0.4	0.05	4.5	0.0018	0.6	0										
SC3-15B	SC3-15B	2-YR 24HR	7.9	350.064	1745.04	0.06	60	0.4	0.05	4.5	0.0018	0.6	0										
SC3-16	SC3-16	2-YR 24HR	245	2900	5800	0.02	60	0.4	0.05	4.9	0.0009	0.9	0										
SC3-17B	SC3-17B	2-YR 24HR	29.82	1178	1963	0.03	46.5	0.4	0.05	4.5	0.0018	0.6	0										
SC3-18	SC3-18	2-YR 24HR	22.688935	938	1963	0.03	62.4	0.4	0.05	4.5	0.0018	0.6	0										
SC3-18B	SC3-18B	2-YR 24HR	19.361662	1250	2471	0.017	3	0.4	0.05	4.5	0.0018	0.6	0										
SC3-17A	SC3-17A	2-YR 24HR	27.86	775	1290	0.02	50	0.4	0.05	4.5	0.0018	0.6	0										
SC3-19	SC3-19	2-YR 24HR	201.57612	2973.168	4970.064	0.06	4	0.4	0.05	4.5	0.0018	0.6	0										
SC3-20	SC3-20	2-YR 24HR	37.071579	891.792	1919	0.0412	12	0.4	0.05	4.5	0.0018	0.6	0										
SC3-21	SC3-21	2-YR 24HR	23.729637	369.072	1704.912	0.06	16	0.4	0.05	4.5	0.0018	0.6	0										
SC3-22	SC3-22	2-YR 24HR	28.895386	827.904	1949.904	0.0563	12	0.4	0.05	4.5	0.0018	0.6	0										
SC3-23	SC3-23	2-YR 24HR	28.028788	949.872	1125.168	0.0593	19	0.4	0.05	4.5	0.0018	0.6	0										
SC3-24A	SC3-24A	2-YR 24HR	35.956038	1388.112	2475.264	0.0499	10	0.4	0.05	4.5	0.0018	0.6	0										
SC3-24B	SC3-24B	2-YR 24HR	10.642516	692.208	1449.888	0.06	9	0.4	0.05	4.5	0.0018	0.6	0										
SC3-25	SC3-25	2-YR 24HR	14.891758	487.872	895	0.0525	15	0.4	0.05	4.5	0.0018	0.6	0										
SC3-26	SC3-26	2-YR 24HR	12.748554	726	1400.256	0.0172	6	0.4	0.05	4.5	0.0018	0.6	0										
SC3-27	SC3-27	2-YR 24HR	64.977594	2000	4000	0.032	21.6	0.4	0.05	4.5	0.0018	0.6	0										
SC3-61	SC3-61	2-YR 24HR	65.5	1257.168	2700.192	0.0189	10	0.4	0.05	4.8	0.0012	0.8	0										
SC3-72	SC3-72	2-YR 24HR	56.2	1587.168	2870.208	0.0437	8	0.4	0.05	4.5	0.0018	0.6	0										
SC3-73	SC3-73	2-YR 24HR	90	2297.856	3180.144	0.033	5	0.4	0.05	4.5	0.0018	0.6	0										
SC3-74	SC3-74	2-YR 24HR	119.7	2261.952	3069.792	0.0281	10	0.4	0.05	4.5	0.0018	0.6	0										
SC3-75	SC3-75	2-YR 24HR	79.3	2453.088	3800.016	0.0284	10	0.4	0.05	4.5	0.0018	0.6	0										
SC3-76	SC3-76	2-YR 24HR	86.4	2278.848	4484.832	0.0265	8	0.4	0.05	4.5	0.0018	0.6	0										
SC3-77	SC3-77	2-YR 24HR	106.9	3025.968	5150.112	0.0282	2	0.4	0.05	4.5	0.0018	0.6	0										
SC3-78	SC3-78	2-YR 24HR	155.6	1825.824	3710.256	0.0321	10	0.4	0.05	4.5	0.0018	0.6	0										
SC3-79	SC3-79	2-YR 24HR	189	2302.08	3140.016	0.0201	7	0.4	0.05	4.5	0.0018	0.6	0										
SC3-80	SC3-80	2-YR 24HR	147.7	2422.992	4065.072	0.0296	7	0.4	0.05	4.5	0.0018	0.6	0										
SC3-81	SC3-81	2-YR 24HR	262.9	3360.192	5899.872	0.0328	2	0.4	0.05	4.5	0.0018	0.6	0										
SC3-82	SC3-82	2-YR 24HR	117.8	1910.832	2925.12	0.0321	2	0.4	0.05	4.5	0.0018	0.6	0										
SC3-88	SC3-88	2-YR 24HR	60.2	1881.792	3524.928	0.0388	2	0.4	0.05	4.5	0.0018	0.6	0										
SC3-89	SC3-89	2-YR 24HR	23.263269	1017.984	1939.872	0.0409	2	0.4	0.05	4.5	0.0018	0.6	0										
SCE-1	SCE-1	2-YR 24HR	64.4	1924.032	3736	0.0171	14	0.4	0.05	4.5	0.0018	0.6	0										
SCE-2	SCE-2	2-YR 24HR	15	1476.816	2459.952	0.0179	10	0.4	0.05	4.5	0.0018	0.6	0										
SCE-3	SCE-3	2-YR 24HR	61.649587	2367.024	4096	0.0151	25	0.4	0.05	4.9	0.0009	0.9	0										
SCE-4	SCE-4	2-YR 24HR	29.5	1967.856	3449.952	0.0065	25	0.4	0.05	4.5	0.0018	0.6	0										
SCE-5	SCE-5	2-YR 24HR	74.774633	1721.808	3500	0.0219	70	0.4	0.05	5	0.0007	1	0										
SCE-6	SCE-6	2-YR 24HR	4.1910468	732.864	1263	0.018	10	0.4	0.05	5	0.0007	1	0										
SCE-7	SCE-7	2-YR 24HR	23.668756	509	1638	0.0217	76	0.4	0.05	4.6	0.0016	0.7	0										
SCE-8	SCE-8	2-YR 24HR	25.5	391.248	1207	0.0192	95	0.4	0.05	5	0.0007	1	0										
SCE-9	SCE-9	2-YR 24HR	4.1878558	583.968	1113	0.0223	10	0.4	0.05	5	0.0007	1	0										
SCE-10	SCE-10	2-YR 24HR	163.03005	1087.152	3749.856	0.0183	45	0.4	0.05	5	0.0007	1	0										
SCE-11	SCE-11	2-YR 24HR	5.8	120	922	0.0294	10	0.4	0.05	5	0.0007	1	0										
SCE-13	SCE-13	2-YR 24HR	78.6	2037.024	4269	0.0239	10	0.4	0.05	4.5	0.0018	0.6	0										
SCE-14	SCE-14	2-YR 24HR	52.5	1419.792	3222	0.022	10	0.4	0.05	4.5	0.0018	0.6	0										
SCE-15	SCE-15	2-YR 24HR	39.68	791	1511	0.02	20	0.4	0.05	4.5	0.0018	0.6	0										

MENTS

t Hydrograph utes)	Fraction of Width Before Peak (Decimal)		
Override At 75%	Override At 50%	Override At 75%	Comment

Typical Depression Losses for Various Land Covers (All Values in Inches)

Land Cover	Range in Depression (Retention) Losses	Recommended
Impervious:		
Large paved areas	0.05 - 0.15	0.1
Roofs-flat	0.1 - 0.3	0.1
Roofs-sloped	0.05 - 0.1	0.05
Pervious:		
Lawn grass	0.2 - 0.5	0.35
Wooded areas and open fields	0.2 - 0.6	0.4

Recommended Horton's Equation Parameters

NRCS Hydrologic Soil Group	Infiltration (inches per hour)		Decay Coefficient - a
	Initial - f_i	Final - f_o	
A	5.0	1.0	0.0007
B	4.5	0.6	0.0018
C	3.0	0.5	0.0018
D	3.0	0.5	0.0018

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 1559 cfs

Maximum Flow: 2600 cfs

Table 1 - Summary of Culvert Flows at Crossing: SRR (separate berm)

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 (low flow) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7000.88	0.00	0.00	0.00	0.00	0
7003.13	260.00	151.32	108.64	0.00	3
7004.37	520.00	339.63	180.32	0.00	4
7005.52	780.00	552.62	227.38	0.00	4
7006.71	1040.00	773.45	266.59	0.00	4
7008.18	1300.00	994.87	305.19	0.00	4
7009.98	1559.00	1213.01	346.03	0.00	4
7011.14	1820.00	1333.25	369.91	116.11	7
7011.40	2080.00	1359.44	375.23	344.68	5
7011.62	2340.00	1380.21	379.47	580.04	5
7011.81	2600.00	1398.21	383.17	817.62	4
7010.88	1672.33	1307.57	364.76	0.00	Overtopping

Rating Curve Plot for Crossing: SRR (separate berm)

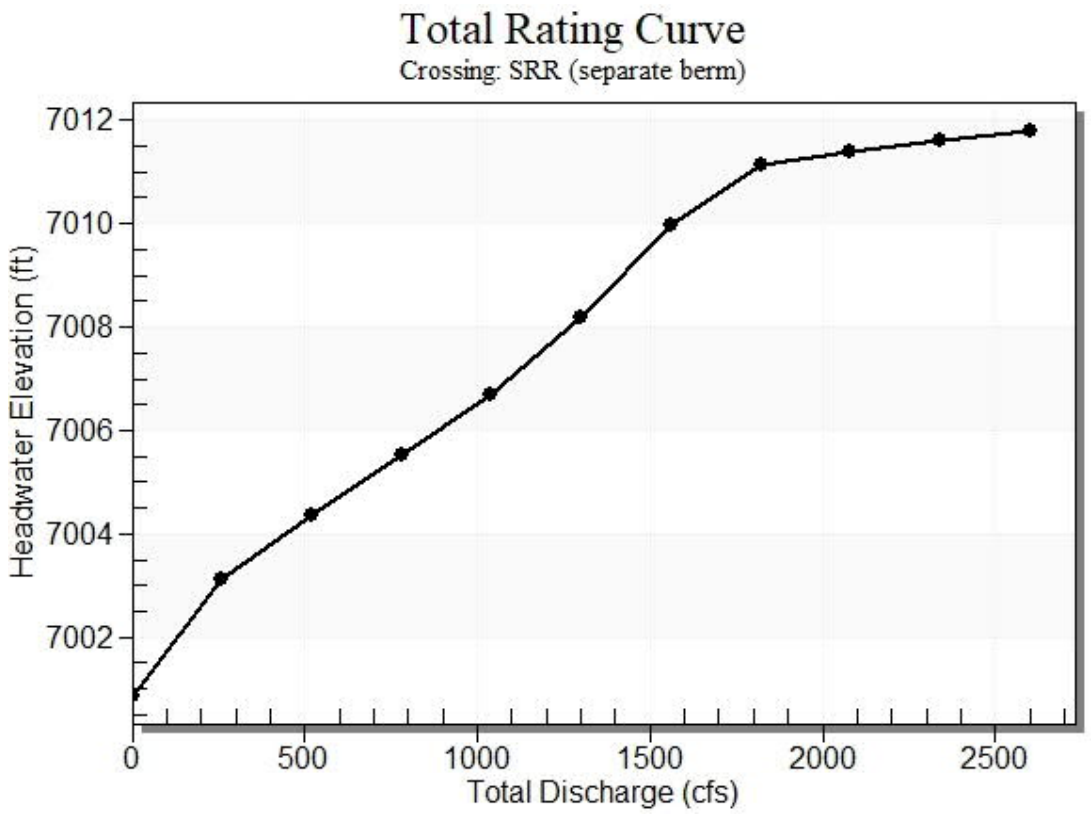


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	7000.88	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
260.00	151.32	7003.13	1.745	1.751	3-M2t	1.225	1.017	1.177	1.738	4.944	2.537
520.00	339.63	7004.37	2.954	2.998	3-M2t	2.077	1.743	2.032	2.593	6.429	3.216
780.00	552.62	7005.52	4.097	4.143	3-M2t	2.886	2.412	2.703	3.264	7.863	3.673
1040.00	773.45	7006.71	5.326	5.184	3-M2t	3.644	3.018	3.274	3.835	9.085	4.027
1300.00	994.87	7008.18	6.800	6.142	7-M2t	4.000	3.569	3.780	4.341	10.124	4.318
1559.00	1213.01	7009.98	8.600	4.126	5-M2t	4.000	4.000	3.780	4.796	0.000	4.566
1820.00	1333.25	7011.14	9.756	4.548	5-M2t	4.000	4.000	3.780	5.218	10.124	4.786
2080.00	1359.44	7011.40	10.024	4.939	5-M2t	4.000	4.000	3.780	5.609	10.124	4.982
2340.00	1380.21	7011.62	10.241	5.306	5-M2t	4.000	4.000	3.780	5.976	10.124	5.159
2600.00	1398.21	7011.81	10.431	5.652	5-M2t	4.000	4.000	3.780	6.322	10.124	5.322

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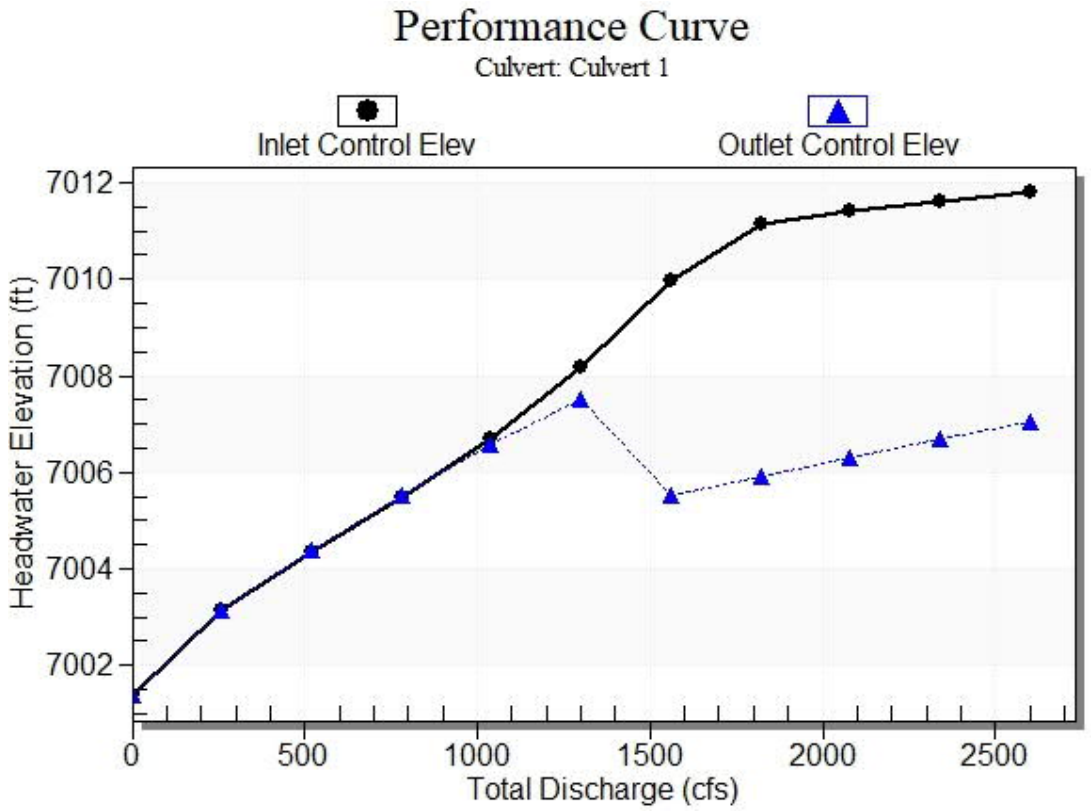
Straight Culvert

Inlet Elevation (invert): 7001.38 ft, Outlet Elevation (invert): 7001.27 ft

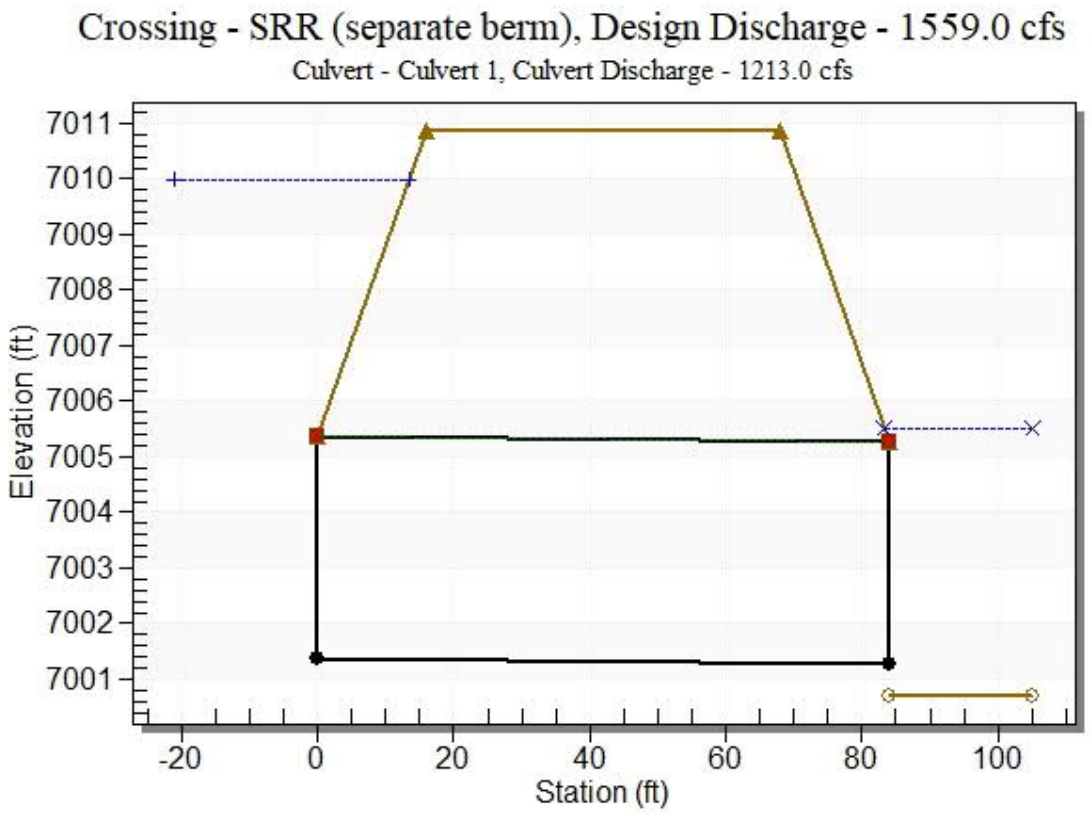
Culvert Length: 84.00 ft, Culvert Slope: 0.0013

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 7001.38 ft

Outlet Station: 84.00 ft

Outlet Elevation: 7001.27 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 13.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Table 3 - Culvert Summary Table: Culvert 2 (low flow)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	7000.88	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
260.00	108.64	7003.13	2.213	2.235	7-M1t	1.340	1.294	1.738	1.738	4.808	2.537
520.00	180.32	7004.37	3.494	3.860	4-FFf	1.865	1.815	2.000	2.593	6.935	3.216
780.00	227.38	7005.52	4.644	5.380	4-FFf	2.000	2.000	2.000	3.264	8.745	3.673
1040.00	266.59	7006.71	5.825	6.807	4-FFf	2.000	2.000	2.000	3.835	10.253	4.027
1300.00	305.19	7008.18	7.300	8.288	4-FFf	2.000	2.000	2.000	4.341	11.738	4.318
1559.00	346.03	7009.98	9.099	9.919	4-FFf	2.000	2.000	2.000	4.796	13.309	4.566
1820.00	369.91	7011.14	10.256	11.097	4-FFf	2.000	2.000	2.000	5.218	14.227	4.786
2080.00	375.23	7011.40	10.524	11.663	4-FFf	2.000	2.000	2.000	5.609	14.432	4.982
2340.00	379.47	7011.62	10.740	12.172	4-FFf	2.000	2.000	2.000	5.976	14.595	5.159
2600.00	383.17	7011.81	10.931	12.642	4-FFf	2.000	2.000	2.000	6.322	14.737	5.322

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Straight Culvert

Inlet Elevation (invert): 7000.88 ft, Outlet Elevation (invert): 7000.71 ft

Culvert Length: 84.00 ft, Culvert Slope: 0.0020

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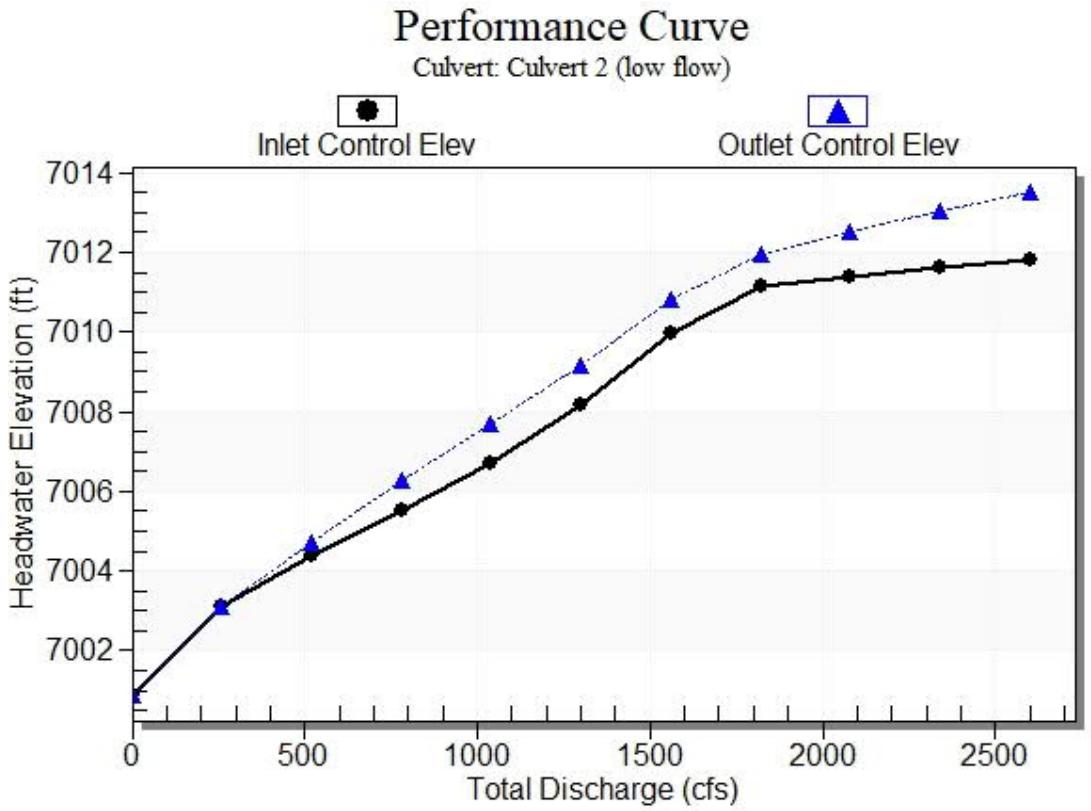
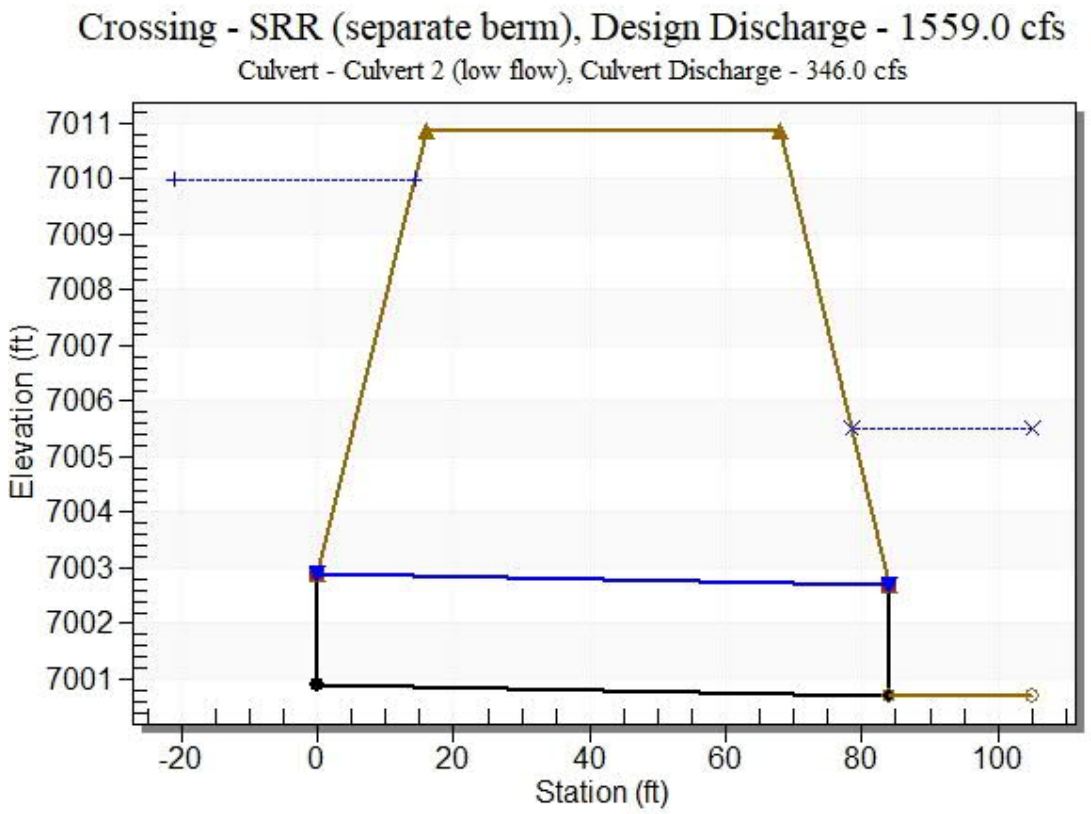
Culvert Performance Curve Plot: Culvert 2 (low flow)



Water Surface Profile Plot for Culvert: Culvert 2 (low flow)



Site Data - Culvert 2 (low flow)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 7000.88 ft

Outlet Station: 84.00 ft

Outlet Elevation: 7000.71 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2 (low flow)

Barrel Shape: Concrete Box

Barrel Span: 13.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Table 4 - Downstream Channel Rating Curve (Crossing: SRR (separate berm))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7000.71	0.00	0.00	0.00	0.00
260.00	7002.45	1.74	2.54	0.22	0.36
520.00	7003.30	2.59	3.22	0.32	0.38
780.00	7003.97	3.26	3.67	0.41	0.39
1040.00	7004.55	3.84	4.03	0.48	0.40
1300.00	7005.05	4.34	4.32	0.54	0.41
1559.00	7005.51	4.80	4.57	0.60	0.41
1820.00	7005.93	5.22	4.79	0.65	0.42
2080.00	7006.32	5.61	4.98	0.70	0.42
2340.00	7006.69	5.98	5.16	0.75	0.43
2600.00	7007.03	6.32	5.32	0.79	0.43

Tailwater Channel Data - SRR (separate berm)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 52.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0020

Channel Manning's n: 0.0350

Channel Invert Elevation: 7000.71 ft

Roadway Data for Crossing: SRR (separate berm)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 7010.88 ft

Roadway Surface: Paved

Roadway Top Width: 52.00 ft

Existing Stock Pond 1 Proposed Outlet Structure

width	25	area	625	open area x 70%	218.75	0.25
length	25	blockage	0.5			
perimeter	100	blockage	0	avail perm.	100	

Elev (ft)	Head (ft)	Orifice	Weir
7036	0	0	0
7036.25	0.25	526.6381	38.75
7036.5	0.5	744.7787	109.6016
7036.75	0.75	912.1639	201.3509
7037	1	1053.276	310
7037.25	1.25	1177.599	433.2382
7037.5	1.5	1289.995	569.5064
7037.75	1.75	1393.353	717.66
7038	2	1489.557	876.8124
7038.25	2.25	1579.914	1046.25
7038.5	2.5	1665.376	1225.383
7038.75	2.75	1746.661	1413.711
7039	3	1824.328	1610.807
7039.25	3.25	1898.821	1816.296
7039.5	3.5	1970.499	2029.849
7039.75	3.75	2039.66	2251.172
7040	4	2106.552	2480
7040.25	4.25	2171.384	2716.096
7040.5	4.5	2234.336	2959.242
7040.75	4.75	2295.562	3209.239
7041	5	2355.197	3465.905
7041.25	5.25	2413.359	3729.071
7041.5	5.5	2470.152	3998.579
7041.75	5.75	2525.667	4274.285
7042	6	2579.989	4556.051
7042.25	6.25	2633.19	4843.75
7042.5	6.5	2685.338	5137.262
7042.75	6.75	2736.492	5436.474
7043	7	2786.707	5741.28
7043.25	7.25	2836.033	6051.579
7043.5	7.5	2884.516	6367.275
7043.75	7.75	2932.197	6688.277
7044	8	2979.115	7014.499
7044.25	8.25	3025.305	7345.859
7044.5	8.5	3070.801	7682.279
7044.75	8.75	3115.633	8023.683
7045	9	3159.828	8370
7045.25	9.25	3203.414	8721.161
7045.5	9.5	3246.415	9077.1
7045.75	9.75	3288.854	9437.753
7046	10	3330.752	9803.061
7046.25	10.25	3372.129	10172.96
7046.5	10.5	3413.005	10547.41
7046.75	10.75	3453.397	10926.33
7047	11	3493.322	11309.69
7047.25	11.25	3532.796	11697.43
7047.5	11.5	3571.833	12089.5
7047.75	11.75	3610.449	12485.86
7048	12	3648.656	12886.46

Existing Stock Pond 2 Proposed Outlet Structure

width	25	area	625	open area x 70%	218.75
length	25	blockage	0.5		
perimeter	100	blockage	0	avail perm.	100

Elev (ft)	Head (ft)	Orifice	Weir
7117.75	0	0	0
7118	0.25	526.6381	38.75
7118.25	0.5	744.7787	109.6016
7118.5	0.75	912.1639	201.3509
7118.75	1	1053.276	310
7119	1.25	1177.599	433.2382
7119.25	1.5	1289.995	569.5064
7119.5	1.75	1393.353	717.66
7119.75	2	1489.557	876.8124
7120	2.25	1579.914	1046.25
7120.25	2.5	1665.376	1225.383
7120.5	2.75	1746.661	1413.711
7120.75	3	1824.328	1610.807
7121	3.25	1898.821	1816.296
7121.25	3.5	1970.499	2029.849
7121.5	3.75	2039.66	2251.172
7121.75	4	2106.552	2480
7122	4.25	2171.384	2716.096
7122.25	4.5	2234.336	2959.242
7122.5	4.75	2295.562	3209.239
7122.75	5	2355.197	3465.905
7123	5.25	2413.359	3729.071
7123.25	5.5	2470.152	3998.579
7123.5	5.75	2525.667	4274.285
7123.75	6	2579.989	4556.051
7124	6.25	2633.19	4843.75
7124.25	6.5	2685.338	5137.262
7124.5	6.75	2736.492	5436.474
7124.75	7	2786.707	5741.28
7125	7.25	2836.033	6051.579
7125.25	7.5	2884.516	6367.275
7125.5	7.75	2932.197	6688.277
7125.75	8	2979.115	7014.499
7126	8.25	3025.305	7345.859
7126.25	8.5	3070.801	7682.279
7126.5	8.75	3115.633	8023.683
7126.75	9	3159.828	8370
7127	9.25	3203.414	8721.161
7127.25	9.5	3246.415	9077.1
7127.5	9.75	3288.854	9437.753
7127.75	10	3330.752	9803.061
7128	10.25	3372.129	10172.96
7128.25	10.5	3413.005	10547.41
7128.5	10.75	3453.397	10926.33
7128.75	11	3493.322	11309.69
7129	11.25	3532.796	11697.43
7129.25	11.5	3571.833	12089.5
7129.5	11.75	3610.449	12485.86
7129.75	12	3648.656	12886.46

Existing vs. Proposed Peak Flow Rate Design Point Summary

Design Point	Existing Q_2 (cfs)	Proposed Q_2 (cfs)	% Difference	Existing Q_5 (cfs)	Proposed Q_5 (cfs)	% Difference	Existing Q_{10} (cfs)	Proposed Q_{10} (cfs)	% Difference	Existing Q_{25} (cfs)	Proposed Q_{25} (cfs)	% Difference	Existing Q_{50} (cfs)	Proposed Q_{50} (cfs)	% Difference	Existing Q_{100} (cfs)	Proposed Q_{100} (cfs)	% Difference
DP-73	171.20	147.28	-14%	503.09	442.59	-12%	791.79	703.56	-11%	1033.04	919.81	-11%	1414.41	1257.44	-11%	1672.0	1497.12	-10%
DP-71	175.00	149.28	-15%	518.37	472.6	-9%	818.24	771.35	-6%	1068.91	1012.75	-5%	1466.2	1386.32	-5%	1734.9	1644.06	-5%
DP-69	189.69	146.52	-23%	579.88	512.38	-12%	923.83	847.5	-8%	1213.68	1108.89	-9%	1675.53	1497.55	-11%	1988.4	1763.93	-11%
DP-63	175.18	128.57	-27%	557.4	480.38	-14%	899.71	763.81	-15%	1192.36	1005.42	-16%	1661.58	1368.28	-18%	1980.7	1585.19	-20%
DP-60A	167.91	135.75	-19%	546.35	544.14	0%	886.79	863.88	-3%	1179	1138.24	-3%	1649.04	1569.79	-5%	1969.2	1882.17	-4%
DP-53A	182.68	135.8	-26%	602.01	545.87	-9%	983.58	866.46	-12%	1311.23	1141.24	-13%	1837.86	1573.95	-14%	2197.7	1887.54	-14%
DP-56	0.35	24.04	6769%	40.19	43.91	9%	96.37	62.31	-35%	141.51	79.42	-44%	207.98	106.6	-49%	242.9	136.21	-44%
DP-8	1.97	26.31	1236%	50.28	47.57	-5%	115.07	67.39	-41%	167.23	84.03	-50%	245.12	107.24	-56%	297.4	137.04	-54%

Existing vs. Proposed Total Runoff Volume Design Point Summary

Design Point	Existing V_2 (ac-ft)	Proposed V_2 (ac-ft)	% Difference	Existing V_5 (ac-ft)	Proposed V_5 (ac-ft)	% Difference	Existing V_{10} (ac-ft)	Proposed V_{10} (ac-ft)	% Difference	Existing V_{25} (ac-ft)	Proposed V_{25} (ac-ft)	% Difference	Existing V_{50} (ac-ft)	Proposed V_{50} (ac-ft)	% Difference	Existing V_{100} (ac-ft)	Proposed V_{100} (ac-ft)	% Difference
DP-73	19.9	20.62	4%	51.9	52.17	1%	78.6	78.56	0%	101.0	100.66	0%	136.3	135.64	0%	159.9	158.97	-1%
DP-71	20.7	26.36	27%	54.6	62.30	14%	82.6	92.07	12%	106.2	117.23	10%	143.6	156.82	9%	168.5	183.52	9%
DP-69	24.0	28.66	19%	64.4	70.58	10%	98.2	105.26	7%	126.4	133.19	5%	171.2	177.07	3%	201.0	205.92	2%
DP-63	25.9	70.28	172%	69.7	134.11	93%	105.9	187.20	77%	136.3	230.78	69%	184.4	297.99	62%	216.4	343.71	59%
DP-60A	26.1	98.20	276%	71.2	180.14	153%	108.6	249.19	129%	139.6	305.05	118%	189.0	392.82	108%	221.9	448.06	102%
DP-53A	31.6	98.82	213%	84.1	181.06	115%	128.0	250.42	96%	164.5	306.89	87%	221.9	392.82	77%	260.5	451.12	73%
DP-56	0.1	29.15	46929%	4.0	42.96	977%	8.7	55.85	539%	12.6	66.59	431%	18.2	83.17	357%	22.0	94.21	328%
DP-8	0.2	30.23	17648%	4.9	45.11	825%	10.3	58.62	472%	14.5	69.97	381%	21.0	87.46	317%	25.3	98.82	290%

MDDP Proposed vs. Amendment Proposed Peak Flow Rate Basin Summary

Basin	MDDP Q_2 (cfs)	Amend Q_2 (cfs)	% Difference	MDDP Q_5 (cfs)	Amend Q_5 (cfs)	% Difference	MDDP Q_{10} (cfs)	Amend Q_{10} (cfs)	% Difference	MDDP Q_{25} (cfs)	Amend Q_{25} (cfs)	% Difference	MDDP Q_{50} (cfs)	Amend Q_{50} (cfs)	% Difference	MDDP Q_{100} (cfs)	Amend Q_{100} (cfs)	% Difference
SC3-1A	16.3	15.4	-6%	23.3	32.05	38%	33	44.63	35%	45.8	54.22	18%	57.1	68.02	19%	68.9	77.21	12%
SC3-5A	40.6	48.38	19%	53.7	75.2	40%	71	95.88	35%	92.4	112.35	22%	110.6	135.5	23%	129.1	150.82	17%
SC3-5B	53.8	60.26	12%	73	97.13	33%	98.5	126.36	28%	130.8	149	14%	158.6	181.48	14%	187	203.13	9%
SC3-6A	61.4	59.98	-2%	79.3	84.21	6%	102.2	106.32	4%	130.1	123.77	-5%	153.6	149.06	-3%	177.1	165.69	-6%
SC3-6B	32.9	30	-9%	43.4	47.16	9%	57	60.52	6%	73.9	70.92	-4%	88.2	85.96	-3%	102.7	95.97	-7%
SC3-6C	53.9	52.26	-3%	72.5	84.02	16%	97.1	115.61	19%	128	140.03	9%	154.5	174.32	13%	181.5	196.64	8%
SC3-7	54	60.94	13%	69.9	87.91	26%	90.3	109.28	21%	115.2	126.05	9%	136.2	150.45	10%	157.2	166.71	6%
SC3-8	25.4	12.18	-52%	42.1	56.41	34%	66.7	93.96	41%	100.7	122.75	22%	132.3	166.13	26%	166.2	195.44	18%
SC3-9	45.8	24.66	-46%	71.5	73.44	3%	108.6	114.01	5%	158.9	146.06	-8%	204.9	193.77	-5%	254	225.81	-11%
SC3-10	7.6	2.94	-61%	12.3	14.36	17%	19.4	23.62	22%	29.1	30.77	6%	38	41.33	9%	47.7	48.66	2%
SC3-11A	5.3	1.99	-62%	7.8	5.36	-31%	11.3	8.05	-29%	15.9	10.06	-37%	20	13.08	-35%	24.3	15.09	-38%
SC3-11B	59.4	68	14%	81.3	99.65	23%	110.8	126.13	14%	148.1	146.85	-1%	180.5	176.93	-2%	213.7	196.96	-8%
SC3-11C		1.37			5.83			9.3			11.93			15.66			18.16	
SC3-12	77.8	47.61	-39%	105.6	71.53	-32%	142.5	91.34	-36%	189.1	106.54	-44%	229.1	129.44	-44%	270	144.67	-46%
SC3-12A		15.01			24.03			31.22			36.66			44.86			50.3	
SC3-12B		2.17			6.35			9.82			12.6			16.83			19.66	
SC3-13	43.9	56.24	28%	57.8	80.96	40%	76.5	100.72	32%	98.5	115.86	18%	117.6	138.53	18%	136.9	153.6	12%
SC3-13A		2.61			7.62			11.81			15.18			20.28			23.7	
SC3-14A	127.6	110.65	-13%	175.4	160.22	-9%	239.8	203.13	-15%	321.9	237.5	-26%	393.2	287.18	-27%	466.3	320.18	-31%
SC3-14B	24.6	63.13	157%	34.3	90	162%	47.4	115.58	144%	64.2	136.1	112%	79	165.72	110%	94.1	185.1	97%
SC3-15A	21.6	13.21	-39%	35.5	38.41	8%	56.3	59.28	5%	85.3	76.32	-11%	112.1	102.43	-9%	141	119.86	-15%
SC3-15B	10.8	8.38	-22%	14	12.29	-12%	18.2	15.45	-15%	23.3	17.9	-23%	27.6	21.56	-22%	31.9	24	-25%
SC3-16		180.7			266.34			343.24			404.73			493.4			552.27	
SC3-16A	84.4		46%	120.4		53%	170		41%	234.8		21%	292.2		19%	351.8		11%
SC3-16B	39		46%	53.7		53%	73.6		41%	99		21%	121.1		19%	143.8		11%
SC3-17A	41.8	25.63	-39%	59.6	39.59	-34%	85.2	50.91	-40%	119	59.5	-50%	149.1	72.46	-51%	180.6	81.07	-55%
SC3-17B		20.59			32.3			41.97			49.43			60.7			68.19	
SC3-18	49.3	22.75	-54%	67.1	32.96	-51%	91	41.34	-55%	121.2	47.83	-61%	147.3	57.56	-61%	174	64.05	-63%
SC3-18B		1.53			4.45			6.89			8.86			11.91			13.95	
SC3-19	28.8	28	-3%	47.7	78.96	66%	75.7	120.84	60%	114.4	154.22	35%	150.2	205.45	37%	188.8	239.67	27%
SC3-20	9.9	9.29	-6%	15.5	21.02	36%	23.8	30.73	29%	35.1	38.5	10%	45.5	50.17	10%	56.6	57.99	2%
SC3-21	7	9.77	40%	10.8	20.68	91%	16.3	29.45	81%	23.7	36.03	52%	30.4	45.92	51%	37.5	52.53	40%
SC3-22	9.4	7.15	-24%	14.8	16.35	10%	22.5	24.05	7%	32.9	30.08	-9%	42.5	39.14	-8%	52.6	45.22	-14%
SC3-23	5.5	10.92	99%	8.3	22.1	166%	12.4	31.23	152%	18	38.2	112%	23	48.72	112%	28.4	55.73	96%
SC3-24A	13	6.43	-51%	20.4	15.26	-25%	31.1	22.51	-28%	45.7	28.3	-38%	59	37.09	-37%	73.2	42.98	-41%
SC3-24B	3.4	1.95	-43%	5.3	4.78	-10%	8.1	7.12	-12%	11.8	8.98	-24%	15.2	11.76	-23%	18.9	13.62	-28%
SC3-25	5.8	5.58	-4%	8.9	12.02	35%	13.4	17.2	28%	19.5	21.1	8%	25.1	26.97	7%	31	30.9	0%
SC3-26	2.5	1.66	-34%	4	4.37	9%	6.2	6.61	7%	9.2	8.4	-9%	12.1	11.13	-8%	15.1	12.95	-14%
SC3-27	35.1	14.49	-59%	51.2	27.87	-46%	73.8	39.1	-47%	103.7	48.09	-54%	130.3	61.8	-53%	158.3	70.95	-55%
SC3-61	13.7	5.61	-59%	22	22.4	2%	34.4	36.4	6%	51.6	47.4	-8%	67.6	63.67	-6%	84.8	74.61	-12%
SC3-72	12.8	9.55	-25%	20.2	23.84	18%	31.4	35.61	13%	46.7	44.98	-4%	60.9	59.19	-3%	76	68.7	-10%
SC3-73	16.4	12.16	-26%	26.4	33.03	25%	41.3	50.14	21%	62.1	63.84	3%	81.3	84.94	4%	102	99.04	-3%
SC3-74	22.3	22.51	1%	36.5	53.27	46%	57.3	79.1	38%	85.9	99.77	16%	112.3	131.03	17%	140.7	151.94	8%
SC3-75	13.1	11.12	-15%	21.5	26.37	23%	33.7	38.98	16%	50.5	49.21	-3%	66.1	64.91	-2%	82.8	75.41	-9%
SC3-76	14.2	10.85	-24%	23.1	27.09	17%	36.4	40.54	11%	54.6	51.45	-6%	71.4	68.18	-5%	89.6	79.38	-11%
SC3-77	16.6	8.93	-46%	27.6	27.11	-2%	43.8	42.16	-4%	66.2	54.46	-18%	87	73.59	-15%	109.4	86.36	-21%
SC3-78	28.1	32.29	15%	45.3	77.46	71%	70.6	114.83	63%	106.2	144.42	36%	139.1	189.21	36%	174.5	219.17	26%
SC3-79	34.9	32.26	-8%	57	82.54	45%	89.5	123.52	38%	134.3	156.01	16%	175.6	205.95	17%	220.1	239.34	9%
SC3-80	27.3	22.36	-18%	44.3	57.34	29%	69.6	86.09	24%	104.5	109.14	4%	136.8	144.5	6%	171.4	168.15	-2%
SC3-81	42.6	26.67	-37%	70.2	81	15%	111	125.85	13%	167.4	162.22	-3%	219.6	218.65	0%	275.7	256.32	-7%
SC3-82	20	17.01	-15%	33.2	50.83	53%	52.8	79.48	51%	80	102.02	28%	105.1	136.18	30%	132.3	158.98	20%
SC3-88	10.5	6.28	-40%	17.4	18.99	9%	27.6	29.44	7%	41.8	37.84	-9%	54.9	50.8	-7%	69	59.46	-14%
SC3-89	6.1	2.86	-53%	10	8.64	-14%	15.7	13.39	-15%	23.6	17.14	-27%	30.8	22.87	-26%	38.6	26.69	-31%
SCE-1	23.3	9.82	-58%	35.9	21.3	-41%	53.8	30.85	-43%	79.1	38.58	-51%	102.4	50.51	-51%	127.4	58.52	-54%
SCE-2	4.4	1.42	-68%	7	3.35	-52%	10.8	4.95	-54%	15.9	6.27	-61%	20.7	8.3	-60%	25.7	9.66	-62%
SCE-3	30.6	8.5	-72%	45.2	16.95	-63%	65.9	25.2	-62%	93.3	31.78	-66%	118	41.56	-65%	143.9	48.16	-67%
SCE-4	13.3	4.16	-69%	19.6	7.52	-62%	28.6	10.35	-64%	40.6	12.67	-69%	257.8	16.29	-94%	62.6	18.71	-70%
SCE-5	100.4	71.73	-29%	130.6	99.51	-24%	169.6	125.72	-26%	217.4	146.92	-32%	257.8	177.83	-31%	298.4	198.17	-34%
SCE-6	1.6	0.18	-89%	2.5	0.55	-78%	3.7	1.03	-72%	5.4	1.42	-74%	7	2	-71%	8.6	2.39	-72%
SCE-7	58.9	33.06	-44%	75.5	46.14	-39%	96.6	56.71	-41%	122.2	64.87	-47%	143.7	77.06	-46%	165.2	85.19	-48%
SCE-8	38.6	47.1	22%	48.4	61.37	27%	60.7	73.41	21%	75.4	82.94	10%	87.7	97.16	11%	99.9	106.61	7%
SCE-9	1.5	0.22	-85%	2.4	0.68	-72%	3.6	1.27	-65%	5.3	1.75	-67%	6.8	2.46	-64%	8.5	2.94	-65%
SCE-10	7.6	106.33	1299%	189.4	165.76	-12%	19.4	230.7	1089%	29.1	283.77	875%	398.9	358.46	-10%	467.5	407.13	-13%
SCE-11	2.3	0.77	-67%	3.6	2.52	-30%	5.5	4.75	-14%	8	6.5	-19%	10.3	8.93	-13%	12.8	10.51	-18%
SCE-13	19.6	10.9	-44%	31.3	25.85	-17%	48.7	38.21	-22%	73.1	48.24	-34%	95.7	63.64	-34%	120	73.94	-38%
SCE-14	13.2	8	-39%	21.2	19.04	-10%	33.3	28.21	-15%	49.9	35.59	-29%	65.2	46.77	-28%	81.7	54.26	-34%
SCE-15	2.2	13.6	518%	5.1	27.2	433%	10.1	38.53	281%	17.7	47.35	168%	25.1	60.67	142%	35.4	69.54	96%

MDDP Proposed vs. Amendment Proposed Peak Flow Rate Design Point Summary

Design Point	MDDP Q_2 (cfs)	Amend Q_2 (cfs)	% Difference	MDDP Q_5 (cfs)	Amend Q_5 (cfs)	% Difference	MDDP Q_{10} (cfs)	Amend Q_{10} (cfs)	% Difference	MDDP Q_{25} (cfs)	Amend Q_{25} (cfs)	% Difference	MDDP Q_{50} (cfs)	Amend Q_{50} (cfs)	% Difference	MDDP Q_{100} (cfs)	Amend Q_{100} (cfs)	% Difference
DP-74	39.3	33.68	-14%	65.3	94.55	45%	104.8	145.74	39%	158.9	187.2	18%	209.1	251.03	20%	262.8	293.76	12%
DP-75	141.2	95.13	-33%	235.1	274.57	17%	376.6	427.98	14%	566.6	555.2	-2%	750.9	754.29	0%	950.5	887.87	-7%
DP-77	209.9	144.08	-31%	351.9	426.57	21%	580.6	672.84	16%	886.6	877.81	-1%	1168.4	1201.19	3%	1467.7	1423.89	-3%
DP-78	59.7	52.82	-12%	98.4	138.33	41%	154	210.37	37%	232.6	269.64	16%	306.2	360.98	18%	385.3	422.09	10%
DP-73	207.5	147.28	-29%	354.3	442.59	25%	588.5	703.56	20%	897.1	919.81	3%	1187.2	1257.44	6%	1506.7	1497.12	-1%
DP-72	206.2	148.02	-28%	352.5	450.59	28%	586.7	718.2	22%	897.2	939.53	5%	1195.3	1285.42	8%	1518.6	1527.18	1%
DP-71	205.9	149.28	-27%	349.3	472.6	35%	610.5	771.35	26%	932.4	1012.75	9%	1226.9	1386.32	13%	1612.2	1644.06	2%
DP-70	205.3	149.57	-27%	349.8	477.23	36%	614	780.47	27%	940.1	1025.79	9%	1260.6	1405.32	11%	1636.7	1666.98	2%
DP-69	212.7	146.52	-31%	366.6	512.38	40%	653.7	847.5	30%	1010.6	1108.89	10%	1364.1	1497.55	10%	1775.7	1763.93	-1%
DP-87	216.9	143.88	-34%	374.6	533.15	42%	681.9	890.76	31%	1072.1	1170.95	9%	1471.5	1589.82	8%	1905.9	1880.39	-1%
DP-68	214.6	126.27	-41%	374.5	579.69	55%	714.9	994.15	39%	1187.6	1327.63	12%	1674.9	1837.13	10%	2204.1	2160.43	-2%
DP-64	85.9	89.76	4%	112.1	133.15	19%	145.9	167.21	15%	187.5	194.25	4%	222.6	233.42	5%	258	259.48	1%
DP-63	154.4	128.57	-17%	201	480.38	139%	375.7	763.81	103%	815.9	1005.42	23%	1112.1	1368.28	23%	1385.1	1585.19	14%
DP-61	156.6	132.9	-15%	223.9	535.22	139%	428	851.44	99%	928.2	1123.05	21%	1287.3	1549.17	20%	1620.1	1859.67	15%
DP-60A	161.6	135.75	-16%	224.8	544.14	142%	439.1	863.88	97%	950.4	1138.24	20%	1320.5	1569.79	19%	1661.8	1882.17	13%
DP-53A	161.6	135.8	-16%	225.7	545.87	142%	441.8	866.46	96%	951.1	1141.24	20%	1326	1573.95	19%	1668.9	1887.54	13%
DP-1E	23.9	12.41	-48%	38.3	29.33	-23%	70.1	43.32	-38%	132.8	54.71	-59%	173	72.19	-58%	220.9	83.88	-62%
DP-2E	48.9	24.93	-49%	76.8	56.12	-27%	123	81.89	-33%	228.7	103.16	-55%	319.7	135.52	-58%	419.4	157.2	-63%
DP-3E	48.5	26.73	-45%	75.7	59.28	-22%	122.2	86.63	-29%	271.1	109.01	-60%	387.1	143.9	-63%	500.1	176.03	-65%
DP-4E	48.1	28.34	-41%	76.2	61.94	-19%	122.4	91.01	-26%	286.9	114.79	-60%	407.3	152.57	-63%	534.8	184.7	-65%
DP-56	23.1	24.04	4%	35.3	43.91	24%	71.5	62.31	-13%	108.3	79.42	-27%	152.1	106.6	-30%	196.4	136.21	-31%
DP-8	24.1	26.31	9%	37.2	47.57	28%	73.5	67.39	-8%	111.3	84.03	-25%	155.4	107.24	-31%	200.7	137.04	-32%
DP-21	0.6	8.07	1245%	8.8	45.76	420%	17.8	92.48	420%	57.1	128.9	126%	116.8	153.87	32%	174.9	200.93	15%
DP-22	0.6	8.07	1245%	8.8	45.78	420%	17.6	92.52	426%	56.8	128.94	127%	105.1	153.88	46%	156.4	191.38	22%
DP-25	5.9	5.58	-5%	9.1	12.02	32%	16.3	17.2	6%	35.1	21.1	-40%	46.4	26.97	-42%	58.2	30.9	-47%
DP-26	0.1	13.62	13520%	1.1	38.87	3434%	3.2	59.76	1768%	7.3	76.84	953%	9.5	102.99	984%	12	120.45	904%
EX_STOCK_POND_1		133.68			512.29			863.82			1143.6			1561.29			1848.83	
EX_STOCK_POND_2		149.57			477.23			780.47			1025.79			1405.32			1666.98	
FSD14B_Outfall		2.57			20.53			44.05			64.95			98.12			116.66	
PNDE7	46.5	31.92	-31%	75.4	68.33	-9%	121.2	100.59	-17%	285.2	126.9	-56%	402.4	176	-56%	548	222.77	-59%
PNDW3	214.6	126.27	-41%	374.5	579.69	55%	714.9	994.15	39%	1187.6	1327.63	12%	1674.9	1837.12	10%	2204.1	2160.43	-2%

MDDP Proposed vs. Amendment Total Runoff Volume Proposed Design Point Summary

Design Point	MDDP V_2 (ac-ft)	Amend V_2 (ac-ft)	% Difference	MDDP V_5 (ac-ft)	Amend V_5 (ac-ft)	% Difference	MDDP V_{10} (ac-ft)	Amend V_{10} (ac-ft)	% Difference	MDDP V_{25} (ac-ft)	Amend V_{25} (ac-ft)	% Difference	MDDP V_{50} (ac-ft)	Amend V_{50} (ac-ft)	% Difference	MDDP V_{100} (ac-ft)	Amend V_{100} (ac-ft)	% Difference
DP-74	5.9	3.03	-49%	9	7.67	-15%	13.6	11.57	-15%	19.8	14.82	-25%	25.5	20.04	-21%	31.6	23.51	-26%
DP-75	22.7	11.05	-51%	34.5	28.82	-16%	51.7	43.58	-16%	75.4	56.16	-26%	97.1	75.80	-22%	120.5	89.00	-26%
DP-77	37.7	18.84	-50%	57.4	48.49	-16%	85.9	73.04	-15%	125.1	93.91	-25%	161.1	126.74	-21%	199.9	148.53	-26%
DP-78	8.9	4.91	-45%	13.5	11.69	-13%	20.1	17.40	-13%	29.3	22.25	-24%	37.7	29.86	-21%	46.7	34.99	-25%
DP-73	40	20.62	-48%	60.8	52.17	-14%	91	78.56	-14%	132.5	100.66	-24%	170.7	135.64	-21%	211.7	158.97	-25%
DP-72	41.3	21.30	-48%	62.9	53.71	-15%	94	80.71	-14%	136.8	103.42	-24%	176.2	139.33	-21%	218.5	163.26	-25%
DP-71	46.3	26.36	-43%	70	62.30	-11%	104.3	92.07	-12%	151.3	117.23	-23%	194.5	156.82	-19%	240.8	183.52	-24%
DP-70	49.5	28.45	-43%	74.5	65.06	-13%	110.6	95.75	-13%	160.1	121.53	-24%	205.4	162.04	-21%	254	189.35	-25%
DP-69	57.5	28.66	-50%	86.1	70.58	-18%	127.4	105.26	-17%	183.8	133.19	-28%	235.3	177.07	-25%	290.6	205.92	-29%
DP-87	66.5	35.29	-47%	98.9	82.55	-17%	145.6	121.53	-17%	209.1	153.75	-26%	267.1	203.16	-24%	329.1	236.30	-28%
DP-68	81.8	65.37	-20%	123.7	126.74	2%	183.9	177.99	-3%	264.9	219.73	-17%	338	284.79	-16%	415.8	328.37	-21%
DP-64	7	7.46	7%	9.1	10.10	11%	11.8	12.34	5%	15.2	14.12	-7%	18.1	16.79	-7%	21.1	18.57	-12%
DP-63	85.6	70.28	-18%	129.5	134.11	4%	192.3	187.20	-3%	276.7	230.78	-17%	352.8	297.99	-16%	433.5	343.71	-21%
DP-61	103.7	89.61	-14%	157.8	166.95	6%	235.1	232.31	-1%	338.4	285.10	-16%	431.3	368.26	-15%	529.8	420.44	-21%
DP-60A	111	98.20	-12%	168.6	180.14	7%	250.4	249.19	0%	359.5	305.05	-15%	457.7	392.82	-14%	561.5	448.06	-20%
DP-53A	112	98.82	-12%	170	181.06	7%	252.6	250.42	-1%	362.6	306.89	-15%	461.7	392.82	-15%	566.5	451.12	-20%
DP-1E	3.1	2.48	-20%	5.2	5.19	0%	8.4	7.73	-8%	12.7	10.00	-21%	16.6	13.56	-18%	20.9	15.96	-24%
DP-2E	6.1	6.01	-1%	10.4	11.66	12%	16.9	16.85	0%	25.7	21.27	-17%	33.7	28.17	-16%	42.2	32.84	-22%
DP-3E	7	13.35	91%	13.7	21.45	57%	23.4	28.85	23%	36.1	34.99	-3%	47.4	44.81	-5%	59.3	51.25	-14%
DP-4E	7.6	19.27	154%	15.6	29.15	87%	27.2	38.05	40%	43	45.73	6%	57.2	57.39	0%	72	65.06	-10%
DP-56	7.7	29.15	279%	16.1	42.96	167%	28.6	55.85	95%	51.3	66.59	30%	71.7	83.17	16%	92.9	94.21	1%
DP-8	8	30.23	278%	16.7	45.11	170%	26.6	58.62	120%	53	69.97	32%	74	87.46	18%	95.9	98.82	3%
DP-21	6.3	20.50	225%	11.3	28.39	151%	18.3	35.29	93%	27.5	40.82	48%	35.6	49.10	38%	44	54.93	25%
DP-22	6.3	20.53	226%	10.7	28.42	166%	16.7	35.29	111%	24.6	40.82	66%	31.5	49.41	57%	38.7	54.93	42%
DP-25	1.3	0.31	-76%	1.9	0.61	-68%	2.8	0.87	-69%	4.1	1.08	-74%	5.2	1.42	-73%	6.4	1.65	-74%
DP-26	0.7	2.01	188%	0.9	4.73	425%	1.2	7.03	486%	1.5	8.93	495%	1.8	11.97	565%	2.1	13.99	566%

Summary of Peak Discharges						
Design Point 75						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	141	235	377	567	751	951
2021 Existing Cond. (cfs)						971
2018 Developed Cond. (cfs)	141	235	377	567	751	951
2022 Developed Cond. (cfs)	95	275	428	555	754	888
Design Point 77						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	n/a	n/a	n/a	n/a	n/a	n/a
2021 Existing Cond. (cfs)						
2018 Developed Cond. (cfs)	210	352	581	887	1168	1468
2022 Developed Cond. (cfs)	144	427	673	878	1201	1424
1996 DBPS Existing Cond. (cfs)						2193
1996 DBPS Developed Cond. (cfs)						2262
Design Point 73						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	226	381	618	957	1260	1582
2021 Existing Cond. (cfs)						1672
2018 Developed Cond. (cfs)	208	354	589	897	1187	1507
2022 Developed Cond. (cfs)	147	443	704	920	1257	1497
Design Point 71						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	229	389	630	979	1277	1638
2021 Existing Cond. (cfs)						1735
2018 Developed Cond. (cfs)	206	349	611	932	1227	1612
2022 Developed Cond. (cfs)	149	473	771	1013	1386	1644
Design Point 69						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	253	435	708	1100	1453	1870
2021 Existing Cond. (cfs)						1988
2018 Developed Cond. (cfs)	213	367	654	1011	1364	1776
2022 Developed Cond. (cfs)	147	512	848	1109	1498	1764
Design Point 68						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	n/a	n/a	n/a	n/a	n/a	n/a
2021 Existing Cond. (cfs)						
2018 Developed Cond. w/o Pnd (cfs)	215	375	715	1188	1675	2204
2018 Developed w/Pnd (cfs) Pnd W3	154	200	367	800	1086	1351
2022 Developed Cond. w/ Pnd(cfs)	126	580	994	1328	1837	2160
Design Point 63						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	251	431	713	1113	1496	1912
2021 Existing Cond. (cfs)						1981
2018 Developed Cond. w/o Pnd (cfs)	213	373	721	1198	1705	2237
2018 Developed w/Pnd (cfs)	154	201	376	816	1112	1385
2021 Developed Cond. w/ Pnd(cfs)	129	480	764	1005	1368	1585
2011 Wilson (cfs)			1066			1791
1996 DBPS Existing Cond. (cfs)						2508
1996 DBPS Developed Cond. (cfs)						2689
Design Point 61						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	n/a	n/a	n/a	n/a	n/a	n/a
2018 Developed Cond. w/o Pnd (cfs)	214	375	783	1370	1967	2607
2018 Developed w/Pnd (cfs)	157	224	428	928	1287	1620
2022 Developed Cond. w/ Pnd(cfs)	133	535	851	1123	1549	1860
2011 Wilson (cfs)			1232			2087
Design Point 60a						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	248	430	707	1113	1497	1914
2021 Existing Cond. (cfs)						1969
2018 Developed Cond. w/o Pnd (cfs)	216	378	795	1395	2004	2645
2018 Developed w/Pnd (cfs)	162	225	439	950	1321	1662
2022 Developed Cond. w/ Pnd(cfs)	136	544	864	1138	1570	1882
2011 Wilson (cfs)			1265			2133
1996 DBPS Existing Cond. (cfs)						2629
1996 DBPS Developed Cond. (cfs)						3295
Design Point 53a						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	262	454	763	1197	1610	2062
2021 Existing Cond. (cfs)						2198
2018 Developed Cond. w/o Pnd (cfs)	215	378	792	1392	2009	2657
2018 Developed w/Pnd (cfs)	162	226	442	951	1326	1669
2022 Developed Cond. w/ Pnd(cfs)	136	546	866	1141	1574	1888

Full Spectrum Detention Pond Updates											
MDDP By M&S				Proposed Designs By JR & Others							
Name	Peak Inflow	Stored Volume	Peak Release Rate	Name	Design Firm	Peak Inflow	Percent Difference	Stored Volume	Percent Difference	Peak Release Rate	Percent Difference
	100-YR (cfs) From MDDP By M&S	100-YR (ac-ft)	100-YR (cfs)			100-YR (cfs) From MDDP By JR		100-YR (ac-ft)		100-YR (cfs)	
FSD1	68.9	2.2	25.4		Unchanged	77.2	12%	2.3	5%	25.4	0%
FSD5	129.1	5.2	30.1	Pond 1	Matrix	150.8	17%	6.2	19%	3.7	-88%
FSD6	608.6	26.0	149.6	Pond W-6	JR	610.0	0%	24.9	-4%	139.3	-7%
FSD9	410.1	13.8	289.9	Pond W-4	JR	386.0	-6%	10.8	-22%	264.8	-9%
FSD11A	24.3	0.6	12.3	Removed							
FSD11B	213.7	8.2	69.5		Classic	197.0	-8%	8.3	1%	82.7	19%
FSD12	270.0	8.9	103.1	Pond 4	M&S	205.1	-24%	5.8	-35%	103.1	0%
Added - FSD12A				Pond 1	M&S	48.9		1.4		23.4	
FSD13	136.9	5.0	47.2	Pond 8	M&S	153.6	12%	5.1	2%	43.8	-7%
FSD14A	466.3	17.3	142.2		Classic	320.2	-31%	15.1	-13%	167.1	17%
FSD14B	94.1	3.8	19.3		Classic	185.1	97%	6.8	79%	107.4	456%
FSD15B	31.9	1.0	12.0		M&S	24.0	-25%	1.2	20%	5.2	-56%
FSD16A	351.8	13.8	128.3		Classic	552.3	11%	18.5	-6%	191.4	22%
FSD16B	143.8	5.8	28.1								
FSD17	180.6	4.7	86.1	Pond C	JR	74.0	-59%	2.7	-43%	26.7	-69%
Added - FSD17B				Pond B	JR	69.3		2.8		24.3	
FSD18	174	5.3	69.6	Pond A	JR	75.5	-57%	2.9	-45%	32.2	-54%
FSD20	56.6	1.2	42.4		Unchanged	62.9	11%	0.5	-58%	44.4	5%
FSD21	37.5	0.8	30.1		Unchanged	51.3	37%	0.9	13%	30.3	1%
FSD22	52.6	1.0	43.8	Pond 1	Classic	56.5	7%	1.5	50%	24.0	-45%
FSD23	28.4	0.6	18.6		Unchanged	22.6	-20%	0.1	-83%	21.2	14%
FSD27	206.3	4.2	161.9	Pond 2	Classic	167.3	-19%	6.9	64%	91.9	-43%
FSD72	76.0	1.3	73.4		Unchanged	68.7	-10%	1.2	-8%	62.1	-15%
Added				EX Stock Pond 1	JR	1977.6		36.0		1819.9	
Added				EX stock Pond 2		1648.7		8.7		1661.2	
PNDW3	2204.1	78.2	1350.6		JR	2160.4	-2%	50.6	-35%	1559.0	15%
FSD-E1	127.4	2.5	84.0		Unchanged	58.5	-54%	4.4	76%	21.8	-74%
FSD-E2	143.9	3.8	74.7		Unchanged	54.7	-62%	4.2	11%	21.1	-72%
FSD-E3	298.4	11.4	101.3		Unchanged	224.7	-25%	13.6	19%	57.0	-44%
FSD-E4	165.2	6.9	43.6		Unchanged	101.3	-39%	5.3	-23%	4.9	-89%
FSD-E5	99.9	5.3	10.0		Unchanged	106.6	7%	5.8	9%	3.8	-62%
FSD-E6	467.5	23.7	123.3		Unchanged	441.6	-6%	22.2	-6%	56.8	-54%
PND-E7	548	28.0	196.4		Unchanged	263.9	-52%	16	-43%	144.8	-26%

```
[TITLE]
;;Project Title/Notes
Sterling Ranch 2021 MDDP Amendment
100-YR Type II Storm

[OPTIONS]
;;Option           Value
FLOW_UNITS         CFS
INFILTRATION       HORTON
FLOW_ROUTING       KINWAVE
LINK_OFFSETS       DEPTH
MIN_SLOPE          0
ALLOW_PONDING      NO
SKIP_STEADY_STATE  NO

START_DATE         01/01/2005
START_TIME         00:00:00
REPORT_START_DATE  01/01/2005
REPORT_START_TIME  00:00:00
END_DATE           01/04/2005
END_TIME           06:00:00
SWEEP_START        01/01
SWEEP_END          12/31
DRY_DAYS           0
REPORT_STEP        00:05:00
WET_STEP           00:05:00
DRY_STEP           01:00:00
ROUTING_STEP       0:00:30

INERTIAL_DAMPING   PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP      0.75
LENGTHENING_STEP   0
MIN_SURFAREA       12.557
MAX_TRIALS         8
HEAD_TOLERANCE     0.005
SYS_FLOW_TOL       5
LAT_FLOW_TOL       5
MINIMUM_STEP       0.5
THREADS            1

[FILES]
;;Interfacing Files
USE INFLOWS "2518804 CUHP SWMM - PROP Conditions-100YR 24hr Storm.xlsm.txt"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT        0.0
DRY_ONLY        NO

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
79               295        0          0          0          0
80               331        0          0          0          0
```

81 229 0 0 0 0
DP-1E 258.9 0 0 0 0
DP-21 184.2 0 0 0 0
DP-22 224.2 0 0 0 0
DP-25 332.2 0 0 0 0
DP-26 199.2 0 0 0 0
DP-2E 218.9 0 0 0 0
DP-3E 128.9 0 0 0 0
DP-4E 60.5 0 0 0 0
DP-53A 0 0 0 0 0
DP-56 32 0 0 0 0
DP-60A 22.2 0 0 0 0
DP-61 63.2 0 0 0 0
DP-63 98.2 0 0 0 0
DP-64 93.2 0 0 0 0
DP-68 118.4 0 0 0 0
DP-69 203.2 0 0 0 0
DP-70 229.2 0 0 0 0
DP-71 257.2 0 0 0 0
DP-72 283.2 0 0 0 0
DP-73 300.2 0 0 0 0
DP-74 497.2 0 0 0 0
DP-75 432.2 0 0 0 0
DP-77 340.2 0 0 0 0
DP-78 462.2 0 0 0 0
DP-8 0 0 0 0 0
DP-87 157.2 0 0 0 0
FSD9_OUTLET 139.2 0 0 0 0
FSDE1_Outlet 264.9 0 0 0 0
FSDE2_Outlet 228.9 0 0 0 0
FSDE4_Outlet 97.6 0 0 0 0
SC3-10 63.2 0 0 0 0
SC3-11A 98.2 0 0 0 0
SC3-11B 98.2 0 0 0 0
SC3-12 157.2 0 0 0 0
SC3-12A 157.2 0 0 0 0
SC3-13 118.6 0 0 0 0
SC3-14A 118.5 0 0 0 0
SC3-14B 184.2 0 0 0 0
SC3-15A 199.2 0 0 0 0
SC3-15B 199.2 0 0 0 0
SC3-16 224.2 0 0 0 0
SC3-17A 230.2 0 0 0 0
;Homestead North Pond C
SC3-17B 258.2 0 0 0 0
;Homestead North Pond A
SC3-18 203.2 0 0 0 0
SC3-18B 203.2 0 0 0 0
SC3-19 245.2 0 0 0 0
SC3-1A 0 0 0 0 0
SC3-20 324.2 0 0 0 0
SC3-21 332.2 0 0 0 0
SC3-22 283.2 0 0 0 0
SC3-23 295.2 0 0 0 0
SC3-24A 300.2 0 0 0 0
SC3-24B 283.2 0 0 0 0
SC3-25 332.2 0 0 0 0

SC3-26 257.2 0 0 0 0
SC3-27 257.2 0 0 0 0
SC3-5A 22.2 0 0 0 0
SC3-5B 0 0 0 0 0
SC3-61 28.2 0 0 0 0
SC3-6A 87.2 0 0 0 0
SC3-6B 93.2 0 0 0 0
SC3-6C 63.2 0 0 0 0
SC3-7 117.2 0 0 0 0
SC3-72 340.2 0 0 0 0
SC3-73 432.2 0 0 0 0
SC3-74 497.2 0 0 0 0
SC3-75 432.2 0 0 0 0
SC3-76 432.2 0 0 0 0
SC3-77 340.2 0 0 0 0
SC3-78 462.2 0 0 0 0
SC3-79 562.2 0 0 0 0
SC3-8 247.2 0 0 0 0
SC3-80 552.2 0 0 0 0
SC3-81 532.2 0 0 0 0
SC3-82 562.2 0 0 0 0
SC3-88 340.2 0 0 0 0
SC3-89 375.2 0 0 0 0
SC3-9 139.2 0 0 0 0
SCE-1 266 0 0 0 0
SCE-10 32.5 0 0 0 0
SCE-11 32.5 0 0 0 0
SCE-13 258.9 0 0 0 0
SCE-14 218.9 0 0 0 0
SCE-15 0 0 0 0 0
SCE-2 258.9 0 0 0 0
SCE-3 230 0 0 0 0
SCE-4 218.9 0 0 0 0
SCE-5 128.9 0 0 0 0
SCE-6 128.9 0 0 0 0
SCE-7 98 0 0 0 0
SCE-8 60.5 0 0 0 0
SCE-9 60.5 0 0 0 0
SC3-12B 157.2 0 0 0 0
SC3-13A 118.6 0 0 0 0
82 184.2 0 0 0 0
SC3-11C 165.2 0 0 0 0

[OUTFALLS]
;;Name Elevation Type Stage Data Gated Route To
;;---------- ---------- ---------- ---------- -------- ----------
SC3_OUTFALL 0 FREE NO
SCE_OUTFALL 0 FREE NO
FSD14B_Outfall 162.2 FREE NO

[STORAGE]
;;Name Elev. MaxDepth InitDepth Shape Curve Name/Params N/A Fevap Psi Ksat IMD
;;---------- -------- ---------- ---------- ---------- ---------- -------- -------- -------- --------
;Pond 1 from Aspen Meadows FDR by Matrix dated 01/19
FSD05 22.2 9 0 TABULAR FSD05_Storage 0 0
;Pond W-5 From SR Filing 2 Drainage Report by JR 4/21
FSD06 63.2 10.5 0 TABULAR FSD06_Storage 0 0

;Pond W-4 From SR Filing 2 Report by JR 4/21
FSD09 139.2 11 0 TABULAR FSD09_Storage 0 0
FSD1 0 9 0 TABULAR FSD01_Storage 0 0
;From SR East PDR
FSD11B 98.2 7.5 0 TABULAR FSD11B_Storage 0 0
;Pond 4 Sterling Ranch F1 by M&S 7/16
FSD12 157 9 0 TABULAR FSD12_Storage 0 0
;Pond 8 Sterling Ranch F1 by M&S 7/16
FSD13 118.5 10.5 0 TABULAR FSD13_Storage 0 0
;From SR East PDR
FSD14A 118.4 9.5 0 TABULAR FSD14A_Storage 0 0
;From SR East PDR
FSD14B 184.2 8 0 TABULAR FSD14B_Storage 0 0
FSD15B 199.2 4.39 0 TABULAR FSD15B 0 0
;From SR East PDR
FSD16 224.2 10 0 TABULAR FSD16_Storage 0 0
;Homestead North Pond B
FSD17A 230.2 9.9 0 TABULAR FSD17A_Storage 0 0
;Homestead North Pond A
FSD17B 258.2 8 0 TABULAR FSD17B_Storage 0 0
;Homestead North Pond C
FSD18 203.2 9.9 0 TABULAR FSD18_Storage 0 0
FSD20 324.2 9 0 TABULAR FSD20_Storage 0 0
FSD21 332.2 9 0 TABULAR FSD21_Storage 0 0
;Pond 1 in Retreat at Timber Ridge by Classic Engineering dated 6/20
FSD22 283.2 8 0 TABULAR FSD22_Storage 0 0
FSD23 296 9 0 TABULAR FSD23_Storage 0 0
;Pond 2 in Retreat at Timber Ridge by Classic Engineering dated 6/20
FSD27 257.2 10 0 TABULAR FSD27_Storage 0 0
FSD72 340.2 9 0 TABULAR FSD72_Storage 0 0
FSDE1 266 9 0 TABULAR FSDE1_Storage 0 0
FSDE2 230 9 0 TABULAR FSDE2_Storage 0 0
FSDE3 128.9 9 0 TABULAR FSDE3_Storage 0 0
FSDE4 98 10 0 TABULAR FSDE4_Storage 0 0
FSDE5 60.5 9 0 TABULAR FSDE5_Storage 0 0
PNDE7 32.5 9 0 TABULAR PNDE7_Storage 0 0
FSDE6 32.5 9 0 TABULAR FSDE6_Storage 0 0
PNDW3 118.3 11 0 TABULAR PNDW3_Storage 0 0
;Existing Stock Pond 1
EX_STOCK_POND_1 142 8.8 0 TABULAR EX_STOCKPOND 0 0
;Pond 1 From Homestead Filing 2 by M&S,dated 1/20
FSD12A 157 9.83 0 TABULAR FSD12A_Storage 0 0
EX_STOCK_POND_2 229.1 7 0 TABULAR EX_STOCKPOND_2 0 0

[CONDUITS]
;;Name From Node To Node Length Roughness InOffset OutOffset InitFlow MaxFlow
;;---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
RT-1 SC3-81 DP-75 3975 .05 0 0 0 0
RT-10A SC3-19 FSD18 1940 0.05 0 0 0 0
RT-10B DP-26 DP-87 1940 0.013 0 0 0 0
RT-11A 81 DP-69 1275 0.05 0 0 0 0
RT-11B DP-69 DP-87 2960 0.05 0 0 0 0
RT-11C DP-87 EX_STOCK_POND_1 2590 0.05 0 0 0 0
RT-12A DP-22 DP-21 2260 0.013 0 0 0 0
RT-12B DP-21 DP-68 1925 0.013 0 0 0 0
RT-16 SC3-6A FSD06 1250 0.013 0 0 0 0
RT-17B FSD9_OUTLET DP-61 3375 0.013 0 0 0 0

RT-18	DP-61	DP-60A	2500	0.05	0	0	0	0
RT-19	SC3-61	DP-60A	1200	0.013	0	0	0	0
RT-1E	FSDE1_Outlet	DP-1E	300	.021	0	0	0	0
RT-2	SC3-80	DP-75	4570	0.05	0	0	0	0
RT-20	DP-60A	DP-53A	400	0.05	0	0	0	0
RT-21	DP-25	FSD27	3300	0.013	0	0	0	0
RT-22	79	FSD27	2000	.013	0	0	0	0
RT-2E	DP-1E	DP-2E	2000	.02	0	0	0	0
RT-3	SC3-82	DP-74	2360	.05	0	0	0	0
RT-3E	FSDE2_Outlet	DP-2E	400	.021	0	0	0	0
RT-4	DP-74	DP-75	2695	0.05	0	0	0	0
RT-4E	DP-2E	DP-3E	3600	0.021	0	0	0	0
RT-5	DP-75	DP-77	4100	0.05	0	0	0	0
RT-5E	DP-3E	DP-4E	1250	0.021	0	0	0	0
RT-6	SC3-79	DP-78	3030	0.05	0	0	0	0
RT-6B	DP-78	DP-77	6145	0.05	0	0	0	0
RT-6E	FSDE4_Outlet	DP-4E	1485	0.021	0	0	0	0
RT-7A	SC3-89	DP-77	1035	.013	0	0	0	0
RT-7E	DP-4E	PNDE7	1410	0.021	0	0	0	0
RT-8	FSD20	DP-73	625	0.013	0	0	0	0
RT-9A	DP-77	DP-73	2600	0.05	0	0	0	0
RT-9B	DP-73	DP-72	760	0.05	0	0	0	0
RT-9C	DP-72	DP-71	1450	0.05	0	0	0	0
RT-9D	DP-71	DP-70	1490	0.05	0	0	0	0
RT-14	DP-63	DP-61	1765	0.05	0	0	0	0
1	SC3-74	DP-74	1	0.05	0	0	0	0
2	SC3-73	DP-75	1	0.05	0	0	0	0
3	SC3-75	DP-75	1	0.05	0	0	0	0
4	SC3-76	DP-75	1	0.05	0	0	0	0
5	SC3-78	DP-78	1	0.05	0	0	0	0
6	SC3-72	FSD72	1	0.05	0	0	0	0
7	SC3-77	DP-77	1	0.05	0	0	0	0
8	SC3-88	DP-77	1	0.05	0	0	0	0
9	SCE-1	FSDE1	1	0.01	0	0	0	0
10	SCE-2	DP-1E	1	0.01	0	0	0	0
11	SC3-26	DP-71	1	0.05	0	0	0	0
12	SC3-27	FSD27	1	0.05	0	0	0	0
13	SC3-23	FSD23	1	0.05	0	0	0	0
14	SC3-21	FSD21	1	0.05	0	0	0	0
15	SC3-25	DP-25	1	0.05	0	0	0	0
16	SC3-24B	DP-72	1	0.05	0	0	0	0
17	SC3-22	FSD22	1	0.05	0	0	0	0
18	SC3-17B	FSD17B	1	0.05	0	0	0	0
20	SC3-20	FSD20	1	0.05	0	0	0	0
22	SC3-14B	FSD14B	1	0.05	0	0	0	0
24	SC3-14A	FSD14A	1	0.05	0	0	0	0
25	SC3-13	FSD13	1	0.05	0	0	0	0
27	SCE-7	FSDE4	1	0.01	0	0	0	0
28	SCE-8	FSDE5	1	0.01	0	0	0	0
29	SCE-5	FSDE3	1	0.01	0	0	0	0
34	SC3-18	FSD18	1	0.05	0	0	0	0
36	SCE-3	FSDE2	1	0.01	0	0	0	0
37	SCE-4	DP-2E	1	0.01	0	0	0	0
38	SC3-9	FSD09	1	0.05	0	0	0	0
RT-17A	SC3-8	FSD09	5000	0.04	0	0	0	0
39	SC3-15A	DP-26	1	0.05	0	0	0	0
40	SC3-15B	FSD15B	1	0.05	0	0	0	0

```
42          SC3-12        FSD12         1       0.05     0       0       0       0
44          SCE-11        PNDE7         1       0.01     0       0       0       0
45          SCE-9         DP-4E         1       0.01     0       0       0       0
46          SCE-6         DP-3E         1       0.01     0       0       0       0
47          SCE-14        DP-2E         1       0.01     0       0       0       0
48          SCE-13        DP-1E         1       0.01     0       0       0       0
51          SCE-10        FSDE6         1       0.01     0       0       0       0
54          SC3-11B       FSD11B        1       0.05     0       0       0       0
56          SC3-11A       FSD06         1       0.05     0       0       0       0
58          DP-68         PNDW3         1       0.05     0       0       0       0
63          SC3-5A        FSD05         1       0.05     0       0       0       0
65          SC3-1A        FSD1          1       0.05     0       0       0       0
67          DP-53A        SC3_OUTFALL   1       0.05     0       0       0       0
RT-15A      SC3-7         DP-64         900     0.013    0       0       0       0
RT-15B      DP-64         FSD06         1450    0.013    0       0       0       0
69          SC3-6C        FSD06         1       0.05     0       0       0       0
70          SC3-6B        DP-64         1       0.05     0       0       0       0
RT-25       DP-56         DP-8          1300    .05      0       0       0       0
71          DP-8          SCE_OUTFALL   400     0.01     0       0       0       0
74          SC3-10        DP-61         1       0.05     0       0       0       0
75          SC3-24A       DP-73         1       0.05     0       0       0       0
77          SC3-5B        DP-60A        1       0.05     0       0       0       0
78          SC3-17A       FSD17A        1       0.05     0       0       0       0
79          SC3-16        FSD16         1       0.05     0       0       0       0
80          80            DP-73         1389    .013     0       0       0       0
81          SC3-12A       FSD12A        1       0.01     0       0       0       0
82          SCE-15        DP-8          1       0.01     0       0       0       0
83          SC3-18B       DP-69         1       .035     0       0       0       0
84          DP-70         EX_STOCK_POND_2 1     0.035    0       0       0       0
85          SC3-12B       DP-87         1       .035     0       0       0       0
86          SC3-13A       DP-68         1       .035     0       0       0       0
87          SC3-11C       FSD14B_Outfall 1      0.03     0       0       0       0
88          82            FSD14B_Outfall 1434   0.013    0       0       0       0

[OUTLETS]
;;Name         From Node      To Node        Offset    Type          QTable/Qcoeff   Qexpon    Gated
;;------------ ---------------- ---------------- ---------- ---------------- ---------- ---------- --------
FSD01_Outlet    FSD1          DP-53A         0       TABULAR/DEPTH   FSD01_Outlet            NO
;From Aspend Meadows FDR by Matrix dated 01/19
FSD05_Outlet    FSD05         DP-60A         0       TABULAR/DEPTH   FSD05_Outlet            NO
FSD06_Outlet    FSD06         DP-61          0       TABULAR/DEPTH   FSD06_Outlet            NO
;Rough calc based on Prelim Sizing
FSD11B_Outlet   FSD11B        DP-63          0       TABULAR/DEPTH   FSD11B_Outlet           NO
FSD12_Outlet    FSD12         DP-87          0       TABULAR/DEPTH   FSD12_Outlet            NO
FSD13_Outlet    FSD13         DP-68          0       TABULAR/DEPTH   FSD13_Outlet            NO
;Rough calc based on Prelim Pond sizing
FSD14A_Outlet   FSD14A        DP-68          0       TABULAR/DEPTH   FSD14A_Outlet           NO
FSD14B_Outlet   FSD14B        82             0       TABULAR/DEPTH   FSD14B_Outlet           NO
FSD15B_Outlet   FSD15B        DP-26          0       TABULAR/DEPTH   FSD15B_Outlet           NO
FSD16_Outlet    FSD16         DP-22          0       TABULAR/DEPTH   FSD16_Outlet            NO
FSD17B_Outlet   FSD17B        DP-71          0       TABULAR/DEPTH   FSD17B_Outlet           NO
FSD18_Outlet    FSD18         DP-69          0       TABULAR/DEPTH   FSD18_Outlet            NO
FSD21_Outlet    FSD21         80             0       TABULAR/DEPTH   FSD21_Outlet            NO
;From Retreat at Timber Ridge F1 FDR
FSD22_Outlet    FSD22         DP-72          0       TABULAR/DEPTH   FSD22_Outlet            NO
FSD72_Outlet    FSD72         DP-77          0       TABULAR/DEPTH   FSD72_Outlet            NO
FSD9_Outlet     FSD09         FSD9_OUTLET    0       TABULAR/DEPTH   FSD09_Outlet            NO
```

FSDE2_Outlet FSDE2 FSDE2_Outlet 0 TABULAR/DEPTH FSDE2_Outlet NO
FSDE3_Outlet FSDE3 DP-3E 0 TABULAR/DEPTH FSDE3_Outlet NO
FSDE4_Outlet FSDE4 FSDE4_Outlet 0 TABULAR/DEPTH FSDE4_Outlet NO
FSDE5_Outlet FSDE5 DP-4E 0 TABULAR/DEPTH FSDE5_Outlet NO
FSDE6_Outlet FSDE6 PNDE7 0 TABULAR/DEPTH FSDE6_Outlet NO
FSDE1_Outlet FSDE1 FSDE1_Outlet 0 TABULAR/DEPTH FSDE1_Outlet NO
PNDE7_Outlet PNDE7 DP-56 0 TABULAR/DEPTH FSDE7_Outlet NO
FSD17A_Outlet FSD17A DP-70 0 TABULAR/DEPTH FSD17A_Outlet NO
PNDW3_Outlet PNDW3 DP-63 0 TABULAR/DEPTH PNDW3 NO
;From Retreat at Timber Ridge F1 FDR
FSD27_Outlet FSD27 DP-71 0 TABULAR/DEPTH FSD27_Outlet NO
EX_STOCK_POND_1_OUTFALL EX_STOCK_POND_1 DP-68 0 TABULAR/DEPTH EX_STOCK_POND NO
FSD23_Outlet FSD23 79 0 TABULAR/DEPTH FSD23_Outlet NO
FSD12A_Outlet FSD12A DP-87 0 TABULAR/DEPTH FSD12A_Outlet NO
EX_STOCK_POND_2_OUTLET EX_STOCK_POND_2 81 0 TABULAR/DEPTH EX_STOCKPOND_2_Outlet NO

[XSECTIONS]
;;Link Shape Geom1 Geom2 Geom3 Geom4 Barrels Culvert
;;---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
RT-1 TRAPEZOIDAL 20 6 10 10 1
RT-10A CIRCULAR 5 0 0 0 1
RT-10B CIRCULAR 5 0 0 0 1
RT-11A TRAPEZOIDAL 20 30 6 6 1
RT-11B TRAPEZOIDAL 20 30 6 6 1
RT-11C TRAPEZOIDAL 20 40 6 6 1
RT-12A CIRCULAR 4 0 0 0 1
RT-12B CIRCULAR 4.5 0 0 0 1
RT-16 CIRCULAR 3.5 0 0 0 1
RT-17B CIRCULAR 4 0 0 0 1
RT-18 TRAPEZOIDAL 20 40 6 6 1
RT-19 CIRCULAR 6 0 0 0 1
RT-1E CIRCULAR 4 0 0 0 1
RT-2 TRAPEZOIDAL 20 6 10 10 1
RT-20 TRAPEZOIDAL 20 40 6 6 1
RT-21 CIRCULAR 3.5 0 0 0 1
RT-22 CIRCULAR 3 0 0 0 1
RT-2E CIRCULAR 4 0 0 0 1
RT-3 TRAPEZOIDAL 20 6 10 10 1
RT-3E CIRCULAR 4 0 0 0 1
RT-4 TRAPEZOIDAL 20 6 10 10 1
RT-4E CIRCULAR 4 0 0 0 1
RT-5 TRAPEZOIDAL 20 10 6 6 1
RT-5E CIRCULAR 5 0 0 0 1
RT-6 TRAPEZOIDAL 20 6 10 10 1
RT-6B TRAPEZOIDAL 20 6 10 10 1
RT-6E CIRCULAR 4 0 0 0 1
RT-7A CIRCULAR 4 0 0 0 1
RT-7E CIRCULAR 6 0 0 0 1
RT-8 CIRCULAR 2 0 0 0 1
RT-9A TRAPEZOIDAL 20 30 6 6 1
RT-9B TRAPEZOIDAL 20 30 6 6 1
RT-9C TRAPEZOIDAL 20 30 6 6 1
RT-9D TRAPEZOIDAL 20 30 6 6 1
RT-14 TRAPEZOIDAL 20 40 6 6 1
1 DUMMY 0 0 0 0 1
2 DUMMY 0 0 0 0 1
3 DUMMY 0 0 0 0 1

4	DUMMY	0	0	0	0	1
5	DUMMY	0	0	0	0	1
6	DUMMY	0	0	0	0	1
7	DUMMY	0	0	0	0	1
8	DUMMY	0	0	0	0	1
9	DUMMY	0	0	0	0	1
10	DUMMY	0	0	0	0	1
11	DUMMY	0	0	0	0	1
12	DUMMY	0	0	0	0	1
13	DUMMY	0	0	0	0	1
14	DUMMY	0	0	0	0	1
15	DUMMY	0	0	0	0	1
16	DUMMY	0	0	0	0	1
17	DUMMY	0	0	0	0	1
18	DUMMY	0	0	0	0	1
20	DUMMY	0	0	0	0	1
22	DUMMY	0	0	0	0	1
24	DUMMY	0	0	0	0	1
25	DUMMY	0	0	0	0	1
27	DUMMY	0	0	0	0	1
28	DUMMY	0	0	0	0	1
29	DUMMY	0	0	0	0	1
34	DUMMY	0	0	0	0	1
36	DUMMY	0	0	0	0	1
37	DUMMY	0	0	0	0	1
38	DUMMY	0	0	0	0	1
RT-17A	TRAPEZOIDAL	20	4	4	4	1
39	DUMMY	0	0	0	0	1
40	DUMMY	0	0	0	0	1
42	DUMMY	0	0	0	0	1
44	DUMMY	0	0	0	0	1
45	DUMMY	0	0	0	0	1
46	DUMMY	0	0	0	0	1
47	DUMMY	0	0	0	0	1
48	DUMMY	0	0	0	0	1
51	DUMMY	0	0	0	0	1
54	DUMMY	0	0	0	0	1
56	DUMMY	0	0	0	0	1
58	TRAPEZOIDAL	20	40	6	6	1
63	DUMMY	0	0	0	0	1
65	DUMMY	0	0	0	0	1
67	DUMMY	0	0	0	0	1
RT-15A	CIRCULAR	4	0	0	0	1
RT-15B	CIRCULAR	6	0	0	0	1
69	DUMMY	0	0	0	0	1
70	DUMMY	0	0	0	0	1
RT-25	TRAPEZOIDAL	10	6	6	6	1
71	CIRCULAR	1	0	0	0	1
74	DUMMY	0	0	0	0	1
75	DUMMY	0	0	0	0	1
77	DUMMY	0	0	0	0	1
78	DUMMY	0	0	0	0	1
79	DUMMY	0	0	0	0	1
80	CIRCULAR	3	0	0	0	1
81	DUMMY	0	0	0	0	1
82	DUMMY	0	0	0	0	1
83	DUMMY	0	0	0	0	1

```
84          DUMMY     0           0       0       0       1
85          DUMMY     0           0       0       0       1
86          DUMMY     0           0       0       0       1
87          DUMMY     0           0       0       0       1
88          CIRCULAR  3.5         0       0       0       1

[CURVES]
;;Name         Type      X-Value   Y-Value
;;-------------- ---------- ---------- ----------
FSD01_Outlet    Rating    0         0
FSD01_Outlet              2.16      0.1
FSD01_Outlet              2.1625    1.7
FSD01_Outlet              2.37      3.3
FSD01_Outlet              2.67      10.9
FSD01_Outlet              3.03      17.5
FSD01_Outlet              3.33      25.5
;
FSD05_Outlet    Rating    0         0
FSD05_Outlet              2.71      0.1
FSD05_Outlet              3.05      0.4
FSD05_Outlet              3.27      0.5
FSD05_Outlet              3.50375   3.2
FSD05_Outlet              4.04      3.6
FSD05_Outlet              4.44      3.7
;
FSD06_Outlet    Rating    0         0
FSD06_Outlet              4.13      1.7
FSD06_Outlet              5.98      3.0
FSD06_Outlet              6.77      3.4
FSD06_Outlet              7.35      5.1
FSD06_Outlet              7.76      38.8
FSD06_Outlet              8.05      77.3
FSD06_Outlet              8.43      139.3
;
FSD09_Outlet    Rating    0         0
FSD09_Outlet              3.58      1.1
FSD09_Outlet              4.55      1.4
FSD09_Outlet              5.30      7.7
FSD09_Outlet              6.04      43.3
FSD09_Outlet              7.15      141.1
FSD09_Outlet              7.83      219.9
FSD09_Outlet              8.71      285.0
;
FSD11A_Outlet   Rating    0         0
FSD11A_Outlet             3.33      0.1
FSD11A_Outlet             3.335     1.6
FSD11A_Outlet             3.57      3.2
FSD11A_Outlet             3.95      7.5
FSD11A_Outlet             4.45      9.7
FSD11A_Outlet             4.94      12.4
;
FSD11B_Outlet   Rating    0         0
FSD11B_Outlet             2.94      0.7
FSD11B_Outlet             4.97      1.6
FSD11B_Outlet             5.25      7.5
FSD11B_Outlet             5.46      16.4
FSD11B_Outlet             5.76      32.7
```

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FSD11B_Outlet          5.97     46.4
FSD11B_Outlet          6.26     67.5
FSD11B_Outlet          6.84     137.8
;
FSD12_Outlet    Rating    0       0
FSD12_Outlet           2.77     0
FSD12_Outlet           4.50     0
FSD12_Outlet           4.93     13.2
FSD12_Outlet           5.21     26.7
FSD12_Outlet           5.51     62.0
FSD12_Outlet           5.78     80.2
FSD12_Outlet           6.33     103.1
;
FSD13_Outlet    Rating    0       0
FSD13_Outlet           2.85     0.3
FSD13_Outlet           4.80     0.8
FSD13_Outlet           5.14     5
FSD13_Outlet           5.51     13.4
FSD13_Outlet           5.90     26.3
FSD13_Outlet           6.19     37.8
FSD13_Outlet           6.59     43.8
;
FSD14A_Outlet   Rating    0       0
FSD14A_Outlet          3.17     1.5
FSD14A_Outlet          6.34     3.2
FSD14A_Outlet          6.82     18.6
FSD14A_Outlet          7.12     44.1
FSD14A_Outlet          7.51     87.6
FSD14A_Outlet          7.76     121.1
FSD14A_Outlet          8.41     128.9
FSD14A_Outlet          9.21     317.9
;
FSD14B_Outlet   Rating    0       0
FSD14B_Outlet          2.97     0.7
FSD14B_Outlet          5.24     1.5
FSD14B_Outlet          5.51     10.6
FSD14B_Outlet          5.71     22.9
FSD14B_Outlet          6.03     48.0
FSD14B_Outlet          6.22     66.5
FSD14B_Outlet          6.49     95.0
FSD14B_Outlet          7.28     158.0
;
FSD15B_Outlet   Rating    0       0
FSD15B_Outlet          3.14     0.1
FSD15B_Outlet          3.1425   1.6
FSD15B_Outlet          3.3      3.2
FSD15B_Outlet          3.63     7.3
FSD15B_Outlet          4.01     9.5
FSD15B_Outlet          4.39     12
;
FSD16_Outlet    Rating    0       0
FSD16_Outlet           4.05     2
FSD16_Outlet           6.4      6.5
FSD16_Outlet           6.85     24.4
FSD16_Outlet           7.23     59.3
FSD16_Outlet           7.69     115.4
FSD16_Outlet           8.04     149.5
```

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FSD16_Outlet           8.78     157.6
FSD16_Outlet           9.76     471.8
;
FSD16B_Outlet   Rating   0       0
FSD16B_Outlet          3.91     0
FSD16B_Outlet          4.7      0.4
FSD16B_Outlet          5.6      0.7
FSD16B_Outlet          5.61     8.3
FSD16B_Outlet          5.75     17.2
FSD16B_Outlet          6.14     28.2
;
FSD17B_Outlet   Rating   0       0
FSD17B_Outlet          4.97     0.5
FSD17B_Outlet          5.44     4.3
FSD17B_Outlet          5.76     10.0
FSD17B_Outlet          6.13     20.1
FSD17B_Outlet          6.37     28.0
FSD17B_Outlet          6.73     36.2
FSD17B_Outlet          7.77     91.0
;
FSD18_Outlet    Rating   0       0
FSD18_Outlet           3.32     0.7
FSD18_Outlet           4.27     0.8
FSD18_Outlet           4.80     2.3
FSD18_Outlet           6.22     20.6
FSD18_Outlet           7.11     43.8
FSD18_Outlet           8.35     91.5
FSD18_Outlet           9.02     124.0
FSD18_Outlet           9.94     173.8
;
FSD17A_Outlet   Rating   0       0
FSD17A_Outlet          3.13     0.2
FSD17A_Outlet          4.18     1.0
FSD17A_Outlet          4.34     3.4
FSD17A_Outlet          4.50     6.8
FSD17A_Outlet          4.73     13.4
FSD17A_Outlet          4.88     18.2
FSD17A_Outlet          5.09     25.4
FSD17A_Outlet          5.75     67.6
;
FSD20_Outlet    Rating   0       0
FSD20_Outlet           3.6      0.4
FSD20_Outlet           3.6055   5.5
FSD20_Outlet           3.64     11.1
FSD20_Outlet           3.94     25.7
FSD20_Outlet           4.335    33.1
FSD20_Outlet           4.83     42.5
;
FSD21_Outlet    Rating   0       0
FSD21_Outlet           2.385    0.3
FSD21_Outlet           2.3855   4.0
FSD21_Outlet           2.645    8.0
FSD21_Outlet           2.9      12
FSD21_Outlet           3.23     14
FSD21_Outlet           3.52     16
;
FSD22_Outlet    Rating   0       0
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FSD22_Outlet           2.22     0.1
FSD22_Outlet           3.05     0.2
FSD22_Outlet           3.18     0.17
FSD22_Outlet           4.00     3.8
FSD22_Outlet           4.67     17.5
FSD22_Outlet           5.11     22.3
FSD22_Outlet           6.22     24.0
;
FSD23_Outlet    Rating    0       0
FSD23_Outlet           2       0.2
FSD23_Outlet           2.0025    2.4
FSD23_Outlet           2.22     4.9
FSD23_Outlet           2.47     11.2
FSD23_Outlet           2.77     14.5
FSD23_Outlet           3.1      18.6
;
FSD27_Outlet    Rating    0       0
FSD27_Outlet           3.65     0.5
FSD27_Outlet           5.15     0.8
FSD27_Outlet           5.37     0.858
FSD27_Outlet           6.24     17.1
FSD27_Outlet           7.13     62.2
FSD27_Outlet           7.61     85.9
FSD27_Outlet           8.91     91.9
;
FSD72_Outlet    Rating    0       0
FSD72_Outlet           4.35     0.6
FSD72_Outlet           4.3525    9.6
FSD72_Outlet           4.58     19.3
FSD72_Outlet           4.61     44.4
FSD72_Outlet           4.83     57.4
FSD72_Outlet           5.065     73.4
;
FSD77_Outlet    Rating    0       0
FSD77_Outlet           2.82     1.6
FSD77_Outlet           2.83     23.7
FSD77_Outlet           3.01     48.1
FSD77_Outlet           3.29     112.2
FSD77_Outlet           3.6      145.1
FSD77_Outlet           3.930     186.9
;
FSD81_Outlet    Rating    0       0
FSD81_Outlet           4.68     2.4
FSD81_Outlet           4.686     36.7
FSD81_Outlet           4.931     74.5
FSD81_Outlet           5.210     174.3
FSD81_Outlet           5.536     225.5
FSD81_Outlet           5.882     290.9
;
FSD82_Outlet    Rating    0       0
FSD82_Outlet           2.13     1.1
FSD82_Outlet           2.14     16.4
FSD82_Outlet           2.29     33.4
FSD82_Outlet           2.53     78.1
FSD82_Outlet           2.84     101.1
FSD82_Outlet           3.21     130.4
;
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FSD88_Outlet    Rating    0       0
FSD88_Outlet              1.543     0.8
FSD88_Outlet              1.5435    12.6
FSD88_Outlet              1.67      26.2
FSD88_Outlet              1.825     59.7
FSD88_Outlet              2.02      77.3
FSD88_Outlet              2.245     99.5
;
FSDE1_Outlet    Rating    0       0
FSDE1_Outlet              4.03      0.4
FSDE1_Outlet              5.39      1.7
FSDE1_Outlet              6.68      14.7
FSDE1_Outlet              7.36      39.5
FSDE1_Outlet              8.74      66.9
FSDE1_Outlet              10.24     71.7
FSDE1_Outlet              12.29     77.8
;
FSDE2_Outlet    Rating    0       0
FSDE2_Outlet              2.99      2.6
FSDE2_Outlet              4.74      5.7
FSDE2_Outlet              6.03      8.1
FSDE2_Outlet              6.81      24.4
FSDE2_Outlet              7.57      56.1
FSDE2_Outlet              8.19      70.0
FSDE2_Outlet              9.42      73.8
;
FSDE3_Outlet    Rating    0       0
FSDE3_Outlet              3.02      1.1
FSDE3_Outlet              5.53      6.1
FSDE3_Outlet              6.11      8.6
FSDE3_Outlet              6.73      21.6
FSDE3_Outlet              7.29      45
FSDE3_Outlet              7.71      67.4
FSDE3_Outlet              8.36      70.5
;
FSDE4_Outlet    Rating    0       0
FSDE4_Outlet              2.86      0.5
FSDE4_Outlet              5.55      4.4
FSDE4_Outlet              5.66      4.7
FSDE4_Outlet              6.36      6.1
FSDE4_Outlet              7.21      7.5
FSDE4_Outlet              7.94      8.4
FSDE4_Outlet              8.68      10.7
;
FSDE5_Outlet    Rating    0       0
FSDE5_Outlet              2.8       0.6
FSDE5_Outlet              5.76      1.2
FSDE5_Outlet              6         1.3
FSDE5_Outlet              6.58      2.1
FSDE5_Outlet              7.13      2.5
FSDE5_Outlet              7.67      3.8
;
FSDE6_Outlet    Rating    0       0
FSDE6_Outlet              3.25      1.3
FSDE6_Outlet              5.56      9.4
FSDE6_Outlet              5.94      10.3
FSDE6_Outlet              7.19      38.9
```

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FSDE6_Outlet            7.81     68.8
FSDE6_Outlet            8.75     71.8
;
PNDW3         Rating    0        0
PNDW3                   2.24     260
PNDW3                   3.86     520
PNDW3                   5.38     780
PNDW3                   6.81     1040
PNDW3                   8.29     1300
PNDW3                   9.86     1550
PNDW3                   11.10    1820
PNDW3                   11.66    2080
PNDW3                   12.17    2340
PNDW3                   12.64    2600
;
EX_STOCK_POND   Rating    0        0
EX_STOCK_POND           4.7      0
EX_STOCK_POND           4.8      0
EX_STOCK_POND           5.3      109.6
EX_STOCK_POND           5.8      310
EX_STOCK_POND           6.3      569.5
EX_STOCK_POND           6.8      876.8
EX_STOCK_POND           7.3      1225.5
EX_STOCK_POND           7.8      1610.8
EX_STOCK_POND           8.3      1970.5
EX_STOCK_POND           8.8      2106.55
;
FSDE7_Outlet    Rating    0        0
FSDE7_Outlet            1        13
FSDE7_Outlet            2        40
FSDE7_Outlet            3        80
FSDE7_Outlet            4        95
FSDE7_Outlet            5        135
FSDE7_Outlet            6        150
FSDE7_Outlet            7.3      185
FSDE7_Outlet            7.9      200
FSDE7_Outlet            8.1      225
;
FSD12A_Outlet   Rating    0        0
FSD12A_Outlet           3.35     0.1
FSD12A_Outlet           5.72     0.2
FSD12A_Outlet           5.96     0.7
FSD12A_Outlet           6.44     6.0
FSD12A_Outlet           6.91     15.8
FSD12A_Outlet           7.15     22.3
FSD12A_Outlet           7.75     23.4
;
EX_STOCKPOND_2_Outlet Rating    0        0
EX_STOCKPOND_2_Outlet           3.75     0
EX_STOCKPOND_2_Outlet           4        38.75
EX_STOCKPOND_2_Outlet           4.25     109.6015511
EX_STOCKPOND_2_Outlet           4.5      201.3509064
EX_STOCKPOND_2_Outlet           4.75     310
EX_STOCKPOND_2_Outlet           5        433.2381706
EX_STOCKPOND_2_Outlet           5.25     569.5063652
EX_STOCKPOND_2_Outlet           5.5      717.6600431
EX_STOCKPOND_2_Outlet           5.75     876.8124087
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EX_STOCKPOND_2_Outlet          6        1046.25
EX_STOCKPOND_2_Outlet          6.25     1225.382593
EX_STOCKPOND_2_Outlet          6.5      1413.711317
EX_STOCKPOND_2_Outlet          6.75     1610.807251
EX_STOCKPOND_2_Outlet          7        1816.296455
;
EX_STOCKPOND    Storage   0       13552
EX_STOCKPOND              0.8     36946
EX_STOCKPOND              1.8     54433
EX_STOCKPOND              2.8     72816
EX_STOCKPOND              3.8     89267
EX_STOCKPOND              4.8     101045
EX_STOCKPOND              5.8     111820
EX_STOCKPOND              6.8     133230
EX_STOCKPOND              7.8     162130
EX_STOCKPOND              8.8     191693
;
EX_STOCKPOND_2  Storage   0       45017
EX_STOCKPOND_2            1       48281
EX_STOCKPOND_2            2       51675
EX_STOCKPOND_2            3       55198
EX_STOCKPOND_2            4       58850
EX_STOCKPOND_2            5       62632
EX_STOCKPOND_2            6       79924
EX_STOCKPOND_2            7       91373
;
FSD01_Storage   Storage   0       0
FSD01_Storage             1       30456
FSD01_Storage             2       33376
FSD01_Storage             3       36424
FSD01_Storage             4       39600
FSD01_Storage             5       42906
FSD01_Storage             6       46336
FSD01_Storage             7       49896
FSD01_Storage             8       53584
FSD01_Storage             9       57400
;
FSD05_Storage   Storage   0       77
FSD05_Storage             0.5     77
FSD05_Storage             1.5     77
FSD05_Storage             2       4494
FSD05_Storage             3       50208
FSD05_Storage             4       54337
FSD05_Storage             5       58563
FSD05_Storage             6       62889
FSD05_Storage             7       67315
FSD05_Storage             8       71840
;
FSD06_Storage   Storage   0       20
FSD06_Storage             0.5     1328
FSD06_Storage             1.5     13823
FSD06_Storage             2.5     40724
FSD06_Storage             3.5     71720
FSD06_Storage             4.5     112095
FSD06_Storage             5.5     136106
FSD06_Storage             6.5     158377
FSD06_Storage             7.5     174976
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FSD06_Storage          8.5      188903
FSD06_Storage          9.5      199637
FSD06_Storage          10.5     210510
;
FSD09_Storage   Storage   0       20
FSD09_Storage          1       7181
FSD09_Storage          2       30115
FSD09_Storage          3       49313
FSD09_Storage          4       52785
FSD09_Storage          5       74559
FSD09_Storage          6       79051
FSD09_Storage          7       84185
FSD09_Storage          8       98917
FSD09_Storage          9       94245
FSD09_Storage          10      99228
FSD09_Storage          11      104318
;
FSD11A_Storage  Storage   0       0
FSD11A_Storage          1       3864
FSD11A_Storage          2       5000
FSD11A_Storage          3       6264
FSD11A_Storage          4       7656
FSD11A_Storage          5       9196
FSD11A_Storage          6       10824
FSD11A_Storage          7       12600
FSD11A_Storage          8       14504
;
FSD11B_Storage  Storage   0       525
FSD11B_Storage          2       25865
FSD11B_Storage          4       70579
FSD11B_Storage          6       119914
FSD11B_Storage          8       147297
;
FSD12_Storage   Storage   0       2326
FSD12_Storage          1       9156
FSD12_Storage          3       14117
FSD12_Storage          5       29614
FSD12_Storage          7       46467
FSD12_Storage          9       55697
;
FSD12A_Storage  Storage   0       0
FSD12A_Storage          0.33     40
FSD12A_Storage          0.83     100
FSD12A_Storage          1.83     4187
FSD12A_Storage          3.83     8006
FSD12A_Storage          5.83     11106
FSD12A_Storage          7.83     14529
FSD12A_Storage          9.83     18087
;
FSD13_Storage   Storage   0       10
FSD13_Storage          0.5      457
FSD13_Storage          1.5      7423
FSD13_Storage          2.5      20206
FSD13_Storage          3.5      28371
FSD13_Storage          4.5      33351
FSD13_Storage          5.5      37998
FSD13_Storage          6.5      41980
```

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FSD13_Storage           7.5     43012
FSD13_Storage           8.5     50147
FSD13_Storage           9.5     54386
FSD13_Storage           10.5    58728
;
FSD14A_Storage  Storage  0      200
FSD14A_Storage          2       50000
FSD14A_Storage          4       85000
FSD14A_Storage          6       100000
FSD14A_Storage          8       118000
FSD14A_Storage          10      132000
;
FSD14B_Storage  Storage  0      100
FSD14B_Storage          2       25000
FSD14B_Storage          4       63400
FSD14B_Storage          6       72250
FSD14B_Storage          8       81500
FSD14B_Storage          10      91150
;
FSD15B        Storage  0       0
FSD15B                3.14    26963.64
FSD15B                3.1425  26985.42
FSD15B                3.3     28706.04
FSD15B                3.63    33062.04
FSD15B                4.01    37897.2
FSD15B                4.39    42688.8
;
FSD16_Storage   Storage  0      683
FSD16_Storage           2       21230
FSD16_Storage           4       160188
FSD16_Storage           6       237278
FSD16_Storage           8       253964
FSD16_Storage           10      271164
;
FSD16B_Storage  Storage  0      0
FSD16B_Storage          1       18943
FSD16B_Storage          2       43220
FSD16B_Storage          3       46969
FSD16B_Storage          4       50873
FSD16B_Storage          5       54930
FSD16B_Storage          6       59144
FSD16B_Storage          7       63512
FSD16B_Storage          8       68024
FSD16B_Storage          9       70710
FSD16B_Storage          10      77514
;
FSD17A_Storage  Storage  0      125
FSD17A_Storage          1       125
FSD17A_Storage          2       7048
FSD17A_Storage          3       24371
FSD17A_Storage          4       52094
FSD17A_Storage          5       80914
FSD17A_Storage          6       85809
FSD17A_Storage          7       90832
FSD17A_Storage          8       95983
FSD17A_Storage          9       101262
FSD17A_Storage          9.9     106123
```

;
FSD17B_Storage Storage 0 128
FSD17B_Storage 1 128
FSD17B_Storage 2 15681
FSD17B_Storage 3 17851
FSD17B_Storage 4 20149
FSD17B_Storage 5 22575
FSD17B_Storage 6 25129
FSD17B_Storage 7 27811
FSD17B_Storage 8 30621
FSD17B_Storage 9 33559
FSD17B_Storage 9.8 36002
;
FSD18_Storage Storage 0 90
FSD18_Storage 0.24 331
FSD18_Storage 1.24 7689
FSD18_Storage 2.24 26604
FSD18_Storage 3.24 37234
FSD18_Storage 4.24 43658
FSD18_Storage 5.24 47762
FSD18_Storage 6.24 51250
FSD18_Storage 7.24 54827
FSD18_Storage 8.24 58544
FSD18_Storage 9.24 62316
FSD18_Storage 9.99 65152
FSD18_Storage 10.24 66643
FSD18_Storage 11.24 70696
FSD18_Storage 12.24 74859
;
FSD20_Storage Storage 0 0
FSD20_Storage 1 9292
FSD20_Storage 2 10676
FSD20_Storage 3 12430
FSD20_Storage 4 14013
FSD20_Storage 5 15785
FSD20_Storage 6 17656
FSD20_Storage 7 19626
FSD20_Storage 8 21985
FSD20_Storage 9 24472
;
FSD21_Storage Storage 0 0
FSD21_Storage 1 9292
FSD21_Storage 2 10676
FSD21_Storage 3 12430
FSD21_Storage 4 14013
FSD21_Storage 5 15785
FSD21_Storage 6 17656
FSD21_Storage 7 19626
FSD21_Storage 8 21985
FSD21_Storage 9 24472
;
FSD22_Storage Storage 0 50
FSD22_Storage 2 6905
FSD22_Storage 4 12575
FSD22_Storage 6 18016
FSD22_Storage 8 26430
;

```
FSD23_Storage   Storage   0       0
FSD23_Storage           1       8576
FSD23_Storage           2       10224
FSD23_Storage           3       12000
FSD23_Storage           4       13904
FSD23_Storage           5       15936
FSD23_Storage           6       18096
FSD23_Storage           7       20384
FSD23_Storage           8       22800
FSD23_Storage           9       25304
;
FSD27_Storage   Storage   0       277
FSD27_Storage           2       10268
FSD27_Storage           4       30108
FSD27_Storage           6       38919
FSD27_Storage           8       45498
FSD27_Storage           10      52628
;
FSD72_Storage   Storage   0       0
FSD72_Storage           1       9292
FSD72_Storage           2       10676
FSD72_Storage           3       12430
FSD72_Storage           4       14013
FSD72_Storage           5       15785
FSD72_Storage           6       17656
FSD72_Storage           7       19626
FSD72_Storage           8       21985
FSD72_Storage           9       24472
;
FSDE1_Storage   Storage   0       0
FSDE1_Storage           1       21618
FSDE1_Storage           2       24523
FSDE1_Storage           3       27481
FSDE1_Storage           4       30595
FSDE1_Storage           5       33863
FSDE1_Storage           6       37286
FSDE1_Storage           7       40864
FSDE1_Storage           8       44579
FSDE1_Storage           9       48485
;
FSDE2_Storage   Storage   0       0
FSDE2_Storage           1       21618
FSDE2_Storage           2       24523
FSDE2_Storage           3       27481
FSDE2_Storage           4       30595
FSDE2_Storage           5       33863
FSDE2_Storage           6       37286
FSDE2_Storage           7       40864
FSDE2_Storage           8       44579
FSDE2_Storage           9       48485
;
FSDE3_Storage   Storage   0       0
FSDE3_Storage           1       30866
FSDE3_Storage           2       76123
FSDE3_Storage           3       86496
FSDE3_Storage           4       91584
FSDE3_Storage           5       96800
```

```
FSDE3_Storage          6       102144
FSDE3_Storage          7       107616
FSDE3_Storage          8       113216
FSDE3_Storage          9       118944
;
FSDE4_Storage   Storage   0       0
FSDE4_Storage          1       18943
FSDE4_Storage          2       43220
FSDE4_Storage          3       46969
FSDE4_Storage          4       50873
FSDE4_Storage          5       54930
FSDE4_Storage          6       59144
FSDE4_Storage          7       63512
FSDE4_Storage          8       68024
FSDE4_Storage          9       70710
FSDE4_Storage          10      77514
;
FSDE5_Storage   Storage   0       0
FSDE5_Storage          1       20604
FSDE5_Storage          2       23100
FSDE5_Storage          3       25724
FSDE5_Storage          4       28476
FSDE5_Storage          5       31356
FSDE5_Storage          6       34364
FSDE5_Storage          7       37500
FSDE5_Storage          8       40764
FSDE5_Storage          9       44156
;
FSDE6_Storage   Storage   0       0
FSDE6_Storage          1       35000
FSDE6_Storage          2       11000
FSDE6_Storage          3       166000
FSDE6_Storage          4       175000
FSDE6_Storage          5       180000
FSDE6_Storage          6       190000
FSDE6_Storage          7       195000
FSDE6_Storage          8       205000
FSDE6_Storage          9       210000
;
PNDE7_Storage   Storage   0       0
PNDE7_Storage          1       35000
PNDE7_Storage          2       110000
PNDE7_Storage          3       165500
PNDE7_Storage          4       176000
PNDE7_Storage          5       179100
PNDE7_Storage          6       191000
PNDE7_Storage          7       285000
PNDE7_Storage          8       310000
PNDE7_Storage          9       325000
;
PNDW3_Storage   Storage   0       0
PNDW3_Storage          1       9992
PNDW3_Storage          2       59043
PNDW3_Storage          3       205185
PNDW3_Storage          4       264198
PNDW3_Storage          5       285521
PNDW3_Storage          6       295282
```

```
PNDW3_Storage           7       304495
PNDW3_Storage           8       314697
PNDW3_Storage           9       324413
PNDW3_Storage           10      341308
PNDW3_Storage           11      350000

[REPORT]
;;Reporting Options
INPUT     NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units     None

[COORDINATES]
;;Node          X-Coord          Y-Coord
;;--------------- ------------------ ------------------
79              5884.515         4712.131
80              5817.704         5171.853
81              5073.229         3732.644
DP-1E           6547.197         4663.182
DP-21           5158.237         2461.303
DP-22           5459.717         3182.701
DP-25           5742.688         5221.372
DP-26           4124.592         3258.071
DP-2E           6775.999         3411.503
DP-3E           6797.533         2948.516
DP-4E           6714.169         2510.093
DP-53A          3642.762         501.684
DP-56           6504.129         1896.028
DP-60A          3963.085         867.767
DP-61           4084.215         1511.103
DP-63           4412.613         1939.097
DP-64           3794.068         2142.966
DP-68           4356.369         2316.580
DP-69           4942.894         3508.407
DP-70           5226.979         3993.237
DP-71           5442.103         4272.974
DP-72           5451.641         4665.874
DP-73           5492.018         4961.970
DP-74           4727.551         6865.062
DP-75           5365.504         6237.876
DP-77           5475.867         5618.766
DP-78           5921.485         6716.523
DP-8            6434.142         1478.802
DP-87           4444.914         2983.509
FSD9_OUTLET     3238.995         2256.727
FSDE1_Outlet    6434.271         4669.016
FSDE2_Outlet    6611.596         3515.305
FSDE4_Outlet    6354.741         2689.617
SC3-10          4194.578         1691.453
```

SC3-11A	4229.398	2117.054
SC3-11B	4810.997	2130.213
SC3-12	4428.057	3368.053
SC3-12A	4611.234	3386.371
SC3-13	4205.345	2690.104
SC3-14A	4939.468	2687.948
SC3-14B	5570.080	2881.221
SC3-15A	3957.994	3935.659
SC3-15B	4253.797	3492.256
SC3-16	5610.874	3769.538
SC3-17A	4897.039	4383.078
SC3-17B	5029.641	4689.536
SC3-18	4661.171	3672.264
SC3-18B	5224.373	3688.343
SC3-19	4700.634	5468.026
SC3-1A	3683.139	1002.356
SC3-20	5233.607	5508.402
SC3-21	6057.293	5486.868
SC3-22	5053.257	4878.525
SC3-23	6014.224	4991.580
SC3-24A	5574.257	5135.860
SC3-24B	5238.990	5048.107
SC3-25	5766.580	5548.779
SC3-26	5493.928	4529.508
SC3-27	5680.443	4700.867
SC3-5A	3887.715	1250.000
SC3-5B	4269.948	1325.370
SC3-61	4689.866	1301.144
SC3-6A	3599.724	2036.725
SC3-6B	3911.941	2278.262
SC3-6C	3931.404	1899.389
SC3-7	3866.181	2719.714
SC3-72	6243.026	5882.560
SC3-73	4660.257	6517.821
SC3-74	4487.983	7134.240
SC3-75	5230.915	6770.849
SC3-76	5642.758	7201.535
SC3-77	6251.101	6280.944
SC3-78	6185.792	7157.036
SC3-79	6385.690	8189.419
SC3-8	3648.146	4254.031
SC3-80	5591.614	8184.036
SC3-81	5125.935	8278.248
SC3-82	4579.503	7912.166
SC3-88	4902.517	6095.211
SC3-89	4886.367	5834.108
SC3-9	3303.598	3543.400
SCE-1	6399.149	5529.937
SCE-10	6035.758	2498.988
SCE-11	6797.533	2267.494
SCE-13	6727.547	5155.779
SCE-14	6773.307	4520.518
SCE-15	6197.784	1540.228
SCE-2	6541.814	5005.039
SCE-3	6329.163	3944.476
SCE-4	7030.774	3734.824
SCE-5	6151.505	3309.215

SCE-6 6725.692 3121.900
SCE-7 6024.991 2935.057
SCE-8 6533.739 2768.166
SCE-9 6893.358 2668.804
SC3-12B 4853.505 3268.196
SC3-13A 4531.145 2580.495
82 5274.019 2434.766
SC3-11C 5067.101 2217.835
SC3_OUTFALL 3610.089 362.777
SCE_OUTFALL 6437.143 1321.540
FSD14B_Outfall 5117.161 1997.567
FSD05 3903.865 964.671
FSD06 3926.222 1751.687
FSD09 3166.317 2329.405
FSD1 3551.242 727.794
FSD11B 4590.270 1990.241
FSD12 4403.012 3117.276
FSD13 4205.345 2437.077
FSD14A 4577.197 2451.551
FSD14B 5333.203 2531.289
FSD15B 4181.119 3398.044
FSD16 5397.806 3311.907
FSD17A 4947.134 4200.382
FSD17B 5126.883 4489.159
FSD18 4743.086 3557.071
FSD20 5286.628 5319.839
FSD21 5965.772 5260.758
FSD22 5271.292 4776.237
FSD23 5938.854 4787.004
FSD27 5586.231 4302.483
FSD72 5683.135 5683.368
FSDE1 6401.841 4671.258
FSDE2 6587.574 3529.941
FSDE3 6652.177 3034.653
FSDE4 6269.944 2711.639
FSDE5 6692.554 2679.337
PNDE7 6555.273 2081.761
FSDE6 6342.622 2130.213
PNDW3 4348.595 2207.747
EX_STOCK_POND_1 4407.171 2730.935
FSD12A 4556.281 3198.614
EX_STOCK_POND_2 5130.815 3839.177

[VERTICES]
;;Link X-Coord Y-Coord
;;---------- ---------- ----------
EX_STOCK_POND_1_OUTFALL 4395.690 2640.525
EX_STOCK_POND_1_OUTFALL 4394.255 2640.525

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
2-YR Type II Storm
NOTE: These warnings are generated from using 1 foot dummy conduits between basin nodes and detention ponds to ensure there is no additional travel time between the bottom of the basin and the detention pond, except where conveyed by a channel.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2021 MDDP Amendment
2-YR Type II Storm

WARNING 04: minimum elevation drop used for Conduit 1
WARNING 04: minimum elevation drop used for Conduit 2
WARNING 04: minimum elevation drop used for Conduit 3
WARNING 04: minimum elevation drop used for Conduit 4
WARNING 04: minimum elevation drop used for Conduit 5
WARNING 04: minimum elevation drop used for Conduit 6
WARNING 04: minimum elevation drop used for Conduit 7
WARNING 04: minimum elevation drop used for Conduit 8
WARNING 04: minimum elevation drop used for Conduit 9
WARNING 04: minimum elevation drop used for Conduit 10
WARNING 04: minimum elevation drop used for Conduit 11
WARNING 04: minimum elevation drop used for Conduit 12
WARNING 04: minimum elevation drop used for Conduit 14
WARNING 04: minimum elevation drop used for Conduit 15
WARNING 04: minimum elevation drop used for Conduit 16
WARNING 04: minimum elevation drop used for Conduit 17
WARNING 04: minimum elevation drop used for Conduit 18
WARNING 04: minimum elevation drop used for Conduit 20
WARNING 04: minimum elevation drop used for Conduit 22
WARNING 04: minimum elevation drop used for Conduit 27
WARNING 04: minimum elevation drop used for Conduit 28
WARNING 04: minimum elevation drop used for Conduit 29
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 54
WARNING 08: elevation drop exceeds length for Conduit 56
WARNING 04: minimum elevation drop used for Conduit 63
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 67
WARNING 04: minimum elevation drop used for Conduit 69
WARNING 04: minimum elevation drop used for Conduit 70
WARNING 04: minimum elevation drop used for Conduit 71

WARNING 04: minimum elevation drop used for Conduit 74
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 08: elevation drop exceeds length for Conduit 77
WARNING 04: minimum elevation drop used for Conduit 78
WARNING 04: minimum elevation drop used for Conduit 79
WARNING 04: minimum elevation drop used for Conduit 82
WARNING 04: minimum elevation drop used for Conduit 83
WARNING 04: minimum elevation drop used for Conduit 85
WARNING 08: elevation drop exceeds length for Conduit 87
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12_Outlet
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12A_Outlet

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 0.000 0.000
Groundwater Inflow 0.000 0.000
RDII Inflow 0.000 0.000
External Inflow 156.221 50.907
External Outflow 104.994 34.214
Flooding Loss 29.763 9.699
Evaporation Loss 0.000 0.000
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 21.723 7.079
Continuity Error (%) ..... -0.166

****
Highest Flow Instability Indexes

****
Link RT-14 (56)
Link PNDW3_Outlet (56)
Link RT-18 (56)
Link 67 (54)
Link RT-20 (54)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
79	JUNCTION	0.05	0.46	295.46	0 12:44	0.46
80	JUNCTION	0.05	0.12	331.12	0 13:28	0.12
81	JUNCTION	0.08	1.02	230.02	0 13:29	1.02
DP-1E	JUNCTION	0.12	0.83	259.73	0 12:25	0.82
DP-21	JUNCTION	0.34	0.56	184.76	0 15:17	0.56
DP-22	JUNCTION	0.34	0.56	224.76	0 15:13	0.56
DP-25	JUNCTION	0.02	0.46	332.66	0 12:15	0.44
DP-26	JUNCTION	0.05	0.64	199.84	0 12:30	0.64
DP-2E	JUNCTION	0.17	1.14	220.04	0 12:30	1.14
DP-3E	JUNCTION	0.23	1.13	130.03	0 12:36	1.13
DP-4E	JUNCTION	0.34	1.12	61.62	0 12:38	1.12
DP-53A	JUNCTION	0.16	0.63	0.63	0 14:49	0.63
DP-56	JUNCTION	0.28	0.75	32.75	0 13:27	0.75
DP-60A	JUNCTION	0.22	0.88	23.08	0 14:48	0.88
DP-61	JUNCTION	0.21	0.89	64.09	0 14:38	0.89
DP-63	JUNCTION	0.17	0.83	99.03	0 14:31	0.83
DP-64	JUNCTION	0.08	1.56	94.76	0 12:16	1.54
DP-68	JUNCTION	0.28	0.51	118.91	0 14:29	0.51
DP-69	JUNCTION	0.10	1.12	204.32	0 13:34	1.12
DP-70	JUNCTION	0.08	1.07	230.27	0 13:18	1.07
DP-71	JUNCTION	0.08	1.08	258.28	0 13:13	1.08
DP-72	JUNCTION	0.05	1.08	284.28	0 13:09	1.08
DP-73	JUNCTION	0.08	1.10	301.30	0 13:07	1.10
DP-74	JUNCTION	0.03	0.81	498.01	0 12:32	0.81
DP-75	JUNCTION	0.04	1.30	433.50	0 12:45	1.30
DP-77	JUNCTION	0.05	1.26	341.46	0 12:59	1.26
DP-78	JUNCTION	0.04	1.04	463.24	0 12:33	1.04
DP-8	JUNCTION	9.63	10.00	10.00	0 02:55	10.00
DP-87	JUNCTION	0.14	1.26	158.46	0 13:48	1.26

FSD9_OUTLET	JUNCTION	0.13	0.23	139.43	0	15:01	0.23
FSDE1_Outlet	JUNCTION	0.10	0.13	265.03	0	15:50	0.13
FSDE2_Outlet	JUNCTION	0.07	0.32	229.22	0	14:55	0.32
FSDE4_Outlet	JUNCTION	0.14	0.22	97.82	0	15:56	0.22
PNDW3_Outfall	JUNCTION	0.00	0.00	118.20	0	00:00	0.00
SC3-10	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-11A	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-11B	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-12	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-12A	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
SC3-14A	JUNCTION	0.00	0.00	118.50	0	00:00	0.00
SC3-14B	JUNCTION	0.00	0.00	184.20	0	00:00	0.00
SC3-15A	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-15B	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-16	JUNCTION	0.00	0.00	224.20	0	00:00	0.00
SC3-17A	JUNCTION	0.00	0.00	230.20	0	00:00	0.00
SC3-17B	JUNCTION	0.00	0.00	258.20	0	00:00	0.00
SC3-18	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-18B	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-19	JUNCTION	0.05	1.81	247.01	0	12:25	1.80
SC3-1A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-20	JUNCTION	0.00	0.00	324.20	0	00:00	0.00
SC3-21	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-22	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-23	JUNCTION	0.00	0.00	295.20	0	00:00	0.00
SC3-24A	JUNCTION	0.00	0.00	300.20	0	00:00	0.00
SC3-24B	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-25	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-26	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-27	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-5A	JUNCTION	0.00	0.00	22.20	0	00:00	0.00
SC3-5B	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-61	JUNCTION	0.03	0.56	28.76	0	12:20	0.56
SC3-6A	JUNCTION	0.08	1.60	88.80	0	12:15	1.59
SC3-6B	JUNCTION	0.00	0.00	93.20	0	00:00	0.00
SC3-6C	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-7	JUNCTION	0.07	1.39	118.59	0	12:15	1.38
SC3-72	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-73	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-74	JUNCTION	0.00	0.00	497.20	0	00:00	0.00
SC3-75	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-76	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-77	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-78	JUNCTION	0.00	0.00	462.20	0	00:00	0.00
SC3-79	JUNCTION	0.02	0.74	562.94	0	12:25	0.73
SC3-8	JUNCTION	0.01	0.61	247.81	0	12:25	0.61
SC3-80	JUNCTION	0.02	0.65	552.85	0	12:25	0.65
SC3-81	JUNCTION	0.02	0.72	532.92	0	12:30	0.71
SC3-82	JUNCTION	0.01	0.57	562.77	0	12:25	0.56
SC3-88	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-89	JUNCTION	0.01	0.29	375.49	0	12:20	0.29
SC3-9	JUNCTION	0.00	0.00	139.20	0	00:00	0.00
SCE-1	JUNCTION	0.00	0.00	266.00	0	00:00	0.00
SCE-10	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-11	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-13	JUNCTION	0.00	0.00	258.90	0	00:00	0.00

SCE-14	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-15	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SCE-2	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-3	JUNCTION	0.00	0.00	230.00	0	00:00	0.00
SCE-4	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-5	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-6	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-7	JUNCTION	0.00	0.00	98.00	0	00:00	0.00
SCE-8	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SCE-9	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SC3-12B	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13A	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
82	JUNCTION	0.20	0.34	184.54	0	14:46	0.34
SC3-11C	JUNCTION	0.00	0.00	165.20	0	00:00	0.00
SC3_OUTFALL	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SCE_OUTFALL	OUTFALL	0.96	1.00	1.00	0	03:23	1.00
FSD14B_Outfall	OUTFALL	0.20	0.34	162.54	0	14:49	0.34
FSD05	STORAGE	2.76	4.28	26.48	0	13:04	4.28
FSD06	STORAGE	4.84	7.09	70.29	0	17:00	7.09
FSD09	STORAGE	1.94	4.38	143.58	0	15:01	4.38
FSD1	STORAGE	1.45	1.86	1.86	1	00:07	1.86
FSD11B	STORAGE	3.21	5.02	103.22	0	14:49	5.02
FSD12	STORAGE	4.21	5.47	162.47	0	12:28	5.47
FSD13	STORAGE	3.10	5.45	123.95	0	12:40	5.45
FSD14A	STORAGE	3.71	6.41	124.81	0	14:50	6.41
FSD14B	STORAGE	3.31	5.27	189.47	0	14:46	5.27
FSD15B	STORAGE	0.53	2.12	201.32	0	13:50	2.12
FSD16	STORAGE	4.29	6.44	230.64	0	15:13	6.44
FSD17A	STORAGE	2.82	4.16	234.36	0	14:19	4.16
FSD17B	STORAGE	3.04	5.05	263.25	0	14:06	5.05
FSD18	STORAGE	2.44	5.12	208.32	0	13:53	5.12
FSD20	STORAGE	0.02	0.61	324.81	0	12:23	0.60
FSD21	STORAGE	0.64	2.35	334.55	0	13:28	2.35
FSD22	STORAGE	1.42	3.31	286.51	0	13:45	3.31
FSD23	STORAGE	0.69	2.21	298.21	0	12:44	2.21
FSD27	STORAGE	3.09	5.27	262.47	0	15:19	5.27
FSD72	STORAGE	0.88	3.25	343.45	0	14:31	3.25
FSDE1	STORAGE	1.57	2.62	268.62	0	15:50	2.62
FSDE2	STORAGE	0.30	2.13	232.13	0	14:55	2.13
FSDE3	STORAGE	2.36	4.10	133.00	0	14:50	4.10
FSDE4	STORAGE	1.96	3.06	101.06	0	15:56	3.06
FSDE5	STORAGE	2.56	5.10	65.60	0	16:46	5.10
PNDE7	STORAGE	0.34	1.41	33.91	0	13:27	1.41
FSDE6	STORAGE	2.66	4.15	36.65	0	14:38	4.15
PNDW3	STORAGE	0.09	1.09	119.39	0	14:31	1.08
EX_STOCK_POND_1	STORAGE	4.02	5.30	147.30	0	14:29	5.30
FSD12A	STORAGE	4.13	6.07	163.07	0	14:11	6.07
EX_STOCK_POND_2	STORAGE	3.16	4.34	233.44	0	13:29	4.34

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Node Inflow Summary
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	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Inflow Type	Inflow CFS	Inflow CFS	Occurrence days	Occurrence hr:min	Volume 10^6 gal	Volume 10^6 gal	Error Percent
79	JUNCTION	0.00	4.77	0	12:44	0	0.236	-0.000
80	JUNCTION	0.00	0.30	0	13:28	0	0.17	0.000
81	JUNCTION	0.00	142.31	0	13:29	0	7.81	0.000
DP-1E	JUNCTION	0.00	12.41	0	12:25	0	0.808	0.000
DP-21	JUNCTION	0.00	8.07	0	15:17	0	6.68	0.000
DP-22	JUNCTION	0.00	8.07	0	15:13	0	6.69	0.000
DP-25	JUNCTION	0.00	5.58	0	12:15	0	0.1	0.000
DP-26	JUNCTION	0.00	13.62	0	12:30	0	0.656	0.000
DP-2E	JUNCTION	0.00	24.93	0	12:30	0	1.96	0.000
DP-3E	JUNCTION	0.00	26.73	0	12:37	0	4.35	0.000
DP-4E	JUNCTION	0.00	28.34	0	12:38	0	6.28	0.000
DP-53A	JUNCTION	0.00	135.80	0	14:49	0	32.2	0.000
DP-56	JUNCTION	0.00	24.04	0	13:27	0	9.5	0.000
DP-60A	JUNCTION	0.00	135.75	0	14:48	0	32	0.000
DP-61	JUNCTION	0.00	132.90	0	14:38	0	29.2	0.000
DP-63	JUNCTION	0.00	128.57	0	14:31	0	22.9	0.000
DP-64	JUNCTION	0.00	89.76	0	12:16	0	2.43	0.000
DP-68	JUNCTION	0.00	126.27	0	14:29	0	21.3	0.000
DP-69	JUNCTION	0.00	146.52	0	13:34	0	9.34	0.000
DP-70	JUNCTION	0.00	149.57	0	13:18	0	9.27	0.000
DP-71	JUNCTION	0.00	149.28	0	13:13	0	8.59	0.000
DP-72	JUNCTION	0.00	148.02	0	13:09	0	6.94	0.000
DP-73	JUNCTION	0.00	147.28	0	13:06	0	6.72	0.000
DP-74	JUNCTION	0.00	33.68	0	12:32	0	0.987	0.000
DP-75	JUNCTION	0.00	95.13	0	12:45	0	3.6	0.000
DP-77	JUNCTION	0.00	144.08	0	12:58	0	6.14	0.000
DP-78	JUNCTION	0.00	52.82	0	12:33	0	1.6	0.000
DP-8	JUNCTION	0.00	26.31	0	13:19	0	9.85	0.002
DP-87	JUNCTION	0.00	143.88	0	13:48	0	11.5	0.000
FSD9_OUTLET	JUNCTION	0.00	1.35	0	15:01	0	1.25	0.000
FSDE1_Outlet	JUNCTION	0.00	0.26	0	15:50	0	0.326	0.000
FSDE2_Outlet	JUNCTION	0.00	1.85	0	14:55	0	0.555	0.000
FSDE4_Outlet	JUNCTION	0.00	0.79	0	15:56	0	0.782	0.000
PNDW3_Outfall	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
SC3-10	JUNCTION	2.94	2.94	0	12:20	0.0737	0.0737	0.000
SC3-11A	JUNCTION	1.99	1.99	0	12:15	0.0283	0.0283	0.000
SC3-11B	JUNCTION	68.00	68.00	0	12:15	2.12	2.12	0.000
SC3-12	JUNCTION	47.61	47.61	0	12:15	1.53	1.53	0.000
SC3-12A	JUNCTION	15.01	15.01	0	12:15	0.362	0.362	0.000
SC3-13	JUNCTION	56.24	56.24	0	12:15	1.33	1.33	0.000
SC3-14A	JUNCTION	110.65	110.65	0	12:20	4.22	4.22	0.000
SC3-14B	JUNCTION	63.13	63.13	0	12:15	2.02	2.02	0.000
SC3-15A	JUNCTION	13.21	13.21	0	12:30	0.422	0.422	0.000
SC3-15B	JUNCTION	8.38	8.38	0	12:15	0.234	0.234	0.000
SC3-16	JUNCTION	180.70	180.70	0	12:20	7.22	7.22	0.000
SC3-17A	JUNCTION	25.63	25.63	0	12:15	0.696	0.696	0.000
SC3-17B	JUNCTION	20.59	20.59	0	12:15	0.696	0.696	0.000
SC3-18	JUNCTION	22.75	22.75	0	12:15	0.721	0.721	0.000
SC3-18B	JUNCTION	1.53	1.53	0	12:25	0.0635	0.0635	0.000
SC3-19	JUNCTION	28.00	28.00	0	12:25	0.707	0.707	0.000
SC3-1A	JUNCTION	15.40	15.40	0	12:15	0.35	0.35	0.000
SC3-20	JUNCTION	9.29	9.29	0	12:20	0.215	0.215	0.000
SC3-21	JUNCTION	9.77	9.77	0	12:15	0.17	0.17	0.000
SC3-22	JUNCTION	7.15	7.15	0	12:20	0.167	0.167	0.000

SC3-23	JUNCTION	10.92	10.92	0	12:15	0.237	0.237	0.000
SC3-24A	JUNCTION	6.43	6.43	0	12:20	0.185	0.185	0.000
SC3-24B	JUNCTION	1.95	1.95	0	12:15	0.0514	0.0514	0.000
SC3-25	JUNCTION	5.58	5.58	0	12:15	0.1	0.1	0.000
SC3-26	JUNCTION	1.66	1.66	0	12:20	0.051	0.051	0.000
SC3-27	JUNCTION	14.49	14.49	0	12:20	0.628	0.628	0.000
SC3-5A	JUNCTION	48.38	48.38	0	12:15	1.13	1.13	0.000
SC3-5B	JUNCTION	60.26	60.26	0	12:15	1.62	1.62	0.000
SC3-61	JUNCTION	5.61	5.61	0	12:20	0.177	0.177	0.000
SC3-6A	JUNCTION	59.98	59.98	0	12:15	1.71	1.71	0.000
SC3-6B	JUNCTION	30.00	30.00	0	12:15	0.817	0.817	0.000
SC3-6C	JUNCTION	52.26	52.26	0	12:15	1.33	1.33	0.000
SC3-7	JUNCTION	60.94	60.94	0	12:15	1.62	1.62	0.000
SC3-72	JUNCTION	9.55	9.55	0	12:20	0.256	0.256	0.000
SC3-73	JUNCTION	12.16	12.16	0	12:25	0.337	0.337	0.000
SC3-74	JUNCTION	22.51	22.51	0	12:25	0.616	0.616	0.000
SC3-75	JUNCTION	11.12	11.12	0	12:25	0.408	0.408	0.000
SC3-76	JUNCTION	10.85	10.85	0	12:25	0.393	0.393	0.000
SC3-77	JUNCTION	8.93	8.93	0	12:30	0.327	0.327	0.000
SC3-78	JUNCTION	32.29	32.29	0	12:20	0.8	0.8	0.000
SC3-79	JUNCTION	32.26	32.26	0	12:25	0.807	0.807	0.000
SC3-8	JUNCTION	12.18	12.18	0	12:25	0.246	0.246	0.000
SC3-80	JUNCTION	22.36	22.36	0	12:25	0.631	0.631	0.000
SC3-81	JUNCTION	26.67	26.67	0	12:30	0.804	0.804	-0.000
SC3-82	JUNCTION	17.01	17.01	0	12:25	0.36	0.36	0.000
SC3-88	JUNCTION	6.28	6.28	0	12:25	0.184	0.184	0.000
SC3-89	JUNCTION	2.86	2.86	0	12:20	0.0711	0.0711	0.000
SC3-9	JUNCTION	24.66	24.66	0	12:25	0.985	0.985	0.000
SCE-1	JUNCTION	9.82	9.82	0	12:25	0.42	0.42	0.000
SCE-10	JUNCTION	106.33	106.33	0	12:15	3.39	3.39	0.000
SCE-11	JUNCTION	0.77	0.77	0	12:15	0.0138	0.0138	0.000
SCE-13	JUNCTION	10.90	10.90	0	12:25	0.404	0.404	0.000
SCE-14	JUNCTION	8.00	8.00	0	12:20	0.27	0.27	0.000
SCE-15	JUNCTION	13.60	13.60	0	12:15	0.354	0.354	0.000
SCE-2	JUNCTION	1.42	1.42	0	12:25	0.0772	0.0772	0.000
SCE-3	JUNCTION	8.50	8.50	0	12:25	0.555	0.555	0.000
SCE-4	JUNCTION	4.16	4.16	0	12:30	0.333	0.333	0.000
SCE-5	JUNCTION	71.73	71.73	0	12:15	2.59	2.59	0.000
SCE-6	JUNCTION	0.18	0.18	0	12:20	0.0103	0.0103	0.000
SCE-7	JUNCTION	33.06	33.06	0	12:15	0.884	0.884	0.000
SCE-8	JUNCTION	47.10	47.10	0	12:15	1.19	1.19	0.000
SCE-9	JUNCTION	0.22	0.22	0	12:20	0.0102	0.0102	0.000
SC3-12B	JUNCTION	2.17	2.17	0	12:20	0.0747	0.0747	0.000
SC3-13A	JUNCTION	2.61	2.61	0	12:25	0.0922	0.0922	0.000
82	JUNCTION	0.00	2.56	0	14:46	0	1.89	0.000
SC3-11C	JUNCTION	1.37	1.37	0	12:15	0.0217	0.0217	0.000
SC3_OUTFALL	OUTFALL	0.00	135.80	0	14:49	0	32.2	0.000
SCE_OUTFALL	OUTFALL	0.00	0.08	0	03:23	0	0.148	0.000
FSD14B_Outfall	OUTFALL	0.00	2.57	0	14:49	0	1.91	0.000
FSD05	STORAGE	0.00	48.38	0	12:15	0	1.13	0.024
FSD06	STORAGE	0.00	199.36	0	12:16	0	5.48	0.001
FSD09	STORAGE	0.00	29.55	0	12:35	0	1.25	0.006
FSD1	STORAGE	0.00	15.40	0	12:15	0	0.35	-0.001
FSD11B	STORAGE	0.00	68.00	0	12:15	0	2.12	0.001
FSD12	STORAGE	0.00	47.61	0	12:15	0	1.53	0.175
FSD13	STORAGE	0.00	56.24	0	12:15	0	1.33	0.072
FSD14A	STORAGE	0.00	110.65	0	12:20	0	4.22	0.002

FSD14B	STORAGE	0.00	63.13	0	12:15	0	2.02	0.001
FSD15B	STORAGE	0.00	8.38	0	12:15	0	0.234	0.006
FSD16	STORAGE	0.00	180.70	0	12:20	0	7.22	0.003
FSD17A	STORAGE	0.00	25.63	0	12:15	0	0.696	0.007
FSD17B	STORAGE	0.00	20.59	0	12:15	0	0.696	0.002
FSD18	STORAGE	0.00	39.81	0	12:31	0	1.42	0.022
FSD20	STORAGE	0.00	9.29	0	12:20	0	0.215	0.317
FSD21	STORAGE	0.00	9.77	0	12:15	0	0.17	0.011
FSD22	STORAGE	0.00	7.15	0	12:20	0	0.167	0.008
FSD23	STORAGE	0.00	10.92	0	12:15	0	0.237	0.168
FSD27	STORAGE	0.00	19.85	0	12:35	0	0.965	0.003
FSD72	STORAGE	0.00	9.55	0	12:20	0	0.256	0.012
FSDE1	STORAGE	0.00	9.82	0	12:25	0	0.42	-0.000
FSDE2	STORAGE	0.00	8.50	0	12:25	0	0.555	0.012
FSDE3	STORAGE	0.00	71.73	0	12:15	0	2.59	0.004
FSDE4	STORAGE	0.00	33.06	0	12:15	0	0.884	-0.001
FSDE5	STORAGE	0.00	47.10	0	12:15	0	1.19	0.003
PNDE7	STORAGE	0.00	31.92	0	12:41	0	9.51	0.012
FSDE6	STORAGE	0.00	106.33	0	12:15	0	3.39	0.004
PNDW3	STORAGE	0.00	126.27	0	14:29	0	21.3	1.364
EX_STOCK_POND_1	STORAGE	0.00	133.68	0	14:04	0	11.5	0.079
FSD12A	STORAGE	0.00	15.01	0	12:15	0	0.362	0.001
EX_STOCK_POND_2	STORAGE	0.00	149.57	0	13:18	0	9.27	0.142

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Node Flooding Summary
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Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-8	75.08	26.24	0 13:20	9.698	0.000

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
FSD05	23.707	6	0	0	96.396	24	0 13:03	3.66
FSD06	265.347	22	0	0	551.126	46	0 17:00	4.34
FSD09	39.835	6	0	0	134.756	19	0 15:01	1.35
FSD1	30.673	8	0	0	42.539	12	1 00:07	0.09
FSD11B	92.706	18	0	0	207.377	41	0 14:48	2.59
FSD12	56.655	23	0	0	87.709	35	0 12:27	34.11
FSD13	37.444	11	0	0	106.671	31	0 12:39	11.95
FSD14A	183.904	24	0	0	411.837	53	0 14:49	5.41
FSD14B	90.197	22	0	0	197.681	49	0 14:46	2.56

FSD15B	2.829	1	0	0	18.213	3	0	13:49	0.45
FSD16	305.746	19	0	0	705.891	44	0	15:13	8.07
FSD17A	22.544	4	0	0	66.325	11	0	14:19	0.98
FSD17B	28.250	20	0	0	66.374	46	0	14:05	1.18
FSD18	39.797	10	0	0	133.440	33	0	13:53	6.39
FSD20	0.020	0	0	0	1.711	1	0	12:23	8.86
FSD21	3.701	3	0	0	18.459	14	0	13:28	0.30
FSD22	5.129	5	0	0	18.385	18	0	13:45	0.73
FSD23	3.485	3	0	0	15.863	12	0	12:44	4.77
FSD27	37.806	12	0	0	92.863	31	0	15:18	0.83
FSD72	6.024	5	0	0	29.280	22	0	14:31	0.45
FSDE1	25.222	9	0	0	49.536	17	0	15:49	0.26
FSDE2	3.889	1	0	0	37.169	13	0	14:55	1.85
FSDE3	106.366	14	0	0	248.606	33	0	14:50	3.25
FSDE4	43.927	9	0	0	88.569	17	0	15:55	0.79
FSDE5	48.902	19	0	0	116.846	44	0	16:46	1.07
PNDE7	3.553	0	0	0	38.082	2	0	13:27	24.04
FSDE6	128.897	10	0	0	325.062	26	0	14:38	4.44
PNDW3	0.119	0	0	0	6.041	0	0	14:31	126.03
EX_STOCK_POND_1	254.992	30	0	0	357.839	42	0	14:29	110.50
FSD12A	18.796	20	0	0	36.248	40	0	14:10	0.52
EX_STOCK_POND_2	162.383	38	0	0	227.286	54	0	13:28	142.31

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
SC3_OUTFALL	96.90	15.80	135.80	32.157
SCE_OUTFALL	96.22	0.07	0.08	0.148
FSD14B_Outfall	96.89	0.94	2.57	1.907
System	96.67	16.81	138.44	34.211

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-1	CONDUIT	22.62	0 12:50	2.91	0.00	0.03
RT-10A	CONDUIT	26.75	0 12:34	4.44	0.27	0.35
RT-10B	CONDUIT	13.53	0 12:32	9.23	0.04	0.13
RT-11A	CONDUIT	139.83	0 13:34	3.86	0.00	0.05
RT-11B	CONDUIT	134.07	0 13:49	3.54	0.00	0.05
RT-11C	CONDUIT	133.68	0 14:04	2.40	0.00	0.06
RT-12A	CONDUIT	8.07	0 15:17	7.57	0.04	0.14
RT-12B	CONDUIT	8.07	0 15:19	9.42	0.02	0.10

RT-16	CONDUIT	58.99	0	12:16	14.05	0.42	0.45
RT-17B	CONDUIT	1.35	0	15:10	4.75	0.01	0.06
RT-18	CONDUIT	130.04	0	14:48	3.29	0.00	0.04
RT-19	CONDUIT	5.44	0	12:25	4.16	0.02	0.09
RT-1E	CONDUIT	0.26	0	15:51	1.98	0.00	0.03
RT-2	CONDUIT	17.16	0	12:50	2.83	0.00	0.03
RT-20	CONDUIT	135.72	0	14:49	4.89	0.00	0.03
RT-21	CONDUIT	4.82	0	12:23	7.52	0.03	0.12
RT-22	CONDUIT	4.75	0	12:48	12.99	0.05	0.15
RT-2E	CONDUIT	12.22	0	12:31	6.62	0.09	0.21
RT-3	CONDUIT	14.50	0	12:36	2.65	0.00	0.03
RT-3E	CONDUIT	1.85	0	14:57	3.91	0.01	0.08
RT-4	CONDUIT	30.94	0	12:44	3.06	0.00	0.04
RT-4E	CONDUIT	24.56	0	12:36	8.50	0.17	0.28
RT-5	CONDUIT	90.46	0	12:59	4.24	0.00	0.06
RT-5E	CONDUIT	26.72	0	12:38	11.13	0.07	0.18
RT-6	CONDUIT	28.06	0	12:39	3.37	0.00	0.03
RT-6B	CONDUIT	41.94	0	13:00	3.35	0.00	0.05
RT-6E	CONDUIT	0.79	0	16:02	2.99	0.01	0.05
RT-7A	CONDUIT	2.82	0	12:23	6.88	0.01	0.07
RT-7E	CONDUIT	28.26	0	12:41	7.75	0.08	0.19
RT-8	CONDUIT	8.86	0	12:24	11.02	0.20	0.30
RT-9A	CONDUIT	141.32	0	13:07	3.57	0.00	0.05
RT-9B	CONDUIT	147.13	0	13:09	4.04	0.00	0.05
RT-9C	CONDUIT	147.38	0	13:13	3.77	0.00	0.05
RT-9D	CONDUIT	148.61	0	13:18	3.84	0.00	0.05
RT-14	CONDUIT	127.34	0	14:37	3.45	0.00	0.04
1	DUMMY	22.51	0	12:25			
2	DUMMY	12.16	0	12:25			
3	DUMMY	11.12	0	12:25			
4	DUMMY	10.85	0	12:25			
5	DUMMY	32.29	0	12:20			
6	DUMMY	9.55	0	12:20			
7	DUMMY	8.93	0	12:30			
8	DUMMY	6.28	0	12:25			
9	DUMMY	9.82	0	12:25			
10	DUMMY	1.42	0	12:25			
11	DUMMY	1.66	0	12:20			
12	DUMMY	14.49	0	12:20			
13	DUMMY	10.92	0	12:15			
14	DUMMY	9.77	0	12:15			
15	DUMMY	5.58	0	12:15			
16	DUMMY	1.95	0	12:15			
17	DUMMY	7.15	0	12:20			
18	DUMMY	20.59	0	12:15			
20	DUMMY	9.29	0	12:20			
22	DUMMY	63.13	0	12:15			
24	DUMMY	110.65	0	12:20			
25	DUMMY	56.24	0	12:15			
27	DUMMY	33.06	0	12:15			
28	DUMMY	47.10	0	12:15			
29	DUMMY	71.73	0	12:15			
34	DUMMY	22.75	0	12:15			
36	DUMMY	8.50	0	12:25			
37	DUMMY	4.16	0	12:30			
38	DUMMY	24.66	0	12:25			
RT-17A	CONDUIT	8.84	0	12:45	3.30	0.00	0.03

39	DUMMY	13.21	0	12:30			
40	DUMMY	8.38	0	12:15			
42	DUMMY	47.61	0	12:15			
44	DUMMY	0.77	0	12:15			
45	DUMMY	0.22	0	12:20			
46	DUMMY	0.18	0	12:20			
47	DUMMY	8.00	0	12:20			
48	DUMMY	10.90	0	12:25			
51	DUMMY	106.33	0	12:15			
54	DUMMY	68.00	0	12:15			
56	DUMMY	1.99	0	12:15			
58	CONDUIT	126.27	0	14:29	5.74	0.00	0.03
63	DUMMY	48.38	0	12:15			
65	DUMMY	15.40	0	12:15			
67	DUMMY	135.80	0	14:49			
RT-15A	CONDUIT	60.46	0	12:16	15.77	0.26	0.35
RT-15B	CONDUIT	88.80	0	12:17	15.53	0.15	0.26
69	DUMMY	52.26	0	12:15			
70	DUMMY	30.00	0	12:15			
RT-25	CONDUIT	24.03	0	13:33	3.03	0.00	0.08
71	CONDUIT	0.08	0	03:23	0.10	1.08	1.00
74	DUMMY	2.94	0	12:20			
75	DUMMY	6.43	0	12:20			
77	DUMMY	60.26	0	12:15			
78	DUMMY	25.63	0	12:15			
79	DUMMY	180.70	0	12:20			
80	CONDUIT	0.30	0	13:33	3.12	0.00	0.04
81	DUMMY	15.01	0	12:15			
82	DUMMY	13.60	0	12:15			
83	DUMMY	1.53	0	12:25			
84	DUMMY	149.57	0	13:18			
85	DUMMY	2.17	0	12:20			
86	DUMMY	2.61	0	12:25			
87	DUMMY	1.37	0	12:15			
88	CONDUIT	2.56	0	14:49	5.23	0.02	0.10
FSD01_Outlet	DUMMY	0.09	1	00:07			
FSD05_Outlet	DUMMY	3.66	0	13:04			
FSD06_Outlet	DUMMY	4.34	0	17:00			
FSD11B_Outlet	DUMMY	2.59	0	14:49			
FSD12_Outlet	DUMMY	34.11	0	12:28			
FSD13_Outlet	DUMMY	11.95	0	12:40			
FSD14A_Outlet	DUMMY	5.41	0	14:50			
FSD14B_Outlet	DUMMY	2.56	0	14:46			
FSD15B_Outlet	DUMMY	0.45	0	13:50			
FSD16_Outlet	DUMMY	8.07	0	15:13			
FSD17B_Outlet	DUMMY	1.18	0	14:06			
FSD18_Outlet	DUMMY	6.39	0	13:53			
FSD21_Outlet	DUMMY	0.30	0	13:28			
FSD22_Outlet	DUMMY	0.73	0	13:45			
FSD72_Outlet	DUMMY	0.45	0	14:31			
FSD9_Outlet	DUMMY	1.35	0	15:01			
FSDE2_Outlet	DUMMY	1.85	0	14:55			
FSDE3_Outlet	DUMMY	3.25	0	14:50			
FSDE4_Outlet	DUMMY	0.79	0	15:56			
FSDE5_Outlet	DUMMY	1.07	0	16:46			
FSDE6_Outlet	DUMMY	4.44	0	14:38			
FSDE1_Outlet	DUMMY	0.26	0	15:50			

PNDE7_Outlet	DUMMY	24.04	0	13:27
FSD17A_Outlet	DUMMY	0.98	0	14:19
PNDW3_Outlet	DUMMY	126.03	0	14:31
FSD27_Outlet	DUMMY	0.83	0	15:19
EX_STOCK_POND_1_OUTFALL	DUMMY	110.50	0	14:29
FSD23_Outlet	DUMMY	4.77	0	12:44
FSD12A_Outlet	DUMMY	0.52	0	14:11
EX_STOCK_POND_2_OUTLET	DUMMY	142.31	0	13:29

****
Conduit Surcharge Summary
****

	Hours Full			Hours Above Full	Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
71	75.08	75.08	75.08	0.04	75.08

Analysis begun on: Thu Jun 23 14:17:28 2022
Analysis ended on: Thu Jun 23 14:17:29 2022
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
5-YR Type II Storm
NOTE: These warnings are generated from using 1 foot dummy conduits between basin nodes and detention ponds to ensure there is no additional travel time between the bottom of the basin and the detention pond, except where conveyed by a channel.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2021 MDDP Amendment
5-YR Type II Storm

WARNING 04: minimum elevation drop used for Conduit 1
WARNING 04: minimum elevation drop used for Conduit 2
WARNING 04: minimum elevation drop used for Conduit 3
WARNING 04: minimum elevation drop used for Conduit 4
WARNING 04: minimum elevation drop used for Conduit 5
WARNING 04: minimum elevation drop used for Conduit 6
WARNING 04: minimum elevation drop used for Conduit 7
WARNING 04: minimum elevation drop used for Conduit 8
WARNING 04: minimum elevation drop used for Conduit 9
WARNING 04: minimum elevation drop used for Conduit 10
WARNING 04: minimum elevation drop used for Conduit 11
WARNING 04: minimum elevation drop used for Conduit 12
WARNING 04: minimum elevation drop used for Conduit 14
WARNING 04: minimum elevation drop used for Conduit 15
WARNING 04: minimum elevation drop used for Conduit 16
WARNING 04: minimum elevation drop used for Conduit 17
WARNING 04: minimum elevation drop used for Conduit 18
WARNING 04: minimum elevation drop used for Conduit 20
WARNING 04: minimum elevation drop used for Conduit 22
WARNING 04: minimum elevation drop used for Conduit 27
WARNING 04: minimum elevation drop used for Conduit 28
WARNING 04: minimum elevation drop used for Conduit 29
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 54
WARNING 08: elevation drop exceeds length for Conduit 56
WARNING 04: minimum elevation drop used for Conduit 63
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 67
WARNING 04: minimum elevation drop used for Conduit 69
WARNING 04: minimum elevation drop used for Conduit 70
WARNING 04: minimum elevation drop used for Conduit 71

WARNING 04: minimum elevation drop used for Conduit 74
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 08: elevation drop exceeds length for Conduit 77
WARNING 04: minimum elevation drop used for Conduit 78
WARNING 04: minimum elevation drop used for Conduit 79
WARNING 04: minimum elevation drop used for Conduit 82
WARNING 04: minimum elevation drop used for Conduit 83
WARNING 04: minimum elevation drop used for Conduit 85
WARNING 08: elevation drop exceeds length for Conduit 87
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12_Outlet
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12A_Outlet

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 0.000 0.000
Groundwater Inflow 0.000 0.000
RDII Inflow 0.000 0.000
External Inflow 257.051 83.764
External Outflow 189.596 61.783
Flooding Loss 44.514 14.505
Evaporation Loss 0.000 0.000
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 23.814 7.760
Continuity Error (%) ..... -0.339

****
Highest Flow Instability Indexes

****
Link PNDW3_Outlet (54)
Link RT-14 (54)
Link RT-18 (54)
Link 67 (53)
Link RT-20 (53)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
79	JUNCTION	0.06	0.77	295.77	0 12:34	0.77
80	JUNCTION	0.06	0.61	331.61	0 12:38	0.61
81	JUNCTION	0.11	2.00	231.00	0 13:08	2.00
DP-1E	JUNCTION	0.17	1.28	260.18	0 12:25	1.28
DP-21	JUNCTION	0.37	1.33	185.53	0 13:25	1.33
DP-22	JUNCTION	0.37	1.33	225.53	0 13:23	1.33
DP-25	JUNCTION	0.02	0.67	332.87	0 12:15	0.65
DP-26	JUNCTION	0.07	1.08	200.28	0 12:30	1.07
DP-2E	JUNCTION	0.22	1.76	220.66	0 12:28	1.75
DP-3E	JUNCTION	0.28	1.75	130.65	0 12:33	1.74
DP-4E	JUNCTION	0.40	1.66	62.16	0 12:35	1.66
DP-53A	JUNCTION	0.19	1.42	1.42	0 14:03	1.42
DP-56	JUNCTION	0.34	1.02	33.02	0 13:33	1.02
DP-60A	JUNCTION	0.27	1.98	24.18	0 14:02	1.98
DP-61	JUNCTION	0.26	1.98	65.18	0 13:57	1.98
DP-63	JUNCTION	0.21	1.77	99.97	0 13:56	1.77
DP-64	JUNCTION	0.09	1.91	95.11	0 12:16	1.88
DP-68	JUNCTION	0.31	1.24	119.64	0 13:35	1.24
DP-69	JUNCTION	0.14	2.24	205.44	0 13:11	2.24
DP-70	JUNCTION	0.11	2.03	231.23	0 13:06	2.03
DP-71	JUNCTION	0.11	2.04	259.24	0 13:02	2.03
DP-72	JUNCTION	0.08	2.01	285.21	0 12:59	2.01
DP-73	JUNCTION	0.10	2.02	302.22	0 12:58	2.01
DP-74	JUNCTION	0.04	1.29	498.49	0 12:30	1.29
DP-75	JUNCTION	0.07	2.17	434.37	0 12:41	2.17
DP-77	JUNCTION	0.08	2.13	342.33	0 12:51	2.13
DP-78	JUNCTION	0.05	1.59	463.79	0 12:31	1.59
DP-8	JUNCTION	9.70	10.00	10.00	0 02:24	10.00
DP-87	JUNCTION	0.18	2.62	159.82	0 13:19	2.62

FSD9_OUTLET	JUNCTION	0.18	1.32	140.52	0	13:18	1.32
FSDE1_Outlet	JUNCTION	0.13	0.23	265.13	0	15:40	0.23
FSDE2_Outlet	JUNCTION	0.09	0.43	229.33	0	14:52	0.43
FSDE4_Outlet	JUNCTION	0.16	0.30	97.90	0	14:31	0.30
PNDW3_Outfall	JUNCTION	0.00	0.00	118.20	0	00:00	0.00
SC3-10	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-11A	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-11B	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-12	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-12A	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
SC3-14A	JUNCTION	0.00	0.00	118.50	0	00:00	0.00
SC3-14B	JUNCTION	0.00	0.00	184.20	0	00:00	0.00
SC3-15A	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-15B	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-16	JUNCTION	0.00	0.00	224.20	0	00:00	0.00
SC3-17A	JUNCTION	0.00	0.00	230.20	0	00:00	0.00
SC3-17B	JUNCTION	0.00	0.00	258.20	0	00:00	0.00
SC3-18	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-18B	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-19	JUNCTION	0.08	3.36	248.56	0	12:25	3.34
SC3-1A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-20	JUNCTION	0.00	0.00	324.20	0	00:00	0.00
SC3-21	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-22	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-23	JUNCTION	0.00	0.00	295.20	0	00:00	0.00
SC3-24A	JUNCTION	0.00	0.00	300.20	0	00:00	0.00
SC3-24B	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-25	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-26	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-27	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-5A	JUNCTION	0.00	0.00	22.20	0	00:00	0.00
SC3-5B	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-61	JUNCTION	0.04	1.11	29.31	0	12:20	1.10
SC3-6A	JUNCTION	0.09	1.96	89.16	0	12:15	1.94
SC3-6B	JUNCTION	0.00	0.00	93.20	0	00:00	0.00
SC3-6C	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-7	JUNCTION	0.08	1.70	118.90	0	12:15	1.68
SC3-72	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-73	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-74	JUNCTION	0.00	0.00	497.20	0	00:00	0.00
SC3-75	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-76	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-77	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-78	JUNCTION	0.00	0.00	462.20	0	00:00	0.00
SC3-79	JUNCTION	0.03	1.14	563.34	0	12:25	1.13
SC3-8	JUNCTION	0.02	1.30	248.50	0	12:20	1.29
SC3-80	JUNCTION	0.03	1.01	553.21	0	12:25	1.01
SC3-81	JUNCTION	0.03	1.20	533.40	0	12:30	1.19
SC3-82	JUNCTION	0.02	0.95	563.15	0	12:20	0.95
SC3-88	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-89	JUNCTION	0.01	0.49	375.69	0	12:20	0.49
SC3-9	JUNCTION	0.00	0.00	139.20	0	00:00	0.00
SCE-1	JUNCTION	0.00	0.00	266.00	0	00:00	0.00
SCE-10	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-11	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-13	JUNCTION	0.00	0.00	258.90	0	00:00	0.00

SCE-14	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-15	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SCE-2	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-3	JUNCTION	0.00	0.00	230.00	0	00:00	0.00
SCE-4	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-5	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-6	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-7	JUNCTION	0.00	0.00	98.00	0	00:00	0.00
SCE-8	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SCE-9	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SC3-12B	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13A	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
82	JUNCTION	0.22	0.94	185.14	0	12:55	0.94
SC3-11C	JUNCTION	0.00	0.00	165.20	0	00:00	0.00
SC3_OUTFALL	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SCE_OUTFALL	OUTFALL	0.97	1.00	1.00	0	02:52	1.00
FSD14B_Outfall	OUTFALL	0.22	0.94	163.14	0	12:56	0.94
FSD05	STORAGE	2.90	4.99	27.19	0	13:19	4.99
FSD06	STORAGE	5.10	7.72	70.92	0	12:55	7.72
FSD09	STORAGE	2.36	6.13	145.33	0	13:18	6.12
FSD1	STORAGE	1.70	2.31	2.31	0	12:58	2.31
FSD11B	STORAGE	3.31	5.43	103.63	0	13:01	5.43
FSD12	STORAGE	4.27	5.70	162.70	0	12:23	5.69
FSD13	STORAGE	3.19	6.00	124.50	0	12:30	6.00
FSD14A	STORAGE	3.84	7.03	125.43	0	13:08	7.03
FSD14B	STORAGE	3.41	5.66	189.86	0	12:55	5.66
FSD15B	STORAGE	0.72	2.44	201.64	0	14:01	2.44
FSD16	STORAGE	4.43	7.08	231.28	0	13:23	7.08
FSD17A	STORAGE	2.92	4.47	234.67	0	13:00	4.47
FSD17B	STORAGE	3.14	5.65	263.85	0	13:04	5.65
FSD18	STORAGE	2.59	6.77	209.97	0	13:15	6.77
FSD20	STORAGE	0.03	0.94	325.14	0	12:23	0.94
FSD21	STORAGE	0.69	2.71	334.91	0	12:38	2.71
FSD22	STORAGE	1.50	4.12	287.32	0	12:57	4.12
FSD23	STORAGE	0.73	2.65	298.65	0	12:34	2.65
FSD27	STORAGE	3.28	6.21	263.41	0	13:25	6.21
FSD72	STORAGE	1.33	4.41	344.61	0	12:56	4.41
FSDE1	STORAGE	2.67	4.43	270.43	0	15:40	4.43
FSDE2	STORAGE	0.51	3.43	233.43	0	14:52	3.43
FSDE3	STORAGE	2.65	4.96	133.86	0	14:29	4.96
FSDE4	STORAGE	2.15	3.59	101.59	0	14:31	3.59
FSDE5	STORAGE	3.19	6.16	66.66	0	15:35	6.16
PNDE7	STORAGE	0.46	2.10	34.60	0	13:33	2.10
FSDE6	STORAGE	3.00	4.91	37.41	0	14:10	4.91
PNDW3	STORAGE	0.17	3.56	121.86	0	13:56	3.56
EX_STOCK_POND_1	STORAGE	4.08	6.17	148.17	0	13:36	6.17
FSD12A	STORAGE	4.22	6.65	163.65	0	12:44	6.65
EX_STOCK_POND_2	STORAGE	3.20	5.08	234.18	0	13:08	5.08

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Node Inflow Summary
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	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Inflow Type	Inflow CFS	Occurrence CFS	Occurrence days hr:min	Volume 10^6 gal	Volume 10^6 gal	Error Percent
79	JUNCTION	0.00	13.23	0 12:34	0	0.43	0.000
80	JUNCTION	0.00	8.99	0 12:38	0	0.328	0.000
81	JUNCTION	0.00	476.24	0 13:08	0	19.8	0.000
DP-1E	JUNCTION	0.00	29.33	0 12:25	0	1.69	0.000
DP-21	JUNCTION	0.00	45.76	0 13:25	0	9.25	0.000
DP-22	JUNCTION	0.00	45.78	0 13:23	0	9.26	0.000
DP-25	JUNCTION	0.00	12.02	0 12:15	0	0.198	0.000
DP-26	JUNCTION	0.00	38.87	0 12:30	0	1.54	0.000
DP-2E	JUNCTION	0.00	56.12	0 12:28	0	3.8	0.000
DP-3E	JUNCTION	0.00	59.28	0 12:34	0	6.99	0.000
DP-4E	JUNCTION	0.00	61.94	0 12:35	0	9.5	0.000
DP-53A	JUNCTION	0.00	545.87	0 14:03	0	59	0.000
DP-56	JUNCTION	0.00	43.91	0 13:33	0	14	0.000
DP-60A	JUNCTION	0.00	544.14	0 14:02	0	58.7	0.000
DP-61	JUNCTION	0.00	535.22	0 13:57	0	54.4	-0.000
DP-63	JUNCTION	0.00	480.38	0 13:56	0	43.7	0.000
DP-64	JUNCTION	0.00	133.15	0 12:16	0	3.29	0.000
DP-68	JUNCTION	0.00	579.69	0 13:35	0	41.3	0.000
DP-69	JUNCTION	0.00	512.38	0 13:11	0	23	0.000
DP-70	JUNCTION	0.00	477.23	0 13:06	0	21.2	0.000
DP-71	JUNCTION	0.00	472.60	0 13:02	0	20.3	0.000
DP-72	JUNCTION	0.00	450.59	0 12:59	0	17.5	0.000
DP-73	JUNCTION	0.00	442.59	0 12:57	0	17	0.000
DP-74	JUNCTION	0.00	94.55	0 12:30	0	2.5	0.000
DP-75	JUNCTION	0.00	274.57	0 12:41	0	9.39	0.000
DP-77	JUNCTION	0.00	426.57	0 12:51	0	15.8	0.000
DP-78	JUNCTION	0.00	138.33	0 12:31	0	3.81	0.000
DP-8	JUNCTION	0.00	47.57	0 13:23	0	14.7	0.001
DP-87	JUNCTION	0.00	533.15	0 13:19	0	26.9	0.000
FSD9_OUTLET	JUNCTION	0.00	50.81	0 13:18	0	3.62	0.000
FSDE1_Outlet	JUNCTION	0.00	0.79	0 15:40	0	0.6	0.000
FSDE2_Outlet	JUNCTION	0.00	3.38	0 14:52	0	0.954	-0.000
FSDE4_Outlet	JUNCTION	0.00	1.55	0 14:31	0	1.05	0.000
PNDW3_Outfall	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 gal
SC3-10	JUNCTION	14.36	14.36	0 12:20	0.299	0.299	0.000
SC3-11A	JUNCTION	5.36	5.36	0 12:15	0.0757	0.0757	0.000
SC3-11B	JUNCTION	99.65	99.65	0 12:15	2.87	2.87	0.000
SC3-12	JUNCTION	71.53	71.53	0 12:15	2.11	2.11	0.000
SC3-12A	JUNCTION	24.03	24.03	0 12:15	0.519	0.519	0.000
SC3-13	JUNCTION	80.96	80.96	0 12:15	1.8	1.8	0.000
SC3-14A	JUNCTION	160.22	160.22	0 12:20	5.7	5.7	0.000
SC3-14B	JUNCTION	90.00	90.00	0 12:15	2.71	2.71	0.000
SC3-15A	JUNCTION	38.41	38.41	0 12:30	1.22	1.22	0.000
SC3-15B	JUNCTION	12.29	12.29	0 12:15	0.319	0.319	0.000
SC3-16	JUNCTION	266.34	266.34	0 12:20	9.85	9.85	0.000
SC3-17A	JUNCTION	39.59	39.59	0 12:15	0.978	0.978	0.000
SC3-17B	JUNCTION	32.30	32.30	0 12:15	0.99	0.99	0.000
SC3-18	JUNCTION	32.96	32.96	0 12:15	0.98	0.98	0.000
SC3-18B	JUNCTION	4.45	4.45	0 12:25	0.184	0.184	0.000
SC3-19	JUNCTION	78.96	78.96	0 12:25	1.97	1.97	0.000
SC3-1A	JUNCTION	32.05	32.05	0 12:15	0.566	0.566	0.000
SC3-20	JUNCTION	21.02	21.02	0 12:20	0.457	0.457	0.000
SC3-21	JUNCTION	20.68	20.68	0 12:15	0.328	0.328	0.000
SC3-22	JUNCTION	16.35	16.35	0 12:15	0.356	0.356	0.000

SC3-23	JUNCTION	22.10	22.10	0	12:15	0.431	0.431	0.000
SC3-24A	JUNCTION	15.26	15.26	0	12:20	0.417	0.417	0.000
SC3-24B	JUNCTION	4.78	4.78	0	12:15	0.12	0.12	0.000
SC3-25	JUNCTION	12.02	12.02	0	12:15	0.198	0.198	0.000
SC3-26	JUNCTION	4.37	4.37	0	12:20	0.131	0.131	0.000
SC3-27	JUNCTION	27.87	27.87	0	12:20	1.1	1.1	0.000
SC3-5A	JUNCTION	75.20	75.20	0	12:15	1.53	1.53	0.000
SC3-5B	JUNCTION	97.13	97.13	0	12:15	2.27	2.27	0.000
SC3-61	JUNCTION	22.40	22.40	0	12:20	0.593	0.593	0.000
SC3-6A	JUNCTION	84.21	84.21	0	12:15	2.27	2.27	0.000
SC3-6B	JUNCTION	47.16	47.16	0	12:15	1.13	1.13	0.000
SC3-6C	JUNCTION	84.02	84.02	0	12:15	1.85	1.85	0.000
SC3-7	JUNCTION	87.91	87.91	0	12:15	2.17	2.17	0.000
SC3-72	JUNCTION	23.84	23.84	0	12:20	0.615	0.615	0.000
SC3-73	JUNCTION	33.03	33.03	0	12:25	0.903	0.903	0.000
SC3-74	JUNCTION	53.27	53.27	0	12:25	1.39	1.39	0.000
SC3-75	JUNCTION	26.37	26.37	0	12:25	0.921	0.921	0.000
SC3-76	JUNCTION	27.09	27.09	0	12:25	0.945	0.945	0.000
SC3-77	JUNCTION	27.11	27.11	0	12:30	0.992	0.992	0.000
SC3-78	JUNCTION	77.46	77.46	0	12:20	1.81	1.81	0.000
SC3-79	JUNCTION	82.54	82.54	0	12:25	2.01	2.01	0.000
SC3-8	JUNCTION	56.41	56.41	0	12:20	1.14	1.14	0.000
SC3-80	JUNCTION	57.34	57.34	0	12:25	1.57	1.57	0.000
SC3-81	JUNCTION	81.00	81.00	0	12:30	2.44	2.44	0.000
SC3-82	JUNCTION	50.83	50.83	0	12:20	1.09	1.09	0.000
SC3-88	JUNCTION	18.99	18.99	0	12:25	0.558	0.558	0.000
SC3-89	JUNCTION	8.64	8.64	0	12:20	0.215	0.215	0.000
SC3-9	JUNCTION	73.44	73.44	0	12:25	2.43	2.43	0.000
SCE-1	JUNCTION	21.30	21.30	0	12:25	0.849	0.849	0.000
SCE-10	JUNCTION	165.76	165.76	0	12:15	4.75	4.75	0.000
SCE-11	JUNCTION	2.52	2.52	0	12:15	0.0369	0.0369	0.000
SCE-13	JUNCTION	25.85	25.85	0	12:25	0.913	0.913	0.000
SCE-14	JUNCTION	19.04	19.04	0	12:20	0.61	0.61	0.000
SCE-15	JUNCTION	27.20	27.20	0	12:15	0.633	0.633	0.000
SCE-2	JUNCTION	3.35	3.35	0	12:25	0.174	0.174	0.000
SCE-3	JUNCTION	16.95	16.95	0	12:25	0.954	0.954	0.000
SCE-4	JUNCTION	7.52	7.52	0	12:30	0.554	0.554	0.000
SCE-5	JUNCTION	99.51	99.51	0	12:15	3.44	3.44	0.000
SCE-6	JUNCTION	0.55	0.55	0	12:20	0.0275	0.0275	0.000
SCE-7	JUNCTION	46.14	46.14	0	12:15	1.17	1.17	0.000
SCE-8	JUNCTION	61.37	61.37	0	12:15	1.54	1.54	0.000
SCE-9	JUNCTION	0.68	0.68	0	12:20	0.0274	0.0274	0.000
SC3-12B	JUNCTION	6.35	6.35	0	12:20	0.217	0.217	0.000
SC3-13A	JUNCTION	7.62	7.62	0	12:20	0.268	0.268	0.000
82	JUNCTION	0.00	19.68	0	12:55	0	2.56	0.000
SC3-11C	JUNCTION	5.83	5.83	0	12:15	0.0728	0.0728	0.000
SC3_OUTFALL	OUTFALL	0.00	545.87	0	14:03	0	59	0.000
SCE_OUTFALL	OUTFALL	0.00	0.08	0	02:51	0	0.149	0.000
FSD14B_Outfall	OUTFALL	0.00	20.53	0	12:56	0	2.63	0.000
FSD05	STORAGE	0.00	75.20	0	12:15	0	1.53	0.015
FSD06	STORAGE	0.00	299.56	0	12:16	0	7.48	0.031
FSD09	STORAGE	0.00	112.72	0	12:33	0	3.62	0.115
FSD1	STORAGE	0.00	32.05	0	12:15	0	0.566	0.035
FSD11B	STORAGE	0.00	99.65	0	12:15	0	2.87	0.027
FSD12	STORAGE	0.00	71.53	0	12:15	0	2.11	0.177
FSD13	STORAGE	0.00	80.96	0	12:15	0	1.8	0.091
FSD14A	STORAGE	0.00	160.22	0	12:20	0	5.7	0.042

FSD14B	STORAGE	0.00	90.00	0	12:15	0	2.71	0.046
FSD15B	STORAGE	0.00	12.29	0	12:15	0	0.319	0.005
FSD16	STORAGE	0.00	266.34	0	12:20	0	9.85	0.026
FSD17A	STORAGE	0.00	39.59	0	12:15	0	0.978	0.028
FSD17B	STORAGE	0.00	32.30	0	12:15	0	0.99	0.057
FSD18	STORAGE	0.00	96.58	0	12:29	0	2.94	0.071
FSD20	STORAGE	0.00	21.02	0	12:20	0	0.457	0.310
FSD21	STORAGE	0.00	20.68	0	12:15	0	0.328	0.212
FSD22	STORAGE	0.00	16.35	0	12:15	0	0.356	0.124
FSD23	STORAGE	0.00	22.10	0	12:15	0	0.431	0.204
FSD27	STORAGE	0.00	48.02	0	12:27	0	1.72	0.075
FSD72	STORAGE	0.00	23.84	0	12:20	0	0.615	-1.739
FSDE1	STORAGE	0.00	21.30	0	12:25	0	0.849	0.001
FSDE2	STORAGE	0.00	16.95	0	12:25	0	0.954	0.019
FSDE3	STORAGE	0.00	99.51	0	12:15	0	3.44	0.008
FSDE4	STORAGE	0.00	46.14	0	12:15	0	1.17	0.004
FSDE5	STORAGE	0.00	61.37	0	12:15	0	1.54	0.003
PNDE7	STORAGE	0.00	68.33	0	12:38	0	14	0.020
FSDE6	STORAGE	0.00	165.76	0	12:15	0	4.75	0.009
PNDW3	STORAGE	0.00	579.69	0	13:35	0	41.3	0.712
EX_STOCK_POND_1	STORAGE	0.00	512.29	0	13:30	0	26.9	0.168
FSD12A	STORAGE	0.00	24.03	0	12:15	0	0.519	0.083
EX_STOCK_POND_2	STORAGE	0.00	477.23	0	13:06	0	21.2	0.189

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Node Flooding Summary
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Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-8	75.60	47.49	0 13:24	14.505	0.000

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
FSD05	30.086	7	0	0	136.865	34	0 13:19	3.70
FSD06	295.582	25	0	0	659.548	55	0 12:55	35.22
FSD09	55.672	8	0	0	263.446	37	0 13:17	50.81
FSD1	38.781	11	0	0	57.600	16	0 12:58	2.83
FSD11B	98.098	19	0	0	248.972	49	0 13:01	15.12
FSD12	57.532	23	0	0	95.637	38	0 12:22	61.05
FSD13	39.377	11	0	0	128.243	37	0 12:30	30.29
FSD14A	193.875	25	0	0	478.231	62	0 13:07	36.64
FSD14B	94.640	23	0	0	224.684	56	0 12:54	19.68

FSD15B	4.971	1	0	0	26.601	5	0	14:00	0.51
FSD16	327.925	20	0	0	862.633	53	0	13:23	45.78
FSD17A	24.970	4	0	0	85.285	15	0	13:00	6.15
FSD17B	29.919	21	0	0	80.462	56	0	13:04	8.10
FSD18	44.323	11	0	0	216.723	54	0	13:14	35.07
FSD20	0.043	0	0	0	4.099	3	0	12:23	19.88
FSD21	4.018	3	0	0	22.630	17	0	12:38	8.99
FSD22	5.622	6	0	0	27.937	28	0	12:57	6.21
FSD23	3.772	3	0	0	20.764	15	0	12:33	13.23
FSD27	42.174	14	0	0	128.077	42	0	13:25	16.48
FSD72	10.475	8	0	0	45.268	34	0	12:55	11.95
FSDE1	53.984	19	0	0	102.501	36	0	15:39	0.79
FSDE2	8.181	3	0	0	71.966	25	0	14:52	3.38
FSDE3	130.163	17	0	0	329.447	43	0	14:28	4.96
FSDE4	51.510	10	0	0	113.902	22	0	14:31	1.55
FSDE5	66.207	25	0	0	151.891	58	0	15:35	1.52
PNDE7	7.810	0	0	0	101.031	6	0	13:33	43.91
FSDE6	167.746	13	0	0	461.061	37	0	14:09	7.13
PNDW3	4.181	0	0	0	295.109	11	0	13:56	471.34
EX_STOCK_POND_1	259.945	30	0	0	454.658	53	0	13:35	500.38
FSD12A	19.474	21	0	0	43.157	47	0	12:43	6.18
EX_STOCK_POND_2	164.450	39	0	0	272.852	64	0	13:07	476.24

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
SC3_OUTFALL	97.49	28.81	545.87	58.998
SCE_OUTFALL	96.89	0.07	0.08	0.149
FSD14B_Outfall	97.49	1.29	20.53	2.632
System	97.29	30.17	553.50	61.778

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-1	CONDUIT	72.48	0 12:46	3.92	0.00	0.06
RT-10A	CONDUIT	76.75	0 12:31	5.75	0.77	0.66
RT-10B	CONDUIT	38.84	0 12:31	12.57	0.10	0.21
RT-11A	CONDUIT	474.86	0 13:11	5.67	0.01	0.10
RT-11B	CONDUIT	497.36	0 13:20	5.31	0.01	0.11
RT-11C	CONDUIT	512.29	0 13:30	3.69	0.01	0.13
RT-12A	CONDUIT	45.76	0 13:25	12.51	0.24	0.33
RT-12B	CONDUIT	45.75	0 13:27	15.65	0.13	0.24

RT-16	CONDUIT	82.73	0	12:16	15.28	0.59	0.55
RT-17B	CONDUIT	50.66	0	13:21	14.07	0.24	0.33
RT-18	CONDUIT	533.99	0	14:02	5.23	0.01	0.10
RT-19	CONDUIT	21.94	0	12:24	6.23	0.07	0.18
RT-1E	CONDUIT	0.79	0	15:41	2.77	0.01	0.06
RT-2	CONDUIT	47.12	0	12:44	3.62	0.00	0.05
RT-20	CONDUIT	544.13	0	14:03	7.92	0.00	0.07
RT-21	CONDUIT	10.76	0	12:21	9.44	0.07	0.18
RT-22	CONDUIT	13.20	0	12:36	12.76	0.14	0.26
RT-2E	CONDUIT	29.01	0	12:29	8.47	0.22	0.32
RT-3	CONDUIT	46.37	0	12:33	3.57	0.00	0.05
RT-3E	CONDUIT	3.38	0	14:53	4.69	0.02	0.11
RT-4	CONDUIT	88.71	0	12:39	3.98	0.00	0.06
RT-4E	CONDUIT	55.49	0	12:33	10.63	0.39	0.44
RT-5	CONDUIT	263.80	0	12:51	5.64	0.00	0.11
RT-5E	CONDUIT	59.26	0	12:35	14.01	0.16	0.27
RT-6	CONDUIT	75.03	0	12:35	4.34	0.00	0.05
RT-6B	CONDUIT	113.27	0	12:52	4.18	0.00	0.07
RT-6E	CONDUIT	1.55	0	14:35	3.69	0.01	0.07
RT-7A	CONDUIT	8.57	0	12:22	9.71	0.03	0.12
RT-7E	CONDUIT	61.74	0	12:38	9.72	0.17	0.28
RT-8	CONDUIT	19.87	0	12:24	13.74	0.45	0.47
RT-9A	CONDUIT	419.94	0	12:58	5.03	0.01	0.10
RT-9B	CONDUIT	442.29	0	12:59	5.74	0.01	0.09
RT-9C	CONDUIT	449.09	0	13:02	5.36	0.01	0.10
RT-9D	CONDUIT	471.17	0	13:06	5.52	0.01	0.10
RT-14	CONDUIT	479.92	0	13:59	5.38	0.01	0.09
1	DUMMY	53.27	0	12:25			
2	DUMMY	33.03	0	12:25			
3	DUMMY	26.37	0	12:25			
4	DUMMY	27.09	0	12:25			
5	DUMMY	77.46	0	12:20			
6	DUMMY	23.84	0	12:20			
7	DUMMY	27.11	0	12:30			
8	DUMMY	18.99	0	12:25			
9	DUMMY	21.30	0	12:25			
10	DUMMY	3.35	0	12:25			
11	DUMMY	4.37	0	12:20			
12	DUMMY	27.87	0	12:20			
13	DUMMY	22.10	0	12:15			
14	DUMMY	20.68	0	12:15			
15	DUMMY	12.02	0	12:15			
16	DUMMY	4.78	0	12:15			
17	DUMMY	16.35	0	12:15			
18	DUMMY	32.30	0	12:15			
20	DUMMY	21.02	0	12:20			
22	DUMMY	90.00	0	12:15			
24	DUMMY	160.22	0	12:20			
25	DUMMY	80.96	0	12:15			
27	DUMMY	46.14	0	12:15			
28	DUMMY	61.37	0	12:15			
29	DUMMY	99.51	0	12:15			
34	DUMMY	32.96	0	12:15			
36	DUMMY	16.95	0	12:25			
37	DUMMY	7.52	0	12:30			
38	DUMMY	73.44	0	12:25			
RT-17A	CONDUIT	46.37	0	12:36	4.98	0.00	0.06

39	DUMMY	38.41	0	12:30			
40	DUMMY	12.29	0	12:15			
42	DUMMY	71.53	0	12:15			
44	DUMMY	2.52	0	12:15			
45	DUMMY	0.68	0	12:20			
46	DUMMY	0.55	0	12:20			
47	DUMMY	19.04	0	12:20			
48	DUMMY	25.85	0	12:25			
51	DUMMY	165.76	0	12:15			
54	DUMMY	99.65	0	12:15			
56	DUMMY	5.36	0	12:15			
58	CONDUIT	579.69	0	13:35	9.85	0.00	0.06
63	DUMMY	75.20	0	12:15			
65	DUMMY	32.05	0	12:15			
67	DUMMY	545.87	0	14:03			
RT-15A	CONDUIT	87.12	0	12:16	17.40	0.37	0.42
RT-15B	CONDUIT	131.91	0	12:16	17.40	0.22	0.32
69	DUMMY	84.02	0	12:15			
70	DUMMY	47.16	0	12:15			
RT-25	CONDUIT	43.90	0	13:38	3.57	0.00	0.10
71	CONDUIT	0.08	0	02:51	0.10	1.08	1.00
74	DUMMY	14.36	0	12:20			
75	DUMMY	15.26	0	12:20			
77	DUMMY	97.13	0	12:15			
78	DUMMY	39.59	0	12:15			
79	DUMMY	266.34	0	12:20			
80	CONDUIT	8.97	0	12:40	15.91	0.09	0.20
81	DUMMY	24.03	0	12:15			
82	DUMMY	27.20	0	12:15			
83	DUMMY	4.45	0	12:25			
84	DUMMY	477.23	0	13:06			
85	DUMMY	6.35	0	12:20			
86	DUMMY	7.62	0	12:20			
87	DUMMY	5.83	0	12:15			
88	CONDUIT	19.66	0	12:56	9.47	0.16	0.27
FSD01_Outlet	DUMMY	2.83	0	12:58			
FSD05_Outlet	DUMMY	3.70	0	12:18			
FSD06_Outlet	DUMMY	35.22	0	12:55			
FSD11B_Outlet	DUMMY	15.12	0	13:01			
FSD12_Outlet	DUMMY	61.05	0	12:23			
FSD13_Outlet	DUMMY	30.29	0	12:30			
FSD14A_Outlet	DUMMY	36.64	0	13:08			
FSD14B_Outlet	DUMMY	19.68	0	12:55			
FSD15B_Outlet	DUMMY	0.51	0	14:01			
FSD16_Outlet	DUMMY	45.78	0	13:23			
FSD17B_Outlet	DUMMY	8.10	0	13:04			
FSD18_Outlet	DUMMY	35.07	0	13:15			
FSD21_Outlet	DUMMY	8.99	0	12:38			
FSD22_Outlet	DUMMY	6.21	0	12:57			
FSD72_Outlet	DUMMY	11.95	0	12:56			
FSD9_Outlet	DUMMY	50.81	0	13:18			
FSDE2_Outlet	DUMMY	3.38	0	14:52			
FSDE3_Outlet	DUMMY	4.96	0	14:29			
FSDE4_Outlet	DUMMY	1.55	0	14:31			
FSDE5_Outlet	DUMMY	1.52	0	15:35			
FSDE6_Outlet	DUMMY	7.13	0	14:10			
FSDE1_Outlet	DUMMY	0.79	0	15:40			

PNDE7_Outlet	DUMMY	43.91	0	13:33
FSD17A_Outlet	DUMMY	6.15	0	13:00
PNDW3_Outlet	DUMMY	471.34	0	13:56
FSD27_Outlet	DUMMY	16.48	0	13:25
EX_STOCK_POND_1_OUTFALL	DUMMY	500.38	0	13:36
FSD23_Outlet	DUMMY	13.23	0	12:34
FSD12A_Outlet	DUMMY	6.18	0	12:44
EX_STOCK_POND_2_OUTLET	DUMMY	476.24	0	13:08

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full: Normal Flow	Capacity Limited
71	75.61	75.61	75.61	0.04	75.61

Analysis begun on: Thu Jun 23 14:19:38 2022
Analysis ended on: Thu Jun 23 14:19:39 2022
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
10-YR Type II Storm
NOTE: These warnings are generated from using 1 foot dummy conduits between basin nodes and detention ponds to ensure there is no additional travel time between the bottom of the basin and the detention pond, except where conveyed by a channel.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2021 MDDP Amendment
10-YR Type II Storm

WARNING 04: minimum elevation drop used for Conduit 1
WARNING 04: minimum elevation drop used for Conduit 2
WARNING 04: minimum elevation drop used for Conduit 3
WARNING 04: minimum elevation drop used for Conduit 4
WARNING 04: minimum elevation drop used for Conduit 5
WARNING 04: minimum elevation drop used for Conduit 6
WARNING 04: minimum elevation drop used for Conduit 7
WARNING 04: minimum elevation drop used for Conduit 8
WARNING 04: minimum elevation drop used for Conduit 9
WARNING 04: minimum elevation drop used for Conduit 10
WARNING 04: minimum elevation drop used for Conduit 11
WARNING 04: minimum elevation drop used for Conduit 12
WARNING 04: minimum elevation drop used for Conduit 14
WARNING 04: minimum elevation drop used for Conduit 15
WARNING 04: minimum elevation drop used for Conduit 16
WARNING 04: minimum elevation drop used for Conduit 17
WARNING 04: minimum elevation drop used for Conduit 18
WARNING 04: minimum elevation drop used for Conduit 20
WARNING 04: minimum elevation drop used for Conduit 22
WARNING 04: minimum elevation drop used for Conduit 27
WARNING 04: minimum elevation drop used for Conduit 28
WARNING 04: minimum elevation drop used for Conduit 29
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 54
WARNING 08: elevation drop exceeds length for Conduit 56
WARNING 04: minimum elevation drop used for Conduit 63
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 67
WARNING 04: minimum elevation drop used for Conduit 69
WARNING 04: minimum elevation drop used for Conduit 70
WARNING 04: minimum elevation drop used for Conduit 71

WARNING 04: minimum elevation drop used for Conduit 74
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 08: elevation drop exceeds length for Conduit 77
WARNING 04: minimum elevation drop used for Conduit 78
WARNING 04: minimum elevation drop used for Conduit 79
WARNING 04: minimum elevation drop used for Conduit 82
WARNING 04: minimum elevation drop used for Conduit 83
WARNING 04: minimum elevation drop used for Conduit 85
WARNING 08: elevation drop exceeds length for Conduit 87
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12_Outlet
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12A_Outlet

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 0.000 0.000
Groundwater Inflow 0.000 0.000
RDII Inflow 0.000 0.000
External Inflow 343.179 111.830
External Outflow 261.064 85.071
Flooding Loss 58.412 19.034
Evaporation Loss 0.000 0.000
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 24.736 8.061
Continuity Error (%) ..... -0.301

****
Highest Flow Instability Indexes

****
Link PNDW3_Outlet (55)
Link RT-14 (55)
Link RT-18 (54)
Link 67 (53)
Link RT-20 (53)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
79	JUNCTION	0.06	0.92	295.92	0 12:29	0.92
80	JUNCTION	0.06	0.75	331.75	0 12:37	0.75
81	JUNCTION	0.12	2.61	231.61	0 13:02	2.60
DP-1E	JUNCTION	0.19	1.58	260.48	0 12:25	1.57
DP-21	JUNCTION	0.39	1.96	186.16	0 13:08	1.96
DP-22	JUNCTION	0.39	1.96	226.16	0 13:06	1.96
DP-25	JUNCTION	0.02	0.80	333.00	0 12:15	0.78
DP-26	JUNCTION	0.09	1.33	200.53	0 12:25	1.33
DP-2E	JUNCTION	0.26	2.19	221.09	0 12:27	2.18
DP-3E	JUNCTION	0.31	2.18	131.08	0 12:32	2.17
DP-4E	JUNCTION	0.44	2.03	62.53	0 12:34	2.03
DP-53A	JUNCTION	0.22	1.84	1.84	0 13:52	1.84
DP-56	JUNCTION	0.37	1.20	33.20	0 13:35	1.20
DP-60A	JUNCTION	0.30	2.55	24.75	0 13:52	2.55
DP-61	JUNCTION	0.29	2.56	65.76	0 13:47	2.55
DP-63	JUNCTION	0.24	2.29	100.49	0 13:48	2.28
DP-64	JUNCTION	0.10	2.15	95.35	0 12:15	2.12
DP-68	JUNCTION	0.33	1.69	120.09	0 13:24	1.68
DP-69	JUNCTION	0.15	2.92	206.12	0 13:04	2.92
DP-70	JUNCTION	0.12	2.64	231.84	0 13:00	2.64
DP-71	JUNCTION	0.12	2.64	259.84	0 12:57	2.64
DP-72	JUNCTION	0.09	2.58	285.78	0 12:54	2.58
DP-73	JUNCTION	0.12	2.58	302.78	0 12:53	2.57
DP-74	JUNCTION	0.04	1.56	498.76	0 12:29	1.56
DP-75	JUNCTION	0.08	2.67	434.87	0 12:39	2.66
DP-77	JUNCTION	0.09	2.62	342.82	0 12:48	2.62
DP-78	JUNCTION	0.06	1.91	464.11	0 12:30	1.91
DP-8	JUNCTION	9.73	10.00	10.00	0 02:06	10.00
DP-87	JUNCTION	0.21	3.45	160.65	0 13:11	3.45

FSD9_OUTLET	JUNCTION	0.20	2.01	141.21	0	13:01	2.01
FSDE1_Outlet	JUNCTION	0.15	0.42	265.32	0	15:08	0.42
FSDE2_Outlet	JUNCTION	0.11	0.52	229.42	0	14:44	0.52
FSDE4_Outlet	JUNCTION	0.17	0.35	97.95	0	14:05	0.35
PNDW3_Outfall	JUNCTION	0.00	0.00	118.20	0	00:00	0.00
SC3-10	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-11A	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-11B	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-12	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-12A	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
SC3-14A	JUNCTION	0.00	0.00	118.50	0	00:00	0.00
SC3-14B	JUNCTION	0.00	0.00	184.20	0	00:00	0.00
SC3-15A	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-15B	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-16	JUNCTION	0.00	0.00	224.20	0	00:00	0.00
SC3-17A	JUNCTION	0.00	0.00	230.20	0	00:00	0.00
SC3-17B	JUNCTION	0.00	0.00	258.20	0	00:00	0.00
SC3-18	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-18B	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-19	JUNCTION	0.10	5.00	250.20	0	12:19	5.00
SC3-1A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-20	JUNCTION	0.00	0.00	324.20	0	00:00	0.00
SC3-21	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-22	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-23	JUNCTION	0.00	0.00	295.20	0	00:00	0.00
SC3-24A	JUNCTION	0.00	0.00	300.20	0	00:00	0.00
SC3-24B	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-25	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-26	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-27	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-5A	JUNCTION	0.00	0.00	22.20	0	00:00	0.00
SC3-5B	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-61	JUNCTION	0.05	1.41	29.61	0	12:20	1.40
SC3-6A	JUNCTION	0.10	2.29	89.49	0	12:15	2.25
SC3-6B	JUNCTION	0.00	0.00	93.20	0	00:00	0.00
SC3-6C	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-7	JUNCTION	0.09	1.92	119.12	0	12:15	1.90
SC3-72	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-73	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-74	JUNCTION	0.00	0.00	497.20	0	00:00	0.00
SC3-75	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-76	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-77	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-78	JUNCTION	0.00	0.00	462.20	0	00:00	0.00
SC3-79	JUNCTION	0.04	1.36	563.56	0	12:25	1.36
SC3-8	JUNCTION	0.03	1.64	248.84	0	12:20	1.62
SC3-80	JUNCTION	0.04	1.22	553.42	0	12:25	1.21
SC3-81	JUNCTION	0.04	1.45	533.65	0	12:30	1.45
SC3-82	JUNCTION	0.02	1.16	563.36	0	12:20	1.15
SC3-88	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-89	JUNCTION	0.01	0.61	375.81	0	12:20	0.61
SC3-9	JUNCTION	0.00	0.00	139.20	0	00:00	0.00
SCE-1	JUNCTION	0.00	0.00	266.00	0	00:00	0.00
SCE-10	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-11	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-13	JUNCTION	0.00	0.00	258.90	0	00:00	0.00

SCE-14	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-15	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SCE-2	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-3	JUNCTION	0.00	0.00	230.00	0	00:00	0.00
SCE-4	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-5	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-6	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-7	JUNCTION	0.00	0.00	98.00	0	00:00	0.00
SCE-8	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SCE-9	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SC3-12B	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13A	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
82	JUNCTION	0.23	1.39	185.59	0	12:41	1.39
SC3-11C	JUNCTION	0.00	0.00	165.20	0	00:00	0.00
SC3_OUTFALL	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SCE_OUTFALL	OUTFALL	0.97	1.00	1.00	0	02:35	1.00
FSD14B_Outfall	OUTFALL	0.23	1.39	163.59	0	12:42	1.38
FSD05	STORAGE	3.07	5.58	27.78	0	13:34	5.58
FSD06	STORAGE	5.18	8.17	71.37	0	12:42	8.17
FSD09	STORAGE	2.42	6.78	145.98	0	13:01	6.78
FSD1	STORAGE	1.72	2.62	2.62	0	12:44	2.62
FSD11B	STORAGE	3.38	5.72	103.92	0	12:50	5.72
FSD12	STORAGE	4.32	5.90	162.90	0	12:23	5.90
FSD13	STORAGE	3.24	6.44	124.94	0	12:29	6.44
FSD14A	STORAGE	3.93	7.40	125.80	0	12:50	7.40
FSD14B	STORAGE	3.48	5.95	190.15	0	12:41	5.95
FSD15B	STORAGE	0.88	2.67	201.87	0	14:09	2.67
FSD16	STORAGE	4.51	7.50	231.70	0	13:06	7.50
FSD17A	STORAGE	2.97	4.67	234.87	0	12:51	4.67
FSD17B	STORAGE	3.20	5.99	264.19	0	12:49	5.98
FSD18	STORAGE	2.67	7.69	210.89	0	13:04	7.69
FSD20	STORAGE	0.03	1.17	325.37	0	12:23	1.17
FSD21	STORAGE	0.71	3.14	335.34	0	12:37	3.14
FSD22	STORAGE	1.53	4.42	287.62	0	12:45	4.42
FSD23	STORAGE	0.76	3.13	299.13	0	12:34	3.13
FSD27	STORAGE	3.35	6.65	263.85	0	13:03	6.64
FSD72	STORAGE	1.35	4.59	344.79	0	12:37	4.59
FSDE1	STORAGE	2.98	5.51	271.51	0	15:08	5.51
FSDE2	STORAGE	0.66	4.45	234.45	0	14:44	4.45
FSDE3	STORAGE	2.87	5.68	134.58	0	14:11	5.68
FSDE4	STORAGE	2.28	4.03	102.03	0	14:05	4.03
FSDE5	STORAGE	3.44	6.84	67.34	0	14:39	6.84
PNDE7	STORAGE	0.54	2.56	35.06	0	13:35	2.56
FSDE6	STORAGE	3.25	5.65	38.15	0	13:56	5.65
PNDW3	STORAGE	0.22	5.20	123.50	0	13:48	5.20
EX_STOCK_POND_1	STORAGE	4.10	6.76	148.76	0	13:24	6.76
FSD12A	STORAGE	4.27	6.98	163.98	0	12:34	6.98
EX_STOCK_POND_2	STORAGE	3.22	5.60	234.70	0	13:02	5.59

****
Node Inflow Summary
****

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Inflow Type	Inflow CFS	Occurrence CFS	Occurrence days hr:min	Volume 10^6 gal	Volume 10^6 gal	Error Percent
79	JUNCTION	0.00	18.60	0 12:29	0	0.596	0.000
80	JUNCTION	0.00	13.47	0 12:37	0	0.463	0.000
81	JUNCTION	0.00	778.43	0 13:02	0	29.7	0.000
DP-1E	JUNCTION	0.00	43.32	0 12:25	0	2.52	0.000
DP-21	JUNCTION	0.00	92.48	0 13:08	0	11.5	0.000
DP-22	JUNCTION	0.00	92.52	0 13:06	0	11.5	0.000
DP-25	JUNCTION	0.00	17.20	0 12:15	0	0.282	0.000
DP-26	JUNCTION	0.00	59.76	0 12:25	0	2.29	0.000
DP-2E	JUNCTION	0.00	81.89	0 12:27	0	5.49	0.000
DP-3E	JUNCTION	0.00	86.63	0 12:32	0	9.4	0.000
DP-4E	JUNCTION	0.00	91.01	0 12:34	0	12.4	0.000
DP-53A	JUNCTION	0.00	866.46	0 13:52	0	81.6	0.000
DP-56	JUNCTION	0.00	62.31	0 13:35	0	18.2	0.000
DP-60A	JUNCTION	0.00	863.88	0 13:52	0	81.2	0.000
DP-61	JUNCTION	0.00	851.44	0 13:47	0	75.7	0.000
DP-63	JUNCTION	0.00	763.81	0 13:48	0	61	0.000
DP-64	JUNCTION	0.00	167.21	0 12:15	0	4.02	-0.000
DP-68	JUNCTION	0.00	994.15	0 13:24	0	58	-0.000
DP-69	JUNCTION	0.00	847.50	0 13:04	0	34.3	0.000
DP-70	JUNCTION	0.00	780.47	0 13:00	0	31.2	0.000
DP-71	JUNCTION	0.00	771.35	0 12:57	0	30	0.000
DP-72	JUNCTION	0.00	718.20	0 12:54	0	26.3	0.000
DP-73	JUNCTION	0.00	703.56	0 12:52	0	25.6	0.000
DP-74	JUNCTION	0.00	145.74	0 12:29	0	3.77	0.000
DP-75	JUNCTION	0.00	427.98	0 12:39	0	14.2	0.000
DP-77	JUNCTION	0.00	672.84	0 12:47	0	23.8	0.000
DP-78	JUNCTION	0.00	210.37	0 12:30	0	5.67	0.000
DP-8	JUNCTION	0.00	67.39	0 13:21	0	19.1	0.001
DP-87	JUNCTION	0.00	890.76	0 13:11	0	39.6	0.000
FSD9_OUTLET	JUNCTION	0.00	108.63	0 13:01	0	5.59	0.000
FSDE1_Outlet	JUNCTION	0.00	2.96	0 15:08	0	0.926	0.000
FSDE2_Outlet	JUNCTION	0.00	5.19	0 14:44	0	1.34	0.000
FSDE4_Outlet	JUNCTION	0.00	2.19	0 14:05	0	1.27	0.000
PNDW3_Outfall	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 gal
SC3-10	JUNCTION	23.62	23.62	0 12:20	0.49	0.49	0.000
SC3-11A	JUNCTION	8.05	8.05	0 12:15	0.116	0.116	0.000
SC3-11B	JUNCTION	126.13	126.13	0 12:15	3.5	3.5	0.000
SC3-12	JUNCTION	91.34	91.34	0 12:15	2.6	2.6	0.000
SC3-12A	JUNCTION	31.22	31.22	0 12:15	0.651	0.651	0.000
SC3-13	JUNCTION	100.72	100.72	0 12:15	2.19	2.19	0.000
SC3-14A	JUNCTION	203.13	203.13	0 12:20	6.97	6.97	0.000
SC3-14B	JUNCTION	115.58	115.58	0 12:15	3.32	3.32	0.000
SC3-15A	JUNCTION	59.28	59.28	0 12:25	1.9	1.9	0.000
SC3-15B	JUNCTION	15.45	15.45	0 12:15	0.391	0.391	0.000
SC3-16	JUNCTION	343.24	343.24	0 12:20	12.1	12.1	0.000
SC3-17A	JUNCTION	50.91	50.91	0 12:15	1.21	1.21	0.000
SC3-17B	JUNCTION	41.97	41.97	0 12:15	1.23	1.23	0.000
SC3-18	JUNCTION	41.34	41.34	0 12:15	1.2	1.2	0.000
SC3-18B	JUNCTION	6.89	6.89	0 12:20	0.285	0.285	0.000
SC3-19	JUNCTION	120.84	120.84	0 12:25	3.03	3.03	0.000
SC3-1A	JUNCTION	44.63	44.63	0 12:15	0.748	0.748	0.000
SC3-20	JUNCTION	30.73	30.73	0 12:15	0.662	0.662	0.000
SC3-21	JUNCTION	29.45	29.45	0 12:15	0.463	0.463	0.000
SC3-22	JUNCTION	24.05	24.05	0 12:15	0.516	0.516	0.000

SC3-23	JUNCTION	31.23	31.23	0	12:15	0.597	0.597	0.000
SC3-24A	JUNCTION	22.51	22.51	0	12:20	0.612	0.612	0.000
SC3-24B	JUNCTION	7.12	7.12	0	12:15	0.177	0.177	0.000
SC3-25	JUNCTION	17.20	17.20	0	12:15	0.282	0.282	0.000
SC3-26	JUNCTION	6.61	6.61	0	12:20	0.199	0.199	0.000
SC3-27	JUNCTION	39.10	39.10	0	12:20	1.5	1.5	0.000
SC3-5A	JUNCTION	95.88	95.88	0	12:15	1.88	1.88	0.000
SC3-5B	JUNCTION	126.36	126.36	0	12:15	2.82	2.82	0.000
SC3-61	JUNCTION	36.40	36.40	0	12:20	0.946	0.946	0.000
SC3-6A	JUNCTION	106.32	106.32	0	12:15	2.76	2.76	0.000
SC3-6B	JUNCTION	60.52	60.52	0	12:15	1.39	1.39	0.000
SC3-6C	JUNCTION	115.61	115.61	0	12:15	2.34	2.34	0.000
SC3-7	JUNCTION	109.28	109.28	0	12:15	2.63	2.63	0.000
SC3-72	JUNCTION	35.61	35.61	0	12:20	0.917	0.917	0.000
SC3-73	JUNCTION	50.14	50.14	0	12:25	1.38	1.38	0.000
SC3-74	JUNCTION	79.10	79.10	0	12:20	2.04	2.04	0.000
SC3-75	JUNCTION	38.98	38.98	0	12:25	1.35	1.35	0.000
SC3-76	JUNCTION	40.54	40.54	0	12:25	1.41	1.41	0.000
SC3-77	JUNCTION	42.16	42.16	0	12:30	1.55	1.55	0.000
SC3-78	JUNCTION	114.83	114.83	0	12:20	2.65	2.65	0.000
SC3-79	JUNCTION	123.52	123.52	0	12:25	3.01	3.01	0.000
SC3-8	JUNCTION	93.96	93.96	0	12:20	1.88	1.88	0.000
SC3-80	JUNCTION	86.09	86.09	0	12:25	2.36	2.36	0.000
SC3-81	JUNCTION	125.85	125.85	0	12:30	3.81	3.81	0.000
SC3-82	JUNCTION	79.48	79.48	0	12:20	1.7	1.7	-0.000
SC3-88	JUNCTION	29.44	29.44	0	12:25	0.871	0.871	0.000
SC3-89	JUNCTION	13.39	13.39	0	12:20	0.336	0.336	0.000
SC3-9	JUNCTION	114.01	114.01	0	12:25	3.64	3.64	0.000
SCE-1	JUNCTION	30.85	30.85	0	12:25	1.21	1.21	0.000
SCE-10	JUNCTION	230.70	230.70	0	12:15	6.05	6.05	0.000
SCE-11	JUNCTION	4.75	4.75	0	12:15	0.0668	0.0668	0.000
SCE-13	JUNCTION	38.21	38.21	0	12:25	1.34	1.34	0.000
SCE-14	JUNCTION	28.21	28.21	0	12:20	0.895	0.895	0.000
SCE-15	JUNCTION	38.53	38.53	0	12:15	0.872	0.872	0.000
SCE-2	JUNCTION	4.95	4.95	0	12:20	0.256	0.256	0.000
SCE-3	JUNCTION	25.20	25.20	0	12:25	1.34	1.34	0.000
SCE-4	JUNCTION	10.35	10.35	0	12:30	0.742	0.742	0.000
SCE-5	JUNCTION	125.72	125.72	0	12:15	4.19	4.19	0.000
SCE-6	JUNCTION	1.03	1.03	0	12:20	0.0497	0.0497	0.000
SCE-7	JUNCTION	56.71	56.71	0	12:15	1.42	1.42	0.000
SCE-8	JUNCTION	73.41	73.41	0	12:15	1.84	1.84	0.000
SCE-9	JUNCTION	1.27	1.27	0	12:20	0.0496	0.0496	0.000
SC3-12B	JUNCTION	9.82	9.82	0	12:20	0.336	0.336	0.000
SC3-13A	JUNCTION	11.81	11.81	0	12:20	0.415	0.415	0.000
82	JUNCTION	0.00	41.48	0	12:41	0	3.16	0.000
SC3-11C	JUNCTION	9.30	9.30	0	12:15	0.116	0.116	0.000
SC3_OUTFALL	OUTFALL	0.00	866.46	0	13:52	0	81.6	0.000
SCE_OUTFALL	OUTFALL	0.00	0.08	0	02:34	0	0.149	0.000
FSD14B_Outfall	OUTFALL	0.00	44.05	0	12:42	0	3.27	0.000
FSD05	STORAGE	0.00	95.88	0	12:15	0	1.88	0.006
FSD06	STORAGE	0.00	389.18	0	12:16	0	9.23	0.077
FSD09	STORAGE	0.00	184.19	0	12:31	0	5.6	0.109
FSD1	STORAGE	0.00	44.63	0	12:15	0	0.748	0.099
FSD11B	STORAGE	0.00	126.13	0	12:15	0	3.5	0.065
FSD12	STORAGE	0.00	91.34	0	12:15	0	2.6	0.115
FSD13	STORAGE	0.00	100.72	0	12:15	0	2.19	0.093
FSD14A	STORAGE	0.00	203.13	0	12:20	0	6.97	0.080

FSD14B	STORAGE	0.00	115.58	0	12:15	0	3.32	0.099
FSD15B	STORAGE	0.00	15.45	0	12:15	0	0.391	0.005
FSD16	STORAGE	0.00	343.24	0	12:20	0	12.1	0.059
FSD17A	STORAGE	0.00	50.91	0	12:15	0	1.21	0.061
FSD17B	STORAGE	0.00	41.97	0	12:15	0	1.23	0.105
FSD18	STORAGE	0.00	133.71	0	12:28	0	4.17	0.058
FSD20	STORAGE	0.00	30.73	0	12:15	0	0.662	0.208
FSD21	STORAGE	0.00	29.45	0	12:15	0	0.463	0.144
FSD22	STORAGE	0.00	24.05	0	12:15	0	0.516	0.184
FSD23	STORAGE	0.00	31.23	0	12:15	0	0.597	0.142
FSD27	STORAGE	0.00	68.94	0	12:25	0	2.37	0.128
FSD72	STORAGE	0.00	35.61	0	12:20	0	0.917	0.179
FSDE1	STORAGE	0.00	30.85	0	12:25	0	1.21	0.007
FSDE2	STORAGE	0.00	25.20	0	12:25	0	1.34	0.026
FSDE3	STORAGE	0.00	125.72	0	12:15	0	4.19	0.010
FSDE4	STORAGE	0.00	56.71	0	12:15	0	1.42	0.008
FSDE5	STORAGE	0.00	73.41	0	12:15	0	1.84	0.005
PNDE7	STORAGE	0.00	100.59	0	12:36	0	18.2	0.024
FSDE6	STORAGE	0.00	230.70	0	12:15	0	6.05	0.011
PNDW3	STORAGE	0.00	994.15	0	13:24	0	58	0.511
EX_STOCK_POND_1	STORAGE	0.00	863.82	0	13:20	0	39.6	0.127
FSD12A	STORAGE	0.00	31.22	0	12:15	0	0.651	0.093
EX_STOCK_POND_2	STORAGE	0.00	780.47	0	13:00	0	31.2	0.139

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Node Flooding Summary
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Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-8	75.91	67.32	0 13:22	18.929	0.000
SC3-19	0.31	20.89	0 12:26	0.104	0.000

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
FSD05	38.500	9	0	0	172.162	42	0 13:33	3.70
FSD06	304.173	25	0	0	742.146	62	0 12:41	97.22
FSD09	58.020	8	0	0	316.857	44	0 13:01	108.63
FSD1	39.114	11	0	0	68.358	19	0 12:44	9.58
FSD11B	101.273	20	0	0	280.492	55	0 12:50	30.41
FSD12	58.226	23	0	0	103.010	41	0 12:23	75.10
FSD13	40.502	12	0	0	146.254	42	0 12:29	41.57
FSD14A	199.679	26	0	0	518.607	67	0 12:50	74.89

FSD14B	97.281	24	0	0	245.341	61	0	12:40	41.48
FSD15B	7.096	1	0	0	33.750	6	0	14:08	0.56
FSD16	339.805	21	0	0	966.728	60	0	13:06	92.52
FSD17A	26.199	5	0	0	98.722	17	0	12:50	11.55
FSD17B	30.880	21	0	0	88.659	61	0	12:48	16.16
FSD18	46.586	12	0	0	266.932	67	0	13:04	66.14
FSD20	0.065	0	0	0	6.293	5	0	12:23	28.77
FSD21	4.196	3	0	0	27.986	21	0	12:36	13.47
FSD22	5.810	6	0	0	32.024	32	0	12:44	12.48
FSD23	4.012	3	0	0	26.434	20	0	12:33	18.60
FSD27	43.642	14	0	0	145.771	48	0	13:03	37.65
FSD72	10.644	8	0	0	47.987	36	0	12:37	28.06
FSDE1	63.250	22	0	0	139.036	49	0	15:08	2.96
FSDE2	11.711	4	0	0	103.053	36	0	14:43	5.19
FSDE3	149.631	20	0	0	400.856	52	0	14:10	6.76
FSDE4	57.154	11	0	0	136.034	26	0	14:05	2.19
FSDE5	73.745	28	0	0	176.545	67	0	14:39	2.29
PNDE7	12.442	1	0	0	159.990	10	0	13:35	62.31
FSDE6	203.215	16	0	0	595.728	47	0	13:56	9.61
PNDW3	12.353	0	0	0	739.698	29	0	13:48	749.85
EX_STOCK_POND_1	262.292	31	0	0	528.797	62	0	13:24	849.20
FSD12A	19.798	22	0	0	47.404	52	0	12:33	13.09
EX_STOCK_POND_2	165.618	39	0	0	308.234	73	0	13:01	778.43

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
SC3_OUTFALL	97.81	39.74	866.46	81.641
SCE_OUTFALL	97.28	0.07	0.08	0.149
FSD14B_Outfall	97.81	1.59	44.05	3.275
System	97.63	41.41	876.29	85.065

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-1	CONDUIT	114.92	0 12:44	4.39	0.00	0.07
RT-10A	CONDUIT	107.82	0 12:30	6.22	1.08	0.96
RT-10B	CONDUIT	59.72	0 12:31	14.24	0.16	0.27
RT-11A	CONDUIT	776.89	0 13:04	6.57	0.01	0.13
RT-11B	CONDUIT	831.19	0 13:11	6.16	0.02	0.14
RT-11C	CONDUIT	863.82	0 13:20	4.30	0.02	0.17
RT-12A	CONDUIT	92.48	0 13:08	15.10	0.48	0.49

RT-12B	CONDUIT	92.47	0	13:10	19.10	0.25	0.34
RT-16	CONDUIT	104.49	0	12:16	16.11	0.75	0.64
RT-17B	CONDUIT	108.48	0	13:04	17.22	0.50	0.50
RT-18	CONDUIT	849.91	0	13:52	6.04	0.01	0.13
RT-19	CONDUIT	35.79	0	12:23	7.17	0.12	0.23
RT-1E	CONDUIT	2.96	0	15:09	4.18	0.02	0.11
RT-2	CONDUIT	72.69	0	12:42	4.01	0.00	0.06
RT-20	CONDUIT	863.84	0	13:52	9.20	0.01	0.09
RT-21	CONDUIT	15.61	0	12:21	10.48	0.10	0.22
RT-22	CONDUIT	18.64	0	12:39	13.37	0.20	0.31
RT-2E	CONDUIT	42.88	0	12:28	9.43	0.32	0.39
RT-3	CONDUIT	73.10	0	12:31	4.01	0.00	0.06
RT-3E	CONDUIT	5.19	0	14:44	5.33	0.04	0.13
RT-4	CONDUIT	138.04	0	12:37	4.44	0.00	0.08
RT-4E	CONDUIT	81.25	0	12:32	11.70	0.58	0.54
RT-5	CONDUIT	413.17	0	12:48	6.32	0.01	0.13
RT-5E	CONDUIT	86.62	0	12:34	15.61	0.23	0.33
RT-6	CONDUIT	114.62	0	12:33	4.80	0.00	0.07
RT-6B	CONDUIT	175.57	0	12:49	4.63	0.00	0.09
RT-6E	CONDUIT	2.19	0	14:10	4.12	0.02	0.09
RT-7A	CONDUIT	13.31	0	12:21	11.03	0.05	0.15
RT-7E	CONDUIT	90.90	0	12:35	10.83	0.25	0.34
RT-8	CONDUIT	28.74	0	12:24	15.02	0.65	0.59
RT-9A	CONDUIT	664.66	0	12:53	5.75	0.01	0.13
RT-9B	CONDUIT	703.15	0	12:54	6.59	0.01	0.12
RT-9C	CONDUIT	716.32	0	12:57	6.15	0.01	0.13
RT-9D	CONDUIT	769.33	0	13:00	6.38	0.01	0.13
RT-14	CONDUIT	763.23	0	13:51	6.23	0.01	0.11
1	DUMMY	79.10	0	12:20			
2	DUMMY	50.14	0	12:25			
3	DUMMY	38.98	0	12:25			
4	DUMMY	40.54	0	12:25			
5	DUMMY	114.83	0	12:20			
6	DUMMY	35.61	0	12:20			
7	DUMMY	42.16	0	12:30			
8	DUMMY	29.44	0	12:25			
9	DUMMY	30.85	0	12:25			
10	DUMMY	4.95	0	12:20			
11	DUMMY	6.61	0	12:20			
12	DUMMY	39.10	0	12:20			
13	DUMMY	31.23	0	12:15			
14	DUMMY	29.45	0	12:15			
15	DUMMY	17.20	0	12:15			
16	DUMMY	7.12	0	12:15			
17	DUMMY	24.05	0	12:15			
18	DUMMY	41.97	0	12:15			
20	DUMMY	30.73	0	12:15			
22	DUMMY	115.58	0	12:15			
24	DUMMY	203.13	0	12:20			
25	DUMMY	100.72	0	12:15			
27	DUMMY	56.71	0	12:15			
28	DUMMY	73.41	0	12:15			
29	DUMMY	125.72	0	12:15			
34	DUMMY	41.34	0	12:15			
36	DUMMY	25.20	0	12:25			
37	DUMMY	10.35	0	12:30			
38	DUMMY	114.01	0	12:25			

RT-17A	CONDUIT	79.25	0	12:35	5.64	0.00	0.07
39	DUMMY	59.28	0	12:25			
40	DUMMY	15.45	0	12:15			
42	DUMMY	91.34	0	12:15			
44	DUMMY	4.75	0	12:15			
45	DUMMY	1.27	0	12:20			
46	DUMMY	1.03	0	12:20			
47	DUMMY	28.21	0	12:20			
48	DUMMY	38.21	0	12:25			
51	DUMMY	230.70	0	12:15			
54	DUMMY	126.13	0	12:15			
56	DUMMY	8.05	0	12:15			
58	CONDUIT	994.15	0	13:24	11.77	0.01	0.08
63	DUMMY	95.88	0	12:15			
65	DUMMY	44.63	0	12:15			
67	DUMMY	866.46	0	13:52			
RT-15A	CONDUIT	108.11	0	12:16	18.40	0.46	0.48
RT-15B	CONDUIT	166.20	0	12:16	18.53	0.27	0.36
69	DUMMY	115.61	0	12:15			
70	DUMMY	60.52	0	12:15			
RT-25	CONDUIT	62.30	0	13:39	3.92	0.01	0.12
71	CONDUIT	0.08	0	02:34	0.10	1.08	1.00
74	DUMMY	23.62	0	12:20			
75	DUMMY	22.51	0	12:20			
77	DUMMY	126.36	0	12:15			
78	DUMMY	50.91	0	12:15			
79	DUMMY	343.24	0	12:20			
80	CONDUIT	13.47	0	12:39	16.04	0.14	0.25
81	DUMMY	31.22	0	12:15			
82	DUMMY	38.53	0	12:15			
83	DUMMY	6.89	0	12:20			
84	DUMMY	780.47	0	13:00			
85	DUMMY	9.82	0	12:20			
86	DUMMY	11.81	0	12:20			
87	DUMMY	9.30	0	12:15			
88	CONDUIT	41.42	0	12:42	11.66	0.33	0.40
FSD01_Outlet	DUMMY	9.58	0	12:44			
FSD05_Outlet	DUMMY	3.70	0	12:14			
FSD06_Outlet	DUMMY	97.22	0	12:42			
FSD11B_Outlet	DUMMY	30.41	0	12:50			
FSD12_Outlet	DUMMY	75.10	0	12:23			
FSD13_Outlet	DUMMY	41.57	0	12:29			
FSD14A_Outlet	DUMMY	74.89	0	12:50			
FSD14B_Outlet	DUMMY	41.48	0	12:41			
FSD15B_Outlet	DUMMY	0.56	0	14:09			
FSD16_Outlet	DUMMY	92.52	0	13:06			
FSD17B_Outlet	DUMMY	16.16	0	12:49			
FSD18_Outlet	DUMMY	66.14	0	13:04			
FSD21_Outlet	DUMMY	13.47	0	12:37			
FSD22_Outlet	DUMMY	12.48	0	12:45			
FSD72_Outlet	DUMMY	28.06	0	12:37			
FSD9_Outlet	DUMMY	108.63	0	13:01			
FSDE2_Outlet	DUMMY	5.19	0	14:44			
FSDE3_Outlet	DUMMY	6.76	0	14:11			
FSDE4_Outlet	DUMMY	2.19	0	14:05			
FSDE5_Outlet	DUMMY	2.29	0	14:39			
FSDE6_Outlet	DUMMY	9.61	0	13:56			

FSDE1_Outlet	DUMMY	2.96	0	15:08
PNDE7_Outlet	DUMMY	62.31	0	13:35
FSD17A_Outlet	DUMMY	11.55	0	12:51
PNDW3_Outlet	DUMMY	749.85	0	13:48
FSD27_Outlet	DUMMY	37.65	0	13:03
EX_STOCK_POND_1_OUTFALL	DUMMY	849.20	0	13:24
FSD23_Outlet	DUMMY	18.60	0	12:29
FSD12A_Outlet	DUMMY	13.09	0	12:34
EX_STOCK_POND_2_OUTLET	DUMMY	778.43	0	13:02

****
Conduit Surcharge Summary
****

	Hours Full			Hours Above Full	Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
RT-10A	0.30	0.30	0.30	0.32	0.30
71	75.91	75.91	75.91	0.04	75.91

Analysis begun on: Thu Jun 23 14:21:16 2022
Analysis ended on: Thu Jun 23 14:21:17 2022
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
25-YR Type II Storm
NOTE: These warnings are generated from using 1 foot dummy conduits between basin nodes and detention ponds to ensure there is no additional travel time between the bottom of the basin and the detention pond, except where conveyed by a channel.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2021 MDDP Amendment
25-YR Type II Storm

WARNING 04: minimum elevation drop used for Conduit 1
WARNING 04: minimum elevation drop used for Conduit 2
WARNING 04: minimum elevation drop used for Conduit 3
WARNING 04: minimum elevation drop used for Conduit 4
WARNING 04: minimum elevation drop used for Conduit 5
WARNING 04: minimum elevation drop used for Conduit 6
WARNING 04: minimum elevation drop used for Conduit 7
WARNING 04: minimum elevation drop used for Conduit 8
WARNING 04: minimum elevation drop used for Conduit 9
WARNING 04: minimum elevation drop used for Conduit 10
WARNING 04: minimum elevation drop used for Conduit 11
WARNING 04: minimum elevation drop used for Conduit 12
WARNING 04: minimum elevation drop used for Conduit 14
WARNING 04: minimum elevation drop used for Conduit 15
WARNING 04: minimum elevation drop used for Conduit 16
WARNING 04: minimum elevation drop used for Conduit 17
WARNING 04: minimum elevation drop used for Conduit 18
WARNING 04: minimum elevation drop used for Conduit 20
WARNING 04: minimum elevation drop used for Conduit 22
WARNING 04: minimum elevation drop used for Conduit 27
WARNING 04: minimum elevation drop used for Conduit 28
WARNING 04: minimum elevation drop used for Conduit 29
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 54
WARNING 08: elevation drop exceeds length for Conduit 56
WARNING 04: minimum elevation drop used for Conduit 63
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 67
WARNING 04: minimum elevation drop used for Conduit 69
WARNING 04: minimum elevation drop used for Conduit 70
WARNING 04: minimum elevation drop used for Conduit 71

WARNING 04: minimum elevation drop used for Conduit 74
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 08: elevation drop exceeds length for Conduit 77
WARNING 04: minimum elevation drop used for Conduit 78
WARNING 04: minimum elevation drop used for Conduit 79
WARNING 04: minimum elevation drop used for Conduit 82
WARNING 04: minimum elevation drop used for Conduit 83
WARNING 04: minimum elevation drop used for Conduit 85
WARNING 08: elevation drop exceeds length for Conduit 87
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12_Outlet
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12A_Outlet

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 0.000 0.000
Groundwater Inflow 0.000 0.000
RDII Inflow 0.000 0.000
External Inflow 414.068 134.930
External Outflow 319.180 104.010
Flooding Loss 70.719 23.045
Evaporation Loss 0.000 0.000
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 25.243 8.226
Continuity Error (%) ..... -0.260

****
Highest Flow Instability Indexes

****
Link PNDW3_Outlet (54)
Link RT-14 (54)
Link RT-18 (53)
Link RT-20 (52)
Link 67 (52)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
79	JUNCTION	0.07	0.92	295.92	0 12:20	0.92
80	JUNCTION	0.06	0.81	331.81	0 12:31	0.81
81	JUNCTION	0.13	3.01	232.01	0 12:59	3.01
DP-1E	JUNCTION	0.20	1.79	260.69	0 12:25	1.79
DP-21	JUNCTION	0.41	2.41	186.61	0 13:01	2.41
DP-22	JUNCTION	0.41	2.41	226.61	0 12:59	2.41
DP-25	JUNCTION	0.02	0.88	333.08	0 12:15	0.87
DP-26	JUNCTION	0.10	1.52	200.72	0 12:25	1.52
DP-2E	JUNCTION	0.28	2.55	221.45	0 12:27	2.53
DP-3E	JUNCTION	0.34	2.53	131.43	0 12:32	2.53
DP-4E	JUNCTION	0.47	2.30	62.80	0 12:33	2.29
DP-53A	JUNCTION	0.23	2.14	2.14	0 13:47	2.14
DP-56	JUNCTION	0.40	1.35	33.35	0 13:47	1.35
DP-60A	JUNCTION	0.32	2.97	25.17	0 13:47	2.96
DP-61	JUNCTION	0.31	2.97	66.17	0 13:42	2.97
DP-63	JUNCTION	0.25	2.66	100.86	0 13:43	2.66
DP-64	JUNCTION	0.11	2.33	95.53	0 12:16	2.30
DP-68	JUNCTION	0.34	1.98	120.38	0 13:18	1.98
DP-69	JUNCTION	0.17	3.35	206.55	0 13:01	3.35
DP-70	JUNCTION	0.14	3.04	232.24	0 12:57	3.04
DP-71	JUNCTION	0.14	3.05	260.25	0 12:54	3.05
DP-72	JUNCTION	0.11	2.97	286.17	0 12:51	2.96
DP-73	JUNCTION	0.13	2.96	303.16	0 12:51	2.96
DP-74	JUNCTION	0.05	1.74	498.94	0 12:28	1.73
DP-75	JUNCTION	0.09	3.00	435.20	0 12:38	2.99
DP-77	JUNCTION	0.10	2.98	343.18	0 12:45	2.98
DP-78	JUNCTION	0.06	2.12	464.32	0 12:29	2.12
DP-8	JUNCTION	9.76	10.00	10.00	0 01:54	10.00
DP-87	JUNCTION	0.22	3.98	161.18	0 13:07	3.97

FSD9_OUTLET	JUNCTION	0.21	2.51	141.71	0	12:56	2.51
FSDE1_Outlet	JUNCTION	0.16	0.65	265.55	0	14:23	0.65
FSDE2_Outlet	JUNCTION	0.12	0.59	229.49	0	14:41	0.59
FSDE4_Outlet	JUNCTION	0.18	0.38	97.98	0	13:55	0.38
PNDW3_Outfall	JUNCTION	0.00	0.00	118.20	0	00:00	0.00
SC3-10	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-11A	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-11B	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-12	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-12A	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
SC3-14A	JUNCTION	0.00	0.00	118.50	0	00:00	0.00
SC3-14B	JUNCTION	0.00	0.00	184.20	0	00:00	0.00
SC3-15A	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-15B	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-16	JUNCTION	0.00	0.00	224.20	0	00:00	0.00
SC3-17A	JUNCTION	0.00	0.00	230.20	0	00:00	0.00
SC3-17B	JUNCTION	0.00	0.00	258.20	0	00:00	0.00
SC3-18	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-18B	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-19	JUNCTION	0.11	5.00	250.20	0	12:15	5.00
SC3-1A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-20	JUNCTION	0.00	0.00	324.20	0	00:00	0.00
SC3-21	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-22	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-23	JUNCTION	0.00	0.00	295.20	0	00:00	0.00
SC3-24A	JUNCTION	0.00	0.00	300.20	0	00:00	0.00
SC3-24B	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-25	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-26	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-27	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-5A	JUNCTION	0.00	0.00	22.20	0	00:00	0.00
SC3-5B	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-61	JUNCTION	0.05	1.61	29.81	0	12:20	1.60
SC3-6A	JUNCTION	0.11	2.57	89.77	0	12:15	2.53
SC3-6B	JUNCTION	0.00	0.00	93.20	0	00:00	0.00
SC3-6C	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-7	JUNCTION	0.09	2.09	119.29	0	12:15	2.07
SC3-72	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-73	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-74	JUNCTION	0.00	0.00	497.20	0	00:00	0.00
SC3-75	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-76	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-77	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-78	JUNCTION	0.00	0.00	462.20	0	00:00	0.00
SC3-79	JUNCTION	0.04	1.50	563.70	0	12:25	1.50
SC3-8	JUNCTION	0.03	1.85	249.05	0	12:20	1.84
SC3-80	JUNCTION	0.04	1.35	553.55	0	12:25	1.35
SC3-81	JUNCTION	0.04	1.62	533.82	0	12:30	1.62
SC3-82	JUNCTION	0.03	1.30	563.50	0	12:20	1.29
SC3-88	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-89	JUNCTION	0.02	0.69	375.89	0	12:20	0.69
SC3-9	JUNCTION	0.00	0.00	139.20	0	00:00	0.00
SCE-1	JUNCTION	0.00	0.00	266.00	0	00:00	0.00
SCE-10	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-11	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-13	JUNCTION	0.00	0.00	258.90	0	00:00	0.00

SCE-14	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-15	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SCE-2	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-3	JUNCTION	0.00	0.00	230.00	0	00:00	0.00
SCE-4	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-5	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-6	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-7	JUNCTION	0.00	0.00	98.00	0	00:00	0.00
SCE-8	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SCE-9	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SC3-12B	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13A	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
82	JUNCTION	0.24	1.72	185.92	0	12:36	1.72
SC3-11C	JUNCTION	0.00	0.00	165.20	0	00:00	0.00
SC3_OUTFALL	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SCE_OUTFALL	OUTFALL	0.97	1.00	1.00	0	02:23	1.00
FSD14B_Outfall	OUTFALL	0.24	1.72	163.92	0	12:38	1.71
FSD05	STORAGE	3.23	6.04	28.24	0	13:47	6.04
FSD06	STORAGE	5.23	8.51	71.71	0	12:38	8.51
FSD09	STORAGE	2.46	7.27	146.47	0	12:56	7.27
FSD1	STORAGE	1.73	2.85	2.85	0	12:40	2.85
FSD11B	STORAGE	3.41	5.93	104.13	0	12:44	5.93
FSD12	STORAGE	4.35	6.08	163.08	0	12:24	6.08
FSD13	STORAGE	3.27	6.88	125.38	0	12:30	6.88
FSD14A	STORAGE	3.98	7.67	126.07	0	12:44	7.67
FSD14B	STORAGE	3.51	6.16	190.36	0	12:36	6.16
FSD15B	STORAGE	1.01	2.86	202.06	0	14:16	2.86
FSD16	STORAGE	4.56	7.83	232.03	0	12:59	7.83
FSD17A	STORAGE	3.00	4.81	235.01	0	12:46	4.81
FSD17B	STORAGE	3.23	6.22	264.42	0	12:43	6.22
FSD18	STORAGE	2.71	8.11	211.31	0	13:05	8.11
FSD20	STORAGE	0.04	1.36	325.56	0	12:23	1.36
FSD21	STORAGE	0.73	3.60	335.80	0	12:38	3.60
FSD22	STORAGE	1.55	4.67	287.87	0	12:40	4.67
FSD23	STORAGE	0.79	3.78	299.78	0	12:40	3.78
FSD27	STORAGE	3.40	6.92	264.12	0	13:01	6.92
FSD72	STORAGE	1.36	4.61	344.81	0	12:30	4.61
FSDE1	STORAGE	3.04	5.94	271.94	0	14:23	5.94
FSDE2	STORAGE	0.77	5.20	235.20	0	14:41	5.20
FSDE3	STORAGE	3.00	6.19	135.09	0	13:43	6.19
FSDE4	STORAGE	2.38	4.38	102.38	0	13:55	4.38
FSDE5	STORAGE	3.64	7.38	67.88	0	14:17	7.38
PNDE7	STORAGE	0.61	2.99	35.49	0	13:47	2.98
FSDE6	STORAGE	3.40	6.18	38.68	0	13:25	6.18
PNDW3	STORAGE	0.26	6.52	124.82	0	13:44	6.52
EX_STOCK_POND_1	STORAGE	4.12	7.16	149.16	0	13:20	7.16
FSD12A	STORAGE	4.30	7.22	164.22	0	12:30	7.22
EX_STOCK_POND_2	STORAGE	3.24	5.97	235.07	0	12:59	5.96

****
Node Inflow Summary
****

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Inflow Type	Inflow CFS	Inflow CFS	Occurrence days	Occurrence hr:min	Volume 10^6 gal	Volume 10^6 gal	Error Percent
79	JUNCTION	0.00	18.60	0	12:20	0	0.736	0.000
80	JUNCTION	0.00	16.00	0	12:31	0	0.577	0.000
81	JUNCTION	0.00	1022.96	0	12:59	0	38.1	-0.000
DP-1E	JUNCTION	0.00	54.71	0	12:25	0	3.26	0.000
DP-21	JUNCTION	0.00	128.90	0	13:01	0	13.3	0.000
DP-22	JUNCTION	0.00	128.94	0	12:59	0	13.3	0.000
DP-25	JUNCTION	0.00	21.10	0	12:15	0	0.352	0.000
DP-26	JUNCTION	0.00	76.84	0	12:25	0	2.91	0.000
DP-2E	JUNCTION	0.00	103.16	0	12:27	0	6.93	0.000
DP-3E	JUNCTION	0.00	109.01	0	12:32	0	11.4	0.000
DP-4E	JUNCTION	0.00	114.79	0	12:33	0	14.9	0.000
DP-53A	JUNCTION	0.00	1141.24	0	13:47	0	100	0.000
DP-56	JUNCTION	0.00	79.42	0	13:47	0	21.7	0.000
DP-60A	JUNCTION	0.00	1138.24	0	13:47	0	99.4	0.000
DP-61	JUNCTION	0.00	1123.05	0	13:42	0	92.9	0.000
DP-63	JUNCTION	0.00	1005.42	0	13:43	0	75.2	0.000
DP-64	JUNCTION	0.00	194.25	0	12:16	0	4.6	0.000
DP-68	JUNCTION	0.00	1327.63	0	13:18	0	71.6	0.000
DP-69	JUNCTION	0.00	1108.89	0	13:01	0	43.4	0.000
DP-70	JUNCTION	0.00	1025.79	0	12:57	0	39.6	0.000
DP-71	JUNCTION	0.00	1012.75	0	12:54	0	38.2	0.000
DP-72	JUNCTION	0.00	939.53	0	12:51	0	33.7	0.000
DP-73	JUNCTION	0.00	919.81	0	12:50	0	32.8	0.000
DP-74	JUNCTION	0.00	187.20	0	12:28	0	4.83	0.000
DP-75	JUNCTION	0.00	555.20	0	12:38	0	18.3	0.000
DP-77	JUNCTION	0.00	877.81	0	12:45	0	30.6	0.000
DP-78	JUNCTION	0.00	269.64	0	12:29	0	7.25	0.000
DP-8	JUNCTION	0.00	84.03	0	13:27	0	22.8	0.001
DP-87	JUNCTION	0.00	1170.95	0	13:07	0	50.1	0.000
FSD9_OUTLET	JUNCTION	0.00	155.28	0	12:56	0	7.16	0.000
FSDE1_Outlet	JUNCTION	0.00	7.20	0	14:23	0	1.23	0.000
FSDE2_Outlet	JUNCTION	0.00	6.56	0	14:41	0	1.64	0.000
FSDE4_Outlet	JUNCTION	0.00	2.70	0	13:55	0	1.46	0.000
PNDW3_Outfall	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
SC3-10	JUNCTION	30.77	30.77	0	12:20	0.643	0.643	0.000
SC3-11A	JUNCTION	10.06	10.06	0	12:15	0.149	0.149	0.000
SC3-11B	JUNCTION	146.85	146.85	0	12:15	4.01	4.01	0.000
SC3-12	JUNCTION	106.54	106.54	0	12:15	3	3	0.000
SC3-12A	JUNCTION	36.66	36.66	0	12:15	0.758	0.758	0.000
SC3-13	JUNCTION	115.86	115.86	0	12:15	2.51	2.51	0.000
SC3-14A	JUNCTION	237.50	237.50	0	12:20	7.99	7.99	0.000
SC3-14B	JUNCTION	136.10	136.10	0	12:15	3.81	3.81	0.000
SC3-15A	JUNCTION	76.32	76.32	0	12:25	2.46	2.46	0.000
SC3-15B	JUNCTION	17.90	17.90	0	12:15	0.449	0.449	0.000
SC3-16	JUNCTION	404.73	404.73	0	12:20	14	14	0.000
SC3-17A	JUNCTION	59.50	59.50	0	12:15	1.4	1.4	0.000
SC3-17B	JUNCTION	49.43	49.43	0	12:15	1.43	1.43	0.000
SC3-18	JUNCTION	47.83	47.83	0	12:15	1.37	1.37	0.000
SC3-18B	JUNCTION	8.86	8.86	0	12:20	0.371	0.371	0.000
SC3-19	JUNCTION	154.22	154.22	0	12:25	3.92	3.92	0.000
SC3-1A	JUNCTION	54.22	54.22	0	12:15	0.894	0.894	0.000
SC3-20	JUNCTION	38.50	38.50	0	12:15	0.835	0.835	0.000
SC3-21	JUNCTION	36.03	36.03	0	12:15	0.577	0.577	0.000
SC3-22	JUNCTION	30.08	30.08	0	12:15	0.65	0.65	0.000

SC3-23	JUNCTION	38.20	38.20	0	12:15	0.736	0.736	0.000
SC3-24A	JUNCTION	28.30	28.30	0	12:20	0.777	0.777	0.000
SC3-24B	JUNCTION	8.98	8.98	0	12:15	0.225	0.225	0.000
SC3-25	JUNCTION	21.10	21.10	0	12:15	0.352	0.352	0.000
SC3-26	JUNCTION	8.40	8.40	0	12:20	0.256	0.256	0.000
SC3-27	JUNCTION	48.09	48.09	0	12:20	1.83	1.83	0.000
SC3-5A	JUNCTION	112.35	112.35	0	12:15	2.16	2.16	0.000
SC3-5B	JUNCTION	149.00	149.00	0	12:15	3.26	3.26	0.000
SC3-61	JUNCTION	47.40	47.40	0	12:20	1.23	1.23	0.000
SC3-6A	JUNCTION	123.77	123.77	0	12:15	3.16	3.16	0.000
SC3-6B	JUNCTION	70.92	70.92	0	12:15	1.6	1.6	0.000
SC3-6C	JUNCTION	140.03	140.03	0	12:15	2.74	2.74	0.000
SC3-7	JUNCTION	126.05	126.05	0	12:15	3	3	0.000
SC3-72	JUNCTION	44.98	44.98	0	12:20	1.17	1.17	0.000
SC3-73	JUNCTION	63.84	63.84	0	12:25	1.78	1.78	0.000
SC3-74	JUNCTION	99.77	99.77	0	12:20	2.59	2.59	0.000
SC3-75	JUNCTION	49.21	49.21	0	12:25	1.72	1.72	0.000
SC3-76	JUNCTION	51.45	51.45	0	12:25	1.8	1.8	0.000
SC3-77	JUNCTION	54.46	54.46	0	12:30	2.02	2.02	0.000
SC3-78	JUNCTION	144.42	144.42	0	12:20	3.37	3.37	0.000
SC3-79	JUNCTION	156.01	156.01	0	12:25	3.87	3.87	0.000
SC3-8	JUNCTION	122.75	122.75	0	12:20	2.48	2.48	0.000
SC3-80	JUNCTION	109.14	109.14	0	12:25	3.02	3.02	0.000
SC3-81	JUNCTION	162.22	162.22	0	12:30	4.96	4.96	0.000
SC3-82	JUNCTION	102.02	102.02	0	12:20	2.22	2.22	0.000
SC3-88	JUNCTION	37.84	37.84	0	12:25	1.14	1.14	0.000
SC3-89	JUNCTION	17.14	17.14	0	12:20	0.438	0.438	0.000
SC3-9	JUNCTION	146.06	146.06	0	12:25	4.62	4.62	0.000
SCE-1	JUNCTION	38.58	38.58	0	12:25	1.52	1.52	0.000
SCE-10	JUNCTION	283.77	283.77	0	12:15	7.09	7.09	0.000
SCE-11	JUNCTION	6.50	6.50	0	12:15	0.091	0.091	0.000
SCE-13	JUNCTION	48.24	48.24	0	12:25	1.7	1.7	0.000
SCE-14	JUNCTION	35.59	35.59	0	12:20	1.14	1.14	0.000
SCE-15	JUNCTION	47.35	47.35	0	12:15	1.07	1.07	0.000
SCE-2	JUNCTION	6.27	6.27	0	12:25	0.325	0.325	0.000
SCE-3	JUNCTION	31.78	31.78	0	12:25	1.65	1.65	0.000
SCE-4	JUNCTION	12.67	12.67	0	12:30	0.9	0.9	0.000
SCE-5	JUNCTION	146.92	146.92	0	12:15	4.79	4.79	0.000
SCE-6	JUNCTION	1.42	1.42	0	12:20	0.0678	0.0678	0.000
SCE-7	JUNCTION	64.87	64.87	0	12:15	1.61	1.61	0.000
SCE-8	JUNCTION	82.94	82.94	0	12:15	2.08	2.08	0.000
SCE-9	JUNCTION	1.75	1.75	0	12:20	0.0676	0.0676	0.000
SC3-12B	JUNCTION	12.60	12.60	0	12:20	0.436	0.436	0.000
SC3-13A	JUNCTION	15.18	15.18	0	12:20	0.539	0.539	0.000
82	JUNCTION	0.00	60.69	0	12:36	0	3.65	0.000
SC3-11C	JUNCTION	11.93	11.93	0	12:15	0.151	0.151	0.000
SC3_OUTFALL	OUTFALL	0.00	1141.24	0	13:47	0	100	0.000
SCE_OUTFALL	OUTFALL	0.00	0.08	0	02:23	0	0.15	0.000
FSD14B_Outfall	OUTFALL	0.00	64.95	0	12:35	0	3.79	0.000
FSD05	STORAGE	0.00	112.35	0	12:15	0	2.16	0.002
FSD06	STORAGE	0.00	458.91	0	12:16	0	10.6	0.075
FSD09	STORAGE	0.00	241.20	0	12:30	0	7.17	0.094
FSD1	STORAGE	0.00	54.22	0	12:15	0	0.894	0.113
FSD11B	STORAGE	0.00	146.85	0	12:15	0	4.01	0.087
FSD12	STORAGE	0.00	106.54	0	12:15	0	3	0.098
FSD13	STORAGE	0.00	115.86	0	12:15	0	2.51	0.077
FSD14A	STORAGE	0.00	237.50	0	12:20	0	7.99	0.082

FSD14B	STORAGE	0.00	136.10	0	12:15	0	3.81	0.103
FSD15B	STORAGE	0.00	17.90	0	12:15	0	0.449	0.005
FSD16	STORAGE	0.00	404.73	0	12:20	0	14	0.065
FSD17A	STORAGE	0.00	59.50	0	12:15	0	1.4	0.082
FSD17B	STORAGE	0.00	49.43	0	12:15	0	1.43	0.097
FSD18	STORAGE	0.00	147.22	0	12:21	0	4.88	0.057
FSD20	STORAGE	0.00	38.50	0	12:15	0	0.835	0.181
FSD21	STORAGE	0.00	36.03	0	12:15	0	0.577	0.054
FSD22	STORAGE	0.00	30.08	0	12:15	0	0.65	0.164
FSD23	STORAGE	0.00	38.20	0	12:15	0	0.736	0.054
FSD27	STORAGE	0.00	84.48	0	12:21	0	2.91	0.097
FSD72	STORAGE	0.00	44.98	0	12:20	0	1.17	0.116
FSDE1	STORAGE	0.00	38.58	0	12:25	0	1.52	0.028
FSDE2	STORAGE	0.00	31.78	0	12:25	0	1.65	0.029
FSDE3	STORAGE	0.00	146.92	0	12:15	0	4.79	0.013
FSDE4	STORAGE	0.00	64.87	0	12:15	0	1.61	0.010
FSDE5	STORAGE	0.00	82.94	0	12:15	0	2.08	0.007
PNDE7	STORAGE	0.00	126.90	0	12:35	0	21.7	0.027
FSDE6	STORAGE	0.00	283.77	0	12:15	0	7.09	0.014
PNDW3	STORAGE	0.00	1327.63	0	13:18	0	71.7	0.405
EX_STOCK_POND_1	STORAGE	0.00	1143.60	0	13:15	0	50	0.114
FSD12A	STORAGE	0.00	36.66	0	12:15	0	0.758	0.096
EX_STOCK_POND_2	STORAGE	0.00	1025.79	0	12:57	0	39.6	0.123

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Node Flooding Summary
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Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-8	76.10	83.96	0 13:27	22.602	0.000
SC3-19	0.53	54.15	0 12:26	0.442	0.000

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
FSD05	46.476	11	0	0	200.342	49	0 13:46	3.70
FSD06	309.743	26	0	0	805.624	67	0 12:37	139.30
FSD09	59.626	8	0	0	358.622	50	0 12:55	155.28
FSD1	39.349	11	0	0	76.723	21	0 12:39	14.25
FSD11B	103.215	20	0	0	304.766	60	0 12:44	43.65
FSD12	58.750	23	0	0	109.795	44	0 12:24	84.49
FSD13	41.314	12	0	0	164.684	48	0 12:30	43.80
FSD14A	203.329	26	0	0	549.345	71	0 12:43	108.52

FSD14B	98.911	25	0	0	260.832	65	0	12:35	60.69
FSD15B	9.012	2	0	0	39.620	7	0	14:16	0.60
FSD16	347.949	22	0	0	1048.761	65	0	12:58	128.94
FSD17A	27.088	5	0	0	109.431	19	0	12:46	16.01
FSD17B	31.532	22	0	0	94.581	65	0	12:43	23.02
FSD18	47.943	12	0	0	290.900	73	0	13:05	82.23
FSD20	0.084	0	0	0	8.097	6	0	12:23	35.73
FSD21	4.372	3	0	0	33.954	25	0	12:38	16.00
FSD22	5.945	6	0	0	35.468	35	0	12:40	17.49
FSD23	4.253	3	0	0	34.780	26	0	12:40	18.60
FSD27	44.686	15	0	0	157.059	52	0	13:00	51.44
FSD72	10.753	8	0	0	48.229	36	0	12:30	40.25
FSDE1	64.875	23	0	0	154.344	54	0	14:23	7.20
FSDE2	14.485	5	0	0	128.111	45	0	14:40	6.56
FSDE3	161.010	21	0	0	452.250	59	0	13:43	10.24
FSDE4	61.468	12	0	0	154.038	30	0	13:55	2.70
FSDE5	79.581	30	0	0	196.697	75	0	14:16	3.09
PNDE7	17.079	1	0	0	225.358	14	0	13:47	79.42
FSDE6	226.658	18	0	0	696.007	55	0	13:25	15.76
PNDW3	20.453	1	0	0	1127.426	44	0	13:44	987.80
EX_STOCK_POND_1	263.926	31	0	0	584.504	68	0	13:19	1127.32
FSD12A	20.027	22	0	0	50.567	55	0	12:29	18.73
EX_STOCK_POND_2	166.516	39	0	0	336.438	79	0	12:59	1022.96

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
SC3_OUTFALL	97.99	48.62	1141.24	100.060
SCE_OUTFALL	97.53	0.07	0.08	0.150
FSD14B_Outfall	98.01	1.84	64.95	3.792
System	97.85	50.53	1152.68	104.002

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-1	CONDUIT	149.77	0 12:43	4.67	0.00	0.08
RT-10A	CONDUIT	107.67	0 12:51	6.20	1.08	1.00
RT-10B	CONDUIT	76.63	0 12:31	15.28	0.20	0.30
RT-11A	CONDUIT	1021.30	0 13:01	7.11	0.02	0.15
RT-11B	CONDUIT	1093.11	0 13:07	6.65	0.02	0.17
RT-11C	CONDUIT	1143.60	0 13:15	4.66	0.03	0.20
RT-12A	CONDUIT	128.90	0 13:01	16.33	0.67	0.60

RT-12B	CONDUIT	128.88	0	13:02	20.90	0.35	0.41
RT-16	CONDUIT	121.70	0	12:16	16.57	0.87	0.72
RT-17B	CONDUIT	154.93	0	12:59	18.74	0.72	0.63
RT-18	CONDUIT	1121.15	0	13:47	6.56	0.02	0.15
RT-19	CONDUIT	46.59	0	12:23	7.73	0.16	0.27
RT-1E	CONDUIT	7.20	0	14:24	5.44	0.06	0.16
RT-2	CONDUIT	94.01	0	12:40	4.27	0.00	0.06
RT-20	CONDUIT	1138.22	0	13:47	10.04	0.01	0.11
RT-21	CONDUIT	19.43	0	12:20	11.12	0.13	0.24
RT-22	CONDUIT	18.72	0	13:04	13.54	0.20	0.31
RT-2E	CONDUIT	54.33	0	12:28	10.04	0.41	0.45
RT-3	CONDUIT	94.58	0	12:30	4.26	0.00	0.06
RT-3E	CONDUIT	6.56	0	14:42	5.73	0.05	0.15
RT-4	CONDUIT	178.58	0	12:36	4.73	0.00	0.08
RT-4E	CONDUIT	102.32	0	12:32	12.33	0.73	0.63
RT-5	CONDUIT	538.07	0	12:46	6.75	0.01	0.15
RT-5E	CONDUIT	108.93	0	12:33	16.64	0.29	0.37
RT-6	CONDUIT	146.64	0	12:33	5.08	0.00	0.07
RT-6B	CONDUIT	228.12	0	12:47	4.92	0.00	0.10
RT-6E	CONDUIT	2.70	0	14:00	4.42	0.02	0.10
RT-7A	CONDUIT	17.05	0	12:21	11.87	0.06	0.17
RT-7E	CONDUIT	114.69	0	12:35	11.55	0.31	0.38
RT-8	CONDUIT	35.72	0	12:24	15.71	0.81	0.68
RT-9A	CONDUIT	868.70	0	12:51	6.21	0.02	0.15
RT-9B	CONDUIT	919.17	0	12:52	7.13	0.01	0.14
RT-9C	CONDUIT	937.33	0	12:54	6.65	0.02	0.15
RT-9D	CONDUIT	1010.51	0	12:57	6.90	0.02	0.15
RT-14	CONDUIT	1004.81	0	13:47	6.78	0.01	0.13
1	DUMMY	99.77	0	12:20			
2	DUMMY	63.84	0	12:25			
3	DUMMY	49.21	0	12:25			
4	DUMMY	51.45	0	12:25			
5	DUMMY	144.42	0	12:20			
6	DUMMY	44.98	0	12:20			
7	DUMMY	54.46	0	12:30			
8	DUMMY	37.84	0	12:25			
9	DUMMY	38.58	0	12:25			
10	DUMMY	6.27	0	12:25			
11	DUMMY	8.40	0	12:20			
12	DUMMY	48.09	0	12:20			
13	DUMMY	38.20	0	12:15			
14	DUMMY	36.03	0	12:15			
15	DUMMY	21.10	0	12:15			
16	DUMMY	8.98	0	12:15			
17	DUMMY	30.08	0	12:15			
18	DUMMY	49.43	0	12:15			
20	DUMMY	38.50	0	12:15			
22	DUMMY	136.10	0	12:15			
24	DUMMY	237.50	0	12:20			
25	DUMMY	115.86	0	12:15			
27	DUMMY	64.87	0	12:15			
28	DUMMY	82.94	0	12:15			
29	DUMMY	146.92	0	12:15			
34	DUMMY	47.83	0	12:15			
36	DUMMY	31.78	0	12:25			
37	DUMMY	12.67	0	12:30			
38	DUMMY	146.06	0	12:25			

RT-17A	CONDUIT	104.75	0	12:34	6.00	0.00	0.09
39	DUMMY	76.32	0	12:25			
40	DUMMY	17.90	0	12:15			
42	DUMMY	106.54	0	12:15			
44	DUMMY	6.50	0	12:15			
45	DUMMY	1.75	0	12:20			
46	DUMMY	1.42	0	12:20			
47	DUMMY	35.59	0	12:20			
48	DUMMY	48.24	0	12:25			
51	DUMMY	283.77	0	12:15			
54	DUMMY	146.85	0	12:15			
56	DUMMY	10.06	0	12:15			
58	CONDUIT	1327.63	0	13:18	12.91	0.01	0.10
63	DUMMY	112.35	0	12:15			
65	DUMMY	54.22	0	12:15			
67	DUMMY	1141.24	0	13:47			
RT-15A	CONDUIT	125.05	0	12:16	19.10	0.53	0.52
RT-15B	CONDUIT	193.24	0	12:16	19.29	0.32	0.39
69	DUMMY	140.03	0	12:15			
70	DUMMY	70.92	0	12:15			
RT-25	CONDUIT	79.41	0	13:51	4.18	0.01	0.13
71	CONDUIT	0.08	0	02:23	0.10	1.08	1.00
74	DUMMY	30.77	0	12:20			
75	DUMMY	28.30	0	12:20			
77	DUMMY	149.00	0	12:15			
78	DUMMY	59.50	0	12:15			
79	DUMMY	404.73	0	12:20			
80	CONDUIT	16.01	0	12:46	16.09	0.16	0.27
81	DUMMY	36.66	0	12:15			
82	DUMMY	47.35	0	12:15			
83	DUMMY	8.86	0	12:20			
84	DUMMY	1025.79	0	12:57			
85	DUMMY	12.60	0	12:20			
86	DUMMY	15.18	0	12:20			
87	DUMMY	11.93	0	12:15			
88	CONDUIT	60.48	0	12:38	12.89	0.49	0.49
FSD01_Outlet	DUMMY	14.25	0	12:40			
FSD05_Outlet	DUMMY	3.70	0	12:11			
FSD06_Outlet	DUMMY	139.30	0	12:30			
FSD11B_Outlet	DUMMY	43.65	0	12:44			
FSD12_Outlet	DUMMY	84.49	0	12:24			
FSD13_Outlet	DUMMY	43.80	0	12:20			
FSD14A_Outlet	DUMMY	108.52	0	12:44			
FSD14B_Outlet	DUMMY	60.69	0	12:36			
FSD15B_Outlet	DUMMY	0.60	0	14:16			
FSD16_Outlet	DUMMY	128.94	0	12:59			
FSD17B_Outlet	DUMMY	23.02	0	12:43			
FSD18_Outlet	DUMMY	82.23	0	13:05			
FSD21_Outlet	DUMMY	16.00	0	12:31			
FSD22_Outlet	DUMMY	17.49	0	12:40			
FSD72_Outlet	DUMMY	40.25	0	12:30			
FSD9_Outlet	DUMMY	155.28	0	12:56			
FSDE2_Outlet	DUMMY	6.56	0	14:41			
FSDE3_Outlet	DUMMY	10.24	0	13:43			
FSDE4_Outlet	DUMMY	2.70	0	13:55			
FSDE5_Outlet	DUMMY	3.09	0	14:17			
FSDE6_Outlet	DUMMY	15.76	0	13:25			

FSDE1_Outlet	DUMMY	7.20	0	14:23
PNDE7_Outlet	DUMMY	79.42	0	13:47
FSD17A_Outlet	DUMMY	16.01	0	12:46
PNDW3_Outlet	DUMMY	987.80	0	13:44
FSD27_Outlet	DUMMY	51.44	0	13:01
EX_STOCK_POND_1_OUTFALL	DUMMY	1127.32	0	13:20
FSD23_Outlet	DUMMY	18.60	0	12:20
FSD12A_Outlet	DUMMY	18.73	0	12:30
EX_STOCK_POND_2_OUTLET	DUMMY	1022.96	0	12:59

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Conduit Surcharge Summary
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	Hours Full			Hours Above Full	Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
RT-10A	0.53	0.53	0.53	0.57	0.53
71	76.11	76.11	76.11	0.03	76.11

Analysis begun on: Thu Jun 23 14:22:34 2022
Analysis ended on: Thu Jun 23 14:22:35 2022
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
50-YR Type II Storm
NOTE: These warnings are generated from using 1 foot dummy conduits between basin nodes and detention ponds to ensure there is no additional travel time between the bottom of the basin and the detention pond, except where conveyed by a channel.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2021 MDDP Amendment
50-YR Type II Storm

WARNING 04: minimum elevation drop used for Conduit 1
WARNING 04: minimum elevation drop used for Conduit 2
WARNING 04: minimum elevation drop used for Conduit 3
WARNING 04: minimum elevation drop used for Conduit 4
WARNING 04: minimum elevation drop used for Conduit 5
WARNING 04: minimum elevation drop used for Conduit 6
WARNING 04: minimum elevation drop used for Conduit 7
WARNING 04: minimum elevation drop used for Conduit 8
WARNING 04: minimum elevation drop used for Conduit 9
WARNING 04: minimum elevation drop used for Conduit 10
WARNING 04: minimum elevation drop used for Conduit 11
WARNING 04: minimum elevation drop used for Conduit 12
WARNING 04: minimum elevation drop used for Conduit 14
WARNING 04: minimum elevation drop used for Conduit 15
WARNING 04: minimum elevation drop used for Conduit 16
WARNING 04: minimum elevation drop used for Conduit 17
WARNING 04: minimum elevation drop used for Conduit 18
WARNING 04: minimum elevation drop used for Conduit 20
WARNING 04: minimum elevation drop used for Conduit 22
WARNING 04: minimum elevation drop used for Conduit 27
WARNING 04: minimum elevation drop used for Conduit 28
WARNING 04: minimum elevation drop used for Conduit 29
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 54
WARNING 08: elevation drop exceeds length for Conduit 56
WARNING 04: minimum elevation drop used for Conduit 63
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 67
WARNING 04: minimum elevation drop used for Conduit 69
WARNING 04: minimum elevation drop used for Conduit 70
WARNING 04: minimum elevation drop used for Conduit 71

WARNING 04: minimum elevation drop used for Conduit 74
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 08: elevation drop exceeds length for Conduit 77
WARNING 04: minimum elevation drop used for Conduit 78
WARNING 04: minimum elevation drop used for Conduit 79
WARNING 04: minimum elevation drop used for Conduit 82
WARNING 04: minimum elevation drop used for Conduit 83
WARNING 04: minimum elevation drop used for Conduit 85
WARNING 08: elevation drop exceeds length for Conduit 87
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12_Outlet
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12A_Outlet

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 0.000 0.000
Groundwater Inflow 0.000 0.000
RDII Inflow 0.000 0.000
External Inflow 523.785 170.683
External Outflow 408.596 133.147
Flooding Loss 90.833 29.599
Evaporation Loss 0.000 0.000
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 25.671 8.365
Continuity Error (%) ..... -0.251

****
Highest Flow Instability Indexes

****
Link PNDW3_Outlet (54)
Link RT-14 (54)
Link RT-18 (54)
Link RT-20 (52)
Link 67 (52)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
79	JUNCTION	0.07	0.92	295.92	0 12:16	0.92
80	JUNCTION	0.07	0.81	331.81	0 12:20	0.81
81	JUNCTION	0.15	3.53	232.53	0 12:56	3.53
DP-1E	JUNCTION	0.22	2.11	261.01	0 12:25	2.11
DP-21	JUNCTION	0.43	2.72	186.92	0 13:01	2.72
DP-22	JUNCTION	0.43	2.72	226.92	0 12:59	2.72
DP-25	JUNCTION	0.03	1.00	333.20	0 12:15	0.98
DP-26	JUNCTION	0.11	1.77	200.97	0 12:25	1.77
DP-2E	JUNCTION	0.30	3.16	222.06	0 12:27	3.14
DP-3E	JUNCTION	0.36	3.14	132.04	0 12:32	3.12
DP-4E	JUNCTION	0.50	2.69	63.19	0 12:34	2.69
DP-53A	JUNCTION	0.25	2.56	2.56	0 13:41	2.56
DP-56	JUNCTION	0.43	1.55	33.55	0 14:17	1.55
DP-60A	JUNCTION	0.35	3.52	25.72	0 13:42	3.52
DP-61	JUNCTION	0.34	3.64	66.84	0 13:02	3.52
DP-63	JUNCTION	0.27	3.14	101.34	0 13:41	3.14
DP-64	JUNCTION	0.12	2.58	95.78	0 12:15	2.55
DP-68	JUNCTION	0.36	2.37	120.77	0 13:13	2.37
DP-69	JUNCTION	0.18	3.91	207.11	0 12:59	3.90
DP-70	JUNCTION	0.15	3.58	232.78	0 12:54	3.58
DP-71	JUNCTION	0.15	3.58	260.78	0 12:52	3.57
DP-72	JUNCTION	0.12	3.49	286.69	0 12:49	3.49
DP-73	JUNCTION	0.14	3.49	303.69	0 12:49	3.49
DP-74	JUNCTION	0.05	1.97	499.17	0 12:27	1.96
DP-75	JUNCTION	0.10	3.44	435.64	0 12:37	3.43
DP-77	JUNCTION	0.12	3.50	343.70	0 12:44	3.50
DP-78	JUNCTION	0.07	2.39	464.59	0 12:28	2.39
DP-8	JUNCTION	9.79	10.00	10.00	0 01:40	10.00
DP-87	JUNCTION	0.25	4.66	161.86	0 13:03	4.65

FSD9_OUTLET	JUNCTION	0.23	4.00	143.20	0	12:43	4.00
FSDE1_Outlet	JUNCTION	0.18	0.89	265.79	0	13:57	0.89
FSDE2_Outlet	JUNCTION	0.14	0.75	229.65	0	14:17	0.75
FSDE4_Outlet	JUNCTION	0.19	0.43	98.03	0	13:48	0.43
PNDW3_Outfall	JUNCTION	0.00	0.00	118.20	0	00:00	0.00
SC3-10	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-11A	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-11B	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-12	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-12A	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
SC3-14A	JUNCTION	0.00	0.00	118.50	0	00:00	0.00
SC3-14B	JUNCTION	0.00	0.00	184.20	0	00:00	0.00
SC3-15A	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-15B	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-16	JUNCTION	0.00	0.00	224.20	0	00:00	0.00
SC3-17A	JUNCTION	0.00	0.00	230.20	0	00:00	0.00
SC3-17B	JUNCTION	0.00	0.00	258.20	0	00:00	0.00
SC3-18	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-18B	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-19	JUNCTION	0.13	5.00	250.20	0	12:12	5.00
SC3-1A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-20	JUNCTION	0.00	0.00	324.20	0	00:00	0.00
SC3-21	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-22	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-23	JUNCTION	0.00	0.00	295.20	0	00:00	0.00
SC3-24A	JUNCTION	0.00	0.00	300.20	0	00:00	0.00
SC3-24B	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-25	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-26	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-27	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-5A	JUNCTION	0.00	0.00	22.20	0	00:00	0.00
SC3-5B	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-61	JUNCTION	0.06	1.88	30.08	0	12:20	1.87
SC3-6A	JUNCTION	0.12	3.50	90.70	0	12:14	3.50
SC3-6B	JUNCTION	0.00	0.00	93.20	0	00:00	0.00
SC3-6C	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-7	JUNCTION	0.10	2.33	119.53	0	12:15	2.31
SC3-72	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-73	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-74	JUNCTION	0.00	0.00	497.20	0	00:00	0.00
SC3-75	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-76	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-77	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-78	JUNCTION	0.00	0.00	462.20	0	00:00	0.00
SC3-79	JUNCTION	0.05	1.69	563.89	0	12:25	1.69
SC3-8	JUNCTION	0.04	2.12	249.32	0	12:20	2.10
SC3-80	JUNCTION	0.05	1.53	553.73	0	12:25	1.53
SC3-81	JUNCTION	0.05	1.84	534.04	0	12:30	1.84
SC3-82	JUNCTION	0.03	1.47	563.67	0	12:20	1.46
SC3-88	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-89	JUNCTION	0.02	0.80	376.00	0	12:20	0.79
SC3-9	JUNCTION	0.00	0.00	139.20	0	00:00	0.00
SCE-1	JUNCTION	0.00	0.00	266.00	0	00:00	0.00
SCE-10	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-11	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-13	JUNCTION	0.00	0.00	258.90	0	00:00	0.00

SCE-14	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-15	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SCE-2	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-3	JUNCTION	0.00	0.00	230.00	0	00:00	0.00
SCE-4	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-5	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-6	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-7	JUNCTION	0.00	0.00	98.00	0	00:00	0.00
SCE-8	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SCE-9	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SC3-12B	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13A	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
82	JUNCTION	0.25	2.22	186.42	0	12:31	2.21
SC3-11C	JUNCTION	0.00	0.00	165.20	0	00:00	0.00
SC3_OUTFALL	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SCE_OUTFALL	OUTFALL	0.97	1.00	1.00	0	02:11	1.00
FSD14B_Outfall	OUTFALL	0.25	2.22	164.42	0	12:32	2.20
FSD05	STORAGE	3.48	6.69	28.89	0	14:01	6.69
FSD06	STORAGE	5.31	9.32	72.52	0	12:41	9.32
FSD09	STORAGE	2.51	7.92	147.12	0	12:52	7.91
FSD1	STORAGE	1.74	3.20	3.20	0	12:36	3.20
FSD11B	STORAGE	3.46	6.22	104.42	0	12:39	6.22
FSD12	STORAGE	4.39	6.40	163.40	0	12:26	6.40
FSD13	STORAGE	3.32	7.66	126.16	0	12:33	7.65
FSD14A	STORAGE	4.03	8.23	126.63	0	12:45	8.23
FSD14B	STORAGE	3.55	6.45	190.65	0	12:31	6.45
FSD15B	STORAGE	1.21	3.12	202.32	0	14:24	3.12
FSD16	STORAGE	4.63	8.44	232.64	0	12:59	8.44
FSD17A	STORAGE	3.05	5.02	235.22	0	12:43	5.02
FSD17B	STORAGE	3.27	6.56	264.76	0	12:39	6.56
FSD18	STORAGE	2.77	8.50	211.70	0	13:11	8.50
FSD20	STORAGE	0.04	1.69	325.89	0	12:25	1.69
FSD21	STORAGE	0.77	4.60	336.80	0	12:44	4.59
FSD22	STORAGE	1.58	5.16	288.36	0	12:42	5.16
FSD23	STORAGE	0.85	4.98	300.98	0	12:48	4.97
FSD27	STORAGE	3.46	7.24	264.44	0	12:54	7.24
FSD72	STORAGE	1.38	4.75	344.95	0	12:30	4.75
FSDE1	STORAGE	3.09	6.59	272.59	0	13:57	6.59
FSDE2	STORAGE	0.90	6.16	236.16	0	14:17	6.16
FSDE3	STORAGE	3.10	6.78	135.68	0	13:14	6.78
FSDE4	STORAGE	2.52	4.89	102.89	0	13:48	4.89
FSDE5	STORAGE	3.87	8.15	68.65	0	14:07	8.15
PNDE7	STORAGE	0.71	4.29	36.79	0	14:17	4.29
FSDE6	STORAGE	3.52	6.88	39.38	0	13:11	6.88
PNDW3	STORAGE	0.33	8.57	126.87	0	13:41	8.57
EX_STOCK_POND_1	STORAGE	4.14	7.71	149.71	0	13:15	7.71
FSD12A	STORAGE	4.34	7.66	164.66	0	12:30	7.66
EX_STOCK_POND_2	STORAGE	3.26	6.48	235.58	0	12:56	6.48

****
Node Inflow Summary
****

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Inflow Type	Inflow CFS	Occurrence CFS	Occurrence days hr:min	Volume 10^6 gal	Volume 10^6 gal	Error Percent
79	JUNCTION	0.00	18.60	0 12:16	0	0.955	0.000
80	JUNCTION	0.00	16.00	0 12:20	0	0.755	0.000
81	JUNCTION	0.00	1400.87	0 12:56	0	51.3	0.000
DP-1E	JUNCTION	0.00	72.19	0 12:25	0	4.42	0.000
DP-21	JUNCTION	0.00	153.87	0 13:01	0	16	0.000
DP-22	JUNCTION	0.00	153.88	0 12:59	0	16.1	0.000
DP-25	JUNCTION	0.00	26.97	0 12:15	0	0.463	0.000
DP-26	JUNCTION	0.00	102.99	0 12:25	0	3.9	0.000
DP-2E	JUNCTION	0.00	135.52	0 12:27	0	9.18	0.000
DP-3E	JUNCTION	0.00	143.90	0 12:33	0	14.6	0.000
DP-4E	JUNCTION	0.00	152.57	0 12:34	0	18.7	0.000
DP-53A	JUNCTION	0.00	1573.95	0 13:41	0	128	0.000
DP-56	JUNCTION	0.00	106.60	0 14:17	0	27.1	0.000
DP-60A	JUNCTION	0.00	1569.79	0 13:41	0	128	0.000
DP-61	JUNCTION	0.00	1549.17	0 13:38	0	120	0.000
DP-63	JUNCTION	0.00	1368.28	0 13:41	0	97.1	0.000
DP-64	JUNCTION	0.00	233.42	0 12:15	0	5.47	0.000
DP-68	JUNCTION	0.00	1837.13	0 13:13	0	92.8	0.000
DP-69	JUNCTION	0.00	1497.55	0 12:59	0	57.7	0.000
DP-70	JUNCTION	0.00	1405.32	0 12:54	0	52.8	0.000
DP-71	JUNCTION	0.00	1386.32	0 12:52	0	51.1	0.000
DP-72	JUNCTION	0.00	1285.42	0 12:49	0	45.4	0.000
DP-73	JUNCTION	0.00	1257.44	0 12:48	0	44.2	0.000
DP-74	JUNCTION	0.00	251.03	0 12:27	0	6.53	-0.000
DP-75	JUNCTION	0.00	754.29	0 12:37	0	24.7	0.000
DP-77	JUNCTION	0.00	1201.19	0 12:44	0	41.3	0.000
DP-78	JUNCTION	0.00	360.98	0 12:28	0	9.73	-0.000
DP-8	JUNCTION	0.00	107.24	0 14:19	0	28.5	0.001
DP-87	JUNCTION	0.00	1589.82	0 13:03	0	66.2	0.000
FSD9_OUTLET	JUNCTION	0.00	226.29	0 12:52	0	9.59	0.000
FSDE1_Outlet	JUNCTION	0.00	13.77	0 13:57	0	1.71	0.000
FSDE2_Outlet	JUNCTION	0.00	10.80	0 14:17	0	2.11	0.000
FSDE4_Outlet	JUNCTION	0.00	3.45	0 13:48	0	1.74	0.000
PNDW3_Outfall	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 gal
SC3-10	JUNCTION	41.33	41.33	0 12:15	0.874	0.874	0.000
SC3-11A	JUNCTION	13.08	13.08	0 12:15	0.202	0.202	0.000
SC3-11B	JUNCTION	176.93	176.93	0 12:15	4.77	4.77	0.000
SC3-12	JUNCTION	129.44	129.44	0 12:15	3.61	3.61	0.000
SC3-12A	JUNCTION	44.86	44.86	0 12:15	0.924	0.924	0.000
SC3-13	JUNCTION	138.53	138.53	0 12:15	2.99	2.99	0.000
SC3-14A	JUNCTION	287.18	287.18	0 12:20	9.53	9.53	0.000
SC3-14B	JUNCTION	165.72	165.72	0 12:15	4.54	4.54	0.000
SC3-15A	JUNCTION	102.43	102.43	0 12:25	3.36	3.36	0.000
SC3-15B	JUNCTION	21.56	21.56	0 12:15	0.537	0.537	0.000
SC3-16	JUNCTION	493.40	493.40	0 12:20	16.7	16.7	0.000
SC3-17A	JUNCTION	72.46	72.46	0 12:15	1.7	1.7	0.000
SC3-17B	JUNCTION	60.70	60.70	0 12:15	1.74	1.74	0.000
SC3-18	JUNCTION	57.56	57.56	0 12:15	1.64	1.64	0.000
SC3-18B	JUNCTION	11.91	11.91	0 12:25	0.507	0.507	0.000
SC3-19	JUNCTION	205.45	205.45	0 12:25	5.34	5.34	0.000
SC3-1A	JUNCTION	68.02	68.02	0 12:15	1.11	1.11	0.000
SC3-20	JUNCTION	50.17	50.17	0 12:15	1.11	1.11	0.000
SC3-21	JUNCTION	45.92	45.92	0 12:15	0.756	0.756	0.000
SC3-22	JUNCTION	39.14	39.14	0 12:15	0.863	0.863	0.000

SC3-23	JUNCTION	48.72	48.72	0	12:15	0.955	0.955	0.000
SC3-24A	JUNCTION	37.09	37.09	0	12:20	1.04	1.04	0.000
SC3-24B	JUNCTION	11.76	11.76	0	12:15	0.302	0.302	0.000
SC3-25	JUNCTION	26.97	26.97	0	12:15	0.463	0.463	0.000
SC3-26	JUNCTION	11.13	11.13	0	12:20	0.346	0.346	0.000
SC3-27	JUNCTION	61.80	61.80	0	12:20	2.35	2.35	0.000
SC3-5A	JUNCTION	135.50	135.50	0	12:15	2.59	2.59	0.000
SC3-5B	JUNCTION	181.48	181.48	0	12:15	3.92	3.92	0.000
SC3-61	JUNCTION	63.67	63.67	0	12:20	1.66	1.66	0.000
SC3-6A	JUNCTION	149.06	149.06	0	12:15	3.75	3.75	-0.000
SC3-6B	JUNCTION	85.96	85.96	0	12:15	1.92	1.92	0.000
SC3-6C	JUNCTION	174.32	174.32	0	12:15	3.34	3.34	0.000
SC3-7	JUNCTION	150.45	150.45	0	12:15	3.55	3.55	0.000
SC3-72	JUNCTION	59.19	59.19	0	12:20	1.58	1.58	0.000
SC3-73	JUNCTION	84.94	84.94	0	12:25	2.41	2.41	0.000
SC3-74	JUNCTION	131.03	131.03	0	12:20	3.46	3.46	0.000
SC3-75	JUNCTION	64.91	64.91	0	12:25	2.29	2.29	0.000
SC3-76	JUNCTION	68.18	68.18	0	12:25	2.42	2.42	0.000
SC3-77	JUNCTION	73.59	73.59	0	12:30	2.76	2.76	0.000
SC3-78	JUNCTION	189.21	189.21	0	12:20	4.5	4.5	0.000
SC3-79	JUNCTION	205.95	205.95	0	12:25	5.22	5.22	0.000
SC3-8	JUNCTION	166.13	166.13	0	12:20	3.41	3.41	0.000
SC3-80	JUNCTION	144.50	144.50	0	12:25	4.08	4.08	0.000
SC3-81	JUNCTION	218.65	218.65	0	12:30	6.79	6.79	0.000
SC3-82	JUNCTION	136.18	136.18	0	12:20	3.04	3.04	0.000
SC3-88	JUNCTION	50.80	50.80	0	12:25	1.55	1.55	0.000
SC3-89	JUNCTION	22.87	22.87	0	12:20	0.6	0.6	0.000
SC3-9	JUNCTION	193.77	193.77	0	12:25	6.11	6.11	0.000
SCE-1	JUNCTION	50.51	50.51	0	12:25	2	2	0.000
SCE-10	JUNCTION	358.46	358.46	0	12:15	8.67	8.67	0.000
SCE-11	JUNCTION	8.93	8.93	0	12:15	0.127	0.127	0.000
SCE-13	JUNCTION	63.64	63.64	0	12:25	2.27	2.27	0.000
SCE-14	JUNCTION	46.77	46.77	0	12:20	1.52	1.52	0.000
SCE-15	JUNCTION	60.67	60.67	0	12:15	1.39	1.39	0.000
SCE-2	JUNCTION	8.30	8.30	0	12:25	0.434	0.434	0.000
SCE-3	JUNCTION	41.56	41.56	0	12:25	2.11	2.11	0.000
SCE-4	JUNCTION	16.29	16.29	0	12:30	1.15	1.15	0.000
SCE-5	JUNCTION	177.83	177.83	0	12:15	5.7	5.7	0.000
SCE-6	JUNCTION	2.00	2.00	0	12:20	0.0949	0.0949	0.000
SCE-7	JUNCTION	77.06	77.06	0	12:15	1.91	1.91	0.000
SCE-8	JUNCTION	97.16	97.16	0	12:15	2.44	2.44	0.000
SCE-9	JUNCTION	2.46	2.46	0	12:20	0.0947	0.0947	0.000
SC3-12B	JUNCTION	16.83	16.83	0	12:20	0.596	0.596	0.000
SC3-13A	JUNCTION	20.28	20.28	0	12:20	0.736	0.736	0.000
82	JUNCTION	0.00	90.75	0	12:31	0	4.38	0.000
SC3-11C	JUNCTION	15.66	15.66	0	12:15	0.203	0.203	0.000
SC3_OUTFALL	OUTFALL	0.00	1573.95	0	13:41	0	128	0.000
SCE_OUTFALL	OUTFALL	0.00	0.08	0	02:10	0	0.15	0.000
FSD14B_Outfall	OUTFALL	0.00	98.12	0	12:31	0	4.58	0.000
FSD05	STORAGE	0.00	135.50	0	12:15	0	2.59	0.001
FSD06	STORAGE	0.00	554.51	0	12:15	0	12.7	0.064
FSD09	STORAGE	0.00	327.53	0	12:30	0	9.6	0.088
FSD1	STORAGE	0.00	68.02	0	12:15	0	1.11	0.106
FSD11B	STORAGE	0.00	176.93	0	12:15	0	4.77	0.090
FSD12	STORAGE	0.00	129.44	0	12:15	0	3.61	0.064
FSD13	STORAGE	0.00	138.53	0	12:15	0	2.99	0.061
FSD14A	STORAGE	0.00	287.18	0	12:20	0	9.53	0.066

FSD14B	STORAGE	0.00	165.72	0	12:15	0	4.54	0.089
FSD15B	STORAGE	0.00	21.56	0	12:15	0	0.537	0.005
FSD16	STORAGE	0.00	493.40	0	12:20	0	16.7	0.056
FSD17A	STORAGE	0.00	72.46	0	12:15	0	1.7	0.109
FSD17B	STORAGE	0.00	60.70	0	12:15	0	1.74	0.081
FSD18	STORAGE	0.00	162.00	0	12:17	0	5.8	0.051
FSD20	STORAGE	0.00	50.17	0	12:15	0	1.11	0.286
FSD21	STORAGE	0.00	45.92	0	12:15	0	0.756	0.079
FSD22	STORAGE	0.00	39.14	0	12:15	0	0.863	0.130
FSD23	STORAGE	0.00	48.72	0	12:15	0	0.955	0.051
FSD27	STORAGE	0.00	105.16	0	12:20	0	3.77	0.106
FSD72	STORAGE	0.00	59.19	0	12:20	0	1.58	0.547
FSDE1	STORAGE	0.00	50.51	0	12:25	0	2	0.054
FSDE2	STORAGE	0.00	41.56	0	12:25	0	2.11	0.033
FSDE3	STORAGE	0.00	177.83	0	12:15	0	5.7	0.030
FSDE4	STORAGE	0.00	77.06	0	12:15	0	1.91	0.013
FSDE5	STORAGE	0.00	97.16	0	12:15	0	2.44	0.012
PNDE7	STORAGE	0.00	176.00	0	12:43	0	27.1	0.026
FSDE6	STORAGE	0.00	358.46	0	12:15	0	8.67	0.029
PNDW3	STORAGE	0.00	1837.12	0	13:13	0	92.8	0.319
EX_STOCK_POND_1	STORAGE	0.00	1561.29	0	13:11	0	66.2	0.100
FSD12A	STORAGE	0.00	44.86	0	12:15	0	0.924	0.090
EX_STOCK_POND_2	STORAGE	0.00	1405.32	0	12:54	0	52.8	0.110

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-8	76.33	107.17	0 14:20	28.317	0.000
FSD9_OUTLET	0.32	10.71	0 12:52	0.062	0.000
SC3-19	0.82	105.25	0 12:26	1.212	0.000
SC3-6A	0.06	8.27	0 12:15	0.007	0.000

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
FSD05	60.384	15	0	0	242.809	60	0 14:01	3.70
FSD06	318.636	26	0	0	962.159	80	0 12:41	139.30
FSD09	61.830	9	0	0	418.499	58	0 12:51	226.29
FSD1	39.698	11	0	0	89.475	25	0 12:36	22.08
FSD11B	105.527	21	0	0	339.837	67	0 12:39	64.45
FSD12	59.489	24	0	0	122.435	49	0 12:25	97.62

FSD13	42.682	12	0	0	198.011	57	0	12:33	43.80
FSD14A	207.406	27	0	0	614.996	80	0	12:44	126.68
FSD14B	100.500	25	0	0	282.155	70	0	12:30	90.75
FSD15B	12.255	2	0	0	48.742	9	0	14:23	0.66
FSD16	358.990	22	0	0	1204.697	74	0	12:59	153.88
FSD17A	28.317	5	0	0	125.605	22	0	12:42	22.92
FSD17B	32.191	22	0	0	103.611	72	0	12:39	32.41
FSD18	49.724	12	0	0	313.821	78	0	13:11	98.72
FSD20	0.117	0	0	0	11.417	9	0	12:24	44.35
FSD21	4.727	4	0	0	48.066	36	0	12:44	16.00
FSD22	6.159	6	0	0	42.896	42	0	12:41	22.38
FSD23	4.746	4	0	0	52.291	39	0	12:47	18.60
FSD27	46.136	15	0	0	170.705	56	0	12:53	67.58
FSD72	10.902	8	0	0	50.412	38	0	12:30	52.63
FSDE1	66.611	23	0	0	179.257	63	0	13:57	13.77
FSDE2	18.205	6	0	0	162.709	57	0	14:16	10.80
FSDE3	169.101	22	0	0	513.808	67	0	13:14	23.50
FSDE4	67.805	13	0	0	181.568	35	0	13:48	3.45
FSDE5	87.007	33	0	0	227.505	86	0	14:06	3.80
PNDE7	29.722	2	0	0	449.664	28	0	14:17	106.60
FSDE6	243.581	19	0	0	831.736	66	0	13:10	31.87
PNDW3	34.591	1	0	0	1763.677	68	0	13:41	1345.30
EX_STOCK_POND_1	266.235	31	0	0	667.789	78	0	13:15	1540.43
FSD12A	20.362	22	0	0	56.649	62	0	12:30	22.86
EX_STOCK_POND_2	167.765	39	0	0	379.112	89	0	12:56	1400.87

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
SC3_OUTFALL	98.22	62.24	1573.95	128.405
SCE_OUTFALL	97.82	0.07	0.08	0.150
FSD14B_Outfall	98.23	2.22	98.12	4.583
System	98.09	64.54	1588.77	133.137

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-1	CONDUIT	204.56	0 12:42	5.02	0.00	0.09
RT-10A	CONDUIT	107.65	0 13:05	6.17	1.08	1.00
RT-10B	CONDUIT	102.94	0 12:31	16.60	0.27	0.35
RT-11A	CONDUIT	1399.12	0 12:58	7.76	0.02	0.18
RT-11B	CONDUIT	1481.42	0 13:04	7.23	0.03	0.19

RT-11C	CONDUIT	1561.29	0	13:11	5.07	0.04	0.23
RT-12A	CONDUIT	153.87	0	13:01	16.96	0.81	0.68
RT-12B	CONDUIT	153.87	0	13:02	21.91	0.42	0.45
RT-16	CONDUIT	149.03	0	12:17	17.04	1.07	0.92
RT-17B	CONDUIT	232.35	0	13:02	20.16	1.08	0.92
RT-18	CONDUIT	1547.70	0	13:42	7.21	0.03	0.18
RT-19	CONDUIT	62.83	0	12:22	8.41	0.21	0.31
RT-1E	CONDUIT	13.77	0	13:58	6.58	0.11	0.22
RT-2	CONDUIT	127.32	0	12:40	4.59	0.00	0.07
RT-20	CONDUIT	1569.72	0	13:41	11.09	0.01	0.13
RT-21	CONDUIT	25.24	0	12:19	11.94	0.17	0.28
RT-22	CONDUIT	18.78	0	13:34	13.54	0.20	0.31
RT-2E	CONDUIT	71.72	0	12:28	10.77	0.54	0.53
RT-3	CONDUIT	127.74	0	12:29	4.57	0.00	0.07
RT-3E	CONDUIT	10.80	0	14:17	6.63	0.08	0.19
RT-4	CONDUIT	241.31	0	12:35	5.08	0.00	0.10
RT-4E	CONDUIT	134.56	0	12:32	12.94	0.96	0.78
RT-5	CONDUIT	734.58	0	12:45	7.29	0.01	0.17
RT-5E	CONDUIT	143.86	0	12:34	17.93	0.38	0.43
RT-6	CONDUIT	195.99	0	12:32	5.44	0.00	0.08
RT-6B	CONDUIT	311.09	0	12:45	5.28	0.00	0.11
RT-6E	CONDUIT	3.45	0	13:52	4.71	0.02	0.11
RT-7A	CONDUIT	22.77	0	12:21	12.90	0.09	0.20
RT-7E	CONDUIT	152.46	0	12:35	12.46	0.41	0.45
RT-8	CONDUIT	46.55	0	12:29	16.45	1.05	0.92
RT-9A	CONDUIT	1191.48	0	12:49	6.78	0.02	0.17
RT-9B	CONDUIT	1256.75	0	12:50	7.79	0.02	0.16
RT-9C	CONDUIT	1282.86	0	12:52	7.26	0.02	0.17
RT-9D	CONDUIT	1383.66	0	12:54	7.54	0.02	0.18
RT-14	CONDUIT	1367.71	0	13:44	7.43	0.02	0.16
1	DUMMY	131.03	0	12:20			
2	DUMMY	84.94	0	12:25			
3	DUMMY	64.91	0	12:25			
4	DUMMY	68.18	0	12:25			
5	DUMMY	189.21	0	12:20			
6	DUMMY	59.19	0	12:20			
7	DUMMY	73.59	0	12:30			
8	DUMMY	50.80	0	12:25			
9	DUMMY	50.51	0	12:25			
10	DUMMY	8.30	0	12:25			
11	DUMMY	11.13	0	12:20			
12	DUMMY	61.80	0	12:20			
13	DUMMY	48.72	0	12:15			
14	DUMMY	45.92	0	12:15			
15	DUMMY	26.97	0	12:15			
16	DUMMY	11.76	0	12:15			
17	DUMMY	39.14	0	12:15			
18	DUMMY	60.70	0	12:15			
20	DUMMY	50.17	0	12:15			
22	DUMMY	165.72	0	12:15			
24	DUMMY	287.18	0	12:20			
25	DUMMY	138.53	0	12:15			
27	DUMMY	77.06	0	12:15			
28	DUMMY	97.16	0	12:15			
29	DUMMY	177.83	0	12:15			
34	DUMMY	57.56	0	12:15			
36	DUMMY	41.56	0	12:25			

37	DUMMY	16.29	0	12:30			
38	DUMMY	193.77	0	12:25			
RT-17A	CONDUIT	144.63	0	12:33	6.48	0.00	0.10
39	DUMMY	102.43	0	12:25			
40	DUMMY	21.56	0	12:15			
42	DUMMY	129.44	0	12:15			
44	DUMMY	8.93	0	12:15			
45	DUMMY	2.46	0	12:20			
46	DUMMY	2.00	0	12:20			
47	DUMMY	46.77	0	12:20			
48	DUMMY	63.64	0	12:25			
51	DUMMY	358.46	0	12:15			
54	DUMMY	176.93	0	12:15			
56	DUMMY	13.08	0	12:15			
58	CONDUIT	1837.12	0	13:13	14.29	0.01	0.12
63	DUMMY	135.50	0	12:15			
65	DUMMY	68.02	0	12:15			
67	DUMMY	1573.95	0	13:41			
RT-15A	CONDUIT	149.34	0	12:16	19.92	0.64	0.58
RT-15B	CONDUIT	232.12	0	12:16	20.25	0.38	0.43
69	DUMMY	174.32	0	12:15			
70	DUMMY	85.96	0	12:15			
RT-25	CONDUIT	106.59	0	14:21	4.51	0.01	0.15
71	CONDUIT	0.08	0	02:10	0.10	1.08	1.00
74	DUMMY	41.33	0	12:15			
75	DUMMY	37.09	0	12:20			
77	DUMMY	181.48	0	12:15			
78	DUMMY	72.46	0	12:15			
79	DUMMY	493.40	0	12:20			
80	CONDUIT	16.04	0	13:18	16.32	0.16	0.27
81	DUMMY	44.86	0	12:15			
82	DUMMY	60.67	0	12:15			
83	DUMMY	11.91	0	12:25			
84	DUMMY	1405.32	0	12:54			
85	DUMMY	16.83	0	12:20			
86	DUMMY	20.28	0	12:20			
87	DUMMY	15.66	0	12:15			
88	CONDUIT	90.66	0	12:32	14.18	0.73	0.63
FSD01_Outlet	DUMMY	22.08	0	12:36			
FSD05_Outlet	DUMMY	3.70	0	12:08			
FSD06_Outlet	DUMMY	139.30	0	12:20			
FSD11B_Outlet	DUMMY	64.45	0	12:39			
FSD12_Outlet	DUMMY	97.62	0	12:26			
FSD13_Outlet	DUMMY	43.80	0	12:15			
FSD14A_Outlet	DUMMY	126.68	0	12:45			
FSD14B_Outlet	DUMMY	90.75	0	12:31			
FSD15B_Outlet	DUMMY	0.66	0	14:24			
FSD16_Outlet	DUMMY	153.88	0	12:59			
FSD17B_Outlet	DUMMY	32.41	0	12:39			
FSD18_Outlet	DUMMY	98.72	0	13:11			
FSD21_Outlet	DUMMY	16.00	0	12:20			
FSD22_Outlet	DUMMY	22.38	0	12:42			
FSD72_Outlet	DUMMY	52.63	0	12:30			
FSD9_Outlet	DUMMY	226.29	0	12:52			
FSDE2_Outlet	DUMMY	10.80	0	14:17			
FSDE3_Outlet	DUMMY	23.50	0	13:14			
FSDE4_Outlet	DUMMY	3.45	0	13:48			

FSDE5_Outlet	DUMMY	3.80	0	12:34
FSDE6_Outlet	DUMMY	31.87	0	13:11
FSDE1_Outlet	DUMMY	13.77	0	13:57
PNDE7_Outlet	DUMMY	106.60	0	14:17
FSD17A_Outlet	DUMMY	22.92	0	12:43
PNDW3_Outlet	DUMMY	1345.30	0	13:41
FSD27_Outlet	DUMMY	67.58	0	12:54
EX_STOCK_POND_1_OUTFALL	DUMMY	1540.43	0	13:15
FSD23_Outlet	DUMMY	18.60	0	12:16
FSD12A_Outlet	DUMMY	22.86	0	12:30
EX_STOCK_POND_2_OUTLET	DUMMY	1400.87	0	12:56

****
Conduit Surcharge Summary
****

	Hours Full			Hours Above Full	Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
RT-10A	0.81	0.81	0.81	0.86	0.81
RT-16	0.05	0.05	0.05	0.05	0.05
RT-17B	0.31	0.31	0.31	0.30	0.31
RT-8	0.14	0.14	0.14	0.14	0.14
71	76.33	76.33	76.33	0.04	76.33

Analysis begun on: Thu Jun 23 14:24:32 2022
Analysis ended on: Thu Jun 23 14:24:33 2022
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
100-YR Type II Storm
NOTE: These warnings are generated from using 1 foot dummy conduits between basin nodes and detention ponds to ensure there is no additional travel time between the bottom of the basin and the detention pond, except where conveyed by a channel.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Sterling Ranch 2022 MDDP Amendment
100-YR Type II Storm

WARNING 04: minimum elevation drop used for Conduit 1
WARNING 04: minimum elevation drop used for Conduit 2
WARNING 04: minimum elevation drop used for Conduit 3
WARNING 04: minimum elevation drop used for Conduit 4
WARNING 04: minimum elevation drop used for Conduit 5
WARNING 04: minimum elevation drop used for Conduit 6
WARNING 04: minimum elevation drop used for Conduit 7
WARNING 04: minimum elevation drop used for Conduit 8
WARNING 04: minimum elevation drop used for Conduit 9
WARNING 04: minimum elevation drop used for Conduit 10
WARNING 04: minimum elevation drop used for Conduit 11
WARNING 04: minimum elevation drop used for Conduit 12
WARNING 04: minimum elevation drop used for Conduit 14
WARNING 04: minimum elevation drop used for Conduit 15
WARNING 04: minimum elevation drop used for Conduit 16
WARNING 04: minimum elevation drop used for Conduit 17
WARNING 04: minimum elevation drop used for Conduit 18
WARNING 04: minimum elevation drop used for Conduit 20
WARNING 04: minimum elevation drop used for Conduit 22
WARNING 04: minimum elevation drop used for Conduit 27
WARNING 04: minimum elevation drop used for Conduit 28
WARNING 04: minimum elevation drop used for Conduit 29
WARNING 04: minimum elevation drop used for Conduit 34
WARNING 04: minimum elevation drop used for Conduit 36
WARNING 04: minimum elevation drop used for Conduit 37
WARNING 04: minimum elevation drop used for Conduit 38
WARNING 04: minimum elevation drop used for Conduit 39
WARNING 04: minimum elevation drop used for Conduit 40
WARNING 04: minimum elevation drop used for Conduit 44
WARNING 04: minimum elevation drop used for Conduit 45
WARNING 04: minimum elevation drop used for Conduit 46
WARNING 04: minimum elevation drop used for Conduit 47
WARNING 04: minimum elevation drop used for Conduit 48
WARNING 04: minimum elevation drop used for Conduit 51
WARNING 04: minimum elevation drop used for Conduit 54
WARNING 08: elevation drop exceeds length for Conduit 56
WARNING 04: minimum elevation drop used for Conduit 63
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 67
WARNING 04: minimum elevation drop used for Conduit 69
WARNING 04: minimum elevation drop used for Conduit 70
WARNING 04: minimum elevation drop used for Conduit 71

WARNING 04: minimum elevation drop used for Conduit 74
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 08: elevation drop exceeds length for Conduit 77
WARNING 04: minimum elevation drop used for Conduit 78
WARNING 04: minimum elevation drop used for Conduit 79
WARNING 04: minimum elevation drop used for Conduit 82
WARNING 04: minimum elevation drop used for Conduit 83
WARNING 04: minimum elevation drop used for Conduit 85
WARNING 08: elevation drop exceeds length for Conduit 87
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12_Outlet
WARNING 10: crest elevation raised to downstream invert for regulator Link FSD12A_Outlet

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NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/04/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 0.000 0.000
Groundwater Inflow 0.000 0.000
RDII Inflow 0.000 0.000
External Inflow 597.462 194.692
External Outflow 466.046 151.868
Flooding Loss 106.443 34.686
Evaporation Loss 0.000 0.000
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 26.496 8.634
Continuity Error (%) ..... -0.255

****
Highest Flow Instability Indexes

****
Link PNDW3_Outlet (54)
Link RT-14 (54)
Link RT-18 (53)
Link RT-20 (53)
Link 67 (52)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
79	JUNCTION	0.08	0.92	295.92	0 12:14	0.92
80	JUNCTION	0.07	0.81	331.81	0 12:18	0.81
81	JUNCTION	0.16	3.85	232.85	0 12:55	3.85
DP-1E	JUNCTION	0.23	2.32	261.22	0 12:25	2.31
DP-21	JUNCTION	0.45	3.50	187.70	0 12:57	3.29
DP-22	JUNCTION	0.45	4.00	228.20	0 12:55	4.00
DP-25	JUNCTION	0.03	1.07	333.27	0 12:15	1.06
DP-26	JUNCTION	0.11	1.95	201.15	0 12:30	1.95
DP-2E	JUNCTION	0.32	4.00	222.90	0 12:19	4.00
DP-3E	JUNCTION	0.38	3.72	132.62	0 12:41	3.51
DP-4E	JUNCTION	0.52	3.00	63.50	0 12:43	2.98
DP-53A	JUNCTION	0.26	2.82	2.82	0 13:40	2.82
DP-56	JUNCTION	0.45	1.73	33.73	0 14:12	1.73
DP-60A	JUNCTION	0.36	3.88	26.08	0 13:40	3.88
DP-61	JUNCTION	0.36	4.00	67.20	0 12:45	4.00
DP-63	JUNCTION	0.29	3.39	101.59	0 13:40	3.39
DP-64	JUNCTION	0.12	2.73	95.93	0 12:15	2.71
DP-68	JUNCTION	0.37	2.59	120.99	0 13:12	2.59
DP-69	JUNCTION	0.19	4.24	207.44	0 12:57	4.23
DP-70	JUNCTION	0.16	3.90	233.10	0 12:53	3.89
DP-71	JUNCTION	0.16	3.90	261.10	0 12:50	3.90
DP-72	JUNCTION	0.13	3.81	287.01	0 12:48	3.80
DP-73	JUNCTION	0.15	3.80	304.00	0 12:48	3.80
DP-74	JUNCTION	0.06	2.11	499.31	0 12:27	2.10
DP-75	JUNCTION	0.11	3.70	435.90	0 12:36	3.69
DP-77	JUNCTION	0.13	3.82	344.02	0 12:43	3.81
DP-78	JUNCTION	0.08	2.55	464.75	0 12:28	2.55
DP-8	JUNCTION	9.80	10.00	10.00	0 01:33	10.00
DP-87	JUNCTION	0.25	5.08	162.28	0 13:01	5.07

FSD9_OUTLET	JUNCTION	0.24	4.00	143.20	0	12:35	4.00
FSDE1_Outlet	JUNCTION	0.18	1.13	266.03	0	13:41	1.13
FSDE2_Outlet	JUNCTION	0.14	0.94	229.84	0	13:58	0.94
FSDE4_Outlet	JUNCTION	0.20	0.46	98.06	0	13:44	0.46
SC3-10	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-11A	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-11B	JUNCTION	0.00	0.00	98.20	0	00:00	0.00
SC3-12	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-12A	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
SC3-14A	JUNCTION	0.00	0.00	118.50	0	00:00	0.00
SC3-14B	JUNCTION	0.00	0.00	184.20	0	00:00	0.00
SC3-15A	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-15B	JUNCTION	0.00	0.00	199.20	0	00:00	0.00
SC3-16	JUNCTION	0.00	0.00	224.20	0	00:00	0.00
SC3-17A	JUNCTION	0.00	0.00	230.20	0	00:00	0.00
SC3-17B	JUNCTION	0.00	0.00	258.20	0	00:00	0.00
SC3-18	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-18B	JUNCTION	0.00	0.00	203.20	0	00:00	0.00
SC3-19	JUNCTION	0.13	5.00	250.20	0	12:11	5.00
SC3-1A	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-20	JUNCTION	0.00	0.00	324.20	0	00:00	0.00
SC3-21	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-22	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-23	JUNCTION	0.00	0.00	295.20	0	00:00	0.00
SC3-24A	JUNCTION	0.00	0.00	300.20	0	00:00	0.00
SC3-24B	JUNCTION	0.00	0.00	283.20	0	00:00	0.00
SC3-25	JUNCTION	0.00	0.00	332.20	0	00:00	0.00
SC3-26	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-27	JUNCTION	0.00	0.00	257.20	0	00:00	0.00
SC3-5A	JUNCTION	0.00	0.00	22.20	0	00:00	0.00
SC3-5B	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SC3-61	JUNCTION	0.06	2.04	30.24	0	12:20	2.03
SC3-6A	JUNCTION	0.13	3.50	90.70	0	12:11	3.50
SC3-6B	JUNCTION	0.00	0.00	93.20	0	00:00	0.00
SC3-6C	JUNCTION	0.00	0.00	63.20	0	00:00	0.00
SC3-7	JUNCTION	0.11	2.49	119.69	0	12:15	2.46
SC3-72	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-73	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-74	JUNCTION	0.00	0.00	497.20	0	00:00	0.00
SC3-75	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-76	JUNCTION	0.00	0.00	432.20	0	00:00	0.00
SC3-77	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-78	JUNCTION	0.00	0.00	462.20	0	00:00	0.00
SC3-79	JUNCTION	0.05	1.81	564.01	0	12:25	1.81
SC3-8	JUNCTION	0.04	2.28	249.48	0	12:20	2.26
SC3-80	JUNCTION	0.05	1.63	553.83	0	12:25	1.63
SC3-81	JUNCTION	0.05	1.97	534.17	0	12:30	1.97
SC3-82	JUNCTION	0.03	1.58	563.78	0	12:20	1.56
SC3-88	JUNCTION	0.00	0.00	340.20	0	00:00	0.00
SC3-89	JUNCTION	0.02	0.86	376.06	0	12:20	0.86
SC3-9	JUNCTION	0.00	0.00	139.20	0	00:00	0.00
SCE-1	JUNCTION	0.00	0.00	266.00	0	00:00	0.00
SCE-10	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-11	JUNCTION	0.00	0.00	32.50	0	00:00	0.00
SCE-13	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-14	JUNCTION	0.00	0.00	218.90	0	00:00	0.00

SCE-15	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
SCE-2	JUNCTION	0.00	0.00	258.90	0	00:00	0.00
SCE-3	JUNCTION	0.00	0.00	230.00	0	00:00	0.00
SCE-4	JUNCTION	0.00	0.00	218.90	0	00:00	0.00
SCE-5	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-6	JUNCTION	0.00	0.00	128.90	0	00:00	0.00
SCE-7	JUNCTION	0.00	0.00	98.00	0	00:00	0.00
SCE-8	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SCE-9	JUNCTION	0.00	0.00	60.50	0	00:00	0.00
SC3-12B	JUNCTION	0.00	0.00	157.20	0	00:00	0.00
SC3-13A	JUNCTION	0.00	0.00	118.60	0	00:00	0.00
82	JUNCTION	0.25	2.51	186.71	0	12:30	2.51
SC3-11C	JUNCTION	0.00	0.00	165.20	0	00:00	0.00
SC3_OUTFALL	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SCE_OUTFALL	OUTFALL	0.98	1.00	1.00	0	02:04	1.00
FSD14B_Outfall	OUTFALL	0.25	2.51	164.71	0	12:31	2.50
FSD05	STORAGE	3.67	7.12	29.32	0	14:14	7.12
FSD06	STORAGE	5.35	9.90	73.10	0	12:43	9.89
FSD09	STORAGE	2.55	8.44	147.64	0	12:52	8.43
FSD1	STORAGE	1.75	3.44	3.44	0	12:36	3.43
FSD11B	STORAGE	3.48	6.39	104.59	0	12:36	6.38
FSD12	STORAGE	4.41	6.63	163.63	0	12:28	6.62
FSD13	STORAGE	3.36	8.16	126.66	0	12:35	8.16
FSD14A	STORAGE	4.07	8.57	126.97	0	12:40	8.57
FSD14B	STORAGE	3.58	6.65	190.85	0	12:30	6.65
FSD15B	STORAGE	2.55	3.46	202.66	0	12:50	3.46
FSD16	STORAGE	4.67	8.89	233.09	0	12:55	8.89
FSD17A	STORAGE	3.08	5.14	235.34	0	12:40	5.14
FSD17B	STORAGE	3.30	6.80	265.00	0	12:36	6.79
FSD18	STORAGE	2.81	8.61	211.81	0	13:16	8.61
FSD20	STORAGE	0.05	2.27	326.47	0	12:31	2.26
FSD21	STORAGE	0.80	5.30	337.50	0	12:48	5.30
FSD22	STORAGE	1.61	5.65	288.85	0	12:47	5.64
FSD23	STORAGE	0.88	5.77	301.77	0	12:52	5.77
FSD27	STORAGE	3.50	7.46	264.66	0	12:51	7.46
FSD72	STORAGE	1.39	4.90	345.10	0	12:30	4.90
FSDE1	STORAGE	3.12	6.88	272.88	0	13:41	6.87
FSDE2	STORAGE	0.94	6.45	236.45	0	13:58	6.45
FSDE3	STORAGE	3.14	7.08	135.98	0	13:07	7.08
FSDE4	STORAGE	2.61	5.23	103.23	0	13:44	5.23
FSDE5	STORAGE	4.09	8.73	69.23	0	14:20	8.73
PNDE7	STORAGE	0.77	5.08	37.58	0	14:12	5.08
FSDE6	STORAGE	3.57	7.32	39.82	0	13:07	7.32
PNDW3	STORAGE	0.37	9.92	128.22	0	13:40	9.92
EX_STOCK_POND_1	STORAGE	4.15	8.09	150.09	0	13:13	8.08
FSD12A	STORAGE	4.37	8.09	165.09	0	12:32	8.08
EX_STOCK_POND_2	STORAGE	3.27	6.81	235.91	0	12:55	6.81

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Node Inflow Summary
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	Maximum Lateral Inflow	Maximum Total Inflow	Time of Max Occurrence	Lateral Inflow Volume	Total Inflow Volume	Flow Balance Error

Node	Type	CFS	CFS	days hr:min	10^6 gal	10^6 gal	Percent
79	JUNCTION	0.00	18.60	0 12:14	0	1.1	0.000
80	JUNCTION	0.00	16.00	0 12:18	0	0.876	0.000
81	JUNCTION	0.00	1661.23	0 12:55	0	60.2	0.000
DP-1E	JUNCTION	0.00	83.88	0 12:25	0	5.2	0.000
DP-21	JUNCTION	0.00	200.93	0 12:57	0	17.9	0.000
DP-22	JUNCTION	0.00	191.38	0 12:55	0	17.9	-0.000
DP-25	JUNCTION	0.00	30.90	0 12:15	0	0.537	0.000
DP-26	JUNCTION	0.00	123.19	0 12:30	0	4.37	0.000
DP-2E	JUNCTION	0.00	157.20	0 12:27	0	10.7	0.000
DP-3E	JUNCTION	0.00	176.03	0 12:42	0	16.7	0.000
DP-4E	JUNCTION	0.00	184.70	0 12:43	0	21.2	0.000
DP-53A	JUNCTION	0.00	1889.84	0 13:40	0	147	0.000
DP-56	JUNCTION	0.00	136.21	0 14:12	0	30.7	0.000
DP-60A	JUNCTION	0.00	1884.47	0 13:39	0	146	-0.000
DP-61	JUNCTION	0.00	1862.23	0 13:37	0	137	0.000
DP-63	JUNCTION	0.00	1588.15	0 13:40	0	111	0.000
DP-64	JUNCTION	0.00	259.48	0 12:15	0	6.05	0.000
DP-68	JUNCTION	0.00	2164.51	0 13:12	0	107	0.000
DP-69	JUNCTION	0.00	1763.93	0 12:57	0	67.1	0.000
DP-70	JUNCTION	0.00	1666.98	0 12:53	0	61.7	0.000
DP-71	JUNCTION	0.00	1644.06	0 12:50	0	59.8	0.000
DP-72	JUNCTION	0.00	1527.18	0 12:48	0	53.2	0.000
DP-73	JUNCTION	0.00	1497.12	0 12:47	0	51.8	0.000
DP-74	JUNCTION	0.00	293.76	0 12:27	0	7.66	0.000
DP-75	JUNCTION	0.00	887.87	0 12:36	0	29	0.000
DP-77	JUNCTION	0.00	1423.89	0 12:43	0	48.4	0.000
DP-78	JUNCTION	0.00	422.09	0 12:28	0	11.4	0.000
DP-8	JUNCTION	0.00	137.04	0 14:12	0	32.2	0.001
DP-87	JUNCTION	0.00	1884.86	0 13:01	0	76.8	0.000
FSD9_OUTLET	JUNCTION	0.00	264.75	0 12:52	0	11.3	0.000
FSDE1_Outlet	JUNCTION	0.00	21.81	0 13:41	0	2.03	0.000
FSDE2_Outlet	JUNCTION	0.00	16.89	0 13:58	0	2.42	0.000
FSDE4_Outlet	JUNCTION	0.00	3.94	0 13:44	0	1.93	0.000
SC3-10	JUNCTION	48.66	48.66	0 12:15	1.03	1.03	0.000
SC3-11A	JUNCTION	15.09	15.09	0 12:15	0.238	0.238	0.000
SC3-11B	JUNCTION	196.96	196.96	0 12:15	5.28	5.28	0.000
SC3-12	JUNCTION	144.67	144.67	0 12:15	4.01	4.01	0.000
SC3-12A	JUNCTION	50.30	50.30	0 12:15	1.04	1.04	0.000
SC3-13	JUNCTION	153.60	153.60	0 12:15	3.31	3.31	0.000
SC3-14A	JUNCTION	320.18	320.18	0 12:20	10.6	10.6	0.000
SC3-14B	JUNCTION	185.10	185.10	0 12:15	5.04	5.04	0.000
SC3-15A	JUNCTION	119.86	119.86	0 12:25	3.97	3.97	0.000
SC3-15B	JUNCTION	24.00	24.00	0 12:15	0.596	0.596	0.000
SC3-16	JUNCTION	552.27	552.27	0 12:20	18.5	18.5	0.000
SC3-17A	JUNCTION	81.07	81.07	0 12:15	1.9	1.9	0.000
SC3-17B	JUNCTION	68.19	68.19	0 12:15	1.95	1.95	0.000
SC3-18	JUNCTION	64.05	64.05	0 12:15	1.82	1.82	0.000
SC3-18B	JUNCTION	13.95	13.95	0 12:25	0.597	0.597	0.000
SC3-19	JUNCTION	239.67	239.67	0 12:25	6.28	6.28	-0.000
SC3-1A	JUNCTION	77.21	77.21	0 12:15	1.27	1.27	0.000
SC3-20	JUNCTION	57.99	57.99	0 12:15	1.29	1.29	0.000
SC3-21	JUNCTION	52.53	52.53	0 12:15	0.876	0.876	0.000
SC3-22	JUNCTION	45.22	45.22	0 12:15	1.01	1.01	0.000
SC3-23	JUNCTION	55.73	55.73	0 12:15	1.1	1.1	0.000
SC3-24A	JUNCTION	42.98	42.98	0 12:20	1.21	1.21	0.000

SC3-24B	JUNCTION	13.62	13.62	0	12:15	0.354	0.354	0.000
SC3-25	JUNCTION	30.90	30.90	0	12:15	0.537	0.537	0.000
SC3-26	JUNCTION	12.95	12.95	0	12:20	0.407	0.407	0.000
SC3-27	JUNCTION	70.95	70.95	0	12:20	2.71	2.71	0.000
SC3-5A	JUNCTION	150.82	150.82	0	12:15	2.87	2.87	0.000
SC3-5B	JUNCTION	203.13	203.13	0	12:15	4.36	4.36	0.000
SC3-61	JUNCTION	74.61	74.61	0	12:20	1.95	1.95	0.000
SC3-6A	JUNCTION	165.69	165.69	0	12:15	4.15	4.15	0.000
SC3-6B	JUNCTION	95.97	95.97	0	12:15	2.13	2.13	0.000
SC3-6C	JUNCTION	196.64	196.64	0	12:15	3.74	3.74	0.000
SC3-7	JUNCTION	166.71	166.71	0	12:15	3.92	3.92	0.000
SC3-72	JUNCTION	68.70	68.70	0	12:20	1.85	1.85	0.000
SC3-73	JUNCTION	99.04	99.04	0	12:25	2.84	2.84	0.000
SC3-74	JUNCTION	151.94	151.94	0	12:20	4.05	4.05	0.000
SC3-75	JUNCTION	75.41	75.41	0	12:25	2.68	2.68	0.000
SC3-76	JUNCTION	79.38	79.38	0	12:25	2.84	2.84	0.000
SC3-77	JUNCTION	86.36	86.36	0	12:30	3.26	3.26	0.000
SC3-78	JUNCTION	219.17	219.17	0	12:20	5.26	5.26	0.000
SC3-79	JUNCTION	239.34	239.34	0	12:25	6.12	6.12	0.000
SC3-8	JUNCTION	195.44	195.44	0	12:20	4.07	4.07	0.000
SC3-80	JUNCTION	168.15	168.15	0	12:25	4.78	4.78	0.000
SC3-81	JUNCTION	256.32	256.32	0	12:30	8.02	8.02	0.000
SC3-82	JUNCTION	158.98	158.98	0	12:20	3.59	3.59	0.000
SC3-88	JUNCTION	59.46	59.46	0	12:25	1.83	1.83	0.000
SC3-89	JUNCTION	26.69	26.69	0	12:20	0.708	0.708	0.000
SC3-9	JUNCTION	225.81	225.81	0	12:25	7.13	7.13	0.000
SCE-1	JUNCTION	58.52	58.52	0	12:25	2.33	2.33	0.000
SCE-10	JUNCTION	407.13	407.13	0	12:15	9.73	9.73	0.000
SCE-11	JUNCTION	10.51	10.51	0	12:15	0.152	0.152	0.000
SCE-13	JUNCTION	73.94	73.94	0	12:25	2.66	2.66	0.000
SCE-14	JUNCTION	54.26	54.26	0	12:20	1.78	1.78	0.000
SCE-15	JUNCTION	69.54	69.54	0	12:15	1.6	1.6	0.000
SCE-2	JUNCTION	9.66	9.66	0	12:25	0.508	0.508	0.000
SCE-3	JUNCTION	48.16	48.16	0	12:25	2.42	2.42	0.000
SCE-4	JUNCTION	18.71	18.71	0	12:30	1.31	1.31	0.000
SCE-5	JUNCTION	198.17	198.17	0	12:15	6.31	6.31	0.000
SCE-6	JUNCTION	2.39	2.39	0	12:20	0.113	0.113	0.000
SCE-7	JUNCTION	85.19	85.19	0	12:15	2.11	2.11	0.000
SCE-8	JUNCTION	106.61	106.61	0	12:15	2.67	2.67	0.000
SCE-9	JUNCTION	2.94	2.94	0	12:15	0.113	0.113	0.000
SC3-12B	JUNCTION	19.66	19.66	0	12:20	0.702	0.702	0.000
SC3-13A	JUNCTION	23.70	23.70	0	12:20	0.867	0.867	0.000
82	JUNCTION	0.00	107.39	0	12:30	0	4.88	0.000
SC3-11C	JUNCTION	18.16	18.16	0	12:15	0.239	0.239	0.000
SC3_OUTFALL	OUTFALL	0.00	1889.84	0	13:40	0	147	0.000
SCE_OUTFALL	OUTFALL	0.00	0.08	0	02:03	0	0.15	0.000
FSD14B_Outfall	OUTFALL	0.00	116.66	0	12:29	0	5.11	0.000
FSD05	STORAGE	0.00	150.82	0	12:15	0	2.87	0.001
FSD06	STORAGE	0.00	604.25	0	12:15	0	14.1	0.056
FSD09	STORAGE	0.00	386.00	0	12:30	0	11.3	0.071
FSD1	STORAGE	0.00	77.21	0	12:15	0	1.27	0.103
FSD11B	STORAGE	0.00	196.96	0	12:15	0	5.28	0.090
FSD12	STORAGE	0.00	144.67	0	12:15	0	4.01	0.047
FSD13	STORAGE	0.00	153.60	0	12:15	0	3.31	0.053
FSD14A	STORAGE	0.00	320.18	0	12:20	0	10.6	0.066
FSD14B	STORAGE	0.00	185.10	0	12:15	0	5.04	0.092
FSD15B	STORAGE	0.00	24.00	0	12:15	0	0.596	0.062

FSD16	STORAGE	0.00	552.27	0	12:20	0	18.5	0.060	
FSD17A	STORAGE	0.00	81.07	0	12:15	0	1.9	0.114	
FSD17B	STORAGE	0.00	68.19	0	12:15	0	1.95	0.082	
FSD18	STORAGE	0.00	169.61	0	12:15	0	6.3	0.044	
FSD20	STORAGE	0.00	57.99	0	12:15	0	1.29	0.486	
FSD21	STORAGE	0.00	52.53	0	12:15	0	0.876	0.021	
FSD22	STORAGE	0.00	45.22	0	12:15	0	1.01	0.086	
FSD23	STORAGE	0.00	55.73	0	12:15	0	1.1	0.043	
FSD27	STORAGE	0.00	118.26	0	12:20	0	4.34	0.106	
FSD72	STORAGE	0.00	68.70	0	12:20	0	1.85	0.414	
FSDE1	STORAGE	0.00	58.52	0	12:25	0	2.33	0.070	
FSDE2	STORAGE	0.00	48.16	0	12:25	0	2.42	0.049	
FSDE3	STORAGE	0.00	198.17	0	12:15	0	6.31	0.046	
FSDE4	STORAGE	0.00	85.19	0	12:15	0	2.11	0.014	
FSDE5	STORAGE	0.00	106.61	0	12:15	0	2.67	0.011	
PNDE7	STORAGE	0.00	222.77	0	12:45	0	30.7	0.026	
FSDE6	STORAGE	0.00	407.13	0	12:15	0	9.73	0.038	
PNDW3	STORAGE	0.00	2164.51	0	13:12	0	107	0.291	
EX_STOCK_POND_1	STORAGE	0.00	1852.91	0	13:08	0	76.7	0.093	
FSD12A	STORAGE	0.00	50.30	0	12:15	0	1.04	0.072	
EX_STOCK_POND_2	STORAGE	0.00	1666.98	0	12:53	0	61.7	0.104	

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Node Flooding Summary
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Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-22	0.04	0.26	0 12:56	0.000	0.000
DP-2E	0.38	16.56	0 12:27	0.108	0.000
DP-8	76.45	136.97	0 14:12	32.092	0.000
FSD9_OUTLET	0.70	49.16	0 12:52	0.600	0.000
SC3-19	0.97	139.41	0 12:25	1.837	0.000
SC3-6A	0.14	24.78	0 12:15	0.047	0.000

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
FSD05	70.954	17	0	0	271.332	67	0 14:13	3.70
FSD06	324.274	27	0	0	1077.797	90	0 12:43	139.30
FSD09	63.364	9	0	0	469.434	65	0 12:51	264.75
FSD1	39.930	11	0	0	98.225	27	0 12:35	25.50
FSD11B	106.959	21	0	0	360.589	71	0 12:36	82.69
FSD12	59.953	24	0	0	132.379	53	0 12:27	103.10

FSD13	43.678	13	0	0	221.356	64	0	12:34	43.80
FSD14A	210.085	27	0	0	656.859	85	0	12:39	167.08
FSD14B	101.520	25	0	0	296.801	74	0	12:29	107.39
FSD15B	30.472	36	0	0	51.685	60	0	12:50	5.24
FSD16	366.185	23	0	0	1320.335	82	0	12:55	191.38
FSD17A	29.076	5	0	0	135.784	23	0	12:40	28.78
FSD17B	32.577	23	0	0	109.876	76	0	12:36	39.67
FSD18	50.755	13	0	0	320.533	80	0	13:16	104.16
FSD20	0.166	0	0	0	17.544	13	0	12:31	44.35
FSD21	5.027	4	0	0	59.169	44	0	12:47	16.00
FSD22	6.349	6	0	0	50.862	50	0	12:46	23.12
FSD23	5.148	4	0	0	65.571	49	0	12:51	18.60
FSD27	47.026	16	0	0	180.168	60	0	12:51	78.35
FSD72	11.001	8	0	0	52.733	39	0	12:29	62.10
FSDE1	67.413	24	0	0	190.726	67	0	13:40	21.81
FSDE2	19.136	7	0	0	173.883	61	0	13:57	16.89
FSDE3	173.031	23	0	0	546.678	72	0	13:06	36.31
FSDE4	72.005	14	0	0	200.282	39	0	13:44	3.94
FSDE5	94.297	36	0	0	251.982	95	0	14:20	3.80
PNDE7	37.336	2	0	0	590.601	37	0	14:11	136.21
FSDE6	252.559	20	0	0	918.399	73	0	13:06	45.40
PNDW3	45.099	2	0	0	2205.442	86	0	13:40	1562.38
EX_STOCK_POND_1	267.352	31	0	0	730.894	85	0	13:13	1819.88
FSD12A	20.606	22	0	0	62.991	69	0	12:32	23.40
EX_STOCK_POND_2	168.552	40	0	0	407.806	96	0	12:55	1661.23

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
SC3_OUTFALL	98.32	70.99	1889.84	146.597
SCE_OUTFALL	97.97	0.07	0.08	0.150
FSD14B_Outfall	98.34	2.47	116.66	5.110
System	98.21	73.53	1906.59	151.857

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
RT-1	CONDUIT	241.28	0 12:41	5.22	0.00	0.10
RT-10A	CONDUIT	107.77	0 13:13	6.20	1.08	1.00
RT-10B	CONDUIT	123.11	0 12:31	17.41	0.32	0.39
RT-11A	CONDUIT	1659.29	0 12:57	8.14	0.03	0.19
RT-11B	CONDUIT	1744.88	0 13:02	7.56	0.03	0.21

RT-11C	CONDUIT	1852.91	0	13:08	5.32	0.05	0.25
RT-12A	CONDUIT	200.93	0	12:57	17.70	1.05	0.90
RT-12B	CONDUIT	196.31	0	12:58	23.78	0.54	0.52
RT-16	CONDUIT	150.78	0	12:20	17.35	1.08	1.00
RT-17B	CONDUIT	233.08	0	12:43	20.54	1.08	1.00
RT-18	CONDUIT	1859.20	0	13:40	7.61	0.03	0.19
RT-19	CONDUIT	73.63	0	12:22	8.80	0.25	0.34
RT-1E	CONDUIT	21.81	0	13:41	7.50	0.17	0.28
RT-2	CONDUIT	149.76	0	12:39	4.77	0.00	0.08
RT-20	CONDUIT	1884.44	0	13:40	11.72	0.02	0.14
RT-21	CONDUIT	29.04	0	12:19	12.40	0.19	0.30
RT-22	CONDUIT	18.79	0	13:51	13.54	0.20	0.31
RT-2E	CONDUIT	83.38	0	12:28	11.16	0.63	0.58
RT-3	CONDUIT	149.88	0	12:29	4.74	0.00	0.08
RT-3E	CONDUIT	16.88	0	13:58	7.55	0.12	0.23
RT-4	CONDUIT	283.34	0	12:34	5.28	0.00	0.10
RT-4E	CONDUIT	152.08	0	12:42	13.20	1.08	0.94
RT-5	CONDUIT	866.84	0	12:44	7.60	0.02	0.18
RT-5E	CONDUIT	175.07	0	12:43	18.88	0.46	0.48
RT-6	CONDUIT	228.99	0	12:32	5.64	0.00	0.09
RT-6B	CONDUIT	367.10	0	12:45	5.49	0.00	0.12
RT-6E	CONDUIT	3.94	0	13:48	4.91	0.03	0.11
RT-7A	CONDUIT	26.58	0	12:21	13.50	0.10	0.21
RT-7E	CONDUIT	183.53	0	12:45	13.08	0.50	0.50
RT-8	CONDUIT	46.59	0	12:46	16.53	1.05	0.93
RT-9A	CONDUIT	1412.57	0	12:48	7.12	0.03	0.19
RT-9B	CONDUIT	1496.36	0	12:48	8.19	0.02	0.18
RT-9C	CONDUIT	1523.58	0	12:51	7.62	0.03	0.19
RT-9D	CONDUIT	1641.38	0	12:53	7.91	0.03	0.19
RT-14	CONDUIT	1587.48	0	13:43	7.76	0.02	0.17
1	DUMMY	151.94	0	12:20			
2	DUMMY	99.04	0	12:25			
3	DUMMY	75.41	0	12:25			
4	DUMMY	79.38	0	12:25			
5	DUMMY	219.17	0	12:20			
6	DUMMY	68.70	0	12:20			
7	DUMMY	86.36	0	12:30			
8	DUMMY	59.46	0	12:25			
9	DUMMY	58.52	0	12:25			
10	DUMMY	9.66	0	12:25			
11	DUMMY	12.95	0	12:20			
12	DUMMY	70.95	0	12:20			
13	DUMMY	55.73	0	12:15			
14	DUMMY	52.53	0	12:15			
15	DUMMY	30.90	0	12:15			
16	DUMMY	13.62	0	12:15			
17	DUMMY	45.22	0	12:15			
18	DUMMY	68.19	0	12:15			
20	DUMMY	57.99	0	12:15			
22	DUMMY	185.10	0	12:15			
24	DUMMY	320.18	0	12:20			
25	DUMMY	153.60	0	12:15			
27	DUMMY	85.19	0	12:15			
28	DUMMY	106.61	0	12:15			
29	DUMMY	198.17	0	12:15			
34	DUMMY	64.05	0	12:15			
36	DUMMY	48.16	0	12:25			

37	DUMMY	18.71	0	12:30			
38	DUMMY	225.81	0	12:25			
RT-17A	CONDUIT	172.21	0	12:32	6.76	0.00	0.11
39	DUMMY	119.86	0	12:25			
40	DUMMY	24.00	0	12:15			
42	DUMMY	144.67	0	12:15			
44	DUMMY	10.51	0	12:15			
45	DUMMY	2.94	0	12:15			
46	DUMMY	2.39	0	12:20			
47	DUMMY	54.26	0	12:20			
48	DUMMY	73.94	0	12:25			
51	DUMMY	407.13	0	12:15			
54	DUMMY	196.96	0	12:15			
56	DUMMY	15.09	0	12:15			
58	CONDUIT	2164.51	0	13:12	15.02	0.01	0.13
63	DUMMY	150.82	0	12:15			
65	DUMMY	77.21	0	12:15			
67	DUMMY	1889.84	0	13:40			
RT-15A	CONDUIT	165.30	0	12:16	20.37	0.70	0.62
RT-15B	CONDUIT	258.11	0	12:16	20.86	0.42	0.45
69	DUMMY	196.64	0	12:15			
70	DUMMY	95.97	0	12:15			
RT-25	CONDUIT	136.21	0	14:15	4.81	0.01	0.17
71	CONDUIT	0.08	0	02:03	0.10	1.08	1.00
74	DUMMY	48.66	0	12:15			
75	DUMMY	42.98	0	12:20			
77	DUMMY	203.13	0	12:15			
78	DUMMY	81.07	0	12:15			
79	DUMMY	552.27	0	12:20			
80	CONDUIT	16.04	0	13:34	16.18	0.16	0.27
81	DUMMY	50.30	0	12:15			
82	DUMMY	69.54	0	12:15			
83	DUMMY	13.95	0	12:25			
84	DUMMY	1666.98	0	12:53			
85	DUMMY	19.66	0	12:20			
86	DUMMY	23.70	0	12:20			
87	DUMMY	18.16	0	12:15			
88	CONDUIT	107.32	0	12:31	14.62	0.86	0.72
FSD01_Outlet	DUMMY	25.50	0	12:27			
FSD05_Outlet	DUMMY	3.70	0	12:06			
FSD06_Outlet	DUMMY	139.30	0	12:17			
FSD11B_Outlet	DUMMY	82.69	0	12:36			
FSD12_Outlet	DUMMY	103.10	0	12:21			
FSD13_Outlet	DUMMY	43.80	0	12:12			
FSD14A_Outlet	DUMMY	167.08	0	12:40			
FSD14B_Outlet	DUMMY	107.39	0	12:30			
FSD15B_Outlet	DUMMY	5.24	0	12:50			
FSD16_Outlet	DUMMY	191.38	0	12:55			
FSD17B_Outlet	DUMMY	39.67	0	12:36			
FSD18_Outlet	DUMMY	104.16	0	13:16			
FSD21_Outlet	DUMMY	16.00	0	12:18			
FSD22_Outlet	DUMMY	23.12	0	12:47			
FSD72_Outlet	DUMMY	62.10	0	12:30			
FSD9_Outlet	DUMMY	264.75	0	12:52			
FSDE2_Outlet	DUMMY	16.89	0	13:58			
FSDE3_Outlet	DUMMY	36.31	0	13:07			
FSDE4_Outlet	DUMMY	3.94	0	13:44			

FSDE5_Outlet	DUMMY	3.80	0	12:23
FSDE6_Outlet	DUMMY	45.40	0	13:07
FSDE1_Outlet	DUMMY	21.81	0	13:41
PNDE7_Outlet	DUMMY	136.21	0	14:12
FSD17A_Outlet	DUMMY	28.78	0	12:40
PNDW3_Outlet	DUMMY	1562.38	0	13:40
FSD27_Outlet	DUMMY	78.35	0	12:51
EX_STOCK_POND_1_OUTFALL	DUMMY	1819.88	0	13:13
FSD23_Outlet	DUMMY	18.60	0	12:14
FSD12A_Outlet	DUMMY	23.40	0	12:25
EX_STOCK_POND_2_OUTLET	DUMMY	1661.23	0	12:55

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Conduit Surcharge Summary
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Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full: Normal Flow	Capacity Limited
RT-10A	0.97	0.97	0.97	1.02	0.97
RT-12A	0.03	0.03	0.03	0.06	0.03
RT-16	0.13	0.13	0.13	0.13	0.13
RT-17B	0.69	0.69	0.69	0.71	0.69
RT-4E	0.37	0.37	0.37	0.38	0.37
RT-8	0.48	0.48	0.48	0.19	0.48
71	76.45	76.45	76.45	0.04	76.45

Analysis begun on: Wed Aug 31 16:32:11 2022
Analysis ended on: Wed Aug 31 16:32:11 2022
Total elapsed time: < 1 sec

APPENDIX D

REFERENCE MATERIAL

TECHNICAL MEMORANDUM

J·R ENGINEERING

To: **Jeff Rice, PE, El Paso County**

From: **Mike Bramlett, PE, JR Engineering**

Date: **April 13, 2021**

Subject: Sterling Ranch MDDP – Hydrology Alternatives

Mr. Rice,

JR Engineering is preparing an updated MDDP for the Sterling Ranch Development, revising the approved *Master Development Drainage Plan for Sterling Ranch* prepared by M&S Civil Consultants, dated October 2018. JR is presenting two alternatives for how the hydrology for the MDDP along Sand Creek could be analyzed. Initially, JR was provided with a HEC-HMS model previously done by M&S for the current MDDP. Due in part to skepticism over the validity of the model, as well as the desire to incorporate all the proposed offline storage into the model, it was decided that rather than revising the existing model in HEC-HMS, it would be preferable to use EPA SWMM for the hydrologic modeling. Unfortunately, there is no clean, easy way to directly convert a HEC-HMS model to SWMM. The HEC-HMS model uses SCS Curve Number for its infiltration calculations. Colorado Springs criteria explicitly states that Curve Number cannot be used in SWMM because it doesn't accurately model infiltration with Curve Number. Unable to directly use Curve Number, it is proposed instead to use Horton's Equation for infiltration.
The two modeling methods presented both use SWMM. One model uses CUHP to generate sub-basin hydrology, while the other uses the internal hydrologic parameters in SWMM. Rather than modeling all the design storms at this time, we decided to use just the Existing Conditions 100-year storm for this comparison, since the model is simpler and where the differences between models would be at their most extreme . Both models use the 24-hour Type II Storm, simulating a frontal storm typically seen along the Front Range.

Alternative 1: This evaluation uses the Colorado Urban Hydrograph Procedure (CUHP) to develop sub-basin hydrographs for use in SWMM. To get as close of a comparison as possible, we tried to use as much original sub-basin information as possible from the 2018 MDDP. From the MDDP Appendices we were able to determine basin area and imperviousness. Basin length and distance to centroid were determined by re-creating the Existing Conditions Map. Basin slope was determined based on the Lag Time tables in the appendices and then adjusted based Colorado Springs criteria for slopes in SWMM models. Horton parameters were determined based on the soil group composition of each basin. The rain gauge for the 24-hr storm was made by converting the cumulative hydrograph into an incremental one, so as to better model the peaks.

All basins were defined as junction nodes. Any nodes that had a defined channel connecting them were used based on parameters taken from the HEC-HMS model. When a channel wasn't defined in the HEC-HMS model, it was assumed that one wasn't present and a dummy conduit of minimal length was used to connect the node to its nearest downstream junction. Results from both alternatives can be seen in the table below.

Alternative 2: This alternative calculates the sub-basin hydrology based on the internal hydrology parameters within SWMM. Basin area, imperviousness, and slope were all the same as those used in alternative 1. Horton parameters were also taken directly from alternative 1. All defined channels were also taken directly from alternative 1. One of the biggest differences between the two is how is calculates basin width. Colorado Springs provides an excel spreadsheet to convert an irregular shaped basin into a uniform width rectangle. The other big difference between the two models is how routing is done. To simulate runoff from single family houses and local roads in the mostly large, undeveloped basins, pervious routing was used. Depression storage depths were the same assumptions used in alternative 1, and it was assumed that zero percent of all the basins had no depression storage available. The rain gauge was identical to the cumulative hydrograph in the HEC-HMS model.

The basins were laid out in a similar fashion as the HEC-HMS model. If a basin doesn't drain directly to a defined channel, then the basin drains to a dummy node at the top of the channel, which then conveys it downstream to the next node. Channel parameters were taken directly from the HEC-HMS model. Results from both alternatives can be seen in the table below.

Basin Summary					
Basin	MDDP (HEC-HMS)	CUHP		SWMM	
	24-hr Type II Storm Q100 (cfs)	CUHP Q100 (cfs)	Percent Difference	Internal Hydrology Q100 (cfs)	Percent Difference
EX-0	32.2	31.5	2%	67.7	210%
EX-1	30.9	27.9	10%	73.3	237%
EX-2	7.1	4.5	36%	58.9	830%
EX-3	143.1	149.6	5%	640.5	448%
EX-3A	192.6	223.4	16%	556.7	289%
EX-4	197.3	221.2	12%	542.5	275%
EX-4A	160.1	104.8	35%	378.6	236%
EX-5	158.2	150.4	5%	786.7	497%
EX-6	100.5	95.3	5%	387.6	386%
EX-7	107.4	147.0	37%	484.5	451%
EX-8	20.5	50.9	248%	151.4	738%
EX-9	125.2	106.6	15%	222.9	178%
EX-10	236.1	247.9	5%	786.5	333%
EX-10A	43.1	121.6	282%	338.2	785%
EX-11	126.1	213.9	170%	365.1	290%
EX-12	33.3	63.4	90%	98.8	297%
EX-13	78.4	70.5	10%	327.7	418%
EX-20	166.2	215.0	29%	453.7	273%
EX-20A	194.6	171.9	12%	235.3	121%
EX-21	49	41.9	14%	259.6	530%
EX-24	73	60.4	17%	148.0	203%
EX-25	25.1	38.2	52%	72.2	287%
EX-73	102	102.0	0%	262.2	257%
EX-74	140.7	197.9	41%	349.0	248%
EX-75	82.8	85.8	4%	330.7	399%
EX-76	89.6	86.2	4%	330.5	369%
EX-77	227.7	190.5	16%	704.5	309%
EX-78	174.5	245.4	41%	318.9	183%
EX-79	220.1	299.7	36%	348.6	158%
EX-80	171.4	181.7	6%	373.6	218%
EX-81	275.7	267.2	3%	349.1	127%
EX-82	132.3	186.8	41%	243.3	184%
EX-88	144.4	156.6	8%	410.1	284%

Results: As seen in the above table, almost across the board, the CUHP model was closer to MDDP results than the SWMM Internal Geometry. There are basins where the CUHP is within a few percent of the MDDP, while the Internal Hydrology is several times higher. A few basins are over double compared to the MDDP in both models, but for the most part the Internal Hydrology model is substantially higher. The discrepancy appears to be mainly in the hydrology itself. The values at the design points of the model are overall closer to the MDDP values. Peak values at design points for the CUHP model are within 40% with one exception, while there are 8 nodes in the Internal Hydrology model that are at least double that of the MDDP. Curiously, volumes across the board show a lower percent difference than peak flows. The CUHP volumes all stay below 50% of the MDDP model, while the highest difference in the Internal Hydrology model is 76%.

Conclusions: As expected, converting a HEC-HMS model to a SWMM model creates differences in results, regardless of how you choose to model it. Due to SWMM's inability to properly model SCS Curve Number, neither of these models is a perfect comparison to the 2018 MDDP's HEC-HMS models. Using as many parameters provided from the MDDP model as possible, we were able to create two functioning SWMM models. Using CUHP to calculate basin hydrology proved to be across the board more similar to the MDDP results than by calculating basin hydrology with SWMM's internal parameters.

It is our recommendation that CUHP and SWMM be used for all further hydrologic modeling involved with this MDDP revision.

FINAL DRAINAGE REPORT FOR HOMESTEAD AT STERLING RANCH FILING NO. 1

EL PASO COUNTY, COLORADO

July 2018

Prepared for:

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

DP5, (**Aka DP5***) 0.80 acres, consists of 0.61 acres proposed backyards of residential lots (Basin G) that have assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, as well 0.19 acres of Dines Boulevard (Basin H) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year as well as flow by from DP4. Developed runoff of 4.2 and 19.7 cfs has been calculated to reach DP5 in the two events respectively. An existing 15' CDOT type R at-grade inlet at. DP5 will intercept flows of Q5=4.2 cfs and Q100=14.7 cfs. These flows are equivalent to the flows documented in the MDDPSR report (Q5=4.2 cfs and Q100=19.7 cfs). An existing 36" RCP will carry the collected runoff under existing Dines Boulevard towards DP6, while flow-by from DP5 will continue south within Dines Boulevard.

DP6, (**Aka DP5***) 4.68 acres, consists backyards of residential lots of 0.43 and 0.61 acres in size (Basins OS3 and OS4) that have been assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year events and 2.1 acre portion of Wheatland Drive and 1.54 acre portion of Dines Boulevard, both with assigned runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year events. Developed runoff of Q5=14.1 cfs and Q100=26.7 cfs has been calculated to reach DP6. An existing 15' CDOT type R at-grade inlet. These flows are equivalent to the flows documented in the MDDPSR report (Q5=14.1 cfs and Q100=26.7 cfs). Flow-by from DP6 will continue south within Dines Boulevard.

DP7, (**Aka DP9***) 9.73 acres, consists of proposed residential lots of the planned development located east of the subject site (Basin 0S-6) that have been assigned runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year events. Developed runoff of Q5=12.6 cfs and Q100=30.5 cfs has been calculated to reach DP7. An existing 30" RCP will convey runoff to existing FSD Pond 4. The flows in PR7 are approximately equivalent to the flows documented in the MDDPSR report of Q5=12.5 cfs and Q100=30.4 cfs.

DP8,(**Aka DP10***) 1.97 acres, consists of Basin S (Existing FSD Pond 4) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and runoff from PR4, PR6 and PR7. Based upon this drainage analysis the total combined developed runoff to reach DP10 at the existing pond will be Q5=49.2 cfs and Q100=105.39 cfs for the 5 and 100 year events respectively, which varies just slightly from the MDDPSR flows of Q5=50.0 cfs and Q100=102.9 cfs that the facility was designed for.

The existing privately maintained facility, as constructed, continues to provide full spectrum detention and water quality for the calculated runoff as planned. The pond will continue to treat approx 27.63 acres, and provide 0.46 ac-ft of water quality storage and 2.915 ac-ft of 100-year storage (refer to UD-Detention worksheet in appendix of this report). According to the updated UD detention worksheet, the slight inflow increase in results in only an increase in the ponding elevation of 0.03'and an increase of 0.6 cfs being released from the pond when compared to the initial design worksheets. Despite the minor increase the pond continues to meet the required drain times and pre-developed flow release rates as necessary with no negative impacts to downstream facilities.

In the event of clogging or total inlet failure, flows at DP8 will over top the existing emergency spillway and outfall into Sand Creek. The existing detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District (SRMD). Access has been granted to the SRMD and El Paso County for access and maintenance of the private detention pond.

DP9,(**Aka DP10***) 3.01 acres, consists of 2.71 acres of existing low density residential (Basin OS1A) that have assigned runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and 0.31 acres of existing

bottom of the rundown provides to dissipate energy and prevent local scour. Runoff is conveyed southerly in an existing earthen swale that leads to existing Detention Pond W-9.

DP14 (Aka DP61*), 4.03 acres, consists 1.15 acres of rear residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and 1.60 acres of landscape area and an existing FSD pond (Basin M2) that has been assigned runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and 2.04 acres of the eastern half of existing Vollmer Road and adjacent landscaped areas, which have been assigned runoff coefficients of 0.63 and 0.76 for the 5 and 100 year events respectively as well as flows from DP13. Runoff reaching the existing pond at DP 14 is calculated to be Q5=8.9 cfs and Q100=21.2 cfs, which matches the MDDPSR flows of Q5=8.9 cfs and Q100=21.2 cfs that the facility was designed for.

The existing facility functions to provide full spectrum detention and water quality for runoff calculated to reach DP14. The existing pond will treat approx 5.87 acres, and provide 0.092 ac-ft of water quality storage and 0.638 ac-ft of 100-year storage. As described within the MDDPSR the detention facility is 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. In the event of clogging or total inlet failure, flows at DP14 will over top the emergency spillway and outfall into a proposed swale which will route flows to an existing Vollmer Road side swale. The peak release rates from Pond W-9 (PR13, Q5=0.6 cfs and Q100=8.7 cfs) are conveyed within an existing 18" RCP to and existing 30” RCP ((PR14) (Q5=7.6 cfs and Q100=47.2 cfs)). These flows will be combine with flows from PR12 and be routed east, within the Homestead Sterling Ranch Filing No. 1 subdivision, via a 54” RCP, PR15 (Q5=23.8 cfs and Q100=164.1 cfs). These flows will combine with flows from PR16 (Q5=2.8 cfs and Q100=36.8 cfs, release rate Pond 4) and be routed south via a 60” RCP, PR12 (Q5=26.6 cfs and Q100=200.9 cfs). These flows are nearly equivalent to the SRMDDP runoff rates of (Q5=26.5 cfs and Q100=200.3 cfs) which the pipe was designed. The collected runoff will outfall into an existing low tailwater riprap basin at Sand Creek.

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 Q5=1.6 cfs and Q100=5.7 cfs have been calculated for the basin. Runoff from the proposed residential backyard lots will flow to an existing swale that falls along the east boundary of the Barbarick Subdivision. Basin N was part of a larger Basin YY* that was as discussed in the MDDPSR. The limited developed flows from Basin N that are discharged to the south are considerably less than the historic flows previously directed toward the Barbarick subdivision as can be seen by noting Basin EX-3A in the Sterling Ranch MDDP Existing Conditions Map. As the backyards are typically permeable, and roof drainage from the back of the house shall be directed to the front of the lot water quality treatment will be addressed in the paragraph below.

The flows generated by Basin N and Tract L will be routed south via overlot grading and swales to a temporary sediment basin (future Pond W-5), at the south end of the Sterling Ranch Development. Upon development of the Sterling Ranch Filing No. 2 infrastructure Pond W-5 will be constructed and flows from Basin N and Tract L will be treated as WQCV and Full Spectrum Detention. As such 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 that have been assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year storm events. Developed runoff of, Q5=0.5 cfs and Q100=1.8 cfs is anticipated to be produced by the basin. Runoff from the proposed residential backyard lots will sheet flows towards the planned Branding Iron at Sterling Ranch Filing No. 1 as discussed in the MDDPSR. Basin O was part of a larger Basin GG* in the MDDPSR. Runoff from basin O and the flow-by from DP1, 2, 5 and 6 will be collected within existing system within existing Dines Boulevard and detained and released at pre-developed flow rates from FSD Pond 4. Refer to Branding Iron at Sterling Ranch filing No.1 FDR for additional information.

DETENTION PONDS

Water Quality/Full Spectrum Detention Facilities

As discussed in the detained drainage summary, developed runoff from Homestead at Sterling Ranch Filing No. 1 is conveyed to existing Full Spectrum Detention Ponds No 4, 8 and W-9 in accordance with the Sterling Ranch Filing Nos. 1&2 MDDP. Based upon the provided analysis the ponds are adequate to serve their intended purpose and require no modification. This is because this final drainage report and the SR Filing 1 and 2 MDDP were nearly concurrent. Thus the larger scale concept planning was very finite and thus allowed for the developed flow rates to align between the two documents and thereby not requiring modifications to facility which is often common between conceptual and final design. The information provided in this report regarding Ponds 8 and W-9 shall supersede the information presented in the MDDP and should be re-referenced with future design.

The flows generated by Basin N and Tract L will be routed south via overlot grading and vegetated swales to a temporary sediment basin (future Pond W-5), at the south end of the Sterling Ranch Development. Upon development of the Sterling Ranch Filing No. 2 infrastructure Pond W-5 will be constructed and flows from Basin N and Tract L will be treated as WQCV (see WQCV deviation request) and Full Spectrum Detention. As such the proposed develop shall not adversely affect the downstream infrastructure.

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

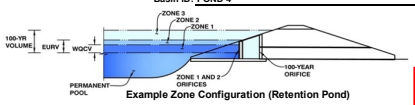
Drainage Facilities:

Minor improvements with the development of Homestead at Sterling Ranch Filing No. 1 are listed below. The majority of the infrastructure construction costs have been accounted for in the "Master Development

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 4



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	27.63	acres
Watershed Length =	1,720	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	53.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.494	acre-feet
Excess Urban Runoff Volume (EURV) =	1.573	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.312	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	1.981	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.542	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	3.324	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	3.977	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.720	acre-feet
500-yr Runoff Volume (P1 = 6.53 in.) =	13.003	acre-feet
Approximate 2-yr Detention Volume =	1.241	acre-feet
Approximate 5-yr Detention Volume =	1.821	acre-feet
Approximate 10-yr Detention Volume =	1.991	acre-feet
Approximate 25-yr Detention Volume =	2.082	acre-feet
Approximate 50-yr Detention Volume =	2.317	acre-feet
Approximate 100-yr Detention Volume =	2.781	acre-feet

Optional User Input 1-hr Precipitation

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

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.494	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.079	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.209	acre-feet
Total Detention Basin Volume =	2.781	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

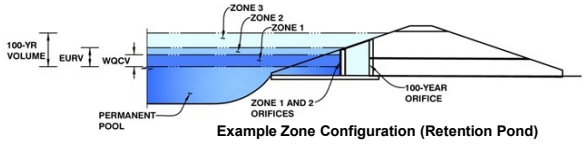
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	10	0.000		
	--	0.33	--	--	--	406	0.009	65	0.001
	--	1.00	--	--	--	2,912	0.067	1,151	0.026
	--	3.00	--	--	--	12,934	0.297	17,026	0.391
	--	5.00	--	--	--	27,336	0.628	57,296	1.315
	--	7.00	--	--	--	52,589	1.207	137,221	3.150
	--	9.00	--	--	--	57,186	1.313	246,996	5.670
	--		--	--	--				

Detention Basin Outlet Structure Design

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 4



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.32	0.494	Orifice Plate
Zone 2 (EURV)	5.38	1.079	Orifice Plate
Zone 3 (100-year)	6.69	1.209	Weir&Pipe (Restrict)
		2.781	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.37	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	19.40	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.79	3.58					
Orifice Area (sq. inches)	2.33	2.33	2.60					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.37	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.10	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.06	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	18.90	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.45	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	27.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	4.65	N/A	ft^2
Outlet Orifice Centroid =	1.19	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.50	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.33	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	34.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

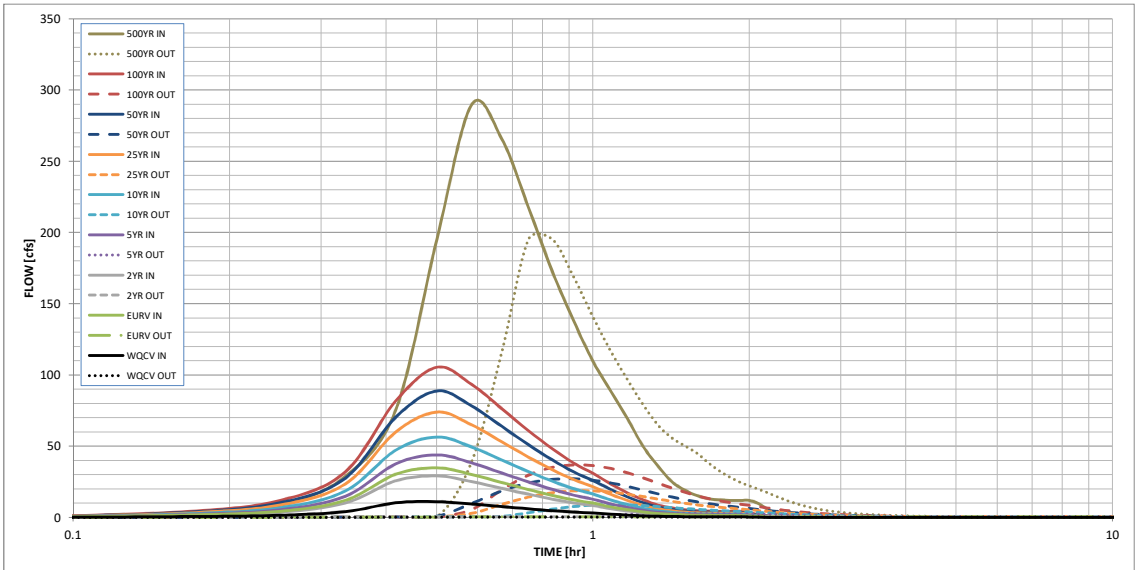
Calculated Parameters for Spillway

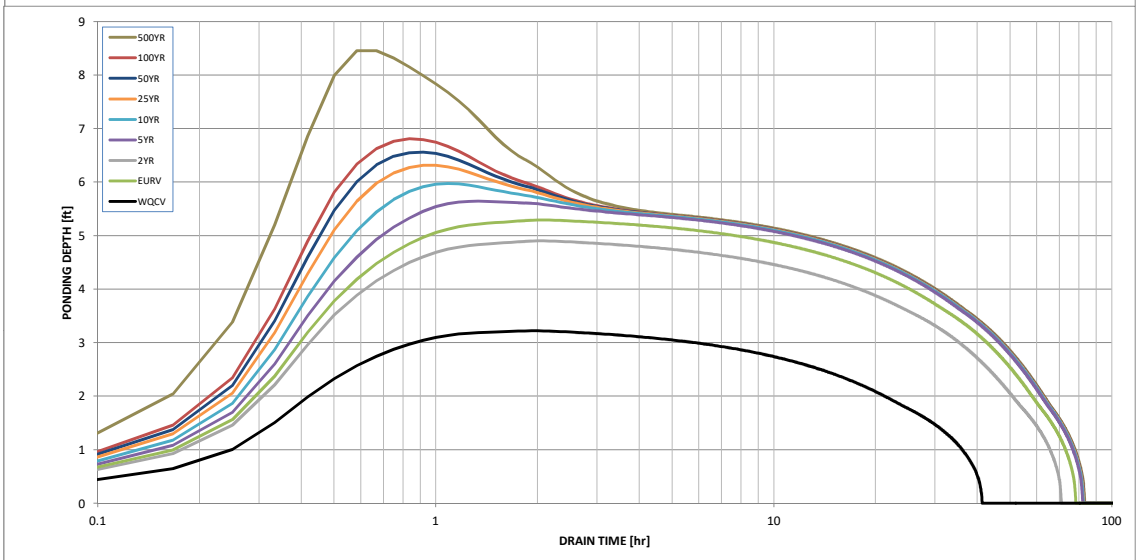
Spillway Design Flow Depth=	0.94	feet
Stage at Top of Freeboard =	9.27	feet
Basin Area at Top of Freeboard =	1.31	acres

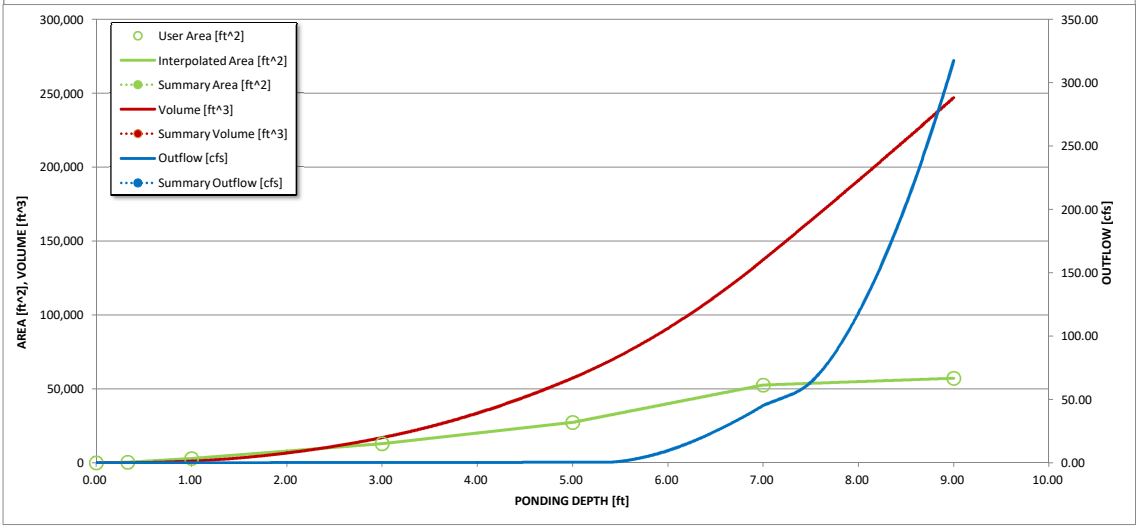
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	6.53
Calculated Runoff Volume (acre-ft) =	0.494	1.573	1.312	1.981	2.542	3.324	3.977	4.720	13.003
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.494	1.573	1.312	1.982	2.543	3.326	3.980	4.723	13.012
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.20	0.40	0.90	1.16	1.48	2.09
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	5.5	11.0	24.8	32.1	40.9	57.7
Peak Inflow Q (cfs) =	11.0	34.8	29.1	43.8	56.3	73.9	88.6	105.3	289.7
Peak Outflow Q (cfs) =	0.2	0.4	0.4	2.8	9.0	18.6	27.1	36.8	195.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.8	0.7	0.8	0.9	3.4
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	1.0	1.4	1.9	3.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	70	64	72	70	68	66	64	48
Time to Drain 99% of Inflow Volume (hours) =	**40**	75	68	78	77	76	76	75	65
Maximum Ponding Depth (ft) =	3.22	5.29	4.90	5.64	5.97	6.32	6.56	6.81	8.46
Area at Maximum Ponding Depth (acres) =	0.33	0.71	0.61	0.81	0.91	1.01	1.08	1.15	1.28
Maximum Volume Stored (acre-ft) =	0.460	1.510	1.253	1.776	2.060	2.386	2.647	2.915	4.956

Detention Basin Outlet Structure Design







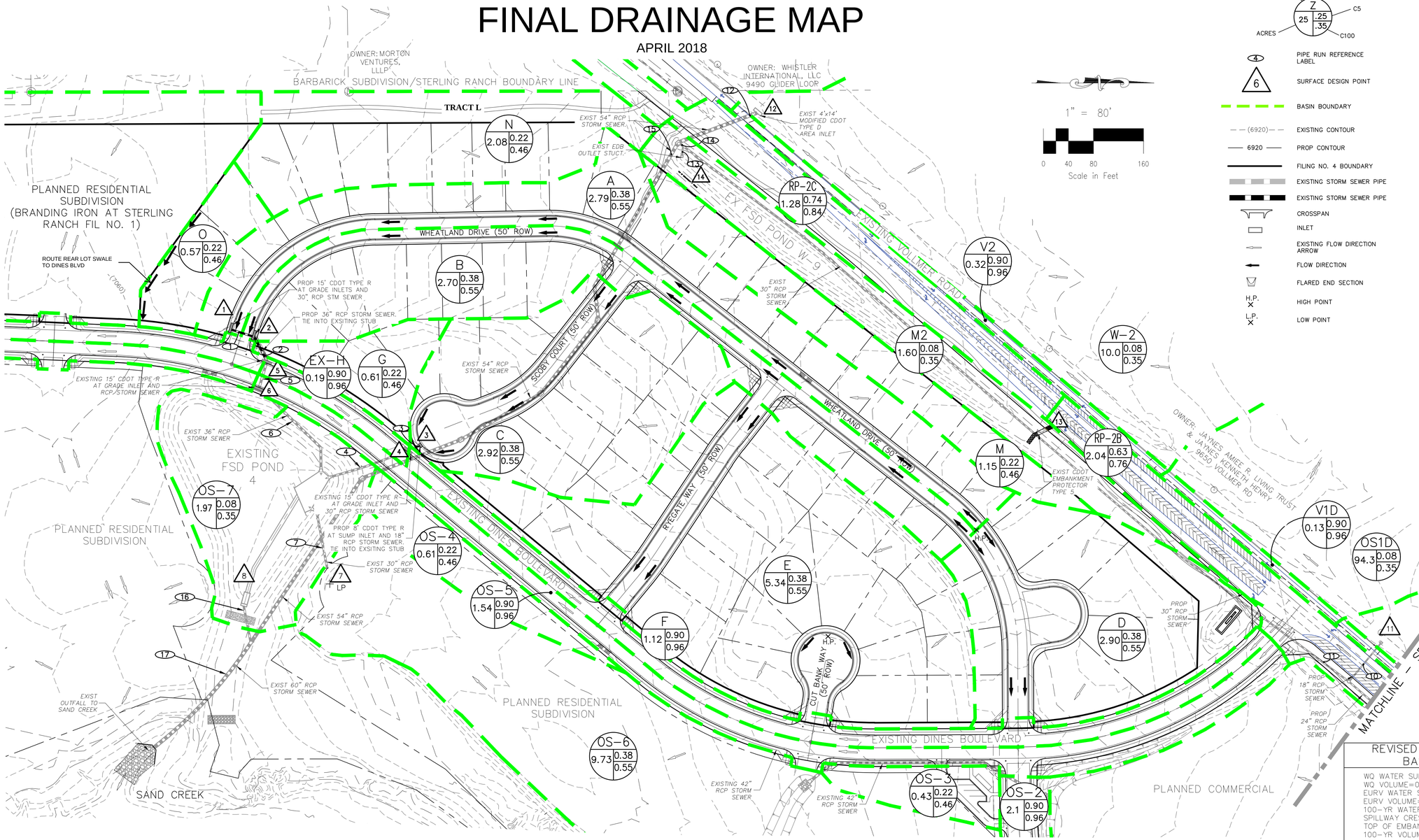
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

HOMESTEAD AT STERLING RANCH FILING NO. 1

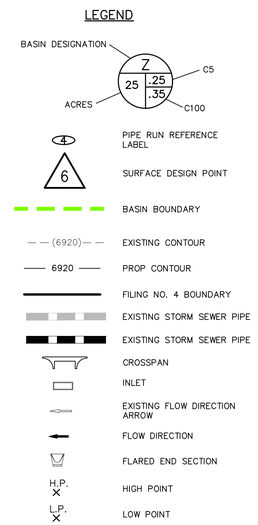
COUNTY OF EL PASO, STATE OF COLORADO

FINAL DRAINAGE MAP

APRIL 2018



LEGEND



1" = 80'

0 40 80 160

Scale in Feet

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
OS6	9.73	12.5	30.4
OS7	1.97	0.7	5.3
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	12.6	30.5	OS6	EX 18' RCP
8	49.2	105.3	OS7, PR4, PR6, PR7	EX FDS POND 4
9	1.6	7.0	OS1A, V1A	EX 12" CMP CULVERT
10	4.8	26.3	OS1B, V1B, DP6	EX 2.9'x5.7' CDOT TYPE D INLET
11	2.2	12.3	OS1C, V1C,	EX 2.9'x2.9' CDOT TYPE C INLET
12	18.9	133.7	OS1D, V1D, W-2, V2	EX 4'x14' MOD CDOT TYPE D INLET
13	2.8	5.6	RP-2B	EX CDOT EMBANKMENT PROTECTOR TYPE 5
14	8.9	21.2	M, M2, RP2C, DP13	EX FSD POND W-9

STORM SEWER SUMMARY				
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DP'S
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	16.8	29.4	30" RCP	DP4, PR3
5	10.8	30.0	36" RCP	DP5, PR2
6	21.0	44.6	36" RCP	DP6, PR5
7	12.6	30.5	24" RCP	DP7
8	1.6	7.0	12" CMP	DP9
9	4.8	26.3	24" RCP	DP10
10	2.2	12.3	18" RCP	DP11
11	7.0	38.6	30" RCP	PR5, PR6
12	18.9	133.7	54" RCP	DP12
13	0.6	8.7	18" RCP	OUTFLOW EDB POND W-9
14	7.6	47.2	30" RCP	PR7, PR9
15	23.8	164.1	54" RCP	PR8, PR10
16	2.7	36.2	30" RCP	OUTFLOW EDB POND 4
17	26.5	200.3	60" RCP	PR11, PR12

REVISED POND 4 FSD BASIN DATA	REVISED POND W-9 FSD BASIN DATA
WQ WATER SURFACE EL = 7056.39	WQ WATER SURFACE EL = 7086.59
WQ VOLUME=0.046 AC-FT	WQ VOLUME=0.092 AC-FT
EURV WATER SURFACE EL = 7058.46	EURV WATER SURFACE EL = 7087.99
EURV VOLUME=1.510 AC-FT	EURV VOLUME=0.390 AC-FT
100-YR WATER SURFACE EL=7059.98	100-YR WATER SURFACE EL=7088.84
SPILLWAY CREST EL=7060.0	SPILLWAY CREST EL=7088.84
TOP OF EMBANKMENT EL=7063.0	TOP OF EMBANKMENT EL=7090.5
100-YR VOLUME=2.915 AC-FT	100-YR VOLUME=0.638 AC-FT
100-YR INFLOW = 105.3 CFS	100-YR INFLOW = 21.2 CFS
100-YR RELEASE = 36.8 CFS	100-YR RELEASE = 8.7 CFS

1" = 80'

0 40 80 160

Scale in Feet

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

FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987

M&S CIVIL CONSULTANTS, INC.

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

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: 4/12/2018

SHEET 1 OF 1

FDM01

File: C:\Users\emoffett\VpsData\Local\Temp\Proposed Drainage Map_1_1_5096.dwg Plotstamp: 4/24/2018 10:06 AM

FINAL DRAINAGE REPORT FOR HOMESTEAD AT STERLING RANCH FILING NO. 2

EL PASO COUNTY, COLORADO

January 2020

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

Prepared by:

CIVIL CONSULTANTS, INC.
20 Boulder Crescent, Suite 110
Colorado Springs, CO 80903
(719) 955-5485

Project #09-007
SF -19-004

respectively. The total combined developed area being discharge to the channel is less than one acre. It is not practicable to provide WQCV for these areas, as stated earlier in this paragraph, areas consists primarily of vegetated tracts with no development.

CHANNEL IMPROVEMENTS

Slope grading and intermittent channel bank lining has been proposed for portions of the developable areas adjacent to Sand Creek to protect the developed lots and prevent excessive erosion until the DBPS recommended Sand Creek Channel improvements are installed. The proposed slope grading is intended to reduce outer bank grades and bring uniformity to areas where significant riling and destabilization has occurred. Proposed channel stabilization improvements includes placement of soil riprap and turf reinforcement matting along embankment toes and along embankment slopes, both of which will function to retain soils and vegetation during heavy rains or larger flood flow events. All disturbed areas, not hardscaped will be re-vegetated with native species grasses, per El Paso County erosion control standards. Storm sewer outfalls into Sand Creek shall be protected by low-tailwater riprap basins. The outfall protection is shown on the accompanying drainage map in the appendix. Refer to the Homestead Filing No.2 Grading and Erosion Control Plans for riprap and turf reinforcement map placement and construction details.

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

WATER QUALITY PROVISIONS

The proposed Full Spectrum Detention Facility, Pond 1 functions to provide detention storage and water quality facility for runoff produced onsite from tributary Basins T, U, V1, V2 and W3. This water quality facility is designed to treat 0.245 ac-ft of water quality storage (WQCV), 0.741 ac-feet of excess urban runoff volume (EURV) and 1.331 ac-ft of 100-year storage. A rolled erosion control blanketed emergency spillway, concrete forebay, trickle channel and outlet structure, and gravel maintenance access road has been designed for Pond 1.

A 24" RCP pipe extending from the proposed modified 6'x2.9' CDOT Type D sump inlet (see Design Point 13) will convey discharge from the pond to Sand Creek. Runoff discharged to Sand Creek is anticipated to reach peak flow rates of Q5=0.7 cfs and Q100=23.4 cfs. A soil riprap stilling basin has been provided at the termination of the pipe to arrest erosion.

Runoff produced within the residential backyard lots, of Basins X1, X2, W1 and Y1 will be conveyed in backyard swales and as sheet flow to a Sand Filter Basin within each lot. The treated flows will be collected by private storm sewer systems and discharged into the Sand Creek Channel. This water quality facility, for each Sand Filter Basin, is designed to treat 0.001 ac-ft of water quality storage (WQCV), 0.005 ac-feet of excess urban runoff volume (EURV) and 0.014 ac-ft of 100-year storage. A 20' wide typical drainage easement is provided within the lots to accommodate the BMP's. The facilities constructed are to be privately maintained by the Sterling Ranch metro district.

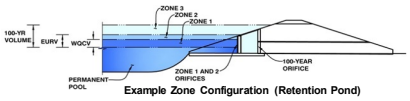
The WQCV and EURV required for the site has been determined using the guidelines set forth in the City of Colorado Springs/El Paso County Drainage Criteria Manual - Volume II. Refer to the water quality

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Homestead At Sterling Ranch Filings Nos. 2

Basin ID: FSD Pond 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	16.51	acres
Watershed Length =	875	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	44.10%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.262	acre-feet
Excess Urban Runoff Volume (EURV) =	0.771	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.614	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.847	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	1.177	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.710	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	2.073	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.550	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.574	acre-feet
Approximate 5-yr Detention Volume =	0.795	acre-feet
Approximate 10-yr Detention Volume =	1.075	acre-feet
Approximate 25-yr Detention Volume =	1.190	acre-feet
Approximate 50-yr Detention Volume =	1.247	acre-feet
Approximate 100-yr Detention Volume =	1.412	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
	inches

Stage-Storage Calculation

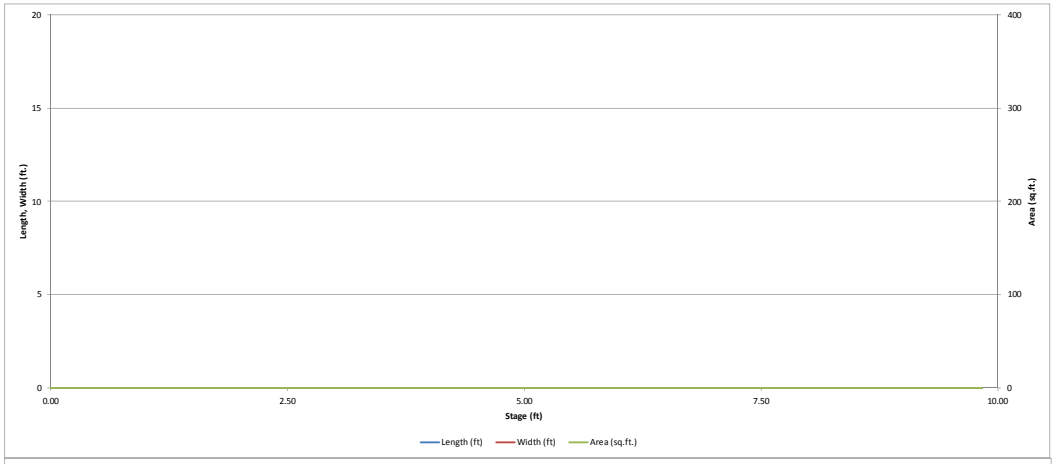
Zone 1 Volume (WQCV) =	0.262	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.508	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.642	acre-feet
Total Detention Basin Volume =	1.412	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

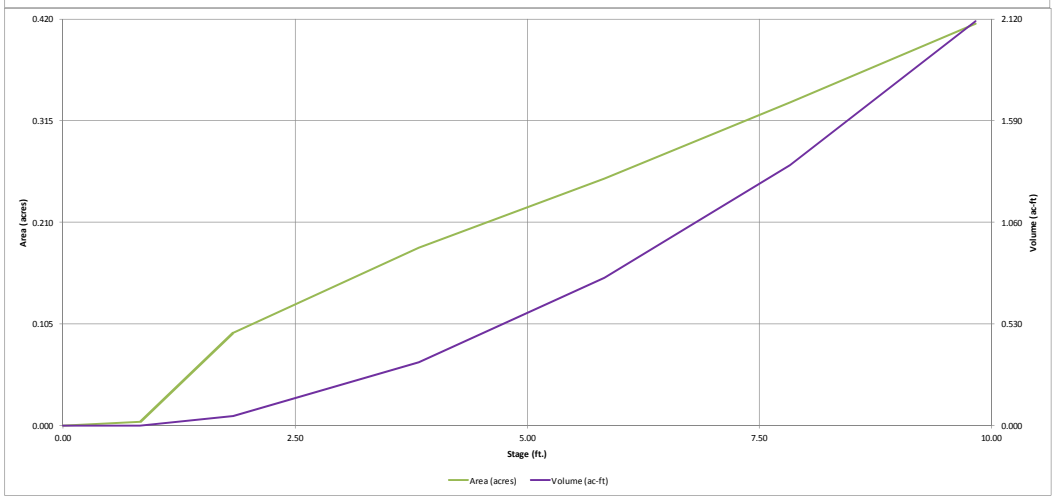
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
76.17 **Top of Micropool**	--	0.00	--	--	--	0	0.000		
76.4	--	0.33	--	--	--	40	0.001	7	0.000
77	--	0.83	--	--	--	100	0.002	40	0.001
78.00	--	1.83	--	--	--	4,187	0.096	2,143	0.049
80.00	--	3.83	--	--	--	8,006	0.184	14,378	0.330
82.00	--	5.83	--	--	--	11,106	0.255	33,490	0.769
84.00	--	7.83	--	--	--	14,529	0.334	59,125	1.357
86.00	--	9.83	--	--	--	18,087	0.415	91,741	2.106

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



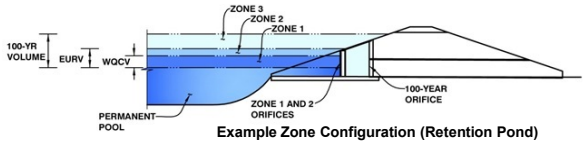


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.45	0.262	Orifice Plate
Zone 2 (EURV)	5.84	0.508	Orifice Plate
Zone 3 (100-year)	8.00	0.642	Weir&Pipe (Restrict)
		1.412	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.84	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	23.40	inches
Orifice Plate: Orifice Area per Row =	1.19	sq. inches (diameter = 1-3/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.264E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.95	3.89					
Orifice Area (sq. inches)	1.19	1.19	1.19					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.84	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.81	N/A	feet
Over Flow Weir Slope Length =	3.07	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.21	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	12.88	N/A	ft^2
Overflow Grate Open Area w/ Debris =	6.44	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	13.30		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.79	N/A	ft^2
Outlet Orifice Centroid =	0.63	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	17.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

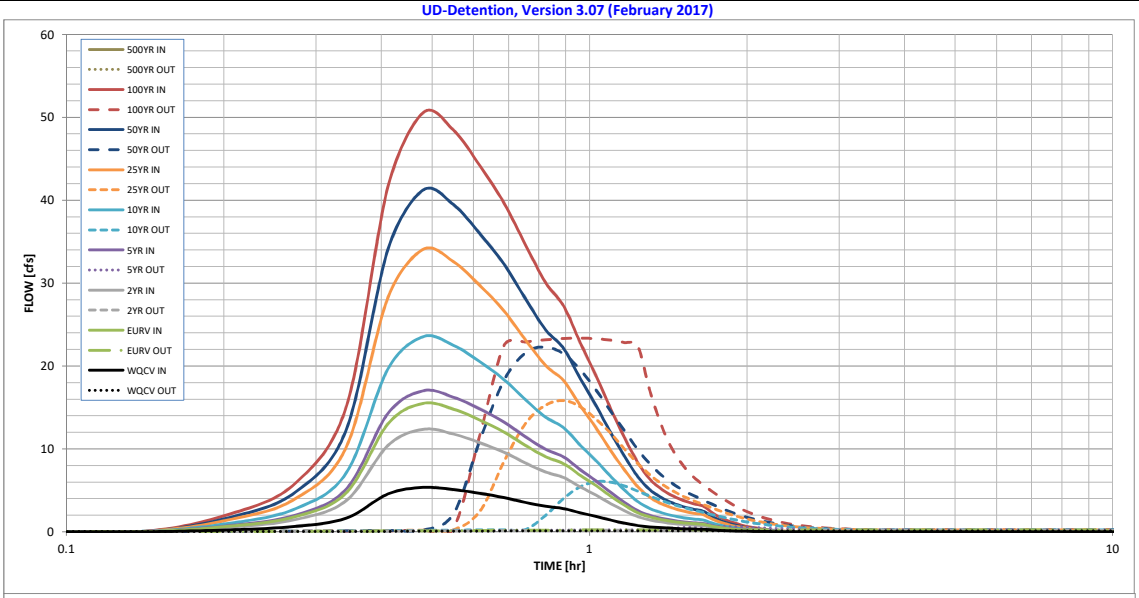
Spillway Design Flow Depth=	0.89	feet
Stage at Top of Freeboard =	9.69	feet
Basin Area at Top of Freeboard =	0.41	acres

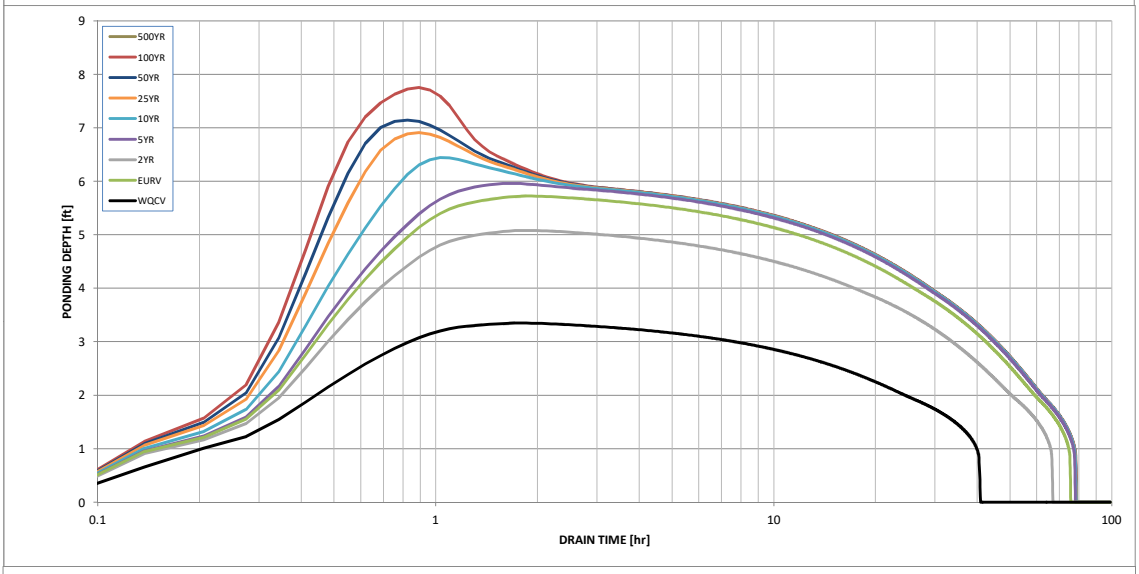
Routed Hydrograph Results

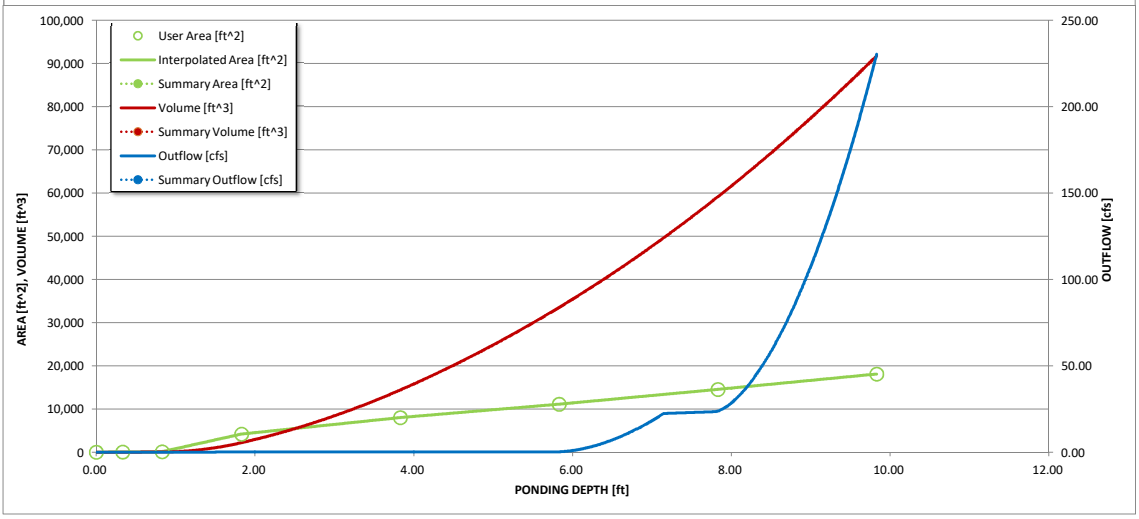
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.177	1.710	2.073	2.550	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.176	1.710	2.074	2.551	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.27	0.84	1.16	1.55	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	0.4	4.4	13.9	19.2	25.5	0.0
Peak Inflow Q (cfs) =	5.3	15.5	12.4	17.0	23.5	34.1	41.2	50.5	#N/A
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.7	6.0	15.8	22.3	23.4	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.4	1.1	1.2	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.4	1.2	1.7	1.8	#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) =	39	69	62	71	69	66	63	61	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	73	65	76	75	74	73	72	#N/A
Maximum Ponding Depth (ft) =	3.35	5.72	5.08	5.96	6.44	6.91	7.15	7.75	#N/A
Area at Maximum Ponding Depth (acres) =	0.16	0.25	0.23	0.26	0.28	0.30	0.31	0.33	#N/A
Maximum Volume Stored (acre-ft) =	0.245	0.741	0.588	0.802	0.932	1.067	1.137	1.331	#N/A

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 Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.12 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:08:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:12:22	0.24	0.68	0.55	0.75	1.03	1.47	1.77	2.15	#N/A
1.214	0:16:29	0.64	1.85	1.48	2.02	2.79	4.01	4.84	5.91	#N/A
	0:20:36	1.65	4.74	3.79	5.20	7.16	10.30	12.42	15.18	#N/A
	0:24:43	4.55	13.03	10.43	14.28	19.66	28.29	34.10	41.64	#N/A
	0:28:50	5.34	15.51	12.37	17.02	23.54	34.08	41.22	50.54	#N/A
	0:32:58	5.08	14.81	11.80	16.25	22.50	32.61	39.48	48.45	#N/A
	0:37:05	4.62	13.48	10.75	14.80	20.49	29.69	35.94	44.09	#N/A
	0:41:12	4.11	12.05	9.59	13.23	18.35	26.64	32.27	39.64	#N/A
	0:45:19	3.53	10.41	8.28	11.44	15.90	23.13	28.07	34.53	#N/A
	0:49:26	3.08	9.07	7.22	9.96	13.83	20.09	24.40	30.06	#N/A
	0:53:34	2.79	8.22	6.54	9.03	12.54	18.22	22.11	27.22	#N/A
	0:57:41	2.28	6.79	5.39	7.47	10.41	15.18	18.44	22.73	#N/A
	1:01:48	1.84	5.56	4.40	6.12	8.55	12.50	15.21	18.77	#N/A
	1:05:55	1.40	4.29	3.39	4.73	6.64	9.78	11.93	14.77	#N/A
	1:10:02	1.02	3.21	2.52	3.54	5.01	7.43	9.10	11.31	#N/A
	1:14:10	0.75	2.32	1.83	2.56	3.64	5.45	6.70	8.37	#N/A
	1:18:17	0.59	1.79	1.42	1.97	2.79	4.15	5.08	6.32	#N/A
	1:22:24	0.48	1.47	1.16	1.62	2.29	3.38	4.13	5.12	#N/A
	1:26:31	0.41	1.25	0.99	1.38	1.94	2.86	3.49	4.32	#N/A
	1:30:38	0.36	1.10	0.87	1.21	1.70	2.50	3.05	3.77	#N/A
	1:34:46	0.33	0.99	0.78	1.09	1.52	2.24	2.73	3.38	#N/A
	1:38:53	0.30	0.91	0.72	1.00	1.40	2.06	2.51	3.10	#N/A
	1:43:00	0.22	0.67	0.53	0.73	1.03	1.52	1.85	2.29	#N/A
	1:47:07	0.16	0.49	0.39	0.54	0.75	1.11	1.35	1.67	#N/A
	1:51:14	0.12	0.36	0.28	0.40	0.55	0.81	0.99	1.23	#N/A
	1:55:22	0.09	0.26	0.21	0.29	0.41	0.60	0.74	0.91	#N/A
	1:59:29	0.06	0.19	0.15	0.21	0.30	0.44	0.53	0.66	#N/A
	2:03:36	0.04	0.13	0.11	0.15	0.21	0.31	0.38	0.47	#N/A
	2:07:43	0.03	0.10	0.08	0.11	0.15	0.23	0.28	0.34	#N/A
	2:11:50	0.02	0.06	0.05	0.07	0.10	0.15	0.19	0.24	#N/A
	2:15:58	0.01	0.04	0.03	0.04	0.06	0.10	0.12	0.15	#N/A
	2:20:05	0.00	0.02	0.01	0.02	0.03	0.05	0.06	0.08	#N/A
	2:24:12	0.00	0.01	0.00	0.01	0.01	0.02	0.03	0.04	#N/A
	2:28:19	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
	2:32:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:36:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:40:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:44:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:48:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:53:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:57:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:01:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:05:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:09:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:13:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:17:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:21:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:26:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:30:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:34:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:38:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:42:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:46:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:50:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:54:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:58:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:03:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:07:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:11:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:15:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:19:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:23:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:31:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:36:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:44:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:48:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:52:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:56:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

STERLING RANCH FILING NO. 1
PROPOSED FINAL DRAINAGE MAP

PROJECT NO. 09-002 | DESIGNED BY: ET | DRAWN BY: BB | CHECKED BY: GT
SCALE: HORIZONTAL: 1"=100' VERTICAL: N/A
DATE: 1/2/2018
SHEET 4 OF 4
SHEET 4

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

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

REVISIONS:

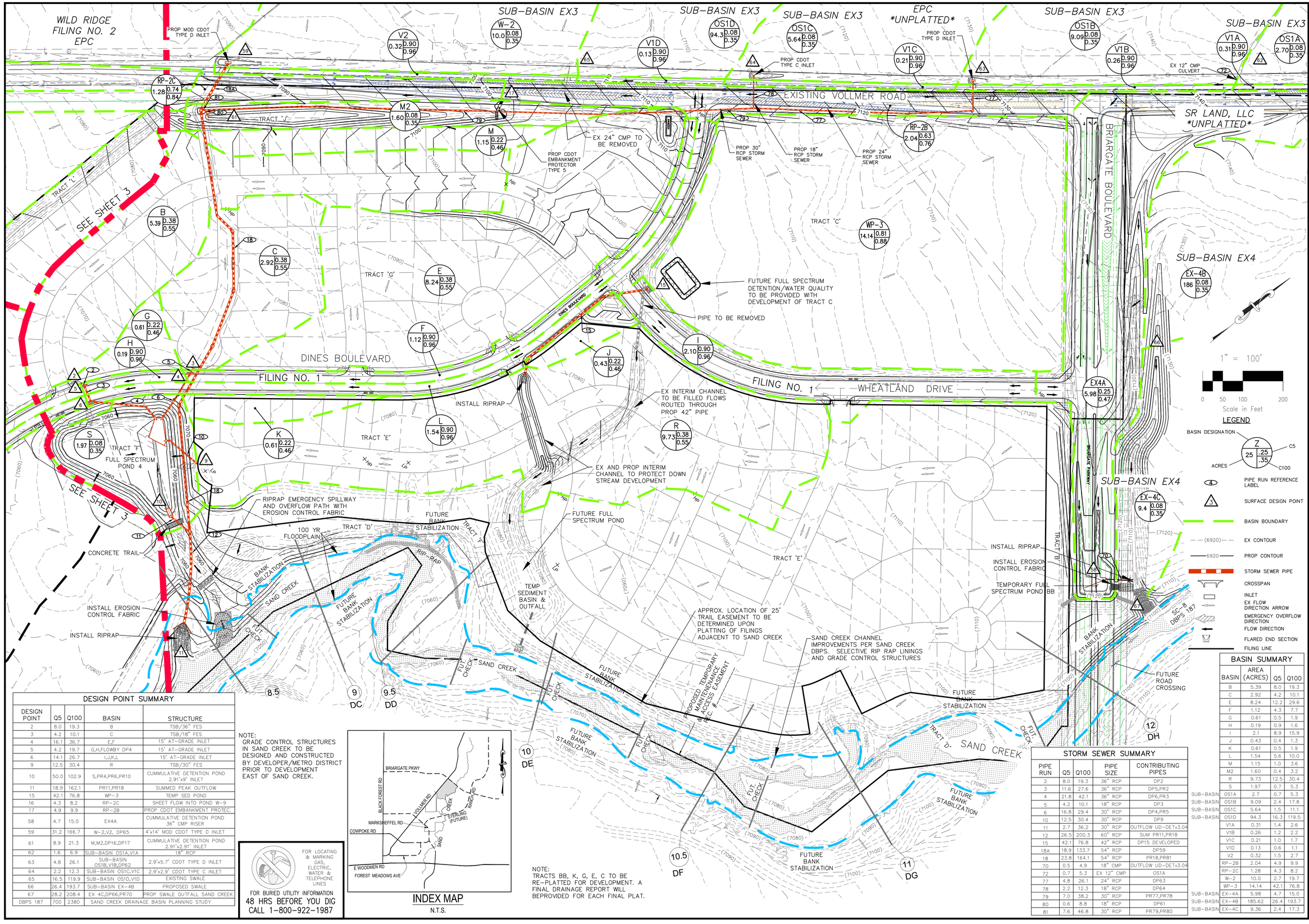
NO.	DATE:	BY:	DESCRIPTION:	APRV'D. BY:	DATE:

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

CAUTION

1" = 100'
0 50 100 200
Scale in Feet

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



DESIGN POINT SUMMARY

DESIGN POINT	Q5	Q100	BASIN	STRUCTURE
2	8.0	19.3	B	TSB/36" FES
3	4.2	10.1	C	TSB/18" FES
4	16.1	36.7	E,F	15' AT-GRADE INLET
5	4.2	19.7	G,H,FLOWBY DP4	15' AT-GRADE INLET
6	14.1	26.7	I,J,K,L	15' AT-GRADE INLET
9	12.5	30.4	R	TSB/30" FES
10	50.0	102.9	S,PR4,PR6,PR10	CUMMULATIVE DETENTION POND 2.91'x9' INLET
11	18.9	162.1	PR11,PR18	SUMMED PEAK OUTFLOW
15	42.1	76.8	WP-3	TEMP. SED POND
16	4.3	8.2	RP-2C	SHEET FLOW INTO POND W-9
17	4.9	9.9	RP-2B	PROP CDOT EMBANKMENT PROTEC.
58	4.7	15.0	EX4A	CUMMULATIVE DETENTION POND 36" CMP RISER
59	31.2	166.7	W-2,V2, DP65	4'x14' MOD CDOT TYPE D INLET
61	8.9	21.3	M,M2,DP16,DP17	CUMMULATIVE DETENTION POND 2.91'x2.91' INLET
62	1.6	6.9	SUB-BASIN OS1A,V1A	18" RCP
63	4.8	26.1	SUB-BASIN OS1B,V1B,DP62	2.9'x5.7' CDOT TYPE D INLET
64	2.2	12.3	SUB-BASIN OS1C,V1C	2.9'x2.9' CDOT TYPE C INLET
65	16.5	119.9	SUB-BASIN OS1D,V1D	EXISTING SWALE
66	26.4	193.7	SUB-BASIN EX-4B	PROPOSED SWALE
67	28.2	208.4	EX 4C,DP66,PR70	PROP SWALE OUTFALL SAND CREEK
DBPS 187	700	2380	SAND CREEK DRAINAGE BASIN PLANNING STUDY	

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

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
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CALL 1-800-922-1987

INDEX MAP
N.T.S.

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

BASIN SUMMARY

BASIN	AREA (ACRES)	Q5	Q100
B	5.39	8.0	19.3
C	2.92	4.2	10.1
E	8.24	12.2	29.6
F	1.12	4.3	7.7
G	0.61	0.5	1.9
H	0.19	0.9	1.6
I	2.1	8.9	15.9
J	0.43	0.4	1.3
K	0.61	0.5	1.9
L	1.54	5.6	10.0
M	1.15	1.0	3.6
M2	1.60	0.4	3.2
R	9.73	12.5	30.4
S	1.97	0.7	5.3
SUB-BASIN OS1A	2.7	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
W-2	10.0	2.7	19.7
WP-3	14.14	42.1	76.8
SUB-BASIN EX-4A	5.98	4.7	15.0
SUB-BASIN EX-4B	185.62	26.4	193.7
SUB-BASIN EX-4C	9.36	2.4	17.3

STORM SEWER SUMMARY

PIPE RUN	Q5	Q100	PIPE SIZE	CONTRIBUTING PIPES
2	8.0	19.3	36" RCP	DP2
3	11.6	27.6	36" RCP	DP5,PR2
4	21.8	42.1	36" RCP	DP6,PR3
5	4.2	10.1	18" RCP	DP3
6	16.8	29.4	30" RCP	DP4,PR5
10	12.5	30.4	30" RCP	DP9
11	2.7	36.2	30" RCP	OUTFLOW UD-DETv3.04
12	26.5	200.3	60" RCP	SUM PR11,PR18
15	42.1	76.8	42" RCP	DP15 DEVELOPED
18A	18.9	133.7	54" RCP	DP59
18	23.8	164.1	54" RCP	PR18,PR81
70	0.5	4.9	18" CMP	OUTFLOW UD-DETv3.04
72	0.7	5.3	EX 12" CMP	OS1A
77	4.8	26.1	24" RCP	DP63
78	2.2	12.3	18" RCP	DP64
79	7.0	38.2	30" RCP	PR77,PR78
80	0.6	8.8	18" RCP	DP61
81	7.6	46.8	30" RCP	PR79,PR80

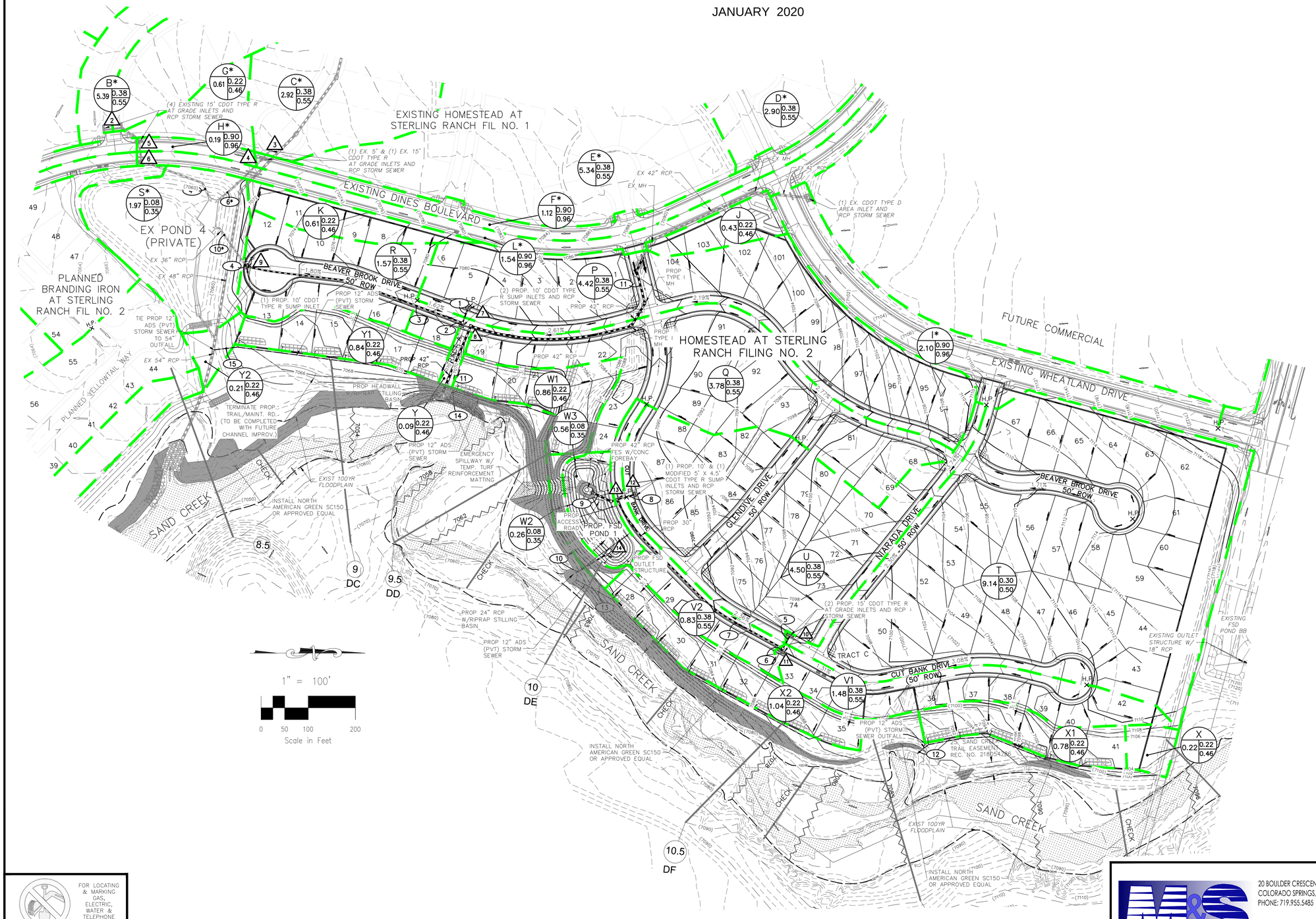
File: Q:\09002A\Sterling Ranch District\dwg\Eng Exhibits\FDP\SR Filing 1-Drainage Map SHEET 4.dwg Plotstamp: 1/13/2020 4:41 PM

HOMESTEAD AT STERLING RANCH FILING NO. 2

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

JANUARY 2020



LEGEND

BASIN DESIGNATION — Z / 25 / .25 / .35 — C5 / C100; ACRES

4 — PIPE RUN REFERENCE LABEL

6 — SURFACE DESIGN POINT

BASIN BOUNDARY

(6920) EXISTING CONTOUR

6920 PROP CONTOUR

HOMESTEAD FILING NOS. 2&3 BOUNDARY

PROPOSED STORM SEWER PIPE

EXISTING STORM SEWER PIPE

CROSSPAN

INLET

EXISTING FLOW DIRECTION ARROW

PROPOSED FLOW DIRECTION ARROW

FLARED END SECTION

H.P. HIGH POINT

L.P. LOW POINT

STORM SEWER SUMMARY				
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
1	5.7	13.8	18" RCP	DP7
2	4.9	11.8	18" RCP	DP8
3	10.6	25.7	24" RCP	PR1, PR2
4	12.4	30.1	30" RCP	DP9, PR3
5	9.1	12.7	18" RCP	DP10
6	1.9	12.7	18" RCP	DP11
7	10.9	25.3	30" RCP	PR5, PR6
8	6.2	17.2	24" RCP	DP12
9	17.9	47.1	42" RCP	DP13, PR7, PR8
10	0.7	23.5	24" RCP	OUTLET STRUC.
11	42.1	76.8	42" RCP	CONTINUED FROM MDDP DP15*
12	0.0	1.3	12" ADS	LOTS 36–41
13	0.0	1.6	12" ADS	LOTS 28–35
14	0.0	1.5	12" ADS	LOTS 19–24
15	0.0	1.4	12" ADS	LOTS 13–18
4*	21.8	42.1	36" RCP	SEE MDDP*
6*	16.8	29.4	30" RCP	SEE MDDP*
10*	12.5	30.4	30" RCP	SEE MDDP*

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
ONSITE BASINS			
J	0.43	0.4	1.3
K	0.61	0.5	1.9
P	4.42	5.7	13.8
Q	3.78	4.9	11.8
R	1.57	2.2	5.4
T	9.14	9.4	26.4
U	4.50	6.4	15.6
V1	1.48	2.1	5.0
V2	0.83	1.2	2.9
W1	0.56	0.2	1.7
W2	0.26	0.1	0.8
W3	0.56	0.2	1.7
X	0.22	0.2	0.8
X1	0.78	0.8	2.8
X2	1.04	1.1	3.7
Y	0.09	0.1	0.3
Y1	0.84	0.8	3.0
Y2	0.21	0.2	0.7
B*	5.39	8.0	19.3
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
H*	0.19	0.9	1.6
I*	2.10	8.9	15.9
L*	1.54	5.6	10.0
S*	1.97	0.7	5.3

FULL SPECTRUM DETENTION INTERIM POND 1	
WQ VOLUME	0.245 AC–FT
EURV VOLUME	0.741 AC–FT
100 YR STORAGE VOLUME	1.331 AC–FT
100 YR WATER SURFACE EL	7083.91
SPILLWAY CREST EL	7084.16
TOP OF EMBANKMENT EL	7086.00
SPILLWAY DESIGN FLOW DEPTH	0.84 FT

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
2*	8.0	19.3	B*	(2) EX. 15' AT–GRADE INLETS
3*	4.2	10.1	C*	EX. 6' SUMP INLET
4*	16.1	36.7	D*, E*, F*	EX. 15' AT–GRADE INLET
5*	4.2	19.7	G*, H*, FLOWBY DP4*	EX. 15' AT–GRADE INLET
6*	14.1	26.7	I*, J*, K*, L*	EX. 15' AT–GRADE INLET
7	5.7	13.8	P	PROP. 10' SUMP INLET
8	4.9	11.8	Q	PROP. 10' SUMP INLET
9	2.2	5.4	R	PROP. 5' SUMP INLET
10	9.4	15.6	T	PROP. 15' AT–GRADE INLET
11	1.9	15.6	V1	PROP. 15' AT–GRADE INLET
12	6.2	17.2	U, FLOWBY DP10	PROP. 10' SUMP INLET
13	1.2	5.9	V2, FLOWBY DP11	PROP. 5' SUMP INLET
14	19.6	52.4	W3, PR9	CUMULATIVE DETENTION POND

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

Refer to Homestead at Sterling Ranch Filing No. 2 Grading and Erosion Control Plan for additional interim channel stabilization improvements.

All elevations provided on map are referenced in NGVD29

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

HOMESTEAD AT STERLING RANCH FIL. NO. 2

PROPOSED DRAINAGE MAP

PROJECT NO. 09–007
DESIGNED BY: CMN
DRAWN BY: CMN
CHECKED BY: VAS

SCALE: HORIZONTAL: 1"=100' VERTICAL: N/A

DATE: 01/15/2020

SHEET 1 OF 1

PDM

File: G:\09007A\Sterling Ranch No 6\Dwg\Eng Exhibits\Prop. Drain. Map Homestead Fil. No 2.dwg Plotstamp: 1/15/2020 11:17 AM

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

EL PASO COUNTY, COLORADO

January 2020

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

Prepared by:

CIVIL CONSULTANTS, INC.
102 E. Pikes Peak, Suite 500
Colorado Springs, CO 80903
(719) 955-5485

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

EXISTING DRAINAGE CONDITIONS

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

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

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

Detailed Drainage Discussion (Design Points)

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

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

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

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

Detailed Drainage Discussion (Drainage Basins)

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

IMPROVEMENTS TO POND 8

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

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

EROSION CONTROL

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

CHANNEL IMPROVEMENTS

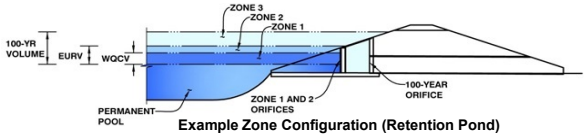
Slope grading and intermittent channel bank lining has been proposed for portions of the developable areas adjacent to Sand Creek to protect the developed lots and prevent excessive erosion until the DBPS recommended Sand Creek Channel improvements are installed. The proposed slope grading is intended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

BRANDING IRON AT STERLING RANCH FIL. NO.2

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 8



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Top of MP=7014.54

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

Optional User Input 1-hr Precipitation

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

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.630	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.374	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.540	acre-feet
Total Detention Basin Volume =	3.543	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Depth Increment = 1 ft

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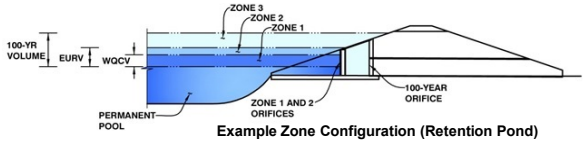
BRANDING IRON AT STERLING RANCH FIL. NO.2

Detention Basin Outlet Structure Design

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 8



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.94	0.630	Orifice Plate
Zone 2 (EURV)	4.92	1.374	Orifice Plate
Zone 3 (100-year)	6.64	1.540	Weir&Pipe (Restrict)
		3.543	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.92	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	19.48	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.60	3.20	4.80				
Orifice Area (sq. inches)	2.87	2.90	4.38	2.88				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.74	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.47	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.90	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	18.90	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.45	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	22.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

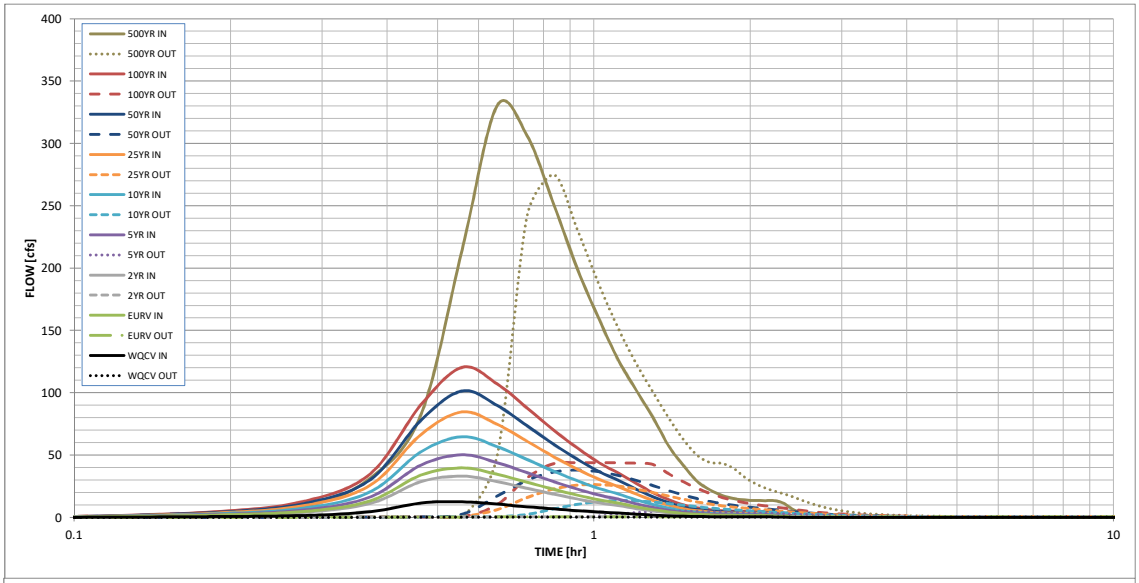
Calculated Parameters for Spillway

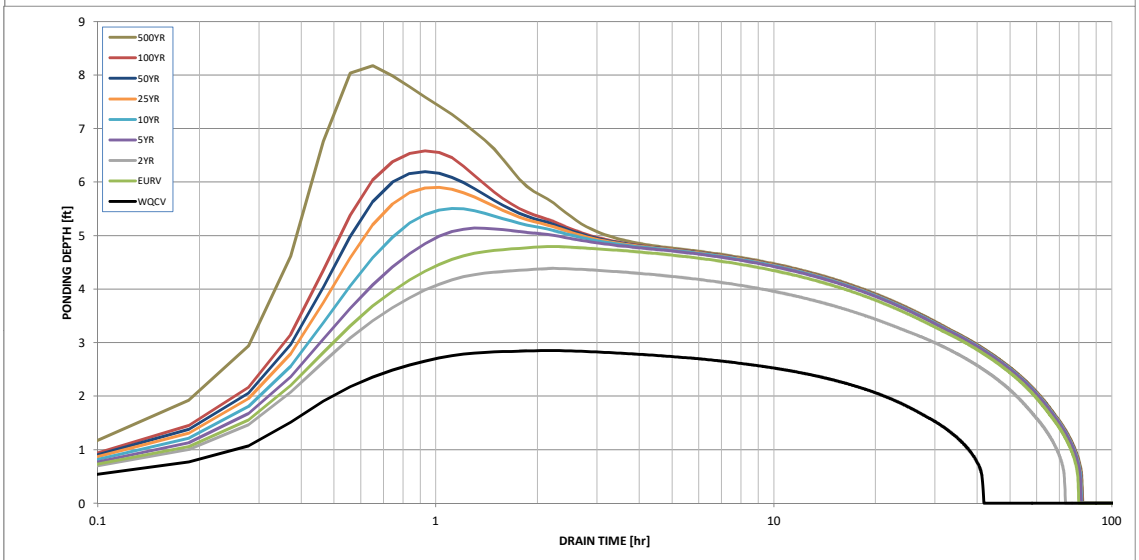
Spillway Design Flow Depth=	1.07	feet
Stage at Top of Freeboard =	8.72	feet
Basin Area at Top of Freeboard =	1.17	acres

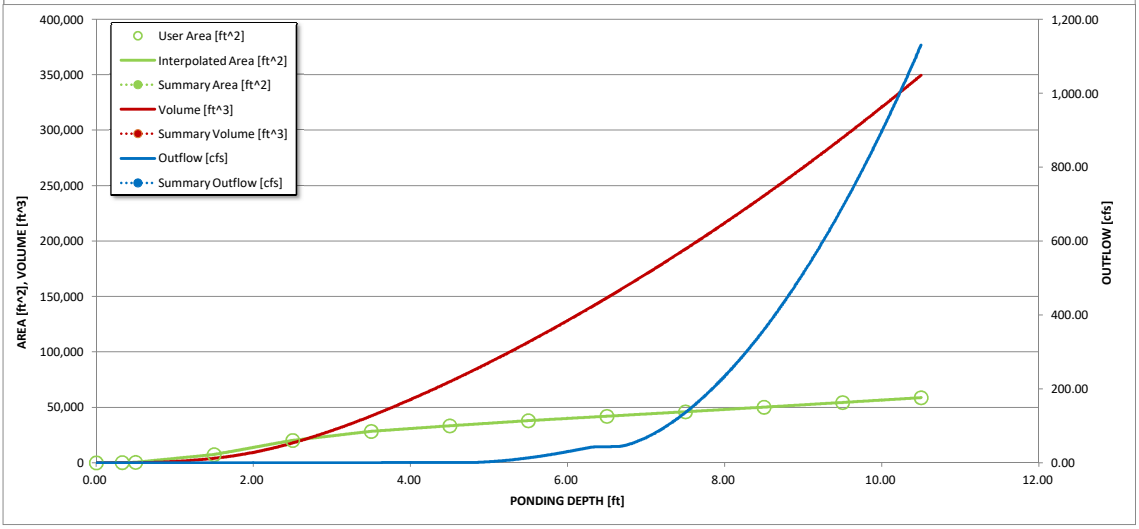
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	6.53
Calculated Runoff Volume (acre-ft) =	0.630	2.004	1.671	2.524	3.238	4.235	5.066	6.013	16.565
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.629	2.003	1.670	2.523	3.237	4.233	5.062	6.008	16.555
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.34	0.78	1.01	1.29	1.83
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	6.0	12.0	27.5	35.6	45.6	64.5
Peak Inflow Q (cfs) =	12.5	39.7	33.2	50.2	64.6	84.7	101.4	120.4	329.9
Peak Outflow Q (cfs) =	0.3	0.8	0.5	5.0	13.4	26.3	37.8	43.8	274.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	1.0	1.1	1.0	4.3
Structure Controlling Flow =	Plate	Overflow Grate 1	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	0.2	0.7	1.3	1.9	2.3	2.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	72	66	72	70	67	65	63	47
Time to Drain 99% of Inflow Volume (hours) =	**41**	77	70	77	77	76	75	74	65
Maximum Ponding Depth (ft) =	2.85	4.80	4.39	5.14	5.51	5.90	6.19	6.59	8.17
Area at Maximum Ponding Depth (acres) =	0.53	0.80	0.75	0.83	0.87	0.91	0.94	0.97	1.12
Maximum Volume Stored (acre-ft) =	0.584	1.902	1.585	2.179	2.495	2.851	3.119	3.490	5.152

Detention Basin Outlet Structure Design







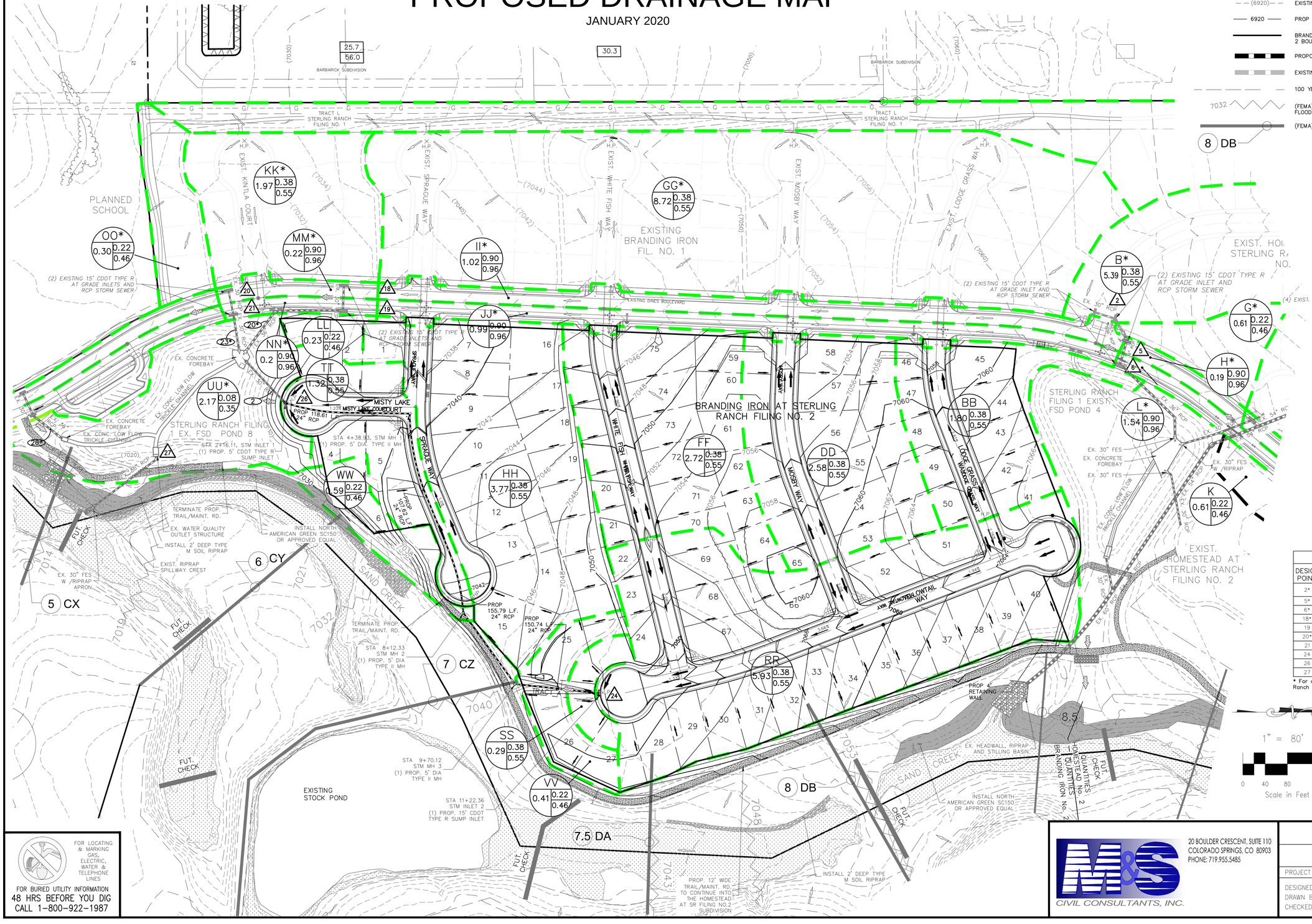
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

BRANDING IRON AT STERLING RANCH FILING NO. 2

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

JANUARY 2020



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

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

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

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

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

FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987

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

BRANDING IRON AT SR FIL. NO. 2

PROPOSED DRAINAGE MAP

PROJECT NO. 09-012

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

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

DATE: 01/27/2020

SHEET 1 OF 1

PDM

File: O:\09012A\Challenger East\dwg\Eng Exhibits\Prop Drain Map Branding Iron Fil No 2.dwg Plotstamp: 3/24/2020 4:27 PM

STERLING RANCH
RETENTION POND VOLUME

(Pond Volume Calculation)

BIG POND

Elevation	SF	CF	Storage AF	Storage Sum
7028	0.00	-		0
7030	53,785.00	53,785.00	1.23	1.23
7032	70,507.00	124,292.00	2.85	4.09
7034	87,672.00	158,179.00	3.63	7.72
7036	109,612.00	197,284.00	4.53	12.25

Total = 533,540 CF

Total = 12.25 Ac-ft

At Elevation 7035, the Storage is 9.98 Ac-ft.
At Elevation 7034, the Storage is 7.72 Ac-ft.

Calculated by: VAS

Date: 4/21/2016

Checked by: VAS

STERLING RANCH

"BIG POND"

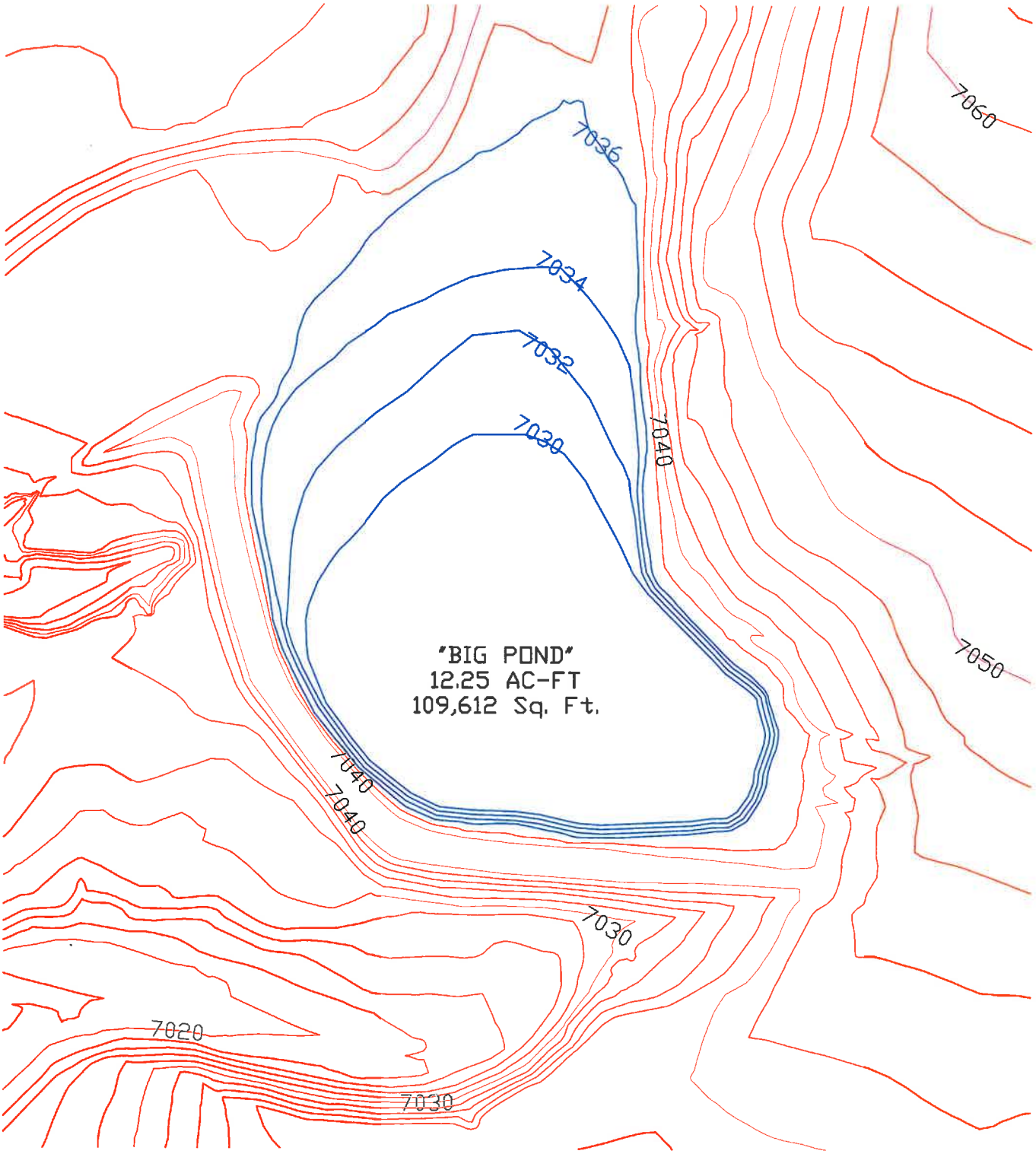


EXHIBIT
STERLING RANCH
JOB NO. 09-001
DATE PREPARED: 4-25-16
DATE REVISED:

CIVIL CONSULTANTS, INC.

20 BOULDER CRESCENT, STE. 110
COLORADO SPRINGS,
COLORADO 80903

v 719.955.5485
f 719.444.8427

INNOVATIVE DESIGN. **CLASSIC RESULTS.**

FINAL DRAINAGE REPORT
FOR
RETREAT AT TIMBERRIDGE
FILING NO. 1

Prepared for:
TIMBERRIDGE DEVELOPMENT GROUP, LLC
2138 FLYING HORSE CLUB DRIVE
COLORADO SPRINGS CO 80921
(719) 592-9333

Prepared by:
CLASSIC CONSULTING
619 N. CASCADE AVE SUITE 200
COLORADO SPRINGS CO 80903
(719) 785-0790

Job No. 1185.00

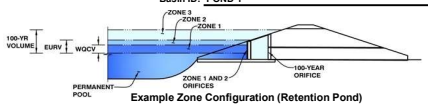
PCD Project No. SF-19-009

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	29.40	acres	
Watershed Length =	2,130	ft	
Watershed Slope =	0.018	ft/ft	
Watershed Imperviousness =	13.80%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.214	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.391	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.278	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.421	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.832	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.922	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.610	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.508	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.85 in.) =	6.448	acre-feet	3.85 inches
Approximate 2-yr Detention Volume =	0.258	acre-feet	
Approximate 5-yr Detention Volume =	0.394	acre-feet	
Approximate 10-yr Detention Volume =	0.720	acre-feet	
Approximate 25-yr Detention Volume =	0.951	acre-feet	
Approximate 50-yr Detention Volume =	1.002	acre-feet	
Approximate 100-yr Detention Volume =	1.268	acre-feet	

Stage-Storage Calculation

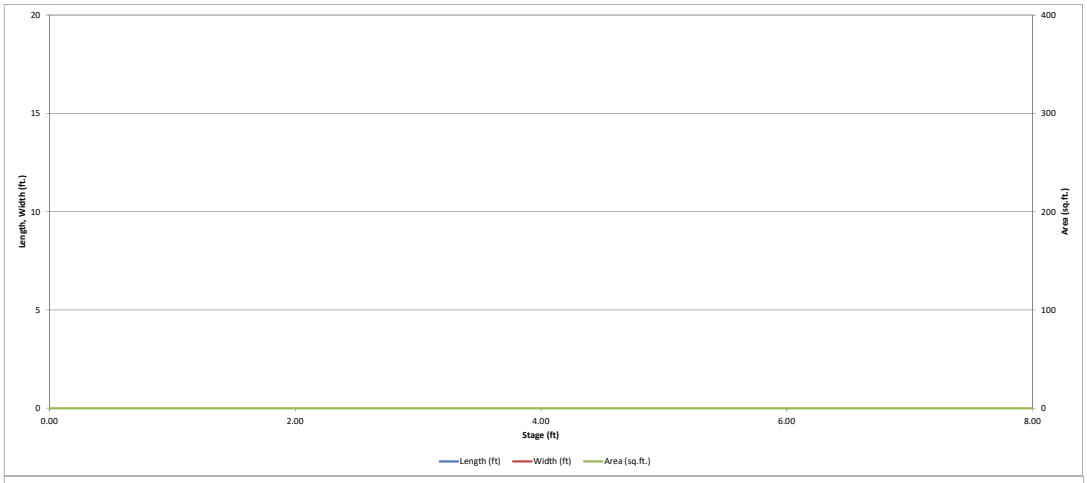
Zone 1 Volume (WQCV) =	0.214	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.177	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.877	acre-feet
Total Detention Basin Volume =	1.268	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

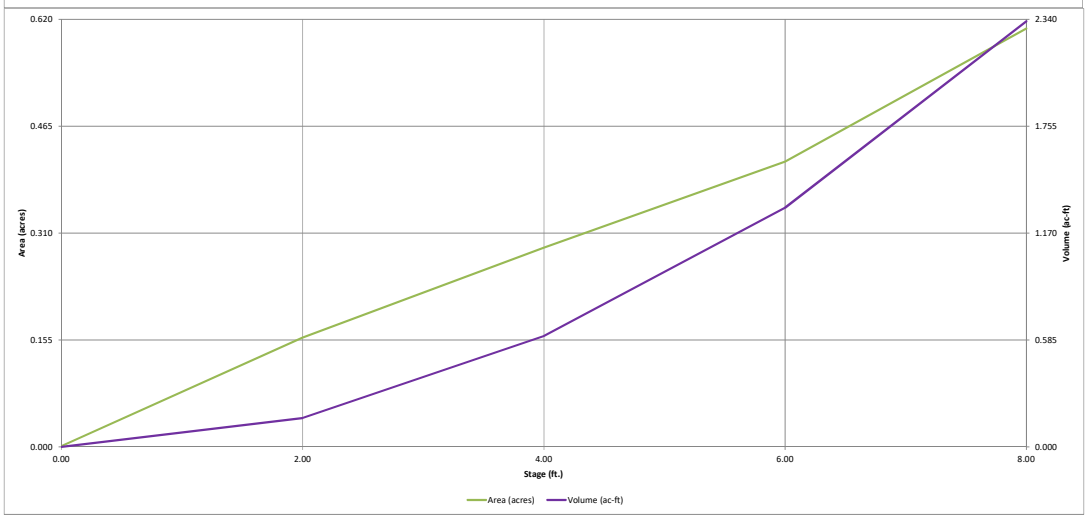
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	2.00	--	--	--	6,905	0.159	6,886	0.158
	--	4.00	--	--	--	12,575	0.289	26,435	0.607
	--	6.00	--	--	--	18,016	0.414	57,026	1.309
	--	8.00	--	--	--	26,430	0.607	101,472	2.329
	--		--	--	--				
	--		--	--	--				
	--		--	--	--			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



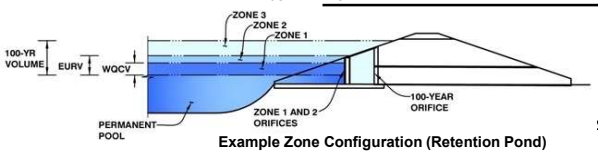


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.33	0.214	Orifice Plate
Zone 2 (EURV)	3.18	0.177	Orifice Plate
Zone 3 (100-year)	5.91	0.877	Weir&Pipe (Restrict)
		1.268	Total

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	3.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	14.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.20	2.40					
Orifice Area (sq. inches)	1.20	1.31	1.31					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		**Calculated Parameters for Vertical Orifice**	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

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

	Zone 3 Weir	Not Selected		**Calculated Parameters for Overflow Weir**	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	7.00	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	12.37	N/A	ft²
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	6.18	N/A	ft²
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	6.30	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.62	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	7.92	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	0.60	acres
Freeboard above Max Water Surface =	1.00	feet			

Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.85
Calculated Runoff Volume (acre-ft) =	0.214	0.391	0.278	0.421	0.832	1.922	2.610	3.508	6.448
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.214	0.391	0.277	0.421	0.832	1.922	2.610	3.508	6.443
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.15	0.53	0.73	0.99	1.81
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	0.479	4.5	15.5	21.5	29.2	53.1
Peak Inflow Q (cfs) =	3.0	5.4	3.8	5.8	11.3	26.0	35.1	47.0	85.1
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.172	3.8	17.5	22.3	24.0	75.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.8	1.1	1.0	0.8	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.3	1.4	1.8	1.9	2.0
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) =	41	53	46	55	57	48	44	39	28
Time to Drain 99% of Inflow Volume (hours) =	**43**	57	49	59	64	60	58	55	47
Maximum Ponding Depth (ft) =	2.22	3.05	2.54	3.18	4.00	4.67	5.11	6.22	6.96
Area at Maximum Ponding Depth (acres) =	0.17	0.23	0.19	0.23	0.29	0.33	0.36	0.43	0.51
Maximum Volume Stored (acre-ft) =	0.194	0.362	0.255	0.390	0.607	0.814	0.962	1.402	1.746

Detention Basin Outlet Structure Design

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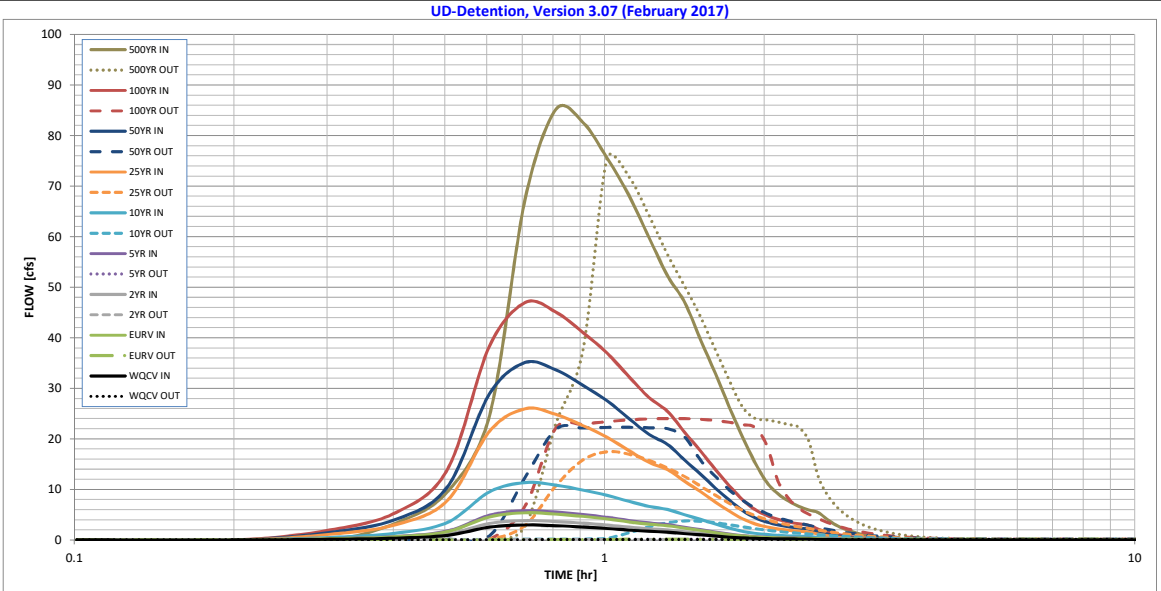
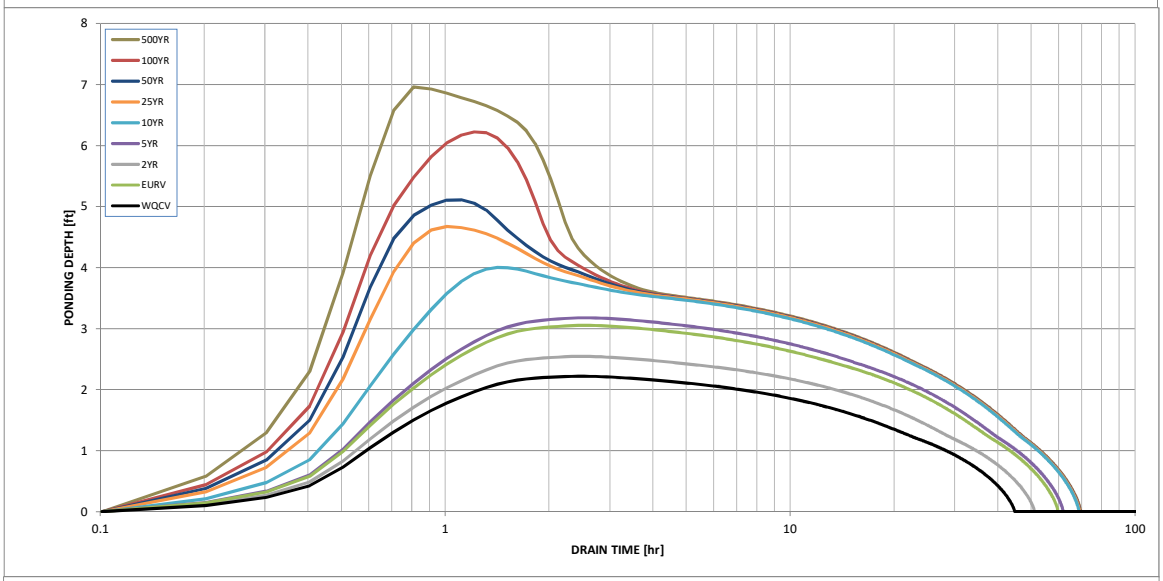
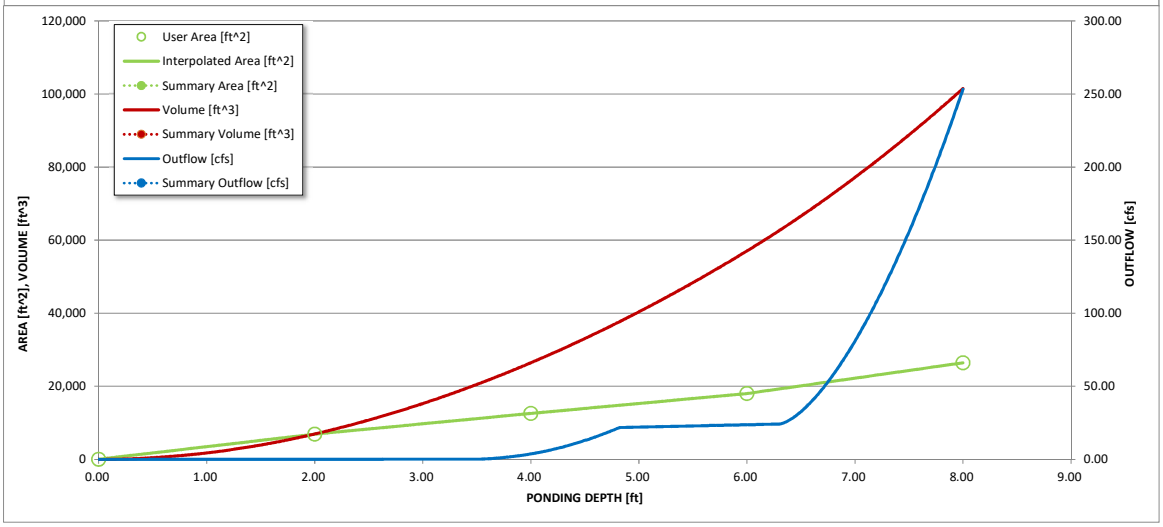






S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
6.07 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:06:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:12:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:18:13	0.13	0.24	0.17	0.26	0.50	1.12	1.49	1.97	3.37
0.824	0:24:17	0.36	0.65	0.46	0.69	1.35	3.05	4.10	5.45	9.57
	0:30:21	0.92	1.66	1.19	1.78	3.47	7.83	10.53	13.99	24.58
	0:36:25	2.53	4.56	3.26	4.90	9.53	21.50	28.90	38.38	67.32
	0:42:29	2.97	5.38	3.83	5.78	11.35	25.95	35.09	46.96	85.14
	0:48:34	2.82	5.12	3.65	5.51	10.84	24.85	33.63	45.09	82.62
	0:54:38	2.57	4.66	3.32	5.02	9.87	22.62	30.61	41.03	75.52
	1:00:42	2.28	4.15	2.95	4.47	8.82	20.30	27.52	36.95	68.09
	1:06:46	1.95	3.57	2.53	3.85	7.63	17.65	23.98	32.28	59.76
	1:12:50	1.71	3.12	2.21	3.36	6.64	15.33	20.88	28.15	52.26
	1:18:55	1.54	2.82	2.00	3.04	6.02	13.90	18.90	25.44	47.02
	1:24:59	1.26	2.32	1.64	2.50	4.98	11.59	15.79	21.29	39.62
	1:31:03	1.02	1.88	1.33	2.03	4.08	9.55	13.04	17.63	32.90
	1:37:07	0.77	1.44	1.01	1.55	3.15	7.49	10.27	13.93	26.25
	1:43:11	0.56	1.06	0.74	1.15	2.36	5.70	7.87	10.73	20.40
	1:49:16	0.41	0.77	0.54	0.84	1.70	4.19	5.82	7.99	15.35
	1:55:20	0.32	0.60	0.42	0.65	1.32	3.18	4.40	6.01	11.43
	2:01:24	0.27	0.50	0.35	0.54	1.08	2.59	3.56	4.84	9.13
	2:07:28	0.23	0.42	0.30	0.46	0.92	2.19	3.00	4.08	7.66
	2:13:32	0.20	0.37	0.26	0.40	0.80	1.91	2.62	3.55	6.65
	2:19:37	0.18	0.33	0.24	0.36	0.72	1.71	2.35	3.18	5.93
	2:25:41	0.17	0.31	0.22	0.33	0.67	1.57	2.15	2.91	5.42
	2:31:45	0.12	0.23	0.16	0.24	0.49	1.16	1.59	2.16	4.10
	2:37:49	0.09	0.17	0.12	0.18	0.36	0.85	1.16	1.57	2.96
	2:43:53	0.07	0.12	0.09	0.13	0.26	0.62	0.85	1.16	2.19
	2:49:58	0.05	0.09	0.06	0.10	0.19	0.46	0.63	0.86	1.63
	2:56:02	0.03	0.06	0.04	0.07	0.14	0.33	0.46	0.63	1.20
	3:02:06	0.02	0.04	0.03	0.05	0.10	0.24	0.33	0.45	0.86
	3:08:10	0.02	0.03	0.02	0.03	0.07	0.17	0.24	0.33	0.63
	3:14:14	0.01	0.02	0.01	0.02	0.05	0.12	0.17	0.23	0.44
	3:20:19	0.01	0.01	0.01	0.01	0.03	0.07	0.10	0.15	0.29
	3:26:23	0.00	0.01	0.00	0.01	0.01	0.04	0.06	0.08	0.17
	3:32:27	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.04	0.08
	3:38:31	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	3:44:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:56:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:02:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:14:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:21:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:33:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:39:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:51:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:57:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:03:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:09:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:33:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:39:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:58:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:04:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:10:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:16:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:22:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:28:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:34:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:40:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:46:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:52:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:58:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:04:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:10:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:17:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	1.00	3,443	0.079	1,729	0.040	0.04
	2.00	6,871	0.158	6,886	0.158	0.10
WQCV	2.22	7,529	0.173	8,543	0.196	0.10
2 YR.	2.54	8,436	0.194	11,097	0.255	0.13
	3.00	9,740	0.224	15,277	0.351	0.16
EURV	3.05	9,882	0.227	15,768	0.362	0.16
5 YR.	3.18	10,250	0.235	17,077	0.392	0.17
	4.00	12,575	0.289	26,435	0.607	3.73
	5.00	15,295	0.351	40,370	0.927	22.11
	6.00	18,016	0.414	57,026	1.309	23.69
100 YR.	6.22	18,942	0.435	61,091	1.402	24.02
	7.00	22,223	0.510	77,145	1.771	80.83
	8.00	26,430	0.607	101,472	2.329	253.19
	0.00	50	0.001	0	0.000	0.00

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

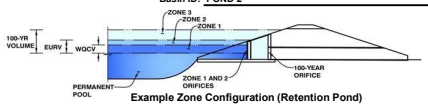
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	100.40	acres	
Watershed Length =	4,000	ft	
Watershed Slope =	0.032	ft/ft	
Watershed Imperviousness =	21.60%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	1.022	acre-feet	
Excess Urban Runoff Volume (EURV) =	2.168	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.608	acre-feet	
5-yr Runoff Volume (P1 = 1.5 in.) =	2.351	acre-feet	
10-yr Runoff Volume (P1 = 1.75 in.) =	3.953	acre-feet	
25-yr Runoff Volume (P1 = 2 in.) =	7.552	acre-feet	
50-yr Runoff Volume (P1 = 2.25 in.) =	9.864	acre-feet	
100-yr Runoff Volume (P1 = 2.52 in.) =	12.887	acre-feet	
500-yr Runoff Volume (P1 = 3.85 in.) =	23.106	acre-feet	
Approximate 2-yr Detention Volume =	1.499	acre-feet	
Approximate 5-yr Detention Volume =	2.205	acre-feet	
Approximate 10-yr Detention Volume =	3.488	acre-feet	
Approximate 25-yr Detention Volume =	4.261	acre-feet	
Approximate 50-yr Detention Volume =	4.500	acre-feet	
Approximate 100-yr Detention Volume =	5.494	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
3.85	inches

Stage-Storage Calculation

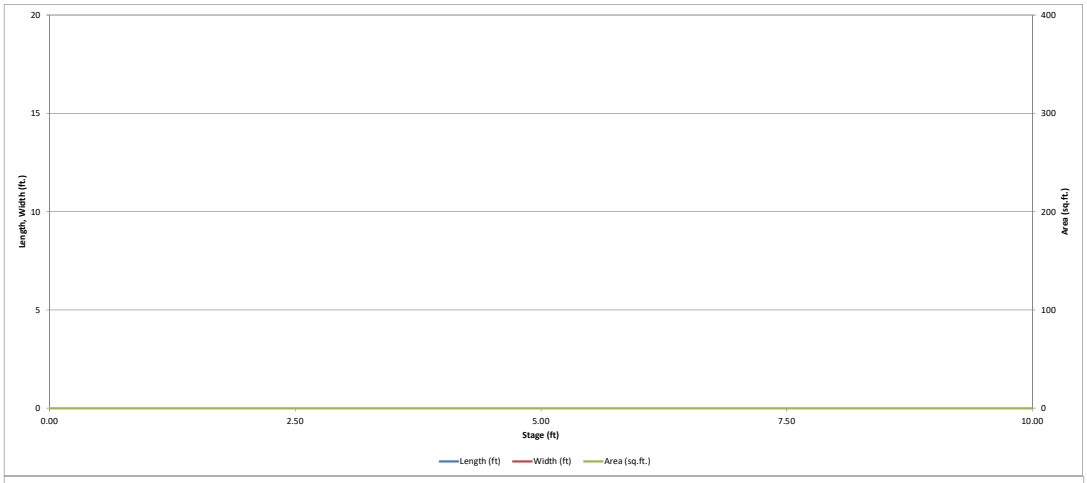
Zone 1 Volume (WQCV) =	1.022	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.146	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.327	acre-feet
Total Detention Basin Volume =	5.494	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

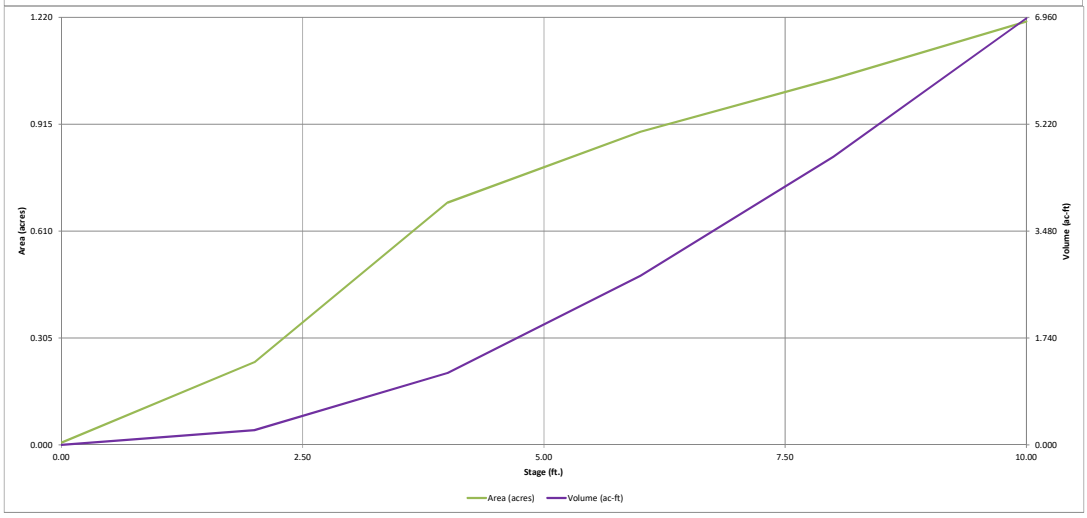
Depth Increment = 2 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	277	0.006		
7162	--	2.00	--	--	--	10,268	0.236	10,442	0.240
7164	--	4.00	--	--	--	30,108	0.691	50,921	1.169
7166	--	6.00	--	--	--	38,919	0.893	119,948	2.754
7168	--	8.00	--	--	--	45,498	1.044	204,365	4.692
7170	--	10.00	--	--	--	52,628	1.208	302,491	6.944

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



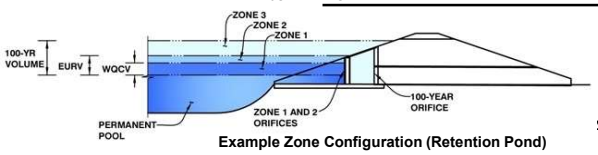


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.78	1.022	Orifice Plate
Zone 2 (EURV)	5.32	1.146	Orifice Plate
Zone 3 (100-year)	8.75	3.327	Weir&Pipe (Restrict)
		5.494	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	16.50	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.40	2.80	4.20				
Orifice Area (sq. inches)	3.00	4.00	4.00	4.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.50	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.22	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	37.11	N/A	ft^2
Overflow Grate Open Area w/ Debris =	18.55	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	25.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	5.97	N/A	ft^2
Outlet Orifice Centroid =	1.18	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.76	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	65.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

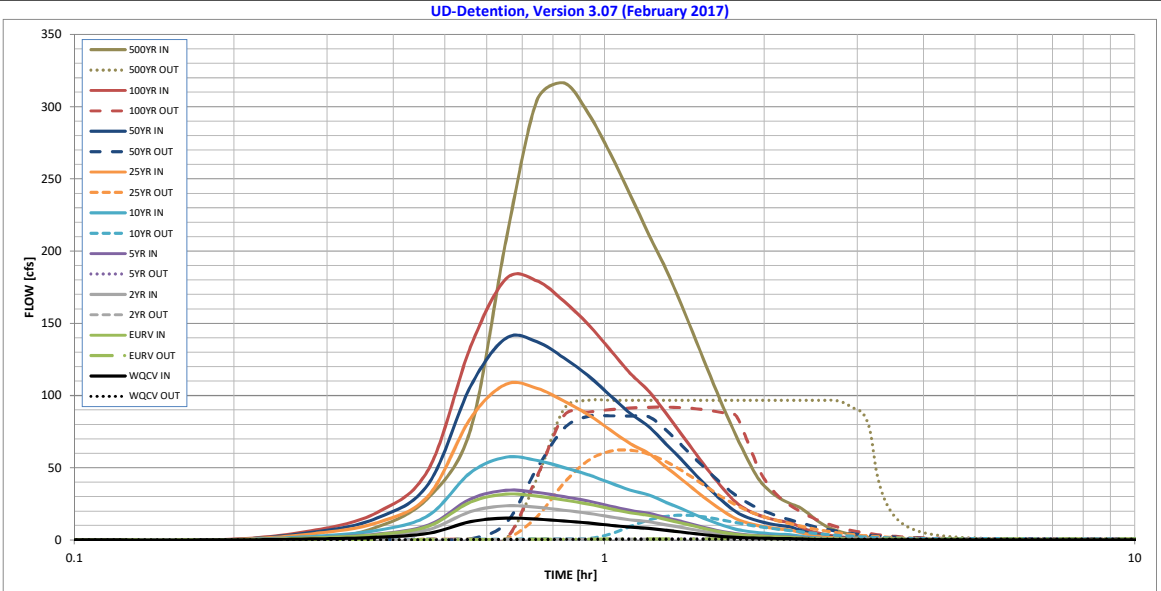
Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	9.96	feet
Basin Area at Top of Freeboard =	1.20	acres

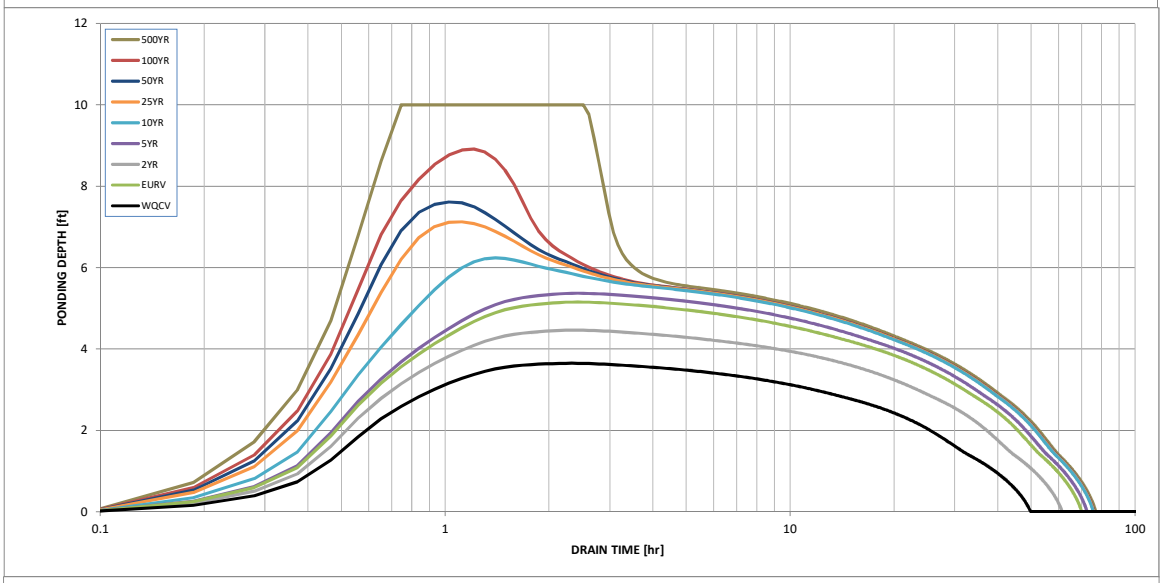
Routed Hydrograph Results

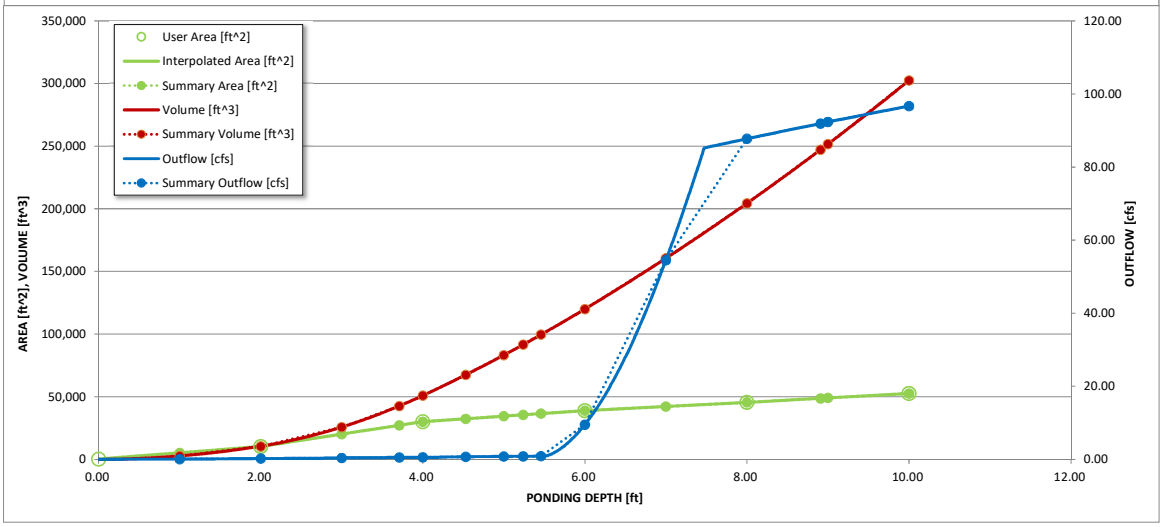
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.85
Calculated Runoff Volume (acre-ft) =	1.022	2.168	1.608	2.351	3.953	7.552	9.864	12.887	23.106
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.021	2.165	1.607	2.349	3.949	7.544	9.852	12.868	23.079
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.17	0.58	0.80	1.08	1.97
Predevelopment Peak Q (cfs) =	0.0	0.0	1.0	1.800	17.0	58.0	80.3	108.7	197.5
Peak Inflow Q (cfs) =	15.1	31.7	23.6	34.3	57.3	107.8	139.7	180.8	316.4
Peak Outflow Q (cfs) =	0.5	0.8	0.7	0.858	17.1	62.2	85.9	91.9	96.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	1.0	1.1	1.1	0.8	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.4	1.7	2.3	2.4	2.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	44	59	53	61	59	53	49	46	36
Time to Drain 99% of Inflow Volume (hours) =	**47**	65	58	68	68	64	62	59	53
Maximum Ponding Depth (ft) =	3.65	5.15	4.46	5.37	6.24	7.13	7.61	8.91	10.00
Area at Maximum Ponding Depth (acres) =	0.61	0.81	0.74	0.83	0.91	0.98	1.02	1.12	1.21
Maximum Volume Stored (acre-ft) =	0.935	2.031	1.498	2.203	2.961	3.802	4.290	5.676	6.944

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 Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.59 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:11:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:16:46	0.66	1.36	1.02	1.47	2.39	4.16	5.15	6.29	8.96
0.894	0:22:22	1.79	3.72	2.78	4.02	6.62	11.98	15.15	19.05	29.41
	0:27:57	4.60	9.54	7.15	10.33	17.00	30.75	38.91	48.98	76.40
	0:33:32	12.62	26.20	19.62	28.34	46.61	84.16	106.36	133.64	207.45
	0:39:08	15.08	31.69	23.61	34.34	57.28	107.80	139.67	180.76	304.12
	0:44:43	14.41	30.36	22.60	32.91	55.08	105.04	137.24	179.41	316.41
	0:50:19	13.12	27.63	20.57	29.95	50.14	96.17	126.02	165.31	295.56
	0:55:54	11.74	24.82	18.45	26.91	45.17	86.74	113.73	149.26	267.69
	1:01:29	10.17	21.59	16.02	23.43	39.50	76.21	100.14	131.70	239.17
	1:07:05	8.85	18.78	13.92	20.39	34.47	66.69	87.69	115.40	211.69
	1:12:40	8.02	17.01	12.62	18.47	31.13	59.91	78.57	103.12	187.91
	1:18:16	6.65	14.19	10.51	15.41	26.08	50.61	66.67	87.93	162.57
	1:23:51	5.45	11.71	8.65	12.72	21.60	42.06	55.47	73.24	137.38
	1:29:26	4.23	9.19	6.76	10.00	17.10	33.64	44.55	59.07	113.47
	1:35:02	3.18	7.02	5.13	7.65	13.20	26.19	34.79	46.26	91.42
	1:40:37	2.30	5.17	3.75	5.65	9.85	19.76	26.35	35.18	72.36
	1:46:13	1.77	3.92	2.86	4.27	7.39	14.67	19.48	25.97	55.47
	1:51:48	1.45	3.18	2.33	3.47	5.95	11.69	15.45	20.48	41.79
	1:57:23	1.23	2.69	1.97	2.92	5.01	9.80	12.94	17.11	33.89
	2:02:59	1.08	2.35	1.73	2.55	4.36	8.50	11.19	14.76	28.81
	2:08:34	0.97	2.10	1.55	2.29	3.90	7.58	9.97	13.13	25.30
	2:14:10	0.89	1.93	1.42	2.10	3.57	6.92	9.09	11.96	22.77
	2:19:45	0.66	1.43	1.05	1.55	2.66	5.26	6.99	9.31	18.38
	2:25:20	0.48	1.04	0.77	1.13	1.93	3.79	5.03	6.70	13.45
	2:30:56	0.35	0.77	0.56	0.83	1.42	2.81	3.74	4.97	9.80
	2:36:31	0.26	0.57	0.42	0.62	1.06	2.09	2.77	3.69	7.33
	2:42:07	0.19	0.41	0.30	0.45	0.77	1.54	2.05	2.73	5.48
	2:47:42	0.13	0.29	0.21	0.32	0.56	1.11	1.48	1.98	4.07
	2:53:17	0.10	0.21	0.16	0.23	0.40	0.81	1.07	1.43	2.98
	2:58:53	0.06	0.15	0.11	0.16	0.28	0.57	0.76	1.03	2.21
	3:04:28	0.04	0.09	0.07	0.10	0.18	0.38	0.51	0.69	1.57
	3:10:04	0.02	0.05	0.03	0.06	0.10	0.22	0.30	0.41	1.04
	3:15:39	0.01	0.02	0.01	0.02	0.05	0.11	0.15	0.21	0.62
	3:21:14	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.07	0.31
	3:26:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	3:32:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:38:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:49:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:54:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:11:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:17:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:28:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:33:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:39:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:56:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:01:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:07:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:24:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:29:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:46:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:57:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:03:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:08:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:14:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:20:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:25:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:31:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:36:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:42:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	1.00	5,223	0.120	2,722	0.062	0.10
	2.00	10,218	0.235	10,442	0.240	0.24
	3.00	20,188	0.463	25,773	0.592	0.40
WQCV	3.71	27,231	0.625	42,607	0.978	0.52
	4.00	30,108	0.691	50,921	1.169	0.56
2 Yr.	4.53	32,443	0.745	67,497	1.550	0.70
	5.00	34,513	0.792	83,232	1.911	0.80
EURV	5.24	35,571	0.817	91,642	2.104	0.84
5 Yr.	5.46	36,540	0.839	99,574	2.286	0.87
	6.00	38,919	0.893	119,948	2.754	9.50
	7.00	42,208	0.969	160,512	3.685	54.49
	8.00	45,498	1.044	204,365	4.692	87.74
100 Yr.	8.91	48,742	1.119	247,244	5.676	91.93
	9.00	49,063	1.126	251,645	5.777	92.33
	10.00	52,628	1.208	302,491	6.944	96.70

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
BASIN IDENTIFIER / AREA IN ACRES	BB / 16.0
DESIGN POINT	1
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
DRAINAGE IMPROVEMENTS	
PIPE RUN	10
WETLAND DELINEATION	

ARROYA LANE (EXIST. GRAVEL ROAD)

EXIST. 60" CMP CULVERT

FUTURE TIMBERRIDGE RURAL LOTS (2.5 AC. MIN.)

FUTURE TIMBERRIDGE RURAL LOTS (1.0 AC. MIN.)

PROPERTY BOUNDARY

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

OS-12 15.0

OS-15 23.4

APPROXIMATE LOCATION 100 YR. FLOODPLAIN (PER LOMR 08-080541P)

APPROXIMATE LOCATION 100 YR. FLOODPLAIN (HEC-RAS CALCULATED)

SAND CREEK REACH SC-9

TEMP. 30" RCP STORM UNTIL FUTURE DEVELOPMENT

FUTURE 30" RCP STORM SYSTEM CONSTRUCTED WITH FUTURE DEVELOPMENT

24" RCP OUTFALL CONSTRUCTED WITH FILING NO. 1 FOR STOCK POND RELEASE

LOCATION OF FUTURE SEDIMENT POND

EXIST. STOCK POND

OS-14 9.1

EXIST. STOCK POND TO BE DRAINED AND REMOVED WITH FUTURE TIMBERRIDGE DEVELOPMENT

OS-13 1.4

FUTURE SEDIMENT POND NOTES:

PROP. OFF-SITE SEDIMENT POND TO BE CONSTRUCTED PRIOR TO EXIST. STOCK POND IS REMOVED

DRAINAGE ESMT. TO BE ACQUIRED PRIOR TO CONSTRUCTION OF OFF-SITE SEDIMENT POND.

FORMAL OUTLET INSTALLED AND CONNECTED DIRECTLY TO 24" RCP OUTFALL TO ROUTE FLOWS DIRECTLY TO SAND CREEK.

FUTURE OFF-SITE DEVELOPMENT WILL BE REQUIRED TO PROVIDE SWQ TREATMENT FOR CONTINUED RELEASE TO SAND CREEK

SIDE ROAD DITCH NOT WELL DEFINED IN THIS AREA SO FLOWS FROM VOLLMER RD. ENTER PROPERTY

FILING NO. 1 BOUNDARY

PROP. NATURAL BERM 6'-8' HEIGHT @ 5:1 (LOTS 1-7)

18" CULVERT REQUIRED

RURAL LOTS (2.5 AC. MIN.)

OS-2 0.9

A 13.8

F 0.9

E 3.2

B 7.7

G 7.2

H 2.0

C 6.7

D1 1.1

D2 2.2

I 3.7

OS-4 3.1

OS-3 2.5

OS-5 20.9

OS-6 1.2

OS-1 1.2

UNPLATTED (6 AC. ± RESIDENTIAL)

EXIST. VOLLMER ROAD SIDE ROAD DITCH (TYP.)

VOLLMER ROAD

40' WIDE ROW DEDICATION

ASPEN VALLEY ROAD (RURAL LOCAL)

SHEET PILE CHECK STRUCTURE W/ CONC. CAP (SEE UDFCD FIG. 9-26 THRU 9-28)

PERMANENT SEDIMENT BASIN

PROP. ACCESS ROAD WITHIN ESMT.

PROP. TRAIL

ACCESS RAMPS

CHANNEL ACCESS RAMP

SELECTIVE RIP-RAP BANK STABILIZATION (TYPE L, 1.5' THICK)

WETLAND DELINEATION PER REPORT BY CORE CONSULTANTS (TYP.)

SELECTIVE RIP-RAP BANK STABILIZATION PROVIDED IN THIS AREA UPON FUTURE LOT DEVELOPMENT

FUTURE TIMBERRIDGE URBAN LOTS (12,000 SF MIN.)

NOTE:
FUTURE DEVELOPED FLOW QUANTITIES WITHIN BASINS OS-5, OS-6 & OS-9 EQUAL TO THE PRE-DEVELOPMENT FLOW QUANTITIES WILL BE TREATED AND DETAINED WITHIN POND 2.

LOCATION OF FUTURE SEDIMENT POND

DRAINAGE ESMT. TO BE ACQUIRED PRIOR TO CONSTRUCTION OF OFF-SITE SEDIMENT POND.

PROPOSED POND 1

PRE-DEVELOPMENT
Q2 YR. = 0.30 CFS
Q5 YR. = 0.48 CFS
Q100 YR. = 29.2 CFS

DEVELOPED RELEASE
Q2 YR. = 0.10 CFS
Q5 YR. = 0.17 CFS
Q100 YR. = 24.0 CFS

PROPOSED POND 1

WQCV = 0.214 AC.-FT.
EURV = 0.177 AC.-FT.
100 YR = 0.877 AC.-FT.
TOTAL = 1.268 AC.-FT.

TWO CELL MULTI-PLATE STEEL ARCH CULVERTS (24'X10.33')

TRACT A

TRACT B

TRACT E

TRACT F

DRAINAGE ESMT.

PROP. DUAL 24" RCP CULVERTS

10' TYPE R AT-GRADE INLET

15' TYPE R AT-GRADE INLET

10' TYPE R SUMP INLET

5' TYPE R SUMP INLET

36" RCP STORM

ELK ANTLER LANE (URBAN LOCAL)

ANTELOPE RAVINE DRIVE (URBAN LOCAL)

POCO ROAD (URBAN LOCAL)

PROPERTY BOUNDARY

FUTURE LP

FUTURE HP

HP

SEE SHEET 3

NOTE:
SEE SHEET 3 FOR BASIN AND DEVELOPED FLOW CALCULATIONS

N

100 50 0 100 200

SCALE: 1" = 100'

CLASSIC CONSULTING

619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(INCL. FUTURE TIMBERRIDGE DEVELOPED BASINS)

DESIGNED BY	MAW	SCALE	DATE	1-31-19
DRAWN BY	MAW	(H) 1"= 100'	SHEET	2 OF 5
CHECKED BY		(V) 1"= N/A	JOB NO.	2520.00

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

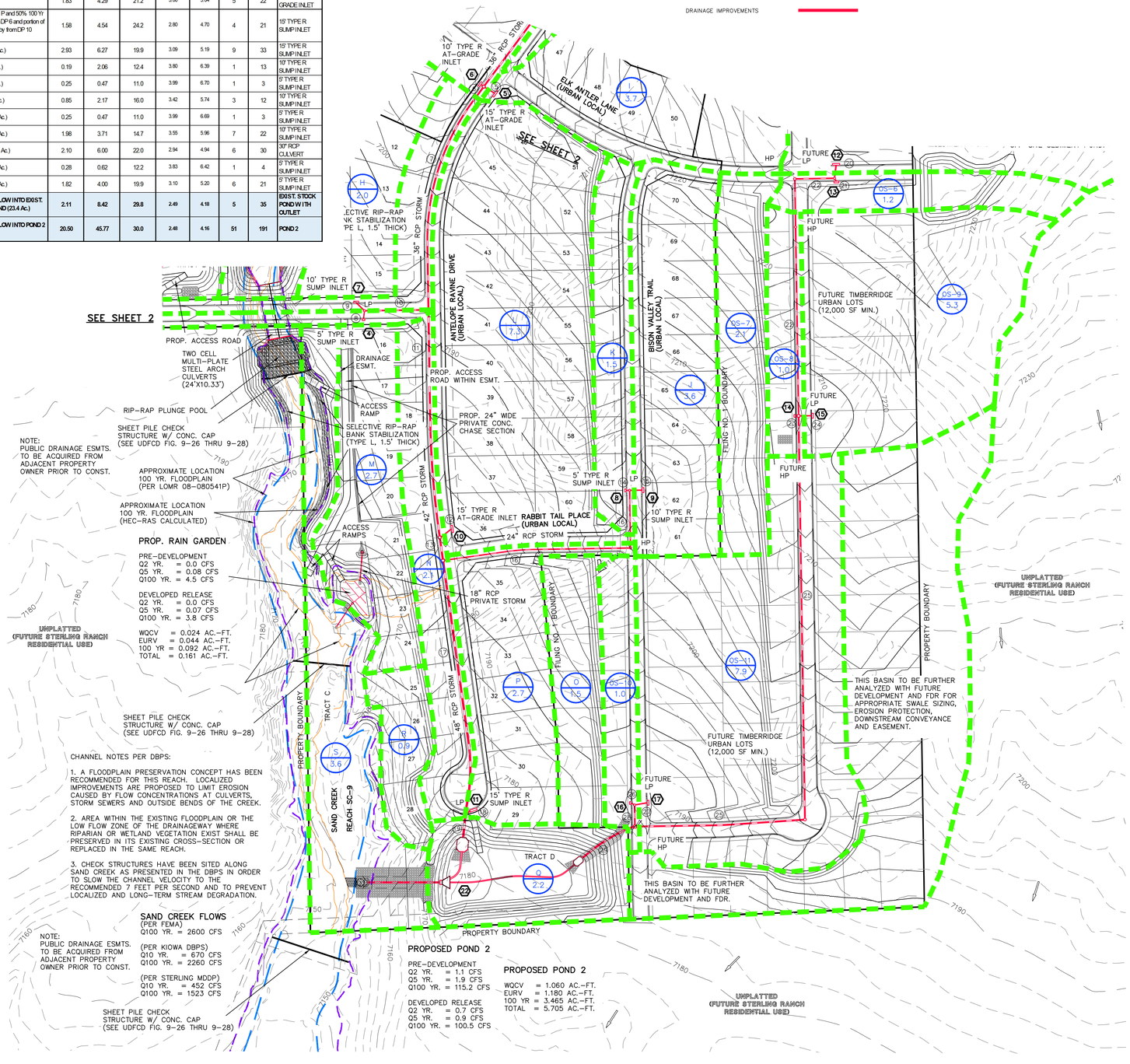
Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Inlet Size
1	A (13.8 Ac.), OS-1 (1.2 Ac.) and C (6.7 Ac.)	3.58	9.08	31.8	2.39	4.02	9	36	DUAL 24" RCP CULVERTS
2	**TOTAL INFLOW INTO POND 1 A, B, C and OS-1 (29.4 Ac.)**	**4.66**	**12.16**	**33.8**	**2.30**	**3.86**	**11**	**47**	**POND 1**
3	No longer used								
4	D1 (1.1 Ac.)	0.74	0.87	15.2	3.50	5.88	3	5	5' TYPE R SUMP INLET
5	OS-4 (3.1 Ac.), I (3.7 Ac.)	1.61	3.17	17.7	3.28	5.50	5	17	15' TYPE R AT-GRADE INLET
6	OS-3 (2.5 Ac.)	0.63	1.18	11.9	3.86	6.49	2	8	10' TYPE R AT-GRADE INLET
7	Basin D2, Basin H and 50% of 100 yr Flowby from DP-6 (5.5 Ac)	1.51	2.47	27.3	2.62	4.40	4	11	10' TYPE R SUMP INLET
8	K (1.5 Ac.)	0.38	0.71	12.6	3.78	6.35	1	4	5' TYPE R SUMP INLET
9	J and OS-7 (5.7 Ac.)	1.43	2.68	16.0	3.43	5.75	5	15	10' TYPE R SUMP INLET
10	Flowby from DP-5 and Basin L (7.3 Ac)	1.83	4.29	21.2	3.00	5.04	5	22	15' TYPE R AT-GRADE INLET
11	Basins N, O, P and 50% 100 Yr. Flowby from DP-6 and portion of 100 Yr Flowby from DP 10 (13.6 Ac)	1.58	4.54	24.2	2.80	4.70	4	21	15' TYPE R SUMP INLET
12	OS-5 (20.9Ac)	2.93	6.27	19.9	3.09	5.19	9	33	15' TYPE R SUMP INLET
13	OS-6 (1.2Ac.)	0.19	2.06	12.4	3.80	6.39	1	13	10' TYPE R SUMP INLET
14	OS-8 (1.0Ac.)	0.25	0.47	11.0	3.99	6.70	1	3	5' TYPE R SUMP INLET
15	OS-9 (5.3 Ac.)	0.85	2.17	16.0	3.42	5.74	3	12	10' TYPE R SUMP INLET
16	OS-10 (1.0 Ac.)	0.25	0.47	11.0	3.99	6.69	1	3	5' TYPE R SUMP INLET
17	OS-11 (7.9 Ac.)	1.98	3.71	14.7	3.55	5.96	7	22	10' TYPE R SUMP INLET
18	OS-12 (15.0 Ac.)	2.10	6.00	22.0	2.94	4.94	6	30	30" RCP CULVERT
19	OS-13 (1.4 Ac.)	0.28	0.62	12.2	3.83	6.42	1	4	5' TYPE R SUMP INLET
20	OS-14 (9.1 Ac.)	1.82	4.00	19.9	3.10	5.20	6	21	5' TYPE R SUMP INLET
21	**TOTAL INFLOW INTO EXIST. STOCK POND (23.4 Ac.)**	**2.11**	**8.42**	**29.8**	**2.49**	**4.18**	**5**	**35**	**EXIST. STOCK POND WITH OUTLET**
22	**TOTAL INFLOW INTO POND 2 (104.8 Ac.)**	**20.50**	**45.77**	**30.0**	**2.48**	**4.16**	**51**	**191**	**POND 2**

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	I(5) (in/hr)	I(10) (in/hr)	I(25) (in/hr)	I(50) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	0.68	0.71	0.76	0.82	0.85	0.88	0.08	10	0.2	4.6	1700	3.5%	1.9	15.1	19.8	2.48	3.11	3.62	4.14	4.66	5.21	2	**2**	**5**
OS-2	0.02	0.07	0.14	0.23	0.27	0.32	0.08	300	10.5	21.1					21.1	2.41	3.01	3.51	4.01	4.51	5.05	0.0	**0.2**	**1.6**
OS-3	0.45	0.63	0.80	0.98	1.08	1.18	0.25	55	1.1	9.1	600	3.0%	3.5	2.9	11.9	3.08	3.86	4.51	5.15	5.80	6.49	1	**2**	**8**
OS-4	0.47	0.68	0.93	1.15	1.27	1.43	0.22	200	6	15.6	400	3.0%	3.5	1.9	17.6	2.62	3.28	3.83	4.38	4.93	5.51	1	**2**	**8**
OS-5	1.25	2.93	4.81	6.48	7.52	8.36	0.14	200	8	15.5	750	2.0%	2.8	4.4	19.9	2.47	3.09	3.61	4.13	4.64	5.19	3	**9**	**43**
OS-6	0.08	0.19	0.29	0.38	0.44	0.49	0.16	55	1.1	10.0	500	3.0%	3.5	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	0.3	**1**	**3**
OS-7	0.38	0.53	0.67	0.82	0.90	0.99	0.25	100	10	7.2					7.2	3.69	4.63	5.40	6.17	6.94	7.77	1	**2**	**8**
OS-8	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	400	3.0%	3.5	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.70	1	**1**	**3**
OS-9	0.37	0.85	1.27	1.70	1.96	2.17	0.16	200	10	14.1	400	3.0%	3.5	1.9	16.0	2.73	3.42	3.99	4.56	5.13	5.74	1	**3**	**12**
OS-10	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	450	3.8%	3.9	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.69	1	**1**	**3**
OS-11	1.42	1.98	2.53	3.08	3.40	3.71	0.25	200	10	12.8	450	3.8%	3.9	1.9	14.7	2.84	3.55	4.14	4.74	5.33	5.96	4	**7**	**22**
OS-12	0.90	2.10	3.45	4.65	5.40	6.00	0.14	300	13	18.5	600	2.0%	2.8	3.5	22.0	2.35	2.94	3.43	3.93	4.42	4.94	2	**6**	**30**
OS-13	0.17	0.28	0.38	0.49	0.56	0.62	0.20	55	1.1	9.6	450	2.0%	2.8	2.7	12.2	3.05	3.83	4.46	5.10	5.74	6.42	0.5	**1**	**4**
OS-14	1.09	1.82	2.46	3.19	3.64	4.00	0.20	300	12	17.8	350	2.0%	2.8	2.1	19.9	2.48	3.10	3.62	4.13	4.65	5.20	3	**6**	**21**
OS-15	0.70	2.11	3.98	6.08	7.25	8.42	0.09	300	16	18.2	1300	3.5%	1.9	11.6	29.8	2.00	2.49	2.91	3.32	3.74	4.18	1	**5**	**35**
OS-16	0.23	0.69	1.31	2.00	2.39	2.77	0.09	300	10	21.2	600	3.5%	1.9	5.3	26.6	2.13	2.66	3.11	3.55	4.00	4.47	0.5	**2**	**12**
OS-17	0.61	1.84	3.47	5.30	6.32	7.34	0.09	300	9.5	21.6	650	3.5%	1.9	5.8	27.4	2.10	2.62	3.05	3.49	3.93	4.39	1.3	**5**	**32**
OS-18	0.33	0.98	1.85	2.83	3.38	3.92	0.09	300	10	21.2	700	3.5%	1.9	6.2	27.5	2.09	2.61	3.05	3.49	3.92	4.39	0.7	**3**	**17**
OS-19	0.22	0.65	1.22	1.87	2.23	2.59	0.09	300	10	21.2	400	3.5%	1.9	3.6	24.8	2.21	2.77	3.23	3.69	4.15	4.64	0.5	**2**	**12**
OS-20	0.75	2.26	4.27	6.53	7.78	9.04	0.09	300	16	18.2	1300	3.5%	1.9	11.6	29.8	2.00	2.49	2.91	3.32	3.74	4.18	2	**6**	**38**
A	0.83	1.93	3.17	4.28	4.97	5.52	0.14	300	10.5	19.9	1280	3.2%	1.8	11.9	31.8	1.92	2.39	2.79	3.19	3.59	4.02	2	**5**	**22**
B	0.46	1.08	1.77	2.39	2.77	3.08	0.14	300	10.5	19.9	400	2.0%	1.4	4.7	24.6	2.23	2.78	3.24	3.71	4.17	4.67	1	**3**	**14**
C	0.40	0.94	1.54	2.08	2.41	2.68	0.14	300	10.5	19.9	1100	1.5%	2.4	7.5	27.3	2.10	2.62	3.06	3.49	3.93	4.40	1	**2**	**12**
D1	0.72	0.74	0.78	0.83	0.85	0.87	0.08	15	0.3	5.7	1400	1.5%	2.4	9.5	15.2	2.80	3.50	4.08	4.67	5.25	5.88	2	**3**	**5**
D2	0.96	1.07	1.18	1.30	1.36	1.43	0.25	55	1.1	9.1	500	2.5%	3.2	2.6	11.7	3.11	3.89	4.54	5.19	5.84	6.54	3	**4**	**9**
E	0.19	0.45	0.74	0.99	1.15	1.28	0.14	300	10.5	19.9	300	2.0%	1.4	3.5	23.4	2.28	2.85	3.33	3.81	4.28	4.79	0.4	**1**	**6**
F	0.05	0.13	0.21	0.28	0.32	0.36	0.14	300	10.5	19.9					19.9	2.48	3.10	3.62	4.13	4.65	5.20	0.1	**0.4**	**1.9**
G	0.14	0.58	1.08	1.80	2.16	2.52	0.08	70	14	5.7	900	2.0%	1.4	10.6	16.3	2.71	3.39	3.96	4.52	5.09	5.70	0.4	**2**	**14**
H	0.30	0.44	0.60	0.74	0.82	0.92	0.22	100	4	10.1	300	3.0%	3.5	1.4	11.5	3.13	3.92	4.57	5.23	5.88	6.58	1	**2**	**6**
I	0.67	0.93	1.18	1.44	1.59	1.74	0.25	120	3	12.4	550	3.5%	3.7	2.4	14.9	2.82	3.53	4.12	4.71	5.30	5.93	2	**3**	**10**
J	0.65	0.90	1.15	1.40	1.55	1.69	0.25	120	3	12.4	600	2.0%	2.8	3.5	16.0	2.74	3.43	4.00	4.57	5.14	5.75	2	**3**	**10**
K	0.27	0.38	0.48	0.59	0.65	0.71	0.25	55	1.1	9.1	600	2.0%	2.8	3.5	12.6	3.02	3.78	4.41	5.05	5.68	6.35	0.8	**1**	**4**
L	1.31	1.83	2.34	2.85	3.14	3.43	0.25	150	4.5	13.1	850	2.5%	3.2	4.5	17.6	2.62	3.28	3.83	4.38	4.93	5.51	3	**6**	**19**
M	0.41	0.59	0.81	1.00	1.11	1.24	0.22	100	4	10.1	400	2.0%	2.8	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	1	**2**	**8**
N	0.38	0.53	0.67	0.82	0.90	0.99	0.25	55	1.1	9.1	1050	2.0%	2.8	6.2	15.2	2.79	3.50	4.08	4.66	5.25	5.87	1	**2**	**6**
O	0.27	0.38	0.48	0.59	0.65	0.71	0.25	80	5	7.5					7.5	3.64	4.56	5.32	6.08	6.84	7.66	1	**2**	**5**
P	0.49	0.68	0.86	1.05	1.16	1.27	0.25	120	3	12.4	450	1.5%	2.4	3.1	15.5	2.77	3.47	4.05	4.63	5.21	5.83	1	**2**	**7**
Q	0.13	0.31	0.51	0.68	0.79	0.88	0.14	90	22	5.7	300	1.5%	1.2	4.1	9.8	3.32	4.16	4.85	5.54	6.24	6.98	0.4	**1**	**6**
R	0.16	0.23	0.29	0.35	0.39	0.42	0.25	90	6	7.8					7.8	3.59	4.50	5.26	6.01	6.76	7.56	1	**1**	**3**
S	0.07	0.29	0.54	0.90	1.08	1.26	0.08	140	14	10.2	750	1.5%	2.4	5.1	15.3	2.79	3.49	4.07	4.66	5.24	5.86	0.2	**1.0**	**7**

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP-18	2.10	6.00	23.2	2.86	4.81	6	29	30" RCP
2	DP-19	0.28	0.62	12.2	3.83	6.42	1	4	18" RCP
3	DP-20	1.82	4.00	19.9	3.10	5.20	6	21	24" RCP
4	PR-1, PR-2, PR-3	4.20	10.62	23.9	2.82	4.73	12	50	36" RCP
5	Captured from DP-5	1.61	2.31	17.7	3.28	5.50	5	13	24" RCP
6	Captured from DP-6	0.63	0.93	11.9	3.86	6.49	2	6	18" RCP
7	PR-4, PR-5, PR-6	6.43	13.86	24.4	2.79	4.68	18	65	36" RCP
8	DP-4	0.74	0.87	15.2	3.50	5.88	3	5	18" RCP
9	DP-7	1.51	2.47	27.3	2.62	4.40	4	11	24" RCP
10	PR-8, PR-9	2.25	3.34	27.5	2.61	4.38	6	15	30" RCP
11	PR-7, PR-10	8.69	17.20	28.0	2.58	4.33	22	75	42" RCP
12	Captured from DP-10	1.83	2.83	21.2	3.00	5.04	5	14	24" RCP
13	PR-11, PR-12	10.51	20.03	28.1	2.58	4.33	27	87	42" RCP
14	DP-8	0.38	0.71	12.6	3.78	6.35	1	4	18" RCP
15	DP-9	1.43	2.68	16.0	3.43	5.75	5	15	24" RCP
16	PR-14, PR-15	1.80	3.38	16.4	3.39	5.69	6	19	24" RCP
17	PR-13, PR-16	12.31	23.41	28.6	2.55	4.28	31	100	48" RCP
18	DP-11	1.58	4.54	24.2	2.80	4.70	4	21	30" RCP
19	**PR-17, PR-18 W'LY FOREBAY OUTFALL**	**13.89**	**27.96**	**28.8**	**2.54**	**4.26**	**35**	**119**	**48" RCP**
20	DP-12	2.93	6.27	19.9	3.09	5.19	9	33	30" RCP
21	DP-13	0.19	2.06	12.4	3.80	6.39	1	13	24" RCP
22	PR-20, PR-21	3.12	8.33	20.7	3.04	5.10	9	42	30" RCP
23	DP-14	0.25	0.47	11.0	3.99	6.70	1	3	18" RCP
24	DP-15	0.85	2.17	16.0	3.42	5.74	3	12	24" RCP
25	PR-22, PR-23, PR-24	4.22	10.97	22.0	2.94	4.94	12	54	36" RCP
26	DP-16	0.25	0.47	11.0	3.99	6.69	1	3	18" RCP
27	DP-17	1.98	3.71	14.7	3.55	5.96	7	22	30" RCP
28	PR-26, PR-27	2.23	4.18	14.9	3.53	5.93	8	25	30" RCP
29	**PR-25, PR-28 E'LY FOREBAY OUTFALL**	**6.44**	**15.16**	**22.3**	**2.92**	**4.91**	**19**	**74**	**42" RCP**



CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(INCL. FUTURE DEVELOPED TIMBERRIDGE BASINS)

DESIGNED BY	MAW	SCALE	DATE 1-31-19
DRAWN BY	MAW	(H) 1"= 100'	SHEET 3 OF 5
CHECKED BY		(V) 1"= N/A	JOB NO. 2520.00

N:\2520\01\ENGR\SYS\DRN\2520DM RE.dwg, 3/12/2020 4:23:04 PM, 11.03451

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
BASIN IDENTIFIER / AREA IN ACRES	BB 16.0
DESIGN POINT	1
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
DRAINAGE IMPROVEMENTS	
PIPE RUN	10

ARROYA LANE (EXIST. GRAVEL ROAD)

EXIST. 60" CMP CULVERT

FUTURE TIMBERRIDGE RURAL LOTS (2.5 AC. MIN.)

OS-12 15.0

SECONDARY ACCESS ROAD CONSTRUCTED WITH FILING NO. 1

FUTURE TIMBERRIDGE RURAL LOTS (1.0 AC. MIN.)

PROPERTY BOUNDARY

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

OS-20 25.1

TEMP. 30" RCP STORM UNTIL FUTURE DEVELOPMENT

APPROXIMATE LOCATION 100 YR. FLOODPLAIN (PER LOMR 08-080541P)

APPROXIMATE LOCATION 100 YR. FLOODPLAIN (HEC-RAS CALCULATED)

24" RCP OUTFALL CONSTRUCTED WITH FILING NO. 1 FOR STOCK POND RELEASE

EXIST. STOCK POND TO REMAIN UNTIL THIS PHASE OF DEVELOPMENT

TEMP. OUTLET INSTALLED CONNECTED TO PERMANENT 24" RCP OUTFALL DIRECTLY TO SAND CREEK

EXIST. STOCK POND

FUTURE TIMBERRIDGE URBAN LOTS (1.0 AC. MIN.)

OS-19 7.2

PROP. TEMP. SEDIMENT BASIN

FILING NO. 1 BOUNDARY

FUTURE TIMBERRIDGE RURAL LOTS (2.5 AC. MIN.)

18" CULVERT REQUIRED

PROP. NATURAL BERM 6'-8" HEIGHT @ 5:1 (LOTS 1-7)

RURAL LOTS (2.5 AC. MIN.)

OS-2 0.9

SHEET PILE CHECK STRUCTURE W/ CONC. CAP (SEE UDFCD FIG. 9-26 THRU 9-28)

APPROXIMATE LOCATION 100 YR. FLOODPLAIN (PER LOMR 08-080541P)

APPROXIMATE LOCATION 100 YR. FLOODPLAIN (HEC-RAS CALCULATED)

FUTURE HP

A 13.8

F 0.9

E 3.2

SELECTIVE RIP-RAP BANK STABILIZATION (TYPE L, 1.5' THICK)

OS-18 10.9

FUTURE TIMBERRIDGE URBAN LOTS (12,000 SF MIN.)

TSB OUTFALL TO BE ROUTED TO CURB LINE

PROP. TEMP. SEDIMENT BASIN

UNPLATTED (6 AC.+ RESIDENTIAL)

OS-1 1.2

EXIST. VOLLMER ROAD SIDE DITCH (TYP.)

VOLLMER ROAD

ASPEN VALLEY ROAD (RURAL LOCAL)

PROP. TRAIL

PERMANENT SEDIMENT BASIN

RURAL LOTS (2.5 AC. MIN.)

PROP. ACCESS ROAD WITHIN ESMT.

B 7.7

G 7.2

CHANNEL ACCESS RAMP

SAND CREEK REACH SC-9 TRACT A

10' TYPE R AT-GRADE INLET

36" RCP STORM

ELK ANTLER LANE (URBAN LOCAL)

3.2

15' TYPE R AT-GRADE INLET

INSTALL PROP. TEMP. SEDIMENT BASIN AND SILT FENCE TO PROTECT DEVELOPMENT

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

OS-17 20.4

SHEET PILE CHECK STRUCTURE W/ CONC. CAP (SEE UDFCD FIG. 9-26 THRU 9-28)

PROPOSED POND 1

PRE-DEVELOPMENT
Q2 YR. = 0.30 CFS
Q5 YR. = 0.48 CFS
Q100 YR. = 29.2 CFS

DEVELOPED RELEASE
Q2 YR. = 0.10 CFS
Q5 YR. = 0.17 CFS
Q100 YR. = 24.0 CFS

24" CULVERT REQUIRED

PROP. NATURAL BERM 6'-0" HEIGHT @ 5:1 (LOTS 1-7)

C 6.7

DRAINAGE ESMT.

PROP. DUAL 24" RCP CULVERTS

TRACT B

H 2.0

ACCESS RAMPS

SELECTIVE RIP-RAP BANK STABILIZATION (TYPE L, 1.5' THICK)

36" RCP STORM

TRACT E

10' TYPE R SUMP INLET

5' TYPE R SUMP INLET

ANTELOPE RAVINE DRIVE (URBAN LOCAL)

POCO ROAD (URBAN LOCAL)

PROPERTY BOUNDARY

D2 2.2

D 1.1

PROPOSED POND 1

WQCV = 0.214 AC.-FT.
EURV = 0.177 AC.-FT.
100 YR = 0.877 AC.-FT.
TOTAL = 1.268 AC.-FT.

TWO CELL MULTI-PLATE STEEL ARCH CULVERTS (24'X10.33')

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

SEE SHEET 5

SEE SHEET 5

NOTE:
SEE SHEET 3 FOR BASIN AND DEVELOPED FLOW CALCULATIONS

N

100 50 0 100 200

SCALE: 1" = 100'

CLASSIC CONSULTING SM
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(FILING NO. 1 GRADING ONLY)

DESIGNED BY	MAW	SCALE		DATE	1-31-19
DRAWN BY	MAW	(H) 1"= 100'		SHEET	4 OF 5
CHECKED BY		(V) 1"= N/A		JOB NO.	1185.00

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

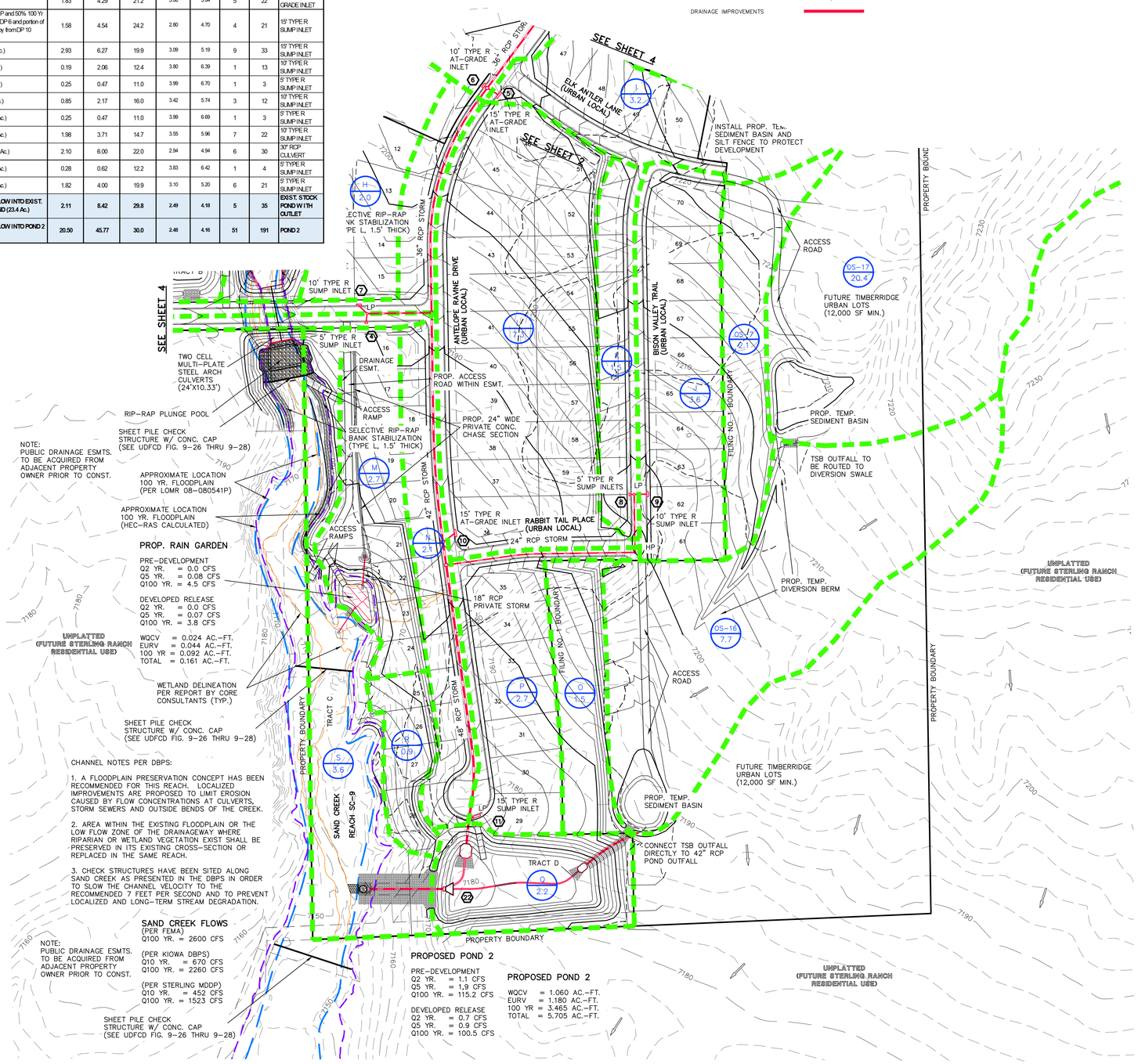
Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Inlet Size
1	A (13.8 Ac.), OS-1 (1.2 Ac.) and C (6.7 Ac.)	3.58	9.08	31.8	2.39	4.02	9	36	DUAL 24" RCP CULVERTS
2	**TOTAL INFLOW INTO POND 1 A, B, C and OS-1 (29.4 Ac.)**	**4.66**	**12.16**	**33.8**	**2.30**	**3.86**	**11**	**47**	**POND 1**
3	No longer used								
4	D1 (1.1 Ac.)	0.74	0.87	15.2	3.50	5.88	3	5	5' TYPE R SUMP INLET
5	OS-4 (3.1 Ac.), I (3.7 Ac.)	1.61	3.17	17.7	3.28	5.50	5	17	15' TYPE R AT-GRADE INLET
6	OS-3 (2.5 Ac.)	0.63	1.18	11.9	3.86	6.49	2	8	10' TYPE R AT-GRADE INLET
7	Basin D2, Basin H and 50% of 100 yr Flowby from DP-6 (5.5 Ac)	1.51	2.47	27.3	2.62	4.40	4	11	10' TYPE R SUMP INLET
8	K (1.5 Ac.)	0.38	0.71	12.6	3.78	6.35	1	4	5' TYPE R SUMP INLET
9	J and OS-7 (5.7 Ac.)	1.43	2.68	16.0	3.43	5.75	5	15	10' TYPE R SUMP INLET
10	Flowby from DP-5 and Basin L (7.3 Ac)	1.83	4.29	21.2	3.00	5.04	5	22	15' TYPE R AT-GRADE INLET
11	Basins N, O, P and 50% 100 Yr Flowby from DP-6 and portion of 100 Yr Flowby from DP-10 (13.6 Ac)	1.58	4.54	24.2	2.80	4.70	4	21	15' TYPE R SUMP INLET
12	OS-5 (20.9Ac.)	2.93	6.27	19.9	3.09	5.19	9	33	15' TYPE R SUMP INLET
13	OS-6 (1.2Ac.)	0.19	2.06	12.4	3.80	6.39	1	13	10' TYPE R SUMP INLET
14	OS-8 (1.0Ac.)	0.25	0.47	11.0	3.99	6.70	1	3	5' TYPE R SUMP INLET
15	OS-9 (5.3 Ac.)	0.85	2.17	16.0	3.42	5.74	3	12	10' TYPE R SUMP INLET
16	OS-10 (1.0 Ac.)	0.25	0.47	11.0	3.99	6.69	1	3	5' TYPE R SUMP INLET
17	OS-11 (7.9 Ac.)	1.98	3.71	14.7	3.55	5.96	7	22	10' TYPE R SUMP INLET
18	OS-12 (15.0 Ac.)	2.10	6.00	22.0	2.94	4.94	6	30	30" RCP CULVERT
19	OS-13 (1.4 Ac.)	0.28	0.62	12.2	3.83	6.42	1	4	5' TYPE R SUMP INLET
20	OS-14 (9.1 Ac.)	1.82	4.00	19.9	3.10	5.20	6	21	5' TYPE R SUMP INLET
21	**TOTAL INFLOW INTO EXIST. STOCK POND (23.4 Ac.)**	**2.11**	**8.42**	**29.8**	**2.49**	**4.18**	**5**	**35**	**EXIST. STOCK POND WITH OUTLET**
22	**TOTAL INFLOW INTO POND 2 (104.8 Ac.)**	**20.50**	**45.77**	**30.0**	**2.48**	**4.16**	**51**	**191**	**POND 2**

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	I(5) (in/hr)	I(10) (in/hr)	I(25) (in/hr)	I(50) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	0.68	0.71	0.76	0.82	0.85	0.88	0.08	10	0.2	4.6	1700	3.5%	1.9	15.1	19.8	2.48	3.11	3.62	4.14	4.66	5.21	2	**2**	**5**
OS-2	0.02	0.07	0.14	0.23	0.27	0.32	0.08	300	10.5	21.1				21.1	2.41	3.01	3.51	4.01	4.51	5.05	0.0	**0.2**	**1.6**
OS-3	0.45	0.63	0.80	0.98	1.08	1.18	0.25	55	1.1	9.1	600	3.0%	3.5	2.9	11.9	3.08	3.86	4.51	5.15	5.80	6.49	1	**2**	**8**
OS-4	0.47	0.68	0.93	1.15	1.27	1.43	0.22	200	6	15.6	400	3.0%	3.5	1.9	17.6	2.62	3.28	3.83	4.38	4.93	5.51	1	**2**	**8**
OS-5	1.25	2.93	4.81	6.48	7.52	8.36	0.14	200	8	15.5	750	2.0%	2.8	4.4	19.9	2.47	3.09	3.61	4.13	4.64	5.19	3	**9**	**43**
OS-6	0.08	0.19	0.29	0.38	0.44	0.49	0.16	55	1.1	10.0	500	3.0%	3.5	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	0.3	**1**	**3**
OS-7	0.38	0.53	0.67	0.82	0.90	0.99	0.25	100	10	7.2				7.2	3.69	4.63	5.40	6.17	6.94	7.77	1	**2**	**8**
OS-8	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	400	3.0%	3.5	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.70	1	**1**	**3**
OS-9	0.37	0.85	1.27	1.70	1.96	2.17	0.16	200	10	14.1	400	3.0%	3.5	1.9	16.0	2.73	3.42	3.99	4.56	5.13	5.74	1	**3**	**12**
OS-10	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	450	3.8%	3.9	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.69	1	**1**	**3**
OS-11	1.42	1.98	2.53	3.08	3.40	3.71	0.25	200	10	12.8	450	3.8%	3.9	1.9	14.7	2.84	3.55	4.14	4.74	5.33	5.96	4	**7**	**22**
OS-12	0.90	2.10	3.45	4.65	5.40	6.00	0.14	300	13	18.5	600	2.0%	2.8	3.5	22.0	2.35	2.94	3.43	3.93	4.42	4.94	2	**6**	**30**
OS-13	0.17	0.28	0.38	0.49	0.56	0.62	0.20	55	1.1	9.6	450	2.0%	2.8	2.7	12.2	3.05	3.83	4.46	5.10	5.74	6.42	0.5	**1**	**4**
OS-14	1.09	1.82	2.46	3.19	3.64	4.00	0.20	300	12	17.8	350	2.0%	2.8	2.1	19.9	2.48	3.10	3.62	4.13	4.65	5.20	3	**6**	**21**
OS-15	0.70	2.11	3.98	6.08	7.25	8.42	0.09	300	16	18.2	1300	3.5%	1.9	11.6	29.8	2.00	2.49	2.91	3.32	3.74	4.18	1	**5**	**35**
OS-16	0.23	0.69	1.31	2.00	2.39	2.77	0.09	300	10	21.2	600	3.5%	1.9	5.3	26.6	2.13	2.66	3.11	3.55	4.00	4.47	0.5	**2**	**12**
OS-17	0.61	1.84	3.47	5.30	6.32	7.34	0.09	300	9.5	21.6	650	3.5%	1.9	5.8	27.4	2.10	2.62	3.05	3.49	3.93	4.39	1.3	**5**	**32**
OS-18	0.33	0.98	1.85	2.83	3.38	3.92	0.09	300	10	21.2	700	3.5%	1.9	6.2	27.5	2.09	2.61	3.05	3.49	3.92	4.39	0.7	**3**	**17**
OS-19	0.22	0.65	1.22	1.87	2.23	2.59	0.09	300	10	21.2	400	3.5%	1.9	3.6	24.8	2.21	2.77	3.23	3.69	4.15	4.64	0.5	**2**	**12**
OS-20	0.75	2.26	4.27	6.53	7.78	9.04	0.09	300	16	18.2	1300	3.5%	1.9	11.6	29.8	2.00	2.49	2.91	3.32	3.74	4.18	2	**6**	**38**
A	0.83	1.93	3.17	4.28	4.97	5.52	0.14	300	10.5	19.9	1280	3.2%	1.8	11.9	31.8	1.92	2.39	2.79	3.19	3.59	4.02	2	**5**	**22**
B	0.46	1.08	1.77	2.39	2.77	3.08	0.14	300	10.5	19.9	400	2.0%	1.4	4.7	24.6	2.23	2.78	3.24	3.71	4.17	4.67	1	**3**	**14**
C	0.40	0.94	1.54	2.08	2.41	2.68	0.14	300	10.5	19.9	1100	1.5%	2.4	7.5	27.3	2.10	2.62	3.06	3.49	3.93	4.40	1	**2**	**12**
D1	0.72	0.74	0.78	0.83	0.85	0.87	0.08	15	0.3	5.7	1400	1.5%	2.4	9.5	15.2	2.80	3.50	4.08	4.67	5.25	5.88	2	**3**	**5**
D2	0.96	1.07	1.18	1.30	1.36	1.43	0.25	55	1.1	9.1	500	2.5%	3.2	2.6	11.7	3.11	3.89	4.54	5.19	5.84	6.54	3	**4**	**9**
E	0.19	0.45	0.74	0.99	1.15	1.28	0.14	300	10.5	19.9	300	2.0%	1.4	3.5	23.4	2.28	2.85	3.33	3.81	4.28	4.79	0.4	**1**	**6**
F	0.05	0.13	0.21	0.28	0.32	0.36	0.14	300	10.5	19.9				19.9	2.48	3.10	3.62	4.13	4.65	5.20	0.1	**0.4**	**1.9**
G	0.14	0.56	1.08	1.80	2.16	2.52	0.08	70	1.4	5.7	900	2.0%	1.4	10.6	16.3	2.71	3.39	3.96	4.52	5.09	5.70	0.4	**2**	**14**
H	0.30	0.44	0.60	0.74	0.82	0.92	0.22	100	4	10.1	300	3.0%	3.5	1.4	11.5	3.13	3.92	4.57	5.23	5.88	6.58	1	**2**	**6**
I	0.67	0.93	1.18	1.44	1.59	1.74	0.25	120	3	12.4	550	3.5%	3.7	2.4	14.9	2.62	3.53	4.12	4.71	5.30	5.93	2	**3**	**10**
J	0.65	0.90	1.15	1.40	1.55	1.69	0.25	120	3	12.4	600	2.0%	2.8	3.5	16.0	2.74	3.43	4.00	4.57	5.14	5.75	2	**3**	**10**
K	0.27	0.38	0.48	0.59	0.65	0.71	0.25	55	1.1	9.1	600	2.0%	2.8	3.5	12.6	3.02	3.78	4.41	5.05	5.68	6.35	0.8	**1**	**4**
L	1.31	1.83	2.34	2.85	3.14	3.43	0.25	150	4.5	13.1	850	2.5%	3.2	4.5	17.6	2.62	3.28	3.83	4.38	4.93	5.51	3	**6**	**19**
M	0.41	0.59	0.81	1.00	1.11	1.24	0.22	100	4	10.1	400	2.0%	2.8	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	1	**2**	**8**
N	0.38	0.53	0.67	0.82	0.90	0.99	0.25	55	1.1	9.1	1050	2.0%	2.8	6.2	15.2	2.79	3.50	4.06	4.66	5.25	5.87	1	**2**	**6**
O	0.27	0.38	0.48	0.59	0.65	0.71	0.25	80	5	7.5				7.5	3.64	4.56	5.32	6.08	6.84	7.66	1	**2**	**5**
P	0.49	0.68	0.86	1.05	1.16	1.27	0.25	120	3	12.4	450	1.5%	2.4	3.1	15.5	2.77	3.47	4.05	4.63	5.21	5.83	1	**2**	**7**
Q	0.13	0.31	0.51	0.68	0.79	0.88	0.14	90	22	5.7	300	1.5%	1.2	4.1	9.8	3.32	4.16	4.85	5.54	6.24	6.98	0.4	**1**	**6**
R	0.16	0.23	0.29	0.35	0.39	0.42	0.25	90	6	7.8				7.8	3.59	4.50	5.26	6.01	6.76	7.56	1	**1**	**3**
S	0.07	0.29	0.54	0.90	1.08	1.26	0.08	140	14	10.2	750	1.5%	2.4	5.1	15.3	2.79	3.49	4.07	4.66	5.24	5.86	0.2	**1.0**	**7**

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP-18	2.10	6.00	23.2	2.86	4.81	6	29	30" RCP
2	DP-19	0.28	0.62	12.2	3.83	6.42	1	4	18" RCP
3	DP-20	1.82	4.00	19.9	3.10	5.20	6	21	24" RCP
4	PR-1, PR-2, PR-3	4.20	10.62	23.9	2.82	4.73	12	50	36" RCP
5	Captured from DP-5	1.61	2.31	17.7	3.28	5.50	5	13	24" RCP
6	Captured from DP-6	0.63	0.93	11.9	3.86	6.49	2	6	18" RCP
7	PR-4, PR-5, PR-6	6.43	13.86	24.4	2.79	4.68	18	65	36" RCP
8	DP-4	0.74	0.87	15.2	3.50	5.88	3	5	18" RCP
9	DP-7	1.51	2.47	27.3	2.62	4.40	4	11	24" RCP
10	PR-8, PR-9	2.25	3.34	27.5	2.61	4.38	6	15	30" RCP
11	PR-7, PR-10	8.69	17.20	28.0	2.58	4.33	22	75	42" RCP
12	Captured from DP-10	1.83	2.83	21.2	3.00	5.04	5	14	24" RCP
13	PR-11, PR-12	10.51	20.03	28.1	2.58	4.33	27	87	42" RCP
14	DP-8	0.38	0.71	12.6	3.78	6.35	1	4	18" RCP
15	DP-9	1.43	2.68	16.0	3.43	5.75	5	15	24" RCP
16	PR-14, PR-15	1.80	3.38	16.4	3.39	5.69	6	19	24" RCP
17	PR-13, PR-16	12.31	23.41	28.6	2.55	4.28	31	100	48" RCP
18	DP-11	1.58	4.54	24.2	2.80	4.70	4	21	30" RCP
19	**PR-17, PR-18 W'LY FOREBAY OUTFALL**	**13.89**	**27.96**	**28.8**	**2.54**	**4.26**	**35**	**119**	**48" RCP**
20	DP-12	2.93	6.27	19.9	3.09	5.19	9	33	30" RCP
21	DP-13	0.19	2.06	12.4	3.80	6.39	1	13	24" RCP
22	PR-20, PR-21	3.12	8.33	20.7	3.04	5.10	9	42	30" RCP
23	DP-14	0.25	0.47	11.0	3.99	6.70	1	3	18" RCP
24	DP-15	0.85	2.17	16.0	3.42	5.74	3	12	24" RCP
25	PR-22, PR-23, PR-24	4.22	10.97	22.0	2.94	4.94	12	54	36" RCP
26	DP-16	0.25	0.47	11.0	3.99	6.69	1	3	18" RCP
27	DP-17	1.98	3.71	14.7	3.55	5.96	7	22	30" RCP
28	PR-26, PR-27	2.23	4.18	14.9	3.53	5.93	8	25	30" RCP
29	**PR-25, PR-28 E'LY FOREBAY OUTFALL**	**6.44**	**15.16**	**22.3**	**2.92**	**4.91**	**19**	**74**	**42" RCP**



CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(FILING NO. 1 GRADING ONLY)

DESIGNED BY	MAW	SCALE		DATE	1-31-19
DRAWN BY	MAW	(H) 1"= 100'		SHEET	5 OF 5
CHECKED BY		(V) 1"= N/A		JOB NO.	1185.00

PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM
FOR
HOMESTEAD NORTH AT STERLING RANCH PRELIMINARY PLAN

Prepared For:

SR Land, LLC
20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903
(719) 491-3024

April 1st, 2021
Project No. 25188.00

Prepared By:

JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

PCD Filing No.:
SP-20-008

The Sand Creek is within the eastern portion of the site. Currently, JR Engineering is performing studies and plans to address Sand Creek stabilization.

There are no known irrigation facilities located on the project site.

FLOODPLAIN STATEMENT

Based on the FEMA Firm Maps Number 08041C0533G and 08041C0535G revised December 7, 2018, the vast majority of the development is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The eastern property boundary will be platted to the center of Sand creek placing a portion of the site within Zone AE. The area of disturbance for site grading is located outside of the delineated floodway within Zone X. The FEMA map containing the site has been presented in Appendix A.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the Sand Creek Drainage Basin based **o**n the "Sand Creek Drainage Basin Planning Study" (DBPS) completed by Kiowa Engineering Corporation in January 1993, revised March 1996. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into major sub-basins. The site is within the respective sub-basin is shown in Appendix E.

The Sand Creek DBPS assumed the Homestead North at Sterling Ranch property to have a "large lot residential" use for the majority of the site. However, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located in the east portion of the site running north to south. This reach of drainage conveyance is not currently improved. There are a few stock ponds within the creek channel used for cattle watering. Currently, JR engineering is performing studies and plans to address Sand Creek stabilization adjacent to the site.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The MMDP "Developed Hydrologic Conditions Map" as shown within Appendix E, shows the estimated detention for the site. The site is tributary to basins SC3-18, SC3-17, and a portion of basin SC-322. Full-spectrum detention in the MMDP was previously analyzed and corresponds to ponds FSD18 and FSD17 for the site. Pond FSD17 is associated with ponds A and B within this report. Pond FSD18 is associated with ponds B and C within this report. Runoff as shown in the proposed M&S conduit RT-10A will be detained within pond C, whereas the 2018 MDDP specified that this runoff outfall directly into Sand Creek. This represents a more conservative approach to attenuate and treat water

quality for the offsite runoff going into Sand Creek. The total estimated/projected detention and estimated outflows from the MDDP are shown in Table 1 on the following page.

Table 1.

FSD17						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	41.8	59.6	85.2	119.0	149.1	180.6
ALLOWABLE RELEASE (CFS)	0.7	11.1	22.5	52	67.2	86.3
MODELED RELEASE (CFS)	0.7	8.4	22.4	52	67.2	86.1
STORED VOLUME (AC-FT)	2.6	2.6	2.8	3.4	4.0	4.7

FSD18						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	49.3	67.1	91.0	121.2	147.3	174
ALLOWABLE RELEASE (CFS)	0.6	9.2	18.4	42.2	54.6	69.9
MODELED RELEASE (CFS)	0.6	6.3	18.4	42.2	54.6	69.6
STORED VOLUME (AC-FT)	3.2	3.2	3.4	4.0	4.7	5.3

The MMDP plans for additional detention to the north of the site, as shown in Appendix E. No future offsite detention is necessary for the site.

In summary, the site will have three detention ponds A, B, and C. Ponds A and B associated with pond FSD17 of the M&S MDDP and Ponds B and C associated with pond FSD18. The release rates of these ponds will be below 90% of the historic drainage in continuity with the approved M&S MDDP. The report deviates with MDDP and detains and treats water quality from the existing offsite runoff from basin SC3-19 of the M&S MDDP via proposed storm pipe along Vollmer road and Briargate parkway that goes into pond C and outfalls within Sand Creek. The MDDP showed the runoff going into Sand Creek undetained. The total net detention being stored onsite in the 100 year event is 14.68 Acre-ft, as shown in Tables 2.1-2.3 of this report. The total runoff released from the detention ponds is 232.3 cfs in the 100 year event for the three ponds, as shown in Tables 2.1-2.3 of this report. The drainage for Vollmer and the corresponding offsite tributary area is detained treated for water quality within pond C.

Pond A has a total tributary area of 29.82 Acres, the net percent impervious area of pond A is 46.5%. Pond A has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 2 of Homestead North at Sterling Ranch. Pond A will outfall directly into the Sand Creek basin. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond A are shown in Table 2.1 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	TABLE 2.1 Pond A		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	2.81	0.498	0.2
5 Year	5.44	1.726	4.3
100 Year	6.73	2.477	36.2

Basin B1.1 3.36 acres 45% percent impervious is comprised of single-family residential lots, a local roads Billy Claiborne Drive, Perry Owens Drive and an urban knuckle. The runoff (Q_5=5.5 cfs, Q_{100}=12.5 cfs) from basin B1.1 drains to design point 1.1B.

Basin B1.2 1.81 acres and 54% percent impervious is comprised of single-family residential lots, a local roads Claiborne Drive, Perry Owens Drive and an urban knuckle. The runoff (Q_5=3.5 cfs, Q_{100}=7.4 cfs) from basin B1.2 drains to design point 1.2B.

Basin B1.3 0.47 acres and 47% percent impervious is comprised of single-family residential lots and a local roads Aspen Valley Road and Perry Owens Drive. The runoff (Q_5=1.0 cfs, Q_{100}=2.2 cfs) from basin B1.3 drains to design point 1.3B.

Basin B2 0.82 acres and 58% percent impervious is comprised of the northern portion of a local residential road Sam Bass Drive adjacent to the intersecting at Vollmer road. Runoff (Q_5=2.3 cfs, Q_{100}=4.9 cfs) from basin B2 drains to design point 2B and confluences with runoff from basins B1.1, B1.2 and B1.3.

Basin B3 0.24 acres and 79% percent impervious is comprised of the southern portion of a local residential road Sam Bass Drive adjacent to the intersection of Vollmer road. Runoff (Q_5=0.9 cfs, Q_{100}=1.7 cfs)from basin B3 drains to design point 3B.

Pond B has a tributary area 27.86 acres and is 50.0 % impervious. Pond B has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 1 of Homestead North at Sterling Ranch. The pond B emergency overflow spillway will drain directly into Sand Creek. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond B are shown in Table 2.2 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	TABLE 2.2 Pond B		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	3.13	0.483	0.2
5 Year	4.34	1.701	3.4
100 Year	5.09	3.019	25.4

Basin C1 2.82 acres and 69% percent impervious is comprised of single-family lots, and the northwestern side of the local residential roads Texas Jack Drive and Harvey Logan Drive. Runoff (Q_5=5.4 cfs, Q_{100}=11.4 cfs) from basin C1 drains to design point 1C at Wheatland Drive.

Basin C2.1 0.20 acres and 91% percent impervious is comprised of single-family lots, and the north western side of the residential road Texas Jack Drive. Runoff (Q_5=0.8 cfs, Q_{100}=1.6 cfs) from basin C2.1 drains to design point 2.1C a 5’ on grade type R inlet.

Basin C2.2 4.69 acres and 73% percent impervious is comprised of local roads, single-family lots, and the north western side of the residential road Wheatland Drive. Runoff (Q_5=9.9 cfs, Q_{100}=20.3 cfs) from basin C2.2 drains to design point 2.2C in confluence with bypass runoff from basin C2.3. The runoff ultimately drains to design point 4C a 20’ type R sump inlet. The total runoff from basins C1, C2.1, C2.2, C2.3 and C4.1 is collected within the sump inlet.

Basin C2.3 0.83 acres and 67% percent impervious is comprised of local roads Tom Ketchum Drive Jack Helm Drive and Harvey Logan Drive, single-family lots, and the north western side of the residential road Wheatland Drive. Runoff (Q_5=1.9 cfs, Q_{100}=3.9 cfs) from basin C2.3 drains to design point 2.3C in confluence with runoff from basin C1 at an on grade 15’ Type R inlet.

Basin C3.1 0.35 acres and 73% percent impervious is comprised of single-family lots, and the southeastern side of the residential road Wheatland Drive. Runoff (Q_5=1.2 cfs, Q_{100}=2.4 cfs) from basin C3.1 drains to design point 3.1C.

Basin C3.2 1.46 acres and 71% percent impervious is comprised of local roads, single-family lots, and the southeastern side of the residential road Wheatland Drive and Tom Ketchum Drive. Runoff (Q_5=3.6 cfs, Q_{100}=7.4 cfs) from basin C3.2 drains to design point 3.2C.

Basin C4.1 6.35 acres and 65% percent impervious is comprised of single-family lots, and the northwestern side of the local residential road Texas Jack Drive, a right in lane and Nat Love Drive. Runoff (Q_5=12.1 cfs, Q_{100}=25.9 cfs) from basin C4.1 drains to design point 4C a 20' type R sump inlet. The total runoff from basins C1, C2.1, C2.2, C2.3 and C4.1 is collected within the sump inlet.

Basin C4.2 3.44 acres and 59% percent impervious is comprised of a local road Texas Jack Drive and single-family lots. Runoff (Q_5=5.9 cfs, Q_{100}=13.3 cfs) from basin C4.2 drains to design point 4.2C a 15' type R on grade inlet.

Basin C5 0.16 acres and 81% percent impervious is comprised of the northwestern side of a residential road Wheatland Drive. Runoff (Q_5=0.6 cfs, Q_{100}=1.0 cfs) from basin C5 drains to design point 5C, a 5' type R sump inlet. Basin C5 collects runoff from basin C3.2 and C5. The runoff from basin C ultimately outfalls into pond C. In the event the inlet clogs at Basin C5 the runoff will overflow to pond C. An overflow path has been graded to ensure that the overflow path will go into pond C.

Basin C6 2.48 acres and 21% percent impervious is comprised of pond C and some single-family residential area. Runoff (Q_5=2.5 cfs, Q_{100}=8.8 cfs) generated in Basin B11 sheet flows into Pond C where it is treated for water-quality and is detained up until the 100 year-event. The MHFD Detention sheet for pond C is shown in Appendix C of this report.

Pond C has a tributary area of 224.42 acres and is 10.3 % impervious. Pond C has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 1 of Homestead North at Sterling Ranch. The Pond C overflow emergency spillway will overflow into Sand Creek. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond C are shown in Table 2.3 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	TABLE 2.3 Pond C		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	3.32	1.288	0.7
5 Year	6.22	4.310	20.6
100 Year	9.94	9.263	173.9

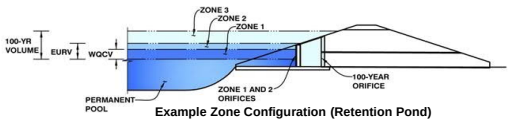
Appendix C
Hydraulic Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	29.82	acres
Watershed Length =	1,963	ft
Watershed Length to Centroid =	1,178	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	46.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.489	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.474	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.416	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.052	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.615	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	3.389	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.007	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.798	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 4 in.) =	8.639	acre-feet	4.00 inches
Approximate 2-yr Detention Volume =	1.104	acre-feet	
Approximate 5-yr Detention Volume =	1.522	acre-feet	
Approximate 10-yr Detention Volume =	2.040	acre-feet	
Approximate 25-yr Detention Volume =	2.247	acre-feet	
Approximate 50-yr Detention Volume =	2.352	acre-feet	
Approximate 100-yr Detention Volume =	2.648	acre-feet	

Define Zones and Basin Geometry

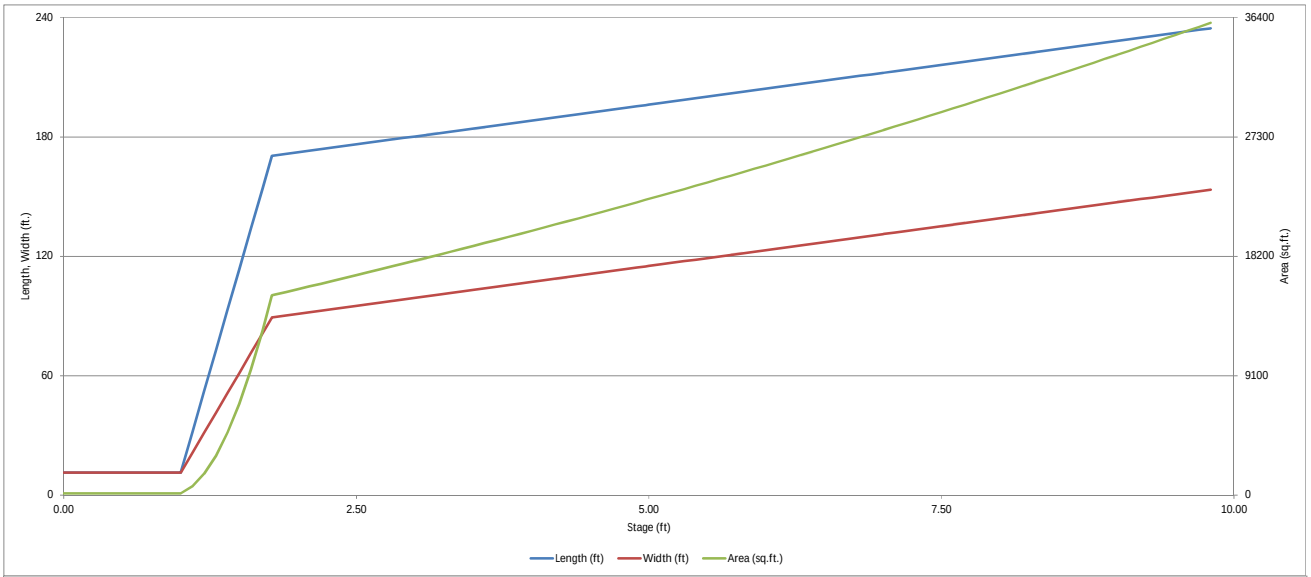
Zone 1 Volume (WQCV) =	0.489	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.985	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.174	acre-feet
Total Detention Basin Volume =	2.648	acre-feet
Initial Surcharge Volume (ISV) =	64	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	7.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	128	ft^2
Surcharge Volume Length (L_{ISV}) =	11.3	ft
Surcharge Volume Width (W_{ISV}) =	11.3	ft
Depth of Basin Floor (H_{FLOOR}) =	0.78	ft
Length of Basin Floor (L_{FLOOR}) =	170.4	ft
Width of Basin Floor (W_{FLOOR}) =	89.3	ft
Area of Basin Floor (A_{FLOOR}) =	15,221	ft^2
Volume of Basin Floor (V_{FLOOR}) =	4,353	ft^3
Depth of Main Basin (H_{MAIN}) =	5.22	ft
Length of Main Basin (L_{MAIN}) =	212.2	ft
Width of Main Basin (W_{MAIN}) =	131.1	ft
Area of Main Basin (A_{MAIN}) =	27,811	ft^2
Volume of Main Basin (V_{MAIN}) =	110,675	ft^3
Calculated Total Basin Volume (V_{total}) =	2.644	acre-feet

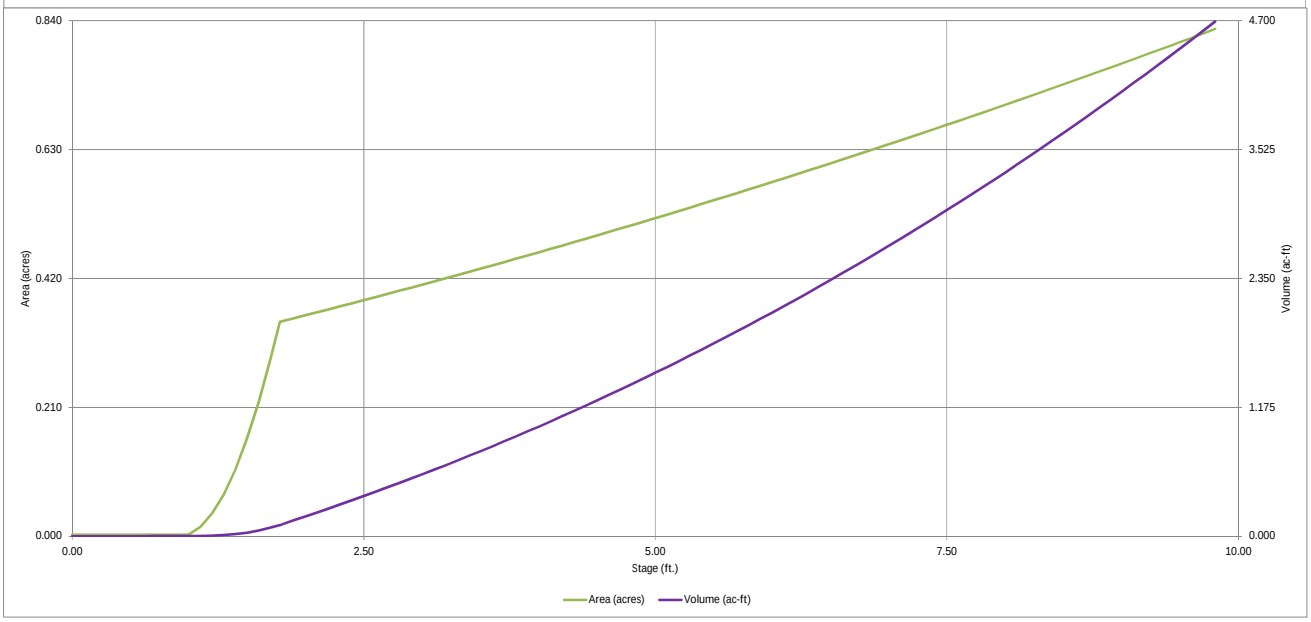
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		11.3	11.3	128		0.003		
ISV	0.50		11.3	11.3	128		0.003	64	0.001
	0.60		11.3	11.3	128		0.003	77	0.002
	0.70		11.3	11.3	128		0.003	90	0.002
	0.80		11.3	11.3	128		0.003	102	0.002
	0.90		11.3	11.3	128		0.003	115	0.003
	1.00		11.3	11.3	128		0.003	128	0.003
	1.10		31.7	21.3	676		0.016	165	0.004
	1.20		52.1	31.3	1,631		0.037	277	0.006
	1.30		72.5	41.3	2,995		0.069	505	0.012
	1.40		92.9	51.3	4,767		0.109	889	0.020
	1.50		113.3	61.3	6,947		0.159	1,472	0.034
	1.60		133.7	71.3	9,534		0.219	2,292	0.053
	1.70		154.1	81.3	12,530		0.288	3,392	0.078
Floor	1.78		170.4	89.3	15,221		0.349	4,500	0.103
	1.80		170.6	89.5	15,262		0.350	4,805	0.110
	1.90		171.4	90.3	15,471		0.355	6,342	0.146
	2.00		172.2	91.1	15,681		0.360	7,899	0.181
	2.10		173.0	91.9	15,892		0.365	9,478	0.218
	2.20		173.8	92.7	16,105		0.370	11,078	0.254
	2.30		174.6	93.5	16,318		0.375	12,699	0.292
	2.40		175.4	94.3	16,534		0.380	14,342	0.329
	2.50		176.2	95.1	16,750		0.385	16,006	0.367
	2.60		177.0	95.9	16,968		0.390	17,692	0.406
	2.70		177.8	96.7	17,186		0.395	19,399	0.445
	2.80		178.6	97.5	17,407		0.400	21,129	0.485
Zone 1 (WQCV)	2.82		178.7	97.6	17,451		0.401	21,477	0.493
	2.90		179.4	98.3	17,628		0.405	22,881	0.525
	3.00		180.2	99.1	17,851		0.410	24,655	0.566
	3.10		181.0	99.9	18,075		0.415	26,451	0.607
	3.20		181.8	100.7	18,300		0.420	28,270	0.649
	3.30		182.6	101.5	18,527		0.425	30,111	0.691
	3.40		183.4	102.3	18,755		0.431	31,975	0.734
	3.50		184.2	103.1	18,984		0.436	33,862	0.777
	3.60		185.0	103.9	19,214		0.441	35,772	0.821
	3.70		185.8	104.7	19,446		0.446	37,705	0.866
	3.80		186.6	105.5	19,679		0.452	39,661	0.910
	3.90		187.4	106.3	19,913		0.457	41,641	0.956
	4.00		188.2	107.1	20,149		0.463	43,644	1.002
	4.10		189.0	107.9	20,386		0.468	45,671	1.048
	4.20		189.8	108.7	20,624		0.473	47,721	1.096
	4.30		190.6	109.5	20,863		0.479	49,795	1.143
	4.40		191.4	110.3	21,104		0.484	51,894	1.191
	4.50		192.2	111.1	21,346		0.490	54,016	1.240
	4.60		193.0	111.9	21,589		0.496	56,163	1.289
	4.70		193.8	112.7	21,834		0.501	58,334	1.339
	4.80		194.6	113.5	22,080		0.507	60,530	1.390
	4.90		195.4	114.3	22,327		0.513	62,750	1.441
Zone 2 (EURV)	4.97		195.9	114.8	22,500		0.517	64,319	1.477
	5.00		196.2	115.1	22,575		0.518	64,995	1.492
	5.10		197.0	115.9	22,825		0.524	67,265	1.544
	5.20		197.8	116.7	23,076		0.530	69,560	1.597
	5.30		198.6	117.5	23,328		0.536	71,880	1.650
	5.40		199.4	118.3	23,581		0.541	74,226	1.704
	5.50		200.2	119.1	23,836		0.547	76,597	1.758
	5.60		201.0	119.9	24,092		0.553	78,993	1.813
	5.70		201.8	120.7	24,349		0.559	81,415	1.869
	5.80		202.6	121.5	24,608		0.565	83,863	1.925
	5.90		203.4	122.3	24,868		0.571	86,337	1.982
	6.00		204.2	123.1	25,129		0.577	88,837	2.039
	6.10		205.0	123.9	25,392		0.583	91,363	2.097
	6.20		205.8	124.7	25,655		0.589	93,915	2.156
	6.30		206.6	125.5	25,920		0.595	96,494	2.215
	6.40		207.4	126.3	26,187		0.601	99,099	2.275
	6.50		208.2	127.1	26,454		0.607	101,731	2.335
	6.60		209.0	127.9	26,723		0.613	104,390	2.396
	6.70		209.8	128.7	26,993		0.620	107,076	2.458
	6.80		210.6	129.5	27,264		0.626	109,788	2.520
	6.90		211.4	130.3	27,537		0.632	112,529	2.583
	7.00		212.2	131.1	27,811		0.638	115,296	2.647
Zone 3 (100-year)	7.01		212.3	131.1	27,839		0.639	115,574	2.653
	7.10		213.0	131.9	28,086		0.645	118,091	2.711
	7.20		213.8	132.7	28,363		0.651	120,913	2.776
	7.30		214.6	133.5	28,641		0.657	123,763	2.841
	7.40		215.4	134.3	28,920		0.664	126,641	2.907
	7.50		216.2	135.1	29,200		0.670	129,547	2.974
	7.60		217.0	135.9	29,482		0.677	132,482	3.041
	7.70		217.8	136.7	29,765		0.683	135,444	3.109
	7.80		218.6	137.5	30,049		0.690	138,435	3.178
	7.90		219.4	138.3	30,334		0.696	141,454	3.247
	8.00		220.2	139.1	30,621		0.703	144,501	3.317
	8.10		221.0	139.9	30,909		0.710	147,578	3.388
	8.20		221.8	140.7	31,199		0.716	150,683	3.459
	8.30		222.6	141.5	31,489		0.723	153,818	3.531
	8.40		223.4	142.3	31,781		0.730	156,981	3.604
	8.50		224.2	143.1	32,074		0.736	160,174	3.677
	8.60		225.0	143.9	32,369		0.743	163,396	3.751
	8.70		225.8	144.7	32,664		0.750	166,648	3.826
	8.80		226.6	145.5	32,961		0.757	169,929	3.901
	8.90		227.4	146.3	33,260		0.764	173,240	3.977
	9.00		228.2	147.1	33,559		0.770	176,581	4.054
	9.10		229.0	147.9	33,860		0.777	179,952	4.131
	9.20		229.8	148.7	34,162		0.784	183,353	4.209
	9.30		230.6	149.5	34,466		0.791	186,784	4.288
	9.40		231.4	150.3	34,770		0.798	190,246	4.367
	9.50		232.2	151.1	35,076		0.805	193,738	4.448
	9.60		233.0	151.9	35,383		0.812	197,261	4.529
	9.70		233.8	152.7	35,692		0.819	200,815	4.610
	9.80		234.6	153.5	36,002		0.826	204,400	4.692

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



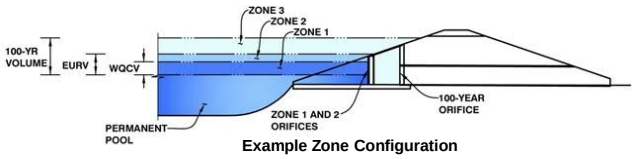


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



Example Zone Configuration

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
V)	2.82	0.489	Orifice Plate
V)	4.97	0.985	Orifice Plate
ır)	7.01	1.174	Weir&Pipe (Restrict)
Total (all zones)		2.648	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	4.97	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.66	3.31	2.85				
Orifice Area (sq. inches)	2.23	2.23	2.23	2.25				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.97	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.22	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.15	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.15	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.33	N/A	ft²
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	9.66	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft²
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	24.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	8.91	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.76	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.98	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.489	1.474	1.416	2.052	2.615	3.389	4.007	4.798	8.639
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.416	2.052	2.615	3.389	4.007	4.798	8.639
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.7	7.7	11.7	21.0	26.4	33.9	66.6
IPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.71	0.89	1.14	2.23
Peak Inflow Q (cfs) =	N/A	N/A	18.8	27.8	34.7	47.3	55.8	66.4	116.7
Peak Outflow Q (cfs) =	0.2	0.5	0.5	4.3	10.0	20.1	28.0	36.2	91.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.9	1.0	1.1	1.1	1.4
Structure Controlling Flow =	Plate	Overflow Weir	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	1.0	1.4	1.8	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	68	67	70	68	66	64	62	53
Time to Drain 99% of Inflow Volume (hours) =	40	72	71	75	75	74	73	72	68
Maximum Ponding Depth (ft) =	2.81	4.97	4.69	5.44	5.76	6.13	6.37	6.73	7.77
Area at Maximum Ponding Depth (acres) =	0.40	0.52	0.50	0.54	0.56	0.58	0.60	0.62	0.69
Maximum Volume Stored (acre-ft) =	0.489	1.477	1.329	1.726	1.903	2.115	2.251	2.477	3.157

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)

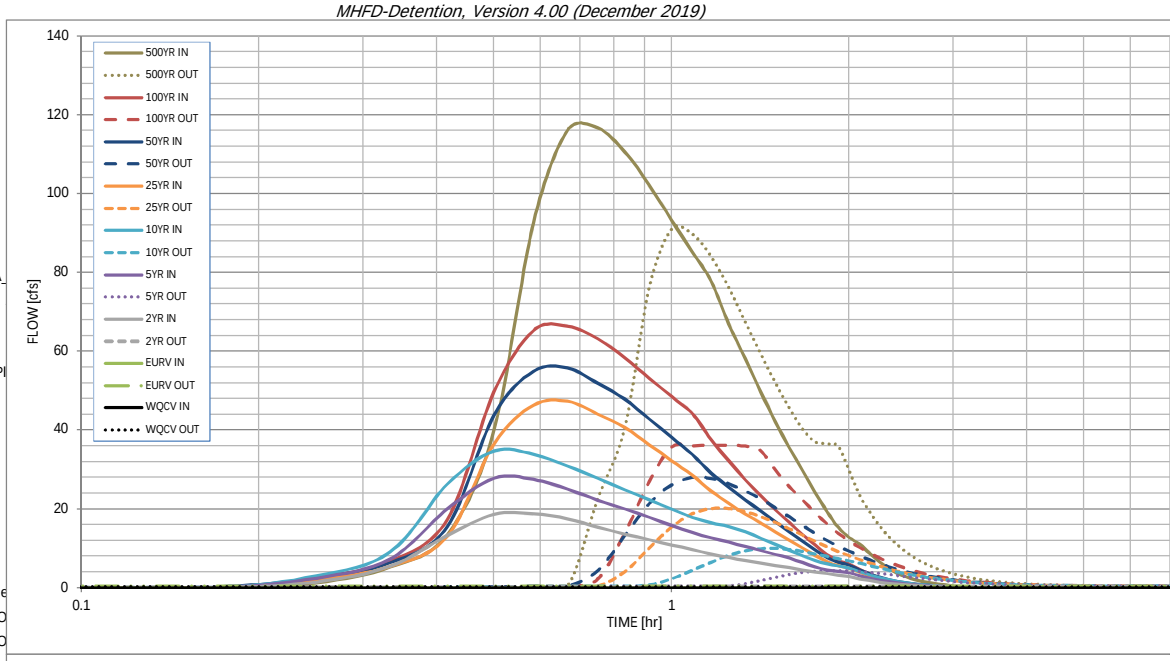
COUNTA_

WQ Pl

Unde

VertO

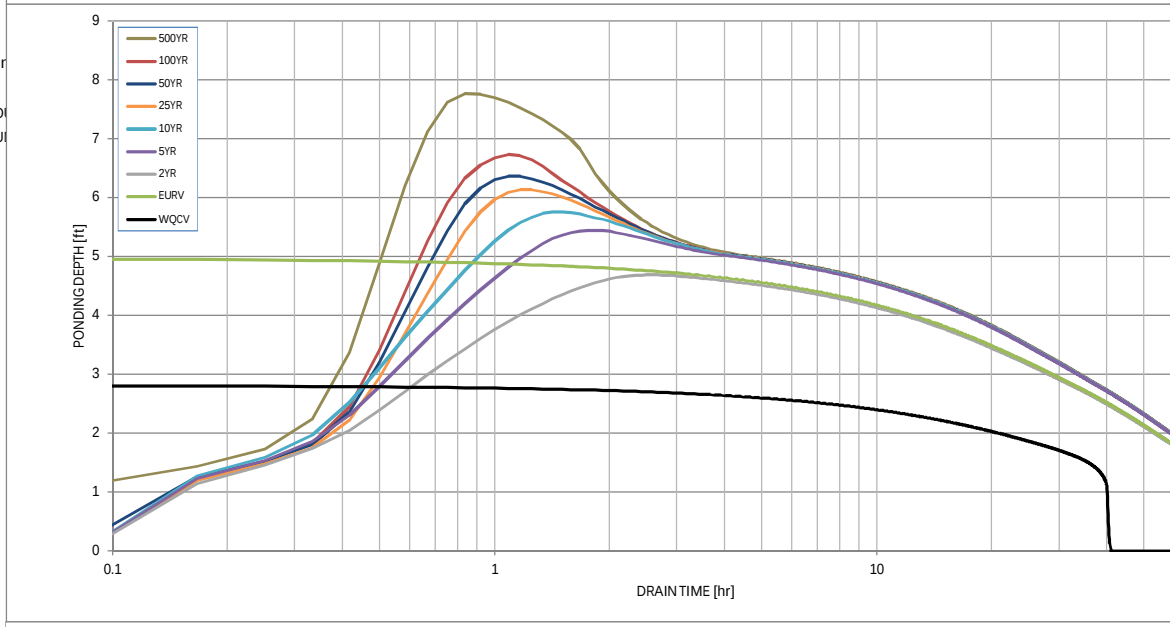
VertO



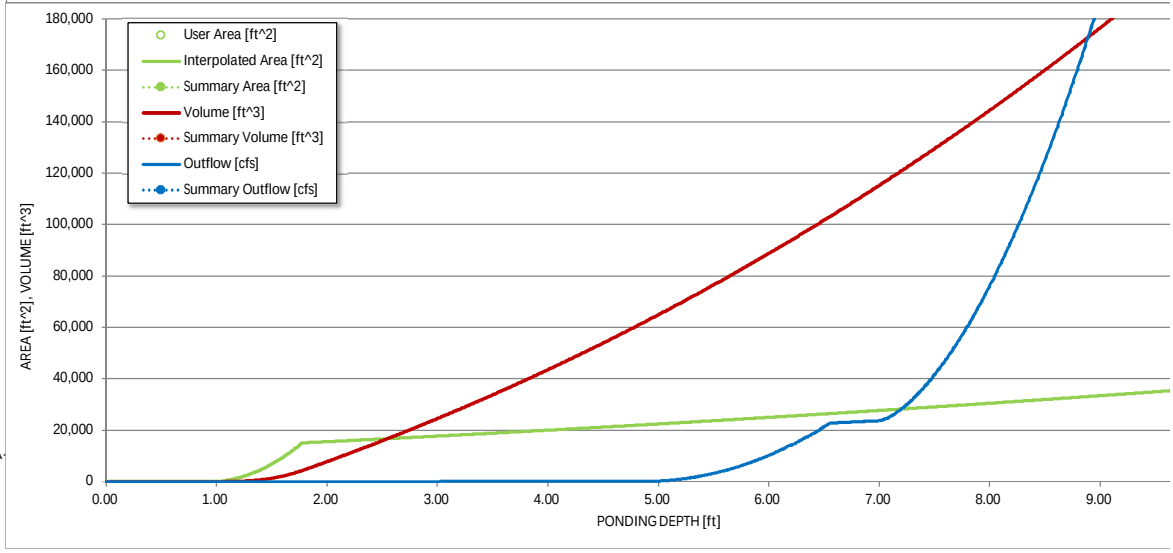
Cour

CO

COU



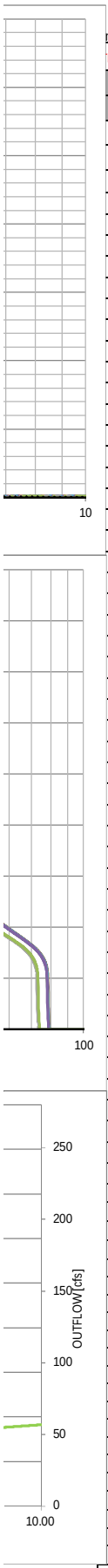
S-A-



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:



Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02	1.28
0:15:00	0.00	0.00	1.48	2.42	3.01	2.02	2.55	2.47	5.23
0:20:00	0.00	0.00	5.46	7.28	9.08	5.44	6.37	6.79	13.47
0:25:00	0.00	0.00	13.26	20.00	26.25	13.07	15.51	17.30	39.87
0:30:00	0.00	0.00	18.64	27.81	34.70	36.50	43.76	49.67	92.54
0:35:00	0.00	0.00	18.84	27.50	33.88	46.32	54.94	65.27	116.18
0:40:00	0.00	0.00	17.48	25.05	30.89	47.34	55.80	66.36	116.74
0:45:00	0.00	0.00	15.41	22.23	27.77	44.07	51.90	63.18	110.64
0:50:00	0.00	0.00	13.65	20.02	24.87	40.68	47.87	58.32	102.22
0:55:00	0.00	0.00	12.20	17.87	22.33	36.32	42.84	53.15	93.36
1:00:00	0.00	0.00	10.89	15.84	20.00	32.25	38.13	48.55	85.33
1:05:00	0.00	0.00	9.73	14.02	17.90	28.63	33.91	44.30	77.86
1:10:00	0.00	0.00	8.56	12.70	16.49	24.54	29.11	37.62	66.92
1:15:00	0.00	0.00	7.67	11.59	15.56	21.47	25.57	32.21	58.18
1:20:00	0.00	0.00	6.95	10.48	14.22	18.76	22.34	27.44	49.66
1:25:00	0.00	0.00	6.31	9.45	12.56	16.43	19.53	23.32	42.12
1:30:00	0.00	0.00	5.70	8.46	10.98	14.14	16.76	19.78	35.62
1:35:00	0.00	0.00	5.10	7.52	9.50	12.02	14.19	16.55	29.71
1:40:00	0.00	0.00	4.51	6.39	8.14	10.05	11.83	13.58	24.30
1:45:00	0.00	0.00	3.98	5.33	6.96	8.24	9.65	10.86	19.38
1:50:00	0.00	0.00	3.60	4.56	6.12	6.66	7.76	8.55	15.38
1:55:00	0.00	0.00	3.15	4.10	5.54	5.57	6.48	6.95	12.76
2:00:00	0.00	0.00	2.80	3.76	5.01	4.93	5.72	5.97	11.11
2:05:00	0.00	0.00	2.29	3.08	4.10	3.92	4.55	4.66	8.72
2:10:00	0.00	0.00	1.83	2.45	3.27	3.04	3.52	3.52	6.61
2:15:00	0.00	0.00	1.46	1.94	2.59	2.36	2.73	2.65	4.99
2:20:00	0.00	0.00	1.15	1.53	2.03	1.83	2.11	1.97	3.71
2:25:00	0.00	0.00	0.91	1.20	1.57	1.41	1.62	1.47	2.77
2:30:00	0.00	0.00	0.71	0.93	1.20	1.08	1.23	1.12	2.09
2:35:00	0.00	0.00	0.56	0.71	0.91	0.82	0.93	0.85	1.58
2:40:00	0.00	0.00	0.43	0.54	0.69	0.62	0.71	0.65	1.21
2:45:00	0.00	0.00	0.33	0.41	0.53	0.48	0.54	0.51	0.94
2:50:00	0.00	0.00	0.24	0.30	0.40	0.36	0.41	0.39	0.71
2:55:00	0.00	0.00	0.17	0.21	0.29	0.27	0.30	0.28	0.52
3:00:00	0.00	0.00	0.11	0.15	0.19	0.18	0.21	0.19	0.35
3:05:00	0.00	0.00	0.07	0.09	0.12	0.12	0.13	0.12	0.22
3:10:00	0.00	0.00	0.04	0.05	0.06	0.06	0.07	0.07	0.11
3:15:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.04
3:20:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

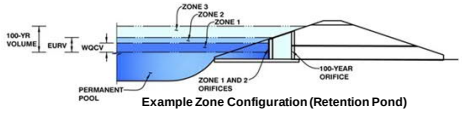
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	27.86	acres
Watershed Length =	1,290	ft
Watershed Length to Centroid =	775	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	50.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.479 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.489 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.408 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.012 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.543 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.255 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.834 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.566 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	8.151 acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.124 acre-feet		
Approximate 5-yr Detention Volume =	1.540 acre-feet		
Approximate 10-yr Detention Volume =	2.040 acre-feet		
Approximate 25-yr Detention Volume =	2.233 acre-feet		
Approximate 50-yr Detention Volume =	2.335 acre-feet		
Approximate 100-yr Detention Volume =	2.606 acre-feet		

Define Zones and Basin Geometry

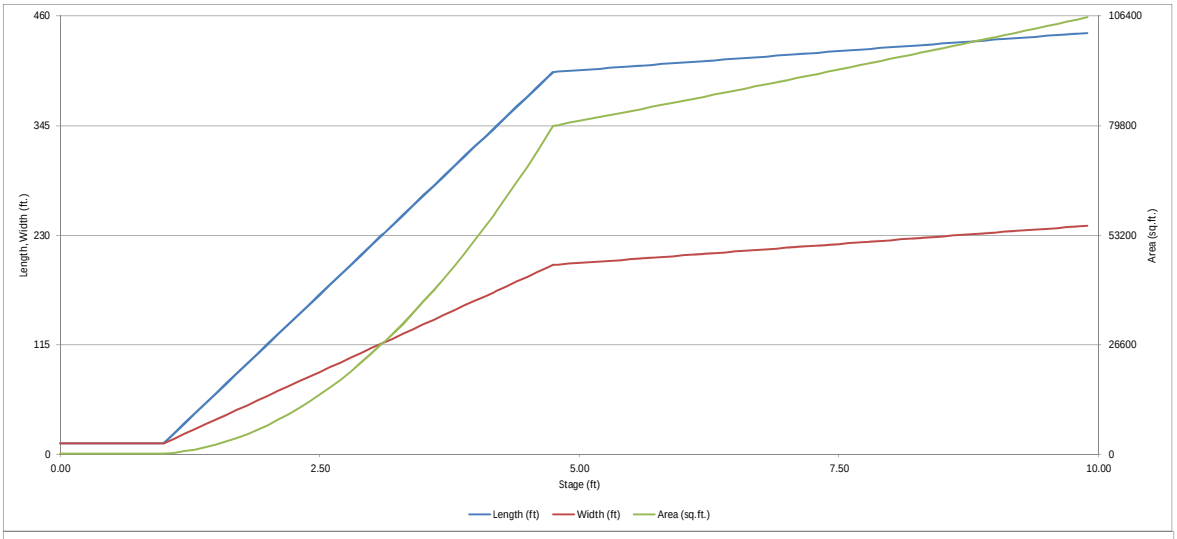
Zone 1 Volume (WQCV) =	0.479	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.010	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.356	acre-feet
Total Detention Basin Volume =	2.845	acre-feet
Initial Surcharge Volume (ISV) =	63	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.010	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio (R_{LW}) =	2	
Initial Surcharge Area (A_{ISV}) =	125	ft^2
Surcharge Volume Length (L_{ISV}) =	11.2	ft
Surcharge Volume Width (W_{ISV}) =	11.2	ft
Depth of Basin Floor (H_{FLOOR}) =	3.75	ft
Length of Basin Floor (L_{FLOOR}) =	401.2	ft
Width of Basin Floor (W_{FLOOR}) =	198.7	ft
Area of Basin Floor (A_{FLOOR}) =	79,711	ft^2
Volume of Basin Floor (V_{FLOOR}) =	103,743	ft^3
Depth of Main Basin (H_{MAIN}) =	0.25	ft
Length of Main Basin (L_{MAIN}) =	403.2	ft
Width of Main Basin (W_{MAIN}) =	200.7	ft
Area of Main Basin (A_{MAIN}) =	80,914	ft^2
Volume of Main Basin (V_{MAIN}) =	20,078	ft^3
Calculated Total Basin Volume (V_{total}) =	2.845	acre-feet

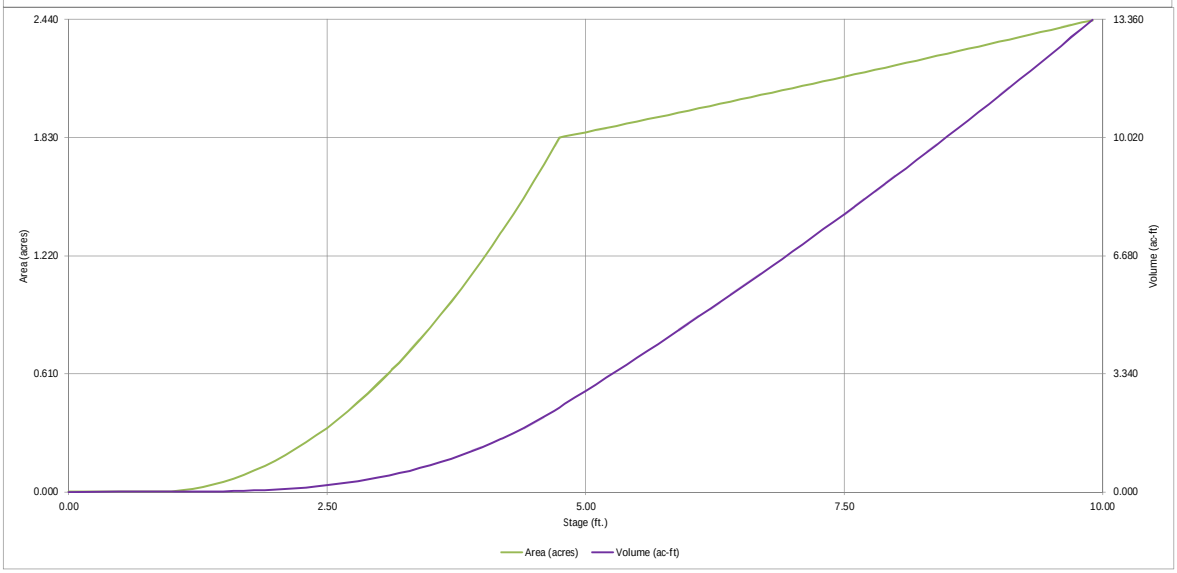
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		11.2	11.2	125		0.003		
ISV	0.50		11.2	11.2	125		0.003	63	0.001
	0.60		11.2	11.2	125		0.003	75	0.002
	0.70		11.2	11.2	125		0.003	88	0.002
	0.80		11.2	11.2	125		0.003	100	0.002
	0.90		11.2	11.2	125		0.003	113	0.003
	1.00		11.2	11.2	125		0.003	125	0.003
	1.10		21.6	16.2	349		0.008	148	0.003
	1.20		32.0	21.2	678		0.016	199	0.005
	1.30		42.4	26.2	1,110		0.025	287	0.007
	1.40		52.8	31.2	1,646		0.038	424	0.010
	1.50		63.2	36.2	2,287		0.052	620	0.014
	1.60		73.6	41.2	3,031		0.070	885	0.020
	1.70		84.0	46.2	3,879		0.089	1,229	0.028
	1.80		94.4	51.2	4,831		0.111	1,664	0.038
	1.90		104.8	56.2	5,888		0.135	2,199	0.050
	2.00		115.2	61.2	7,048		0.162	2,845	0.065
	2.10		125.6	66.2	8,312		0.191	3,612	0.083
	2.20		136.0	71.2	9,681		0.222	4,511	0.104
	2.30		146.4	76.2	11,153		0.256	5,552	0.127
	2.40		156.8	81.2	12,729		0.292	6,745	0.155
	2.50		167.2	86.2	14,409		0.331	8,101	0.186
	2.60		177.6	91.2	16,194		0.372	9,630	0.221
	2.70		188.0	96.2	18,082		0.415	11,343	0.260
	2.80		198.4	101.2	20,074		0.461	13,250	0.304
	2.90		208.8	106.2	22,170		0.509	15,362	0.353
	3.00		219.2	111.2	24,371		0.559	17,688	0.406
	3.10		229.6	116.2	26,675		0.612	20,239	0.465
Zone 1 (WQCV)	3.13		232.7	117.7	27,387		0.629	21,050	0.483
	3.20		240.0	121.2	29,083		0.668	23,026	0.529
	3.30		250.4	126.2	31,596		0.725	26,059	0.598
	3.40		260.8	131.2	34,212		0.785	29,349	0.674
	3.50		271.2	136.2	36,932		0.848	32,905	0.755
	3.60		281.6	141.2	39,756		0.913	36,739	0.843
	3.70		292.0	146.2	42,685		0.980	40,860	0.938
	3.80		302.4	151.2	45,717		1.050	45,279	1.039
	3.90		312.8	156.2	48,853		1.122	50,007	1.148
	4.00		323.2	161.2	52,094		1.196	55,053	1.264
	4.10		333.6	166.2	55,438		1.273	60,429	1.387
Zone 2 (EURV)	4.18		341.9	170.2	58,188		1.336	64,974	1.492
	4.20		344.0	171.2	58,886		1.352	66,144	1.518
	4.30		354.4	176.2	62,438		1.433	72,210	1.658
	4.40		364.8	181.2	66,095		1.517	78,635	1.805
	4.50		375.2	186.2	69,855		1.604	85,432	1.961
	4.60		385.6	191.2	73,719		1.692	92,610	2.126
	4.70		396.0	196.2	77,688		1.783	100,179	2.300
Floor	4.75		401.2	198.7	79,711		1.830	104,114	2.390
	4.80		401.6	199.1	79,951		1.835	108,106	2.482
	4.90		402.4	199.9	80,432		1.846	116,125	2.666
Z3 (100+1/2WQCV	5.00		403.2	200.7	80,914		1.858	124,192	2.851
	5.10		404.0	201.5	81,398		1.869	132,308	3.037
	5.20		404.8	202.3	81,883		1.880	140,472	3.225
	5.30		405.6	203.1	82,369		1.891	148,684	3.413
	5.40		406.4	203.9	82,857		1.902	156,946	3.603
	5.50		407.2	204.7	83,346		1.913	165,256	3.794
	5.60		408.0	205.5	83,836		1.925	173,615	3.986
	5.70		408.8	206.3	84,327		1.936	182,023	4.179
	5.80		409.6	207.1	84,820		1.947	190,481	4.373
	5.90		410.4	207.9	85,314		1.959	198,987	4.568
	6.00		411.2	208.7	85,809		1.970	207,543	4.765
	6.10		412.0	209.5	86,306		1.981	216,149	4.962
	6.20		412.8	210.3	86,804		1.993	224,805	5.161
	6.30		413.6	211.1	87,303		2.004	233,510	5.361
	6.40		414.4	211.9	87,803		2.016	242,265	5.562
	6.50		415.2	212.7	88,305		2.027	251,071	5.764
	6.60		416.0	213.5	88,808		2.039	259,926	5.967
	6.70		416.8	214.3	89,312		2.050	268,832	6.172
	6.80		417.6	215.1	89,818		2.062	277,789	6.377
	6.90		418.4	215.9	90,324		2.074	286,796	6.584
	7.00		419.2	216.7	90,832		2.085	295,854	6.792
	7.10		420.0	217.5	91,342		2.097	304,962	7.001
	7.20		420.8	218.3	91,852		2.109	314,122	7.211
	7.30		421.6	219.1	92,364		2.120	323,333	7.423
	7.40		422.4	219.9	92,877		2.132	332,595	7.635
	7.50		423.2	220.7	93,392		2.144	341,908	7.849
	7.60		424.0	221.5	93,908		2.156	351,273	8.064
	7.70		424.8	222.3	94,425		2.168	360,690	8.280
	7.80		425.6	223.1	94,943		2.180	370,158	8.498
	7.90		426.4	223.9	95,463		2.192	379,679	8.716
	8.00		427.2	224.7	95,983		2.203	389,251	8.936
	8.10		428.0	225.5	96,506		2.215	398,875	9.157
	8.20		428.8	226.3	97,029		2.227	408,552	9.379
	8.30		429.6	227.1	97,554		2.240	418,281	9.602
	8.40		430.4	227.9	98,080		2.252	428,063	9.827
	8.50		431.2	228.7	98,607		2.264	437,897	10.053
	8.60		432.0	229.5	99,135		2.276	447,784	10.280
	8.70		432.8	230.3	99,665		2.288	457,724	10.508
	8.80		433.6	231.1	100,196		2.300	467,717	10.737
	8.90		434.4	231.9	100,729		2.312	477,764	10.968
	9.00		435.2	232.7	101,262		2.325	487,863	11.200
	9.10		436.0	233.5	101,797		2.337	498,016	11.433
	9.20		436.8	234.3	102,334		2.349	508,223	11.667
	9.30		437.6	235.1	102,871		2.362	518,483	11.903
	9.40		438.4	235.9	103,410		2.374	528,797	12.140
	9.50		439.2	236.7	103,950		2.386	539,165	12.378
	9.60		440.0	237.5	104,491		2.399	549,587	12.617
	9.70		440.8	238.3	105,034		2.411	560,063	12.857
	9.80		441.6	239.1	105,578		2.424	570,594	13.099
	9.90		442.4	239.9	106,123		2.436	581,179	13.342

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



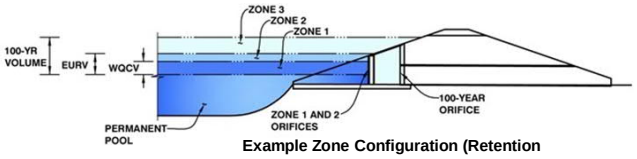


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
e 1 (WQCV)	3.13	0.479	Orifice Plate
e 2 (EURV)	4.18	1.010	Orifice Plate
1/2WQCV)	5.00	1.356	Weir&Pipe (Restrict)
Total (all zones)		2.845	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	4.11	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	ow 4 (optiona	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.37	2.74	3.20				
Orifice Area (sq. inches)	1.60	1.60	1.60	9.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =		N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =		N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =		N/A	feet
Vertical Orifice Diameter =		N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.11	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.11	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.76	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.50	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.25	N/A	ft²
Debris Clogging % =	70%	N/A	%				

Calculated Parameters for Overflow Weir

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

	one 3 Restrictc	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.04	N/A	ft²
Outlet Pipe Diameter =	33.00	N/A	inches	Outlet Orifice Centroid =	0.80	N/A	feet
Restrictor Plate Height Above Pipe Invert =	16.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.59	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.16	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	7.07	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.09	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.94	acre-ft

Calculated Parameters for Spillway

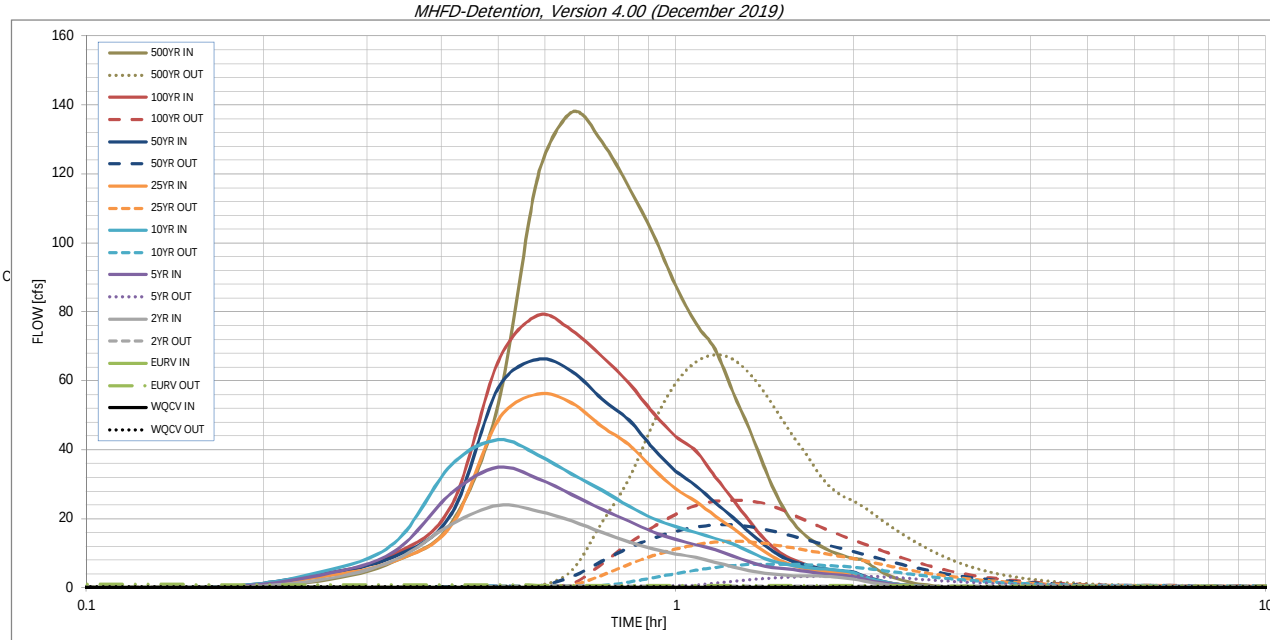
Routed Hydrograph Results

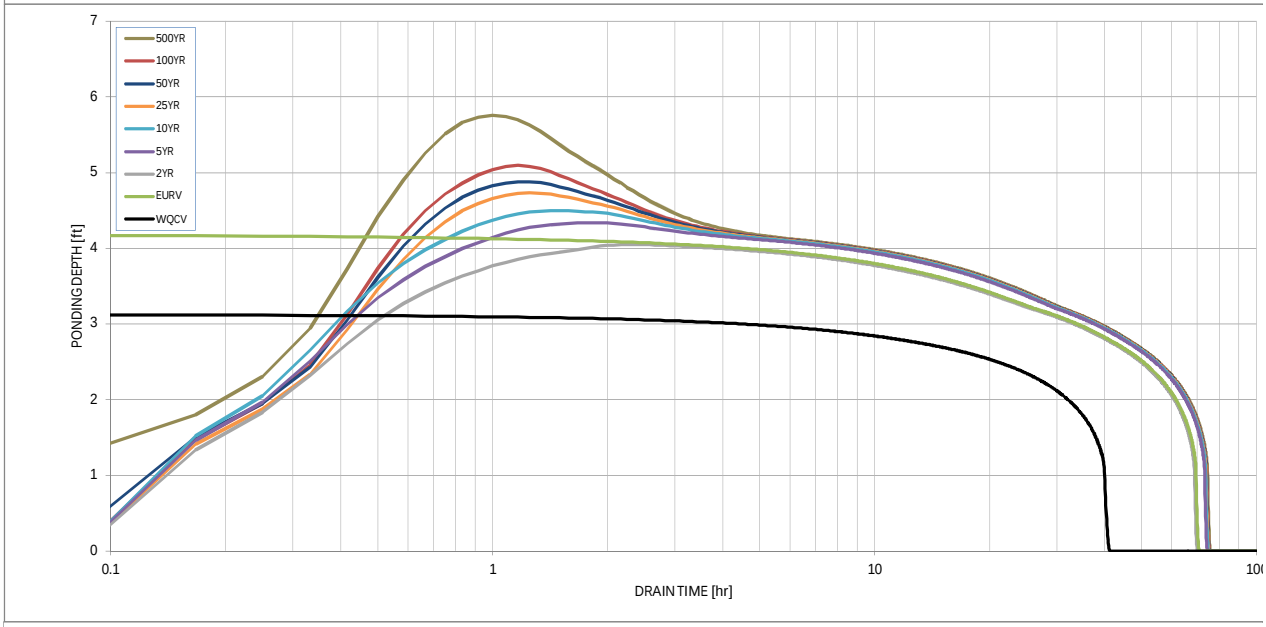
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

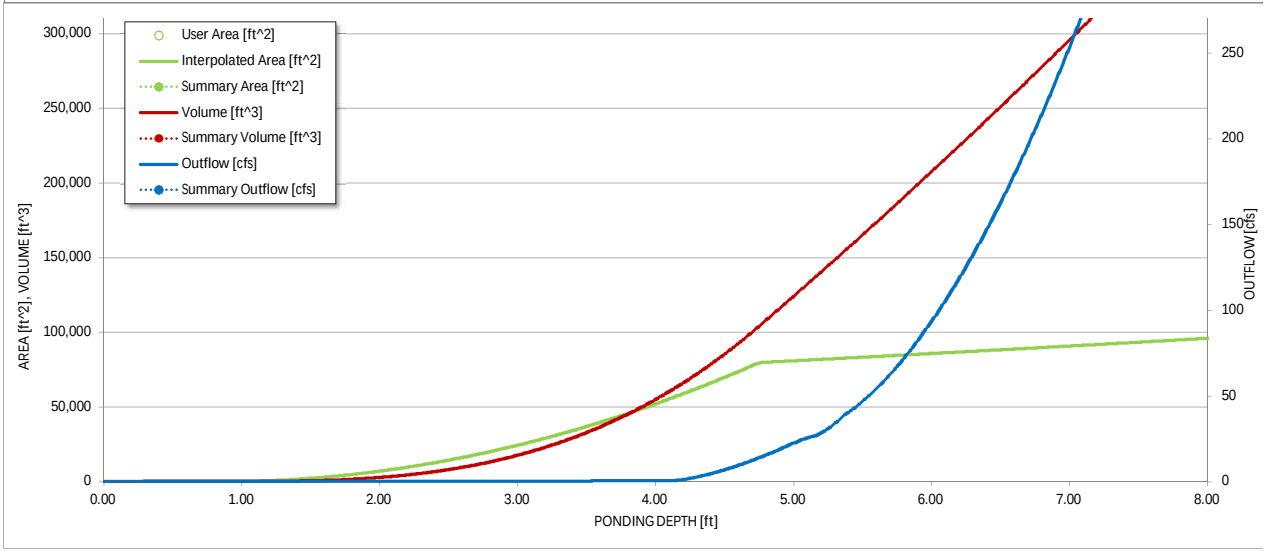
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.479	1.489	1.408	2.012	2.543	3.255	3.834	4.566	8.151
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.408	2.012	2.543	3.255	3.834	4.566	8.151
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.2	9.1	13.8	24.2	30.4	38.6	75.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.33	0.49	0.87	1.09	1.39	2.71
Peak Inflow Q (cfs) =	N/A	N/A	23.9	34.9	42.9	56.2	66.2	79.0	137.9
Peak Outflow Q (cfs) =	0.2	1.0	0.5	3.4	6.8	13.4	18.2	25.4	67.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.6	0.6	0.7	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	verflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	verflow Weir	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.2	0.4	0.7	1.0	1.4	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	64	63	66	65	63	61	59	51
Time to Drain 99% of Inflow Volume (hours) =	40	67	67	70	70	70	69	68	65
Maximum Ponding Depth (ft) =	3.13	4.18	4.05	4.34	4.50	4.73	4.88	5.09	5.75
Area at Maximum Ponding Depth (acres) =	0.63	1.34	1.23	1.46	1.59	1.81	1.84	1.87	1.94
Maximum Volume Stored (acre-ft) =	0.483	1.492	1.312	1.701	1.945	2.354	2.629	3.019	4.276

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.03	1.94
0:15:00	0.00	0.00	2.25	3.68	4.56	3.07	3.82	3.74	7.60
0:20:00	0.00	0.00	7.96	10.47	12.93	7.75	9.02	9.68	18.73
0:25:00	0.00	0.00	18.41	27.41	35.61	18.07	21.36	23.77	53.14
0:30:00	0.00	0.00	23.88	34.90	42.90	48.54	57.90	65.58	118.97
0:35:00	0.00	0.00	22.17	31.65	38.52	56.18	66.22	79.00	137.93
0:40:00	0.00	0.00	19.33	26.98	32.92	53.54	62.76	74.62	129.24
0:45:00	0.00	0.00	16.01	22.72	28.26	46.69	54.71	67.07	116.05
0:50:00	0.00	0.00	13.29	19.30	23.63	41.48	48.60	59.29	102.37
0:55:00	0.00	0.00	11.19	16.14	20.00	34.37	40.35	50.64	87.66
1:00:00	0.00	0.00	9.79	14.00	17.71	28.69	33.79	43.89	76.53
1:05:00	0.00	0.00	8.75	12.42	15.96	24.94	29.48	39.51	69.11
1:10:00	0.00	0.00	7.35	10.96	14.29	20.83	24.67	32.15	56.88
1:15:00	0.00	0.00	6.06	9.22	12.69	17.21	20.44	25.64	46.02
1:20:00	0.00	0.00	4.95	7.48	10.52	13.53	16.04	19.30	34.53
1:25:00	0.00	0.00	4.15	6.23	8.45	10.42	12.31	14.00	25.12
1:30:00	0.00	0.00	3.71	5.57	7.21	7.92	9.35	10.26	18.74
1:35:00	0.00	0.00	3.50	5.22	6.44	6.42	7.55	8.05	14.86
1:40:00	0.00	0.00	3.40	4.64	5.89	5.49	6.42	6.66	12.33
1:45:00	0.00	0.00	3.33	4.18	5.51	4.88	5.67	5.69	10.58
1:50:00	0.00	0.00	3.27	3.85	5.24	4.47	5.16	5.03	9.37
1:55:00	0.00	0.00	2.86	3.60	4.89	4.20	4.82	4.56	8.50
2:00:00	0.00	0.00	2.51	3.31	4.37	4.01	4.58	4.26	7.93
2:05:00	0.00	0.00	1.89	2.48	3.24	3.00	3.42	3.16	5.85
2:10:00	0.00	0.00	1.38	1.80	2.32	2.16	2.46	2.28	4.19
2:15:00	0.00	0.00	1.00	1.30	1.67	1.56	1.77	1.65	3.04
2:20:00	0.00	0.00	0.72	0.93	1.20	1.12	1.27	1.20	2.19
2:25:00	0.00	0.00	0.51	0.64	0.84	0.79	0.89	0.84	1.54
2:30:00	0.00	0.00	0.35	0.43	0.58	0.55	0.62	0.59	1.07
2:35:00	0.00	0.00	0.23	0.30	0.39	0.38	0.43	0.40	0.73
2:40:00	0.00	0.00	0.14	0.19	0.24	0.24	0.27	0.26	0.46
2:45:00	0.00	0.00	0.07	0.10	0.13	0.14	0.15	0.14	0.25
2:50:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.11
2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

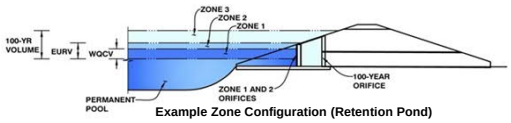
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Pond C with offsite flow

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	224.42	acres
Watershed Length =	5,645	ft
Watershed Length to Centroid =	3,387	ft
Watershed Slope =	0.034	ft/ft
Watershed Imperviousness =	10.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.285	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.178	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.054	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.693	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.318	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	16.758	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	21.161	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	27.489	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	55.501	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.394	acre-feet		
Approximate 5-yr Detention Volume =	2.182	acre-feet		
Approximate 10-yr Detention Volume =	4.471	acre-feet		
Approximate 25-yr Detention Volume =	6.215	acre-feet		
Approximate 50-yr Detention Volume =	6.507	acre-feet		
Approximate 100-yr Detention Volume =	8.396	acre-feet		

Define Zones and Basin Geometry

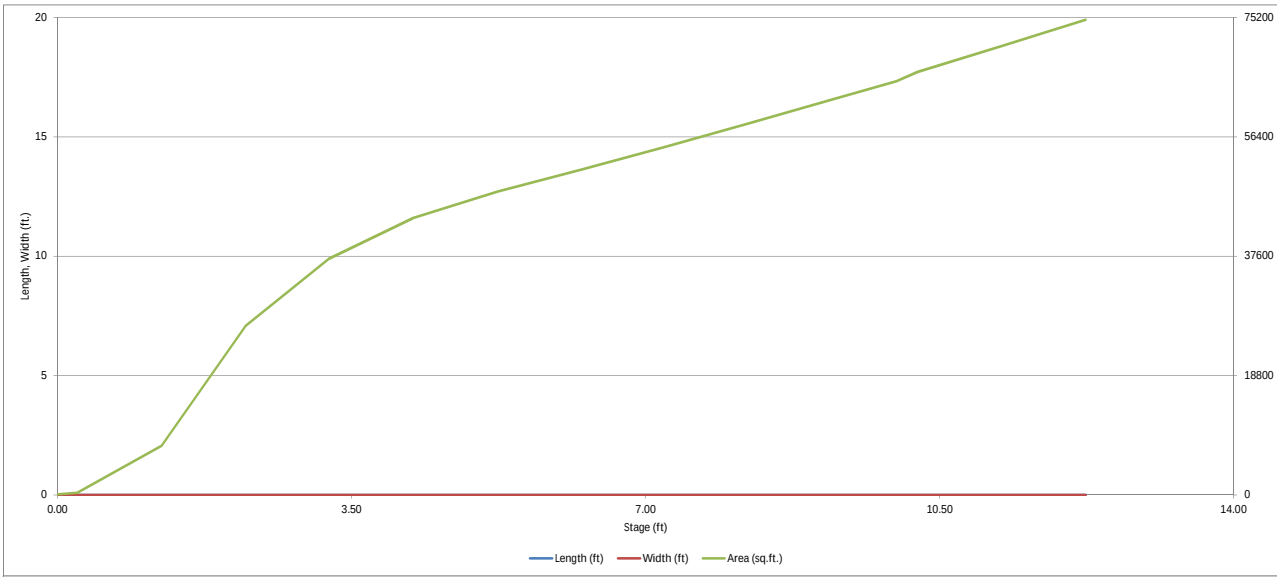
Zone 1 Volume (WQCV) =	1.285	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.893	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	6.861	acre-feet
Total Detention Basin Volume =	9.038	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

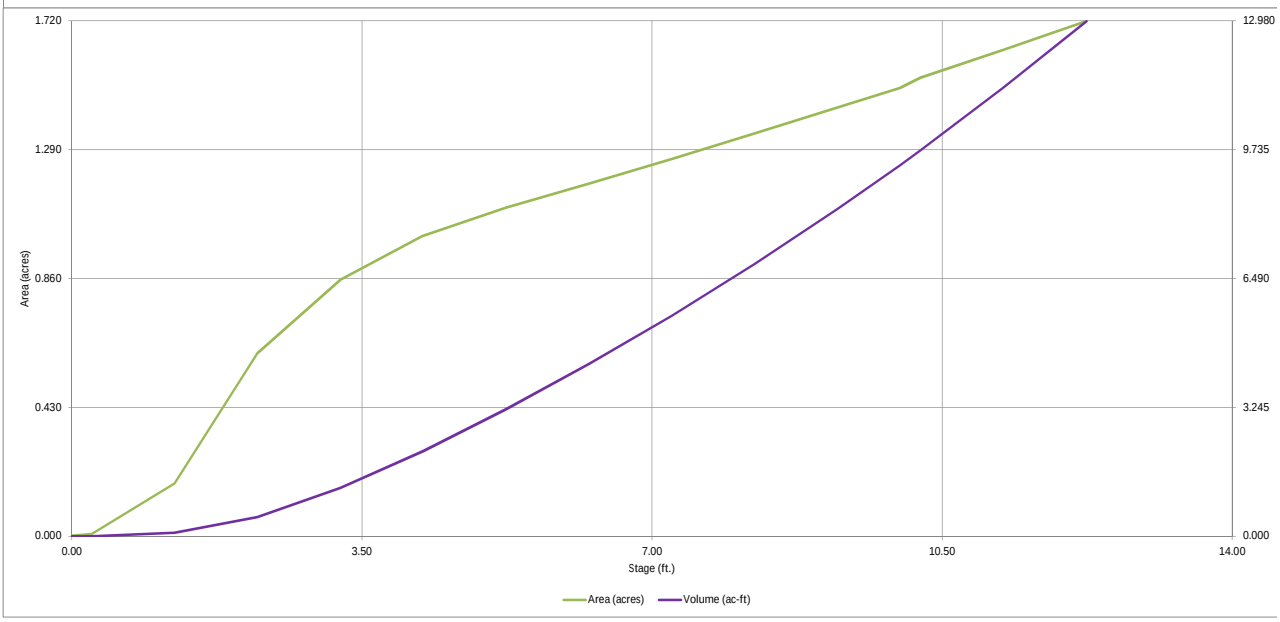
Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	90	0.002		
7107	--	0.24	--	--	--	331	0.008	51	0.001
7108	--	1.24	--	--	--	7,689	0.177	4,061	0.093
7109	--	2.24	--	--	--	26,604	0.611	21,207	0.487
7110	--	3.24	--	--	--	37,234	0.855	53,126	1.220
7111	--	4.24	--	--	--	43,658	1.002	93,573	2.148
7112	--	5.24	--	--	--	47,762	1.096	139,282	3.197
7113	--	6.24	--	--	--	51,250	1.177	188,788	4.334
7114	--	7.24	--	--	--	54,827	1.259	241,827	5.552
7115	--	8.24	--	--	--	58,544	1.344	298,513	6.853
7116	--	9.24	--	--	--	62,316	1.431	358,943	8.240
7116.75* Spillway	--	9.99	--	--	--	65,152	1.496	406,744	9.338
7117	--	10.24	--	--	--	66,643	1.530	423,218	9.716
7118	--	11.24	--	--	--	70,696	1.623	491,888	11.292
7119	--	12.24	--	--	--	74,859	1.719	564,665	12.963

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



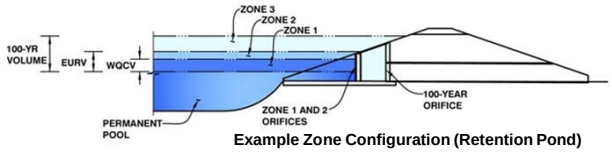


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Pond C with offsite flow

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.32	1.285	Orifice Plate
Zone 2 (EURV)	4.27	0.893	Orifice Plate
Zone 3 (100+1/2WQCV)	9.79	6.861	Weir&Pipe (Restrict)
Total (all zones)		9.038	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	3.660E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.27	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	17.72	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	5.27	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	3.00					
Orifice Area (sq. inches)	5.27	5.27	5.27					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orif

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	4.36	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.47	N/A
Overflow Weir Front Edge Length =	7.00	N/A	feet	Overflow Weir Slope Length =	12.80	N/A
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.22	N/A
Horiz. Length of Weir Sides =	12.42	N/A	feet	Overflow Grate Open Area w/o Debris =	70.89	N/A
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	17.72	N/A
Debris Clogging % =	75%	N/A	%			

Calculated Parameters for Overflow W

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	6.29	0.00	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	9.82	
Outlet Pipe Diameter =	48.00		inches	Outlet Orifice Centroid =	1.62	
Restrictor Plate Height Above Pipe Invert =	35.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.05	

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.99	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.74	feet
Spillway Crest Length =	123.00	feet	Stage at Top of Freeboard =	11.73	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.67	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	12.10	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AI*

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	1.285	2.178	3.054	6.693	10.318	16.758	21.161	27.489
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.054	6.693	10.318	16.758	21.161	27.489
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	17.6	49.5	77.1	142.4	179.0	229.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.22	0.34	0.63	0.80	1.02
Peak Inflow Q (cfs) =	N/A	N/A	29.3	63.0	90.7	154.7	191.6	243.4
Peak Outflow Q (cfs) =	0.7	0.9	2.4	20.6	43.8	91.6	124.1	173.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.6	0.7	0.8
Structure Controlling Flow =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.02	0.3	0.6	1.3	1.7	2.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	50	57	54	50	45	41	36
Time to Drain 99% of Inflow Volume (hours) =	40	53	62	61	59	56	54	52
Maximum Ponding Depth (ft) =	3.32	4.27	4.80	6.22	7.10	8.35	9.02	9.94
Area at Maximum Ponding Depth (acres) =	0.87	1.01	1.05	1.17	1.25	1.35	1.41	1.49
Maximum Volume Stored (acre-ft) =	1.288	2.178	2.714	4.310	5.376	6.988	7.928	9.263

ice

ft^2
feet

eir

feet
feet

ft^2
ft^2

ate

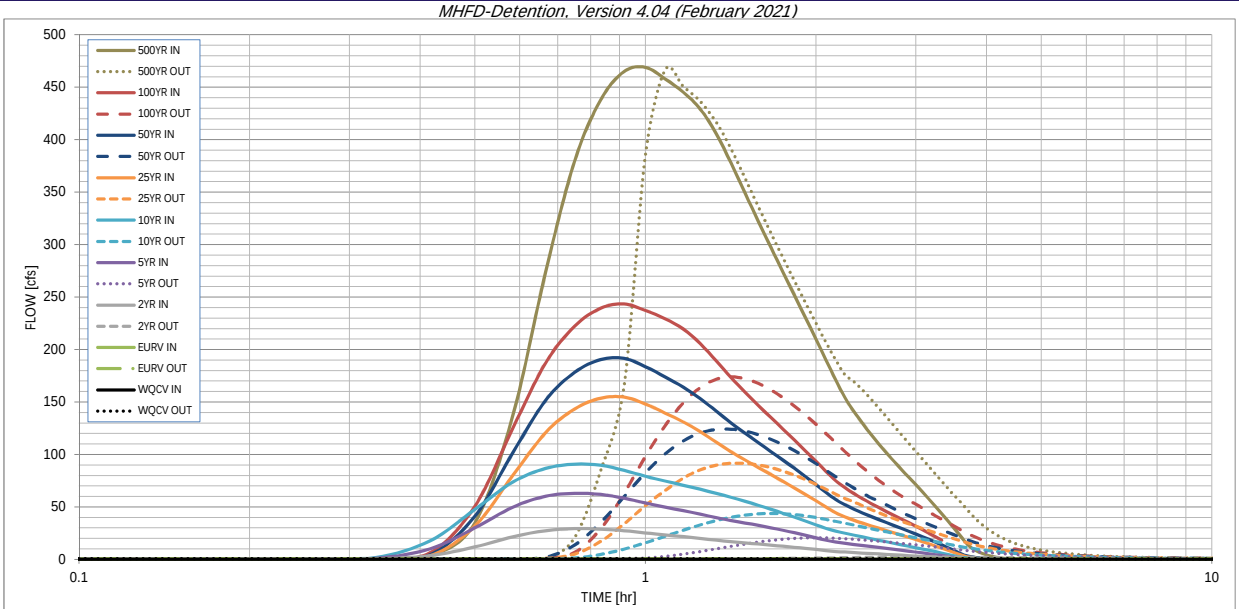
ft^2
feet
radians

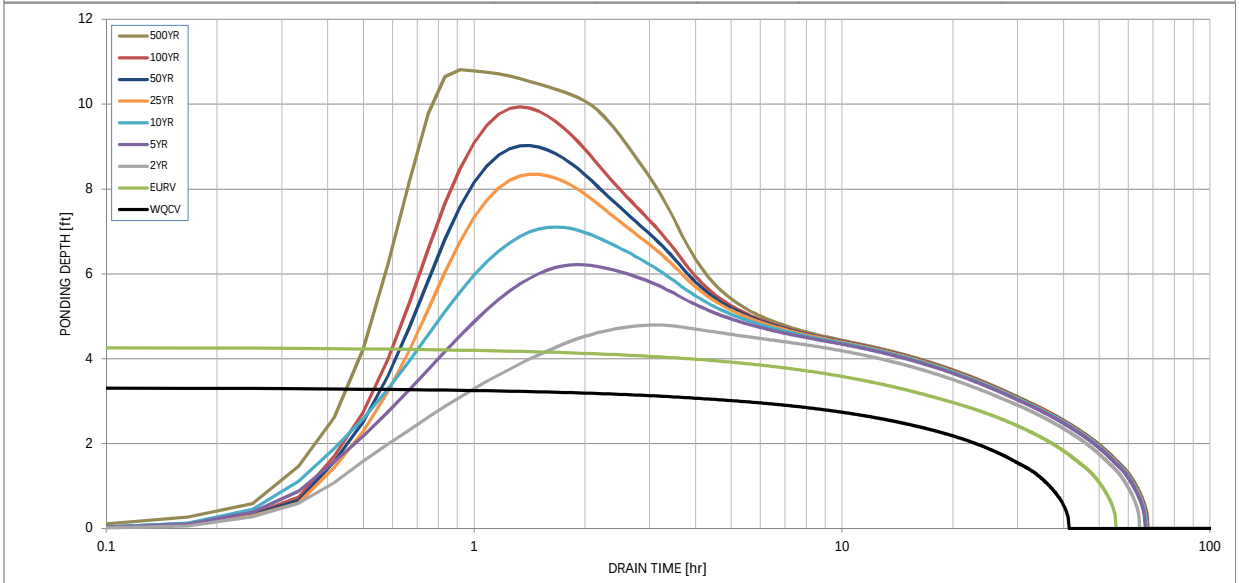
5).

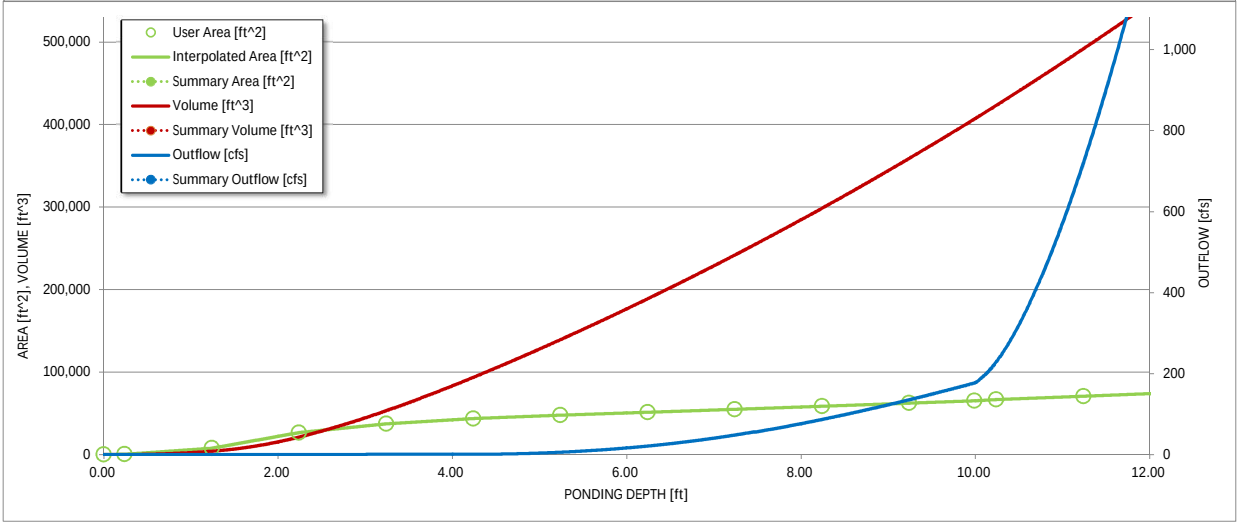
500 Year
4.00
55.501
55.501
455.8
2.03
469.0
466.7
1.0
Spillway
2.6
N/A
20
44
10.81
1.58
10.603

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.08
	0:15:00	0.00	0.00	0.09	0.15	0.19	0.13	0.17	0.16	0.44
	0:20:00	0.00	0.00	0.46	1.05	1.76	0.51	0.62	0.65	3.37
	0:25:00	0.00	0.00	3.52	9.98	17.69	3.45	4.47	6.28	34.90
	0:30:00	0.00	0.00	11.93	30.05	47.70	31.84	41.28	50.76	137.07
	0:35:00	0.00	0.00	21.52	49.78	73.78	79.92	101.83	125.08	274.28
	0:40:00	0.00	0.00	27.38	60.22	86.67	120.91	151.70	187.33	379.67
	0:45:00	0.00	0.00	29.25	62.98	90.72	143.37	178.24	222.26	437.75
	0:50:00	0.00	0.00	28.91	61.90	89.69	153.61	190.33	239.35	464.94
	0:55:00	0.00	0.00	27.31	58.31	84.83	154.68	191.57	243.35	468.96
	1:00:00	0.00	0.00	25.18	53.76	79.20	148.05	183.67	237.22	457.96
	1:05:00	0.00	0.00	23.30	49.83	74.65	139.47	173.85	229.30	445.23
	1:10:00	0.00	0.00	21.67	46.46	70.66	130.94	164.08	219.55	429.09
	1:15:00	0.00	0.00	20.00	43.13	66.79	121.64	153.20	205.59	405.92
	1:20:00	0.00	0.00	18.33	39.85	62.92	111.74	141.31	189.15	377.68
	1:25:00	0.00	0.00	16.89	37.05	59.18	102.49	129.96	173.22	348.90
	1:30:00	0.00	0.00	15.71	34.69	55.38	94.65	120.20	159.28	322.04
	1:35:00	0.00	0.00	14.62	32.42	51.53	87.45	111.13	146.62	296.98
	1:40:00	0.00	0.00	13.57	30.12	47.70	80.71	102.63	135.06	273.69
	1:45:00	0.00	0.00	12.54	27.73	43.94	74.27	94.49	124.18	251.62
	1:50:00	0.00	0.00	11.51	25.31	40.27	68.04	86.63	113.68	230.48
	1:55:00	0.00	0.00	10.47	22.89	36.64	61.91	78.93	103.47	209.98
	2:00:00	0.00	0.00	9.42	20.50	32.98	55.88	71.36	93.53	190.08
	2:05:00	0.00	0.00	8.40	18.24	29.54	49.93	63.88	83.80	170.99
	2:10:00	0.00	0.00	7.56	16.54	26.96	44.50	57.07	74.97	154.29
	2:15:00	0.00	0.00	6.99	15.33	24.95	40.53	52.07	68.30	141.02
	2:20:00	0.00	0.00	6.50	14.25	23.11	37.31	47.94	62.76	129.64
	2:25:00	0.00	0.00	6.05	13.24	21.40	34.51	44.31	57.85	119.36
	2:30:00	0.00	0.00	5.61	12.27	19.77	31.96	40.98	53.40	109.96
	2:35:00	0.00	0.00	5.19	11.33	18.21	29.61	37.92	49.28	101.24
	2:40:00	0.00	0.00	4.78	10.42	16.69	27.35	34.98	45.43	93.08
	2:45:00	0.00	0.00	4.38	9.53	15.24	25.17	32.18	41.82	85.46
	2:50:00	0.00	0.00	3.99	8.66	13.83	23.07	29.47	38.41	78.26
	2:55:00	0.00	0.00	3.61	7.80	12.48	20.99	26.82	35.02	71.23
	3:00:00	0.00	0.00	3.22	6.96	11.18	18.93	24.20	31.66	64.33
	3:05:00	0.00	0.00	2.84	6.13	9.88	16.88	21.59	28.30	57.45
	3:10:00	0.00	0.00	2.46	5.30	8.60	14.84	19.00	24.94	50.60
	3:15:00	0.00	0.00	2.09	4.48	7.32	12.80	16.41	21.60	43.76
	3:20:00	0.00	0.00	1.71	3.67	6.05	10.77	13.83	18.25	36.94
	3:25:00	0.00	0.00	1.34	2.85	4.79	8.74	11.25	14.92	30.15
	3:30:00	0.00	0.00	0.98	2.05	3.54	6.71	8.69	11.59	23.40
	3:35:00	0.00	0.00	0.62	1.27	2.37	4.71	6.15	8.30	16.92
	3:40:00	0.00	0.00	0.35	0.78	1.68	2.85	3.83	5.32	11.64
	3:45:00	0.00	0.00	0.24	0.58	1.32	1.82	2.56	3.55	8.30
	3:50:00	0.00	0.00	0.19	0.45	1.05	1.19	1.76	2.42	6.00
	3:55:00	0.00	0.00	0.15	0.37	0.84	0.80	1.23	1.61	4.27
	4:00:00	0.00	0.00	0.12	0.29	0.67	0.52	0.84	1.03	2.97
	4:05:00	0.00	0.00	0.10	0.23	0.52	0.36	0.60	0.63	2.00
	4:10:00	0.00	0.00	0.08	0.18	0.39	0.24	0.41	0.35	1.29
	4:15:00	0.00	0.00	0.06	0.13	0.28	0.16	0.28	0.20	0.83
	4:20:00	0.00	0.00	0.05	0.10	0.20	0.12	0.20	0.15	0.60
	4:25:00	0.00	0.00	0.04	0.07	0.14	0.08	0.15	0.12	0.44
	4:30:00	0.00	0.00	0.03	0.05	0.11	0.06	0.12	0.09	0.35
	4:35:00	0.00	0.00	0.02	0.04	0.08	0.05	0.09	0.07	0.27
	4:40:00	0.00	0.00	0.02	0.02	0.06	0.03	0.06	0.05	0.20
	4:45:00	0.00	0.00	0.01	0.01	0.04	0.02	0.05	0.04	0.14
	4:50:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.09
	4:55:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.06
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

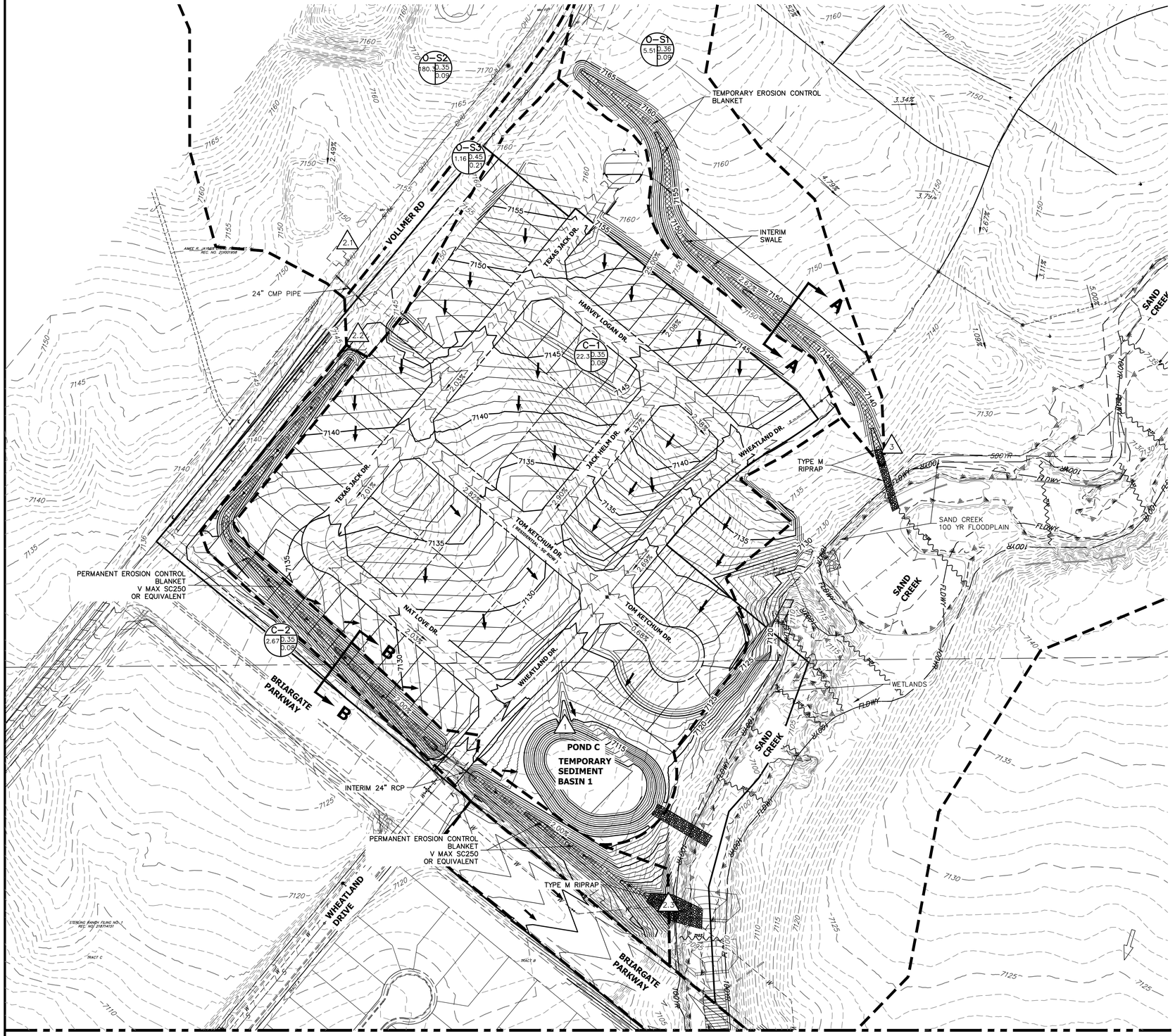
Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

EARLY GRADING - DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

CHECK DAM

EXISTING 6100 PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

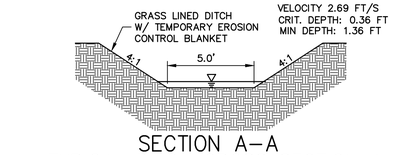
Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Off-Site Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	OS,O-S4,O-S5,OS-6,OS-7	250.76	2%	187,624	201,393

BASIN - SUMMARY TABLE

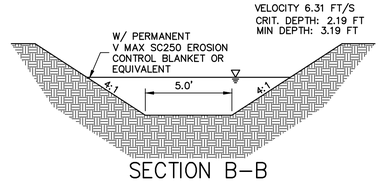
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
C-1	22.30	2.0%	0.08	0.35	40.1	3.6	26.8
C-2	2.67	2.0%	0.08	0.35	24.9	0.6	4.3
D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
2.1	28.1	192.9
2.2	28.5	194.5
2.3	28.9	197.3
3	1.1	7.3
4	12.4	91.3
5	1.2	8.9
6.1	7.1	52.1
6.2	3.5	77.4
7	26.7	196.2
8	2.3	16.8



SECTION A–A
TYPICAL DITCH CROSS SECTION A–A



SECTION B–B
TYPICAL DITCH CROSS SECTION B–B

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
3/23/22
SHEET 1 OF 4

J·R ENGINEERING
A Westrian Company

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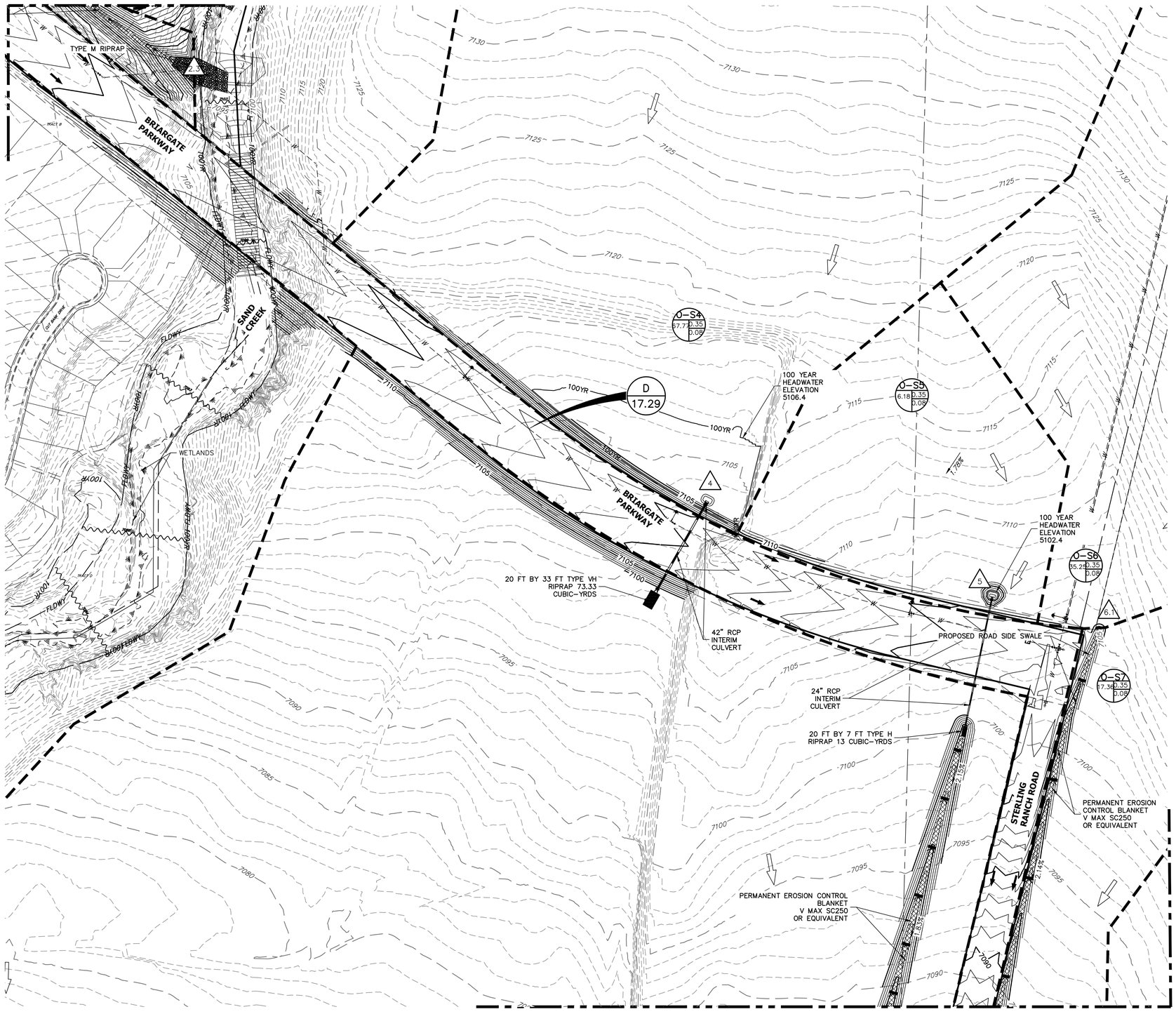
EARLY GRADING - DRAINAGE MAP

SEE SHEET 1

SEE SHEET 1



SEE SHEET 3

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

CHECK DAM

EXISTING 6100

PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Off-Site Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	OS,O-S4,O-S5,OS-6,OS-7	250.76	2%	187,624	201,393

BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
C-1	22.30	2.0%	0.08	0.35	40.1	3.6	26.8
C-2	2.67	2.0%	0.08	0.35	24.9	0.6	4.3
D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
2.1	28.1	192.9
2.2	28.5	194.5
2.3	28.9	197.3
3	1.1	7.3
4	12.4	91.3
5	1.2	8.9
6.1	7.1	52.1
6.2	3.5	77.4
7	26.7	196.2
8	2.3	16.8

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
3/23/22
SHEET 2 OF 4

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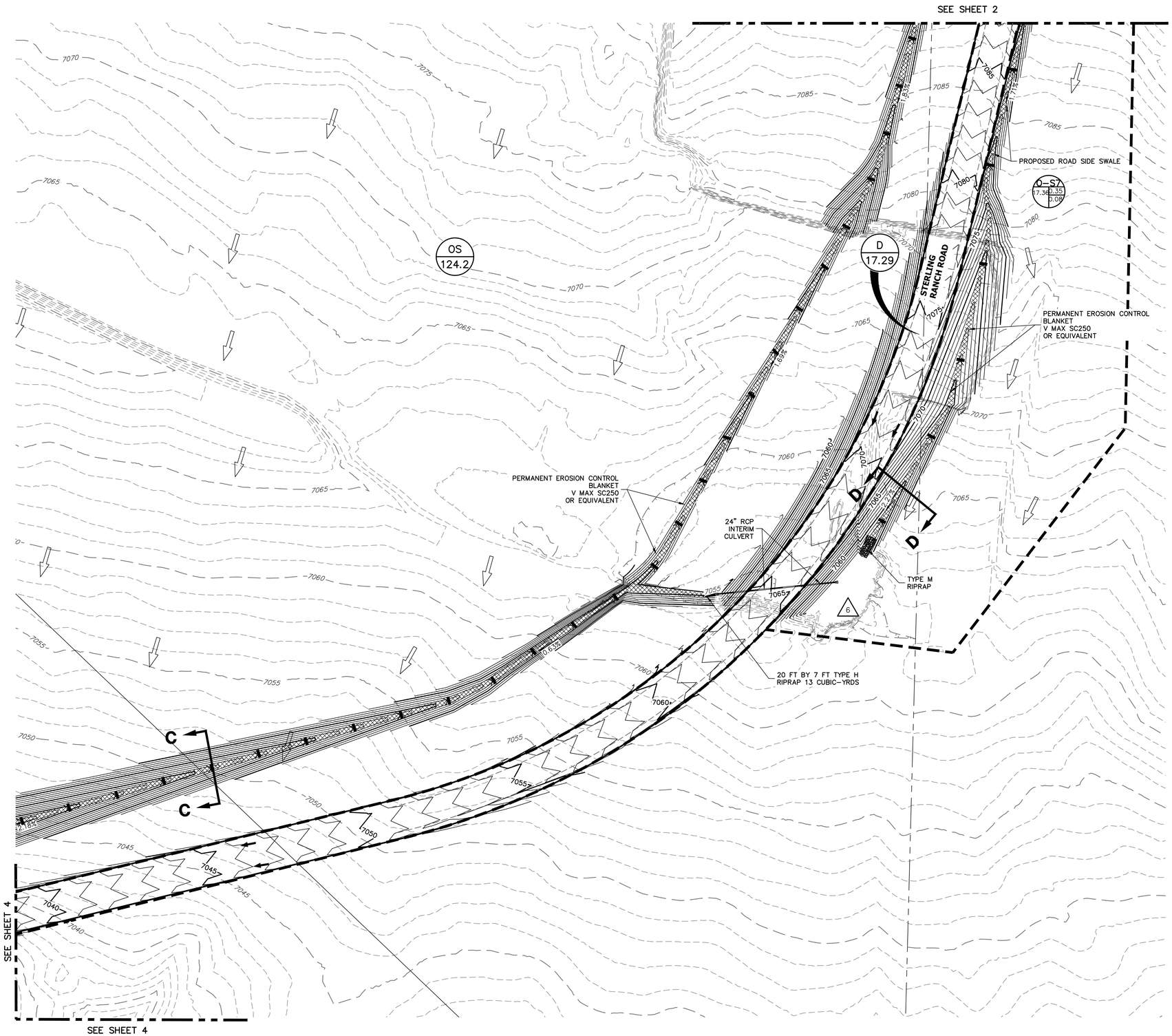
EARLY GRADING - DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

CHECK DAM

EXISTING 6100

PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

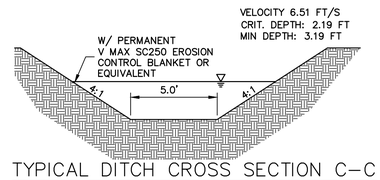
Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Off-Site Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	OS,O-S4,O-S5,OS-6,OS-7	250.76	2%	187,624	201,393

BASIN - SUMMARY TABLE

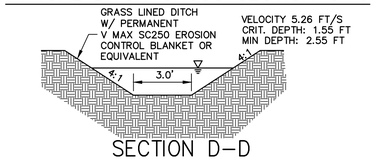
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
C-1	22.30	2.0%	0.08	0.35	40.1	3.6	26.8
C-2	2.67	2.0%	0.08	0.35	24.9	0.6	4.3
D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
2.1	28.1	192.9
2.2	28.5	194.5
2.3	28.9	197.3
3	1.1	7.3
4	12.4	91.3
5	1.2	8.9
6.1	7.1	52.1
6.2	3.5	77.4
7	26.7	196.2
8	2.3	16.8



TYPICAL DITCH CROSS SECTION C–C



SECTION D–D
TYPICAL DITCH CROSS SECTION D–D

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/5/22
SHEET 3 OF 4

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A Westrian Company

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EARLY GRADING - DRAINAGE MAP

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

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STORM SEWER PROPOSED

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PROPOSED PROPERTY LINES

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ROW EXISTING

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PROPOSED 6100

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D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
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7	26.7	196.2
8	2.3	16.8

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/5/22
SHEET 4 OF 4

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X:\25\10000.all\25188000\Drawings\Sheet Dwgs\Homestead North Filing No1\Drainage\25188000R01 Early Grading.dwg, Early Grading (4), 1/11/2022 2:31:28 PM, FC

Description

Mulching consists of evenly applying straw, hay, shredded wood mulch, rock, bark or compost to disturbed soils and securing the mulch by crimping, tackifiers, netting or other measures. Mulching helps reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff. Although often applied in conjunction with temporary or permanent seeding, it can also be used for temporary stabilization of areas that cannot be reseeded due to seasonal constraints.

Photograph MU-1. An area that was recently seeded, mulched, and crimped.

Mulch can be applied either using standard mechanical dry application methods or using hydromulching equipment that hydraulically applies a slurry of water, wood fiber mulch, and often a tackifier.

Appropriate Uses

Use mulch in conjunction with seeding to help protect the seedbed and stabilize the soil. Mulch can also be used as a temporary cover on low to mild slopes to help temporarily stabilize disturbed areas where growing season constraints prevent effective reseeding. Disturbed areas should be properly mulched and tacked, or seeded, mulched and tacked promptly after final grade is reached (typically within no longer than 14 days) on portions of the site not otherwise permanently stabilized.

Standard dry mulching is encouraged in most jurisdictions; however, hydromulching may not be allowed in certain jurisdictions or may not be allowed near waterways.

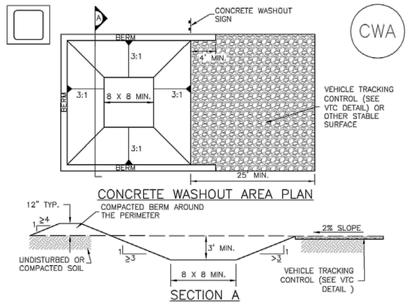
Do not apply mulch during windy conditions.

Design and Installation

Prior to mulching, surface-roughen areas by rolling with a crimping or punching type roller or by track walking. Track walking should only be used where other methods are impractical because track walking with heavy equipment typically compacts the soil.

A variety of mulches can be used effectively at construction sites. Consider the following:

Mulch	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No



CWA-1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -CWA INSTALLATION LOCATION.
2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.
3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.
4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.
5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.
6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.
7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

Table TS/PS-2. Minimum Drill Seeding Rates for Perennial Grasses

Common[a] Name	Botanical Name	Growth Season[b]	Growth Form	Seeds/ Pound	Pounds of PLS/acre
Alakali Soil Seed Mix					
Alkali sacaton	*Sporobolus airoides*	Cool	Bunch	1,750,000	0.25
Basin wildrye	*Elymus cinereus*	Cool	Bunch	165,000	2.5
Sodar streambank wheatgrass	*Agropyron riparium 'Sodar'*	Cool	Sod	170,000	2.5
Jose tall wheatgrass	*Agropyron elongatum 'Jose'*	Cool	Bunch	79,000	7.0
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	5.5
Total					**17.75**
Fertile Loamy Soil Seed Mix					
Ephriam crested wheatgrass	*Agropyron cristatum 'Ephriam'*	Cool	Sod	175,000	2.0
Dural hard fescue	*Festuca ovina 'duriuscula'*	Cool	Bunch	565,000	1.0
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Sodar streambank wheatgrass	*Agropyron riparium 'Sodar'*	Cool	Sod	170,000	2.5
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	7.0
Total					**15.5**
High Water Table Soil Seed Mix					
Meadow foxtail	*Alopecurus pratensis*	Cool	Sod	900,000	0.5
Redtop	*Agrostis alba*	Warm	Open sod	5,000,000	0.25
Reed canarygrass	*Phalaris arundinacea*	Cool	Sod	68,000	0.5
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Pathfinder switchgrass	*Panicum virgatum 'Pathfinder'*	Warm	Sod	389,000	1.0
Alkar tall wheatgrass	*Agropyron elongatum 'Alkar'*	Cool	Bunch	79,000	5.5
Total					**10.75**
Transition Turf Seed Mix[c]					
Ruebens Canadian bluegrass	*Poa compressa 'Ruebens'*	Cool	Sod	2,500,000	0.5
Dural hard fescue	*Festuca ovina 'duriuscula'*	Cool	Bunch	565,000	1.0
Citation perennial ryegrass	*Lolium perenne 'Citation'*	Cool	Sod	247,000	3.0
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Total					**7.5**

Table TS/PS-2. Minimum Drill Seeding Rates for Perennial Grasses (cont.)

Common Name	Botanical Name	Growth Season[b]	Growth Form	Seeds/ Pound	Pounds of PLS/acre
Sandy Soil Seed Mix					
Blue grama	*Boutelous gracilis*	Warm	Sod-forming bunchgrass	825,000	0.5
Camper little bluestem	*Schizachyrium scoparium 'Camper'*	Warm	Bunch	240,000	1.0
Prairie sandreed	*Calamovilfa longifolia*	Warm	Open sod	274,000	1.0
Sand dropseed	*Sporobolus cryptandrus*	Cool	Bunch	5,298,000	0.25
Vaughn sideoats grama	*Boutelous curtipendula 'Vaughn'*	Warm	Sod	191,000	2.0
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	5.5
Total					**10.25**
Heavy Clay, Rocky Foothill Seed Mix					
Ephriam crested wheatgrass[d]	*Agropyron cristatum 'Ephriam'*	Cool	Sod	175,000	1.5
Oahe Intermediate wheatgrass	*Agropyron intermedium 'Oahe'*	Cool	Sod	115,000	5.5
Vaughn sideoats grama[e]	*Boutelous curtipendula 'Vaughn'*	Warm	Sod	191,000	2.0
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	5.5
Total					**17.5**

[a] All of the above seeding mixes and rates are based on drill seeding followed by crimped straw mulch. These rates should be doubled if seed is broadcast and should be increased by 50 percent if the seeding is done using a Brillion Drill or is applied through hydraulic seeding. Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1. If hydraulic seeding is used, hydraulic mulching should be done as a separate operation.

[b] See Table TS/PS-3 for seeding dates.

[c] If site is to be irrigated, the transition turf seed rates should be doubled.

[d] Crested wheatgrass should not be used on slopes steeper than 6H to 1V.

[e] Can substitute 0.5 lbs PLS of blue grama for the 2.0 lbs PLS of Vaughn sideoats grama.

Table TS/PS-3. Seeding Dates for Annual and Perennial Grasses

	Annual Grasses (Numbers in table reference species in Table TS/PS-1)		Perennial Grasses	
Seeding Dates	**Warm**	**Cool**	**Warm**	**Cool**
January 1–March 15			✓	✓
March 16–April 30	4	1,2,3	✓	✓
May 1–May 15	4		✓	
May 16–June 30	4,5,6,7			
July 1–July 15	5,6,7			
July 16–August 31				
September 1–September 30		8,9,10,11		
October 1–December 31			✓	✓

Mulch

Cover seeded areas with mulch or an appropriate rolled erosion control product to promote establishment of vegetation. Anchor mulch by crimping, netting or use of a non-toxic tackifier. See the Mulching BMP Fact Sheet for additional guidance.

Maintenance and Removal

Monitor and observe seeded areas to identify areas of poor growth or areas that fail to germinate. Reseed and mulch these areas, as needed.

An area that has been permanently seeded should have a good stand of vegetation within one growing season if irrigated and within three growing seasons without irrigation in Colorado. Reseed portions of the site that fail to germinate or remain bare after the first growing season.

Seeded areas may require irrigation, particularly during extended dry periods. Targeted weed control may also be necessary.

Protect seeded areas from construction equipment and vehicle access.

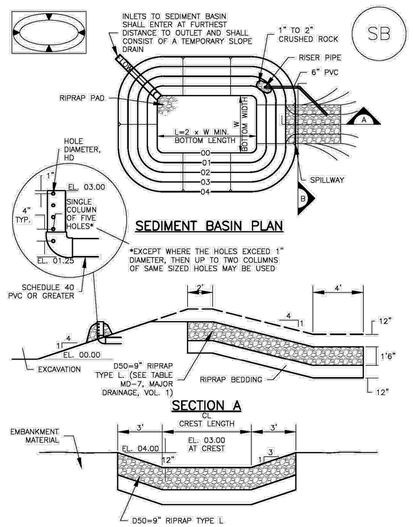


TABLE SB-1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN

Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/64
3	28	5	1/4
4	33 ½	6	9/16
5	38 ½	8	5/32
6	43	9	23/32
7	47 ¼	11	25/32
8	51	12	27/32
9	55	13	7/8
10	58 ¾	15	15/16
11	61	16	31/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 1/8
15	73 ¼	22	1 3/16
SEDIMENT BASIN 1	22	100	31	1 ¾
SEDIMENT BASIN 2	17 ONSITE ACRES 253 OFFSITE ACRES	152	103	2

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -LOCATION OF SEDIMENT BASIN.
   -TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   -FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   -FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.
2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.
3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND-DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.
4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.
5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.
6. PIPE SCH 40 OR GREATER SHALL BE USED.
7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).
5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.
6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM BOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
SR LAND, LLC
20 BOULDER CRESCENT
SUITE 201
COLORADO SPRINGS, CO 80903
JAMES F. MORLEY
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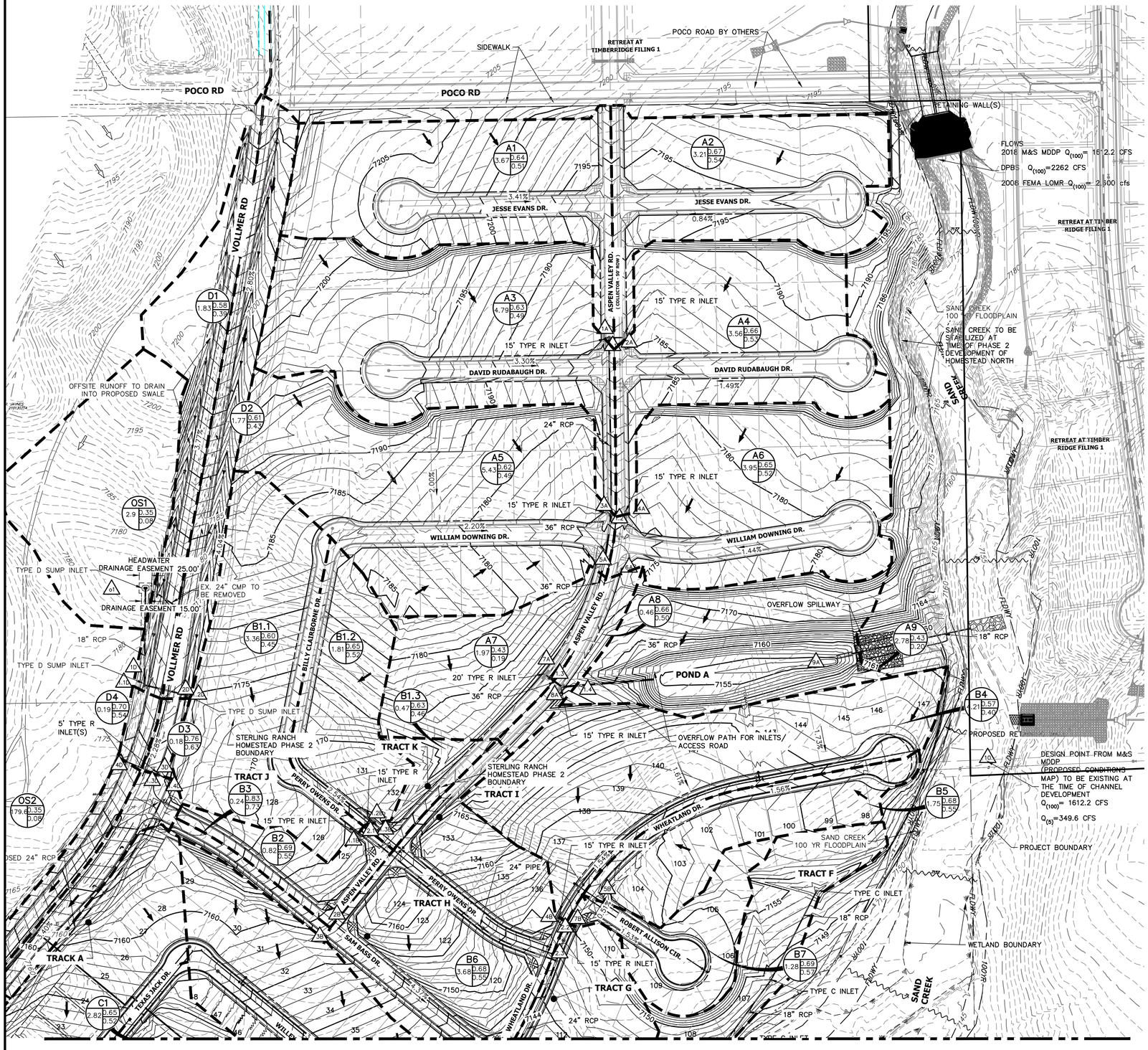
No.	REVISION	BY	DATE

H-SCALE N/A
V-SCALE N/A
DATE 06/30/21
DESIGNED BY XXX
DRAWN BY XXX
CHECKED BY

HOMESTEAD NORTH AT STERLING RANCH
DETAIL

SHEET 8 OF 10
JOB NO. 25188.00

DRAINAGE MAP



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DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1a	6.9	14.7
3a	8.3	20.5
5a	9.5	26.1
7a	10.4	29.9
2a	6.4	13.3
1.1	13.0	18.7
4a	6.6	15.2
1.2	23.5	48.1
6a	10.7	18.5
1.3	43.6	94.5
8a	11.3	20.0
1.4	44.4	96.2
9A	21.6	103.0
1.1b	5.5	12.5
1.2b	3.5	7.4
2.1	8.7	17.5
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
6b	10.3	26.5
9b	12.1	30.3
5b	4.3	8.9
7b	7.3	14.9
2.2	16.3	32.9
2.3	23.5	47.3
8b	5.0	13.1
2.4	35.6	77.6
10b	5.7	14.3
2.5	42.5	91.5
11b	0.9	3.7
12b	1.5	4.1
2.6	46.1	102.6
1c	5.4	11.4
2.3c	7.1	14.9
2.1C	0.8	1.6
2.2C	9.8	20.1
4.2c	5.9	13.2
3.1	6.5	11.7
4C	18.9	41.9
3.1c	1.2	2.4
3.2	7.9	12.6
3.2c	3.6	7.9
3.3	14.3	24.1
3.4	31.5	63.1
5C	4.1	8.8
3.5	34.5	69.7
6C	2.5	8.8
3.6	41.4	78.9
1o	0.8	6.0
1d	2.4	6.0
1.1d	3.2	11.6
2d	2.5	6.1
1.2d	5.7	17.7
3d	0.6	1.2
4d	1.0	1.1
1.3d	0.5	2.2
1.4d	6.4	19.2
2o	27.1	190.9
6d	2.5	4.6
5d	3.1	6.1
1.5d	29.2	195.0
1.6d	32.6	205.3
3o	1.7	12.6
8d	2.5	14.4
7d	2.8	4.7
2.1d	3.5	16.1
1.7d	36.0	220.9
5	56.0	264.1

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
A2	3.21	57%	0.54	0.67	13.7	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.56	55%	0.53	0.66	14.0	6.8	14.2
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.95	53%	0.52	0.65	12.5	7.7	16.2
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
B7	1.28	60%	0.57	0.69	8.9	3.1	6.4
B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.35	65%	0.49	0.63	12.1	12.0	25.8
C4.2	3.44	59%	0.46	0.61	12.7	5.9	13.2
C5	0.16	81%	0.74	0.84	7.2	0.6	1.0
C6	2.48	21%	0.22	0.45	6.8	2.5	8.8
D1	1.83	39%	0.39	0.58	16.7	2.4	6.0
D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.75	79%	0.72	0.83	5.0	2.8	5.4
D8	0.72	69%	0.64	0.77	5.0	2.4	4.8
OS1	2.85	2%	0.08	0.35	14.5	0.8	6.0
OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
3/23/22
SHEET 1 OF 2

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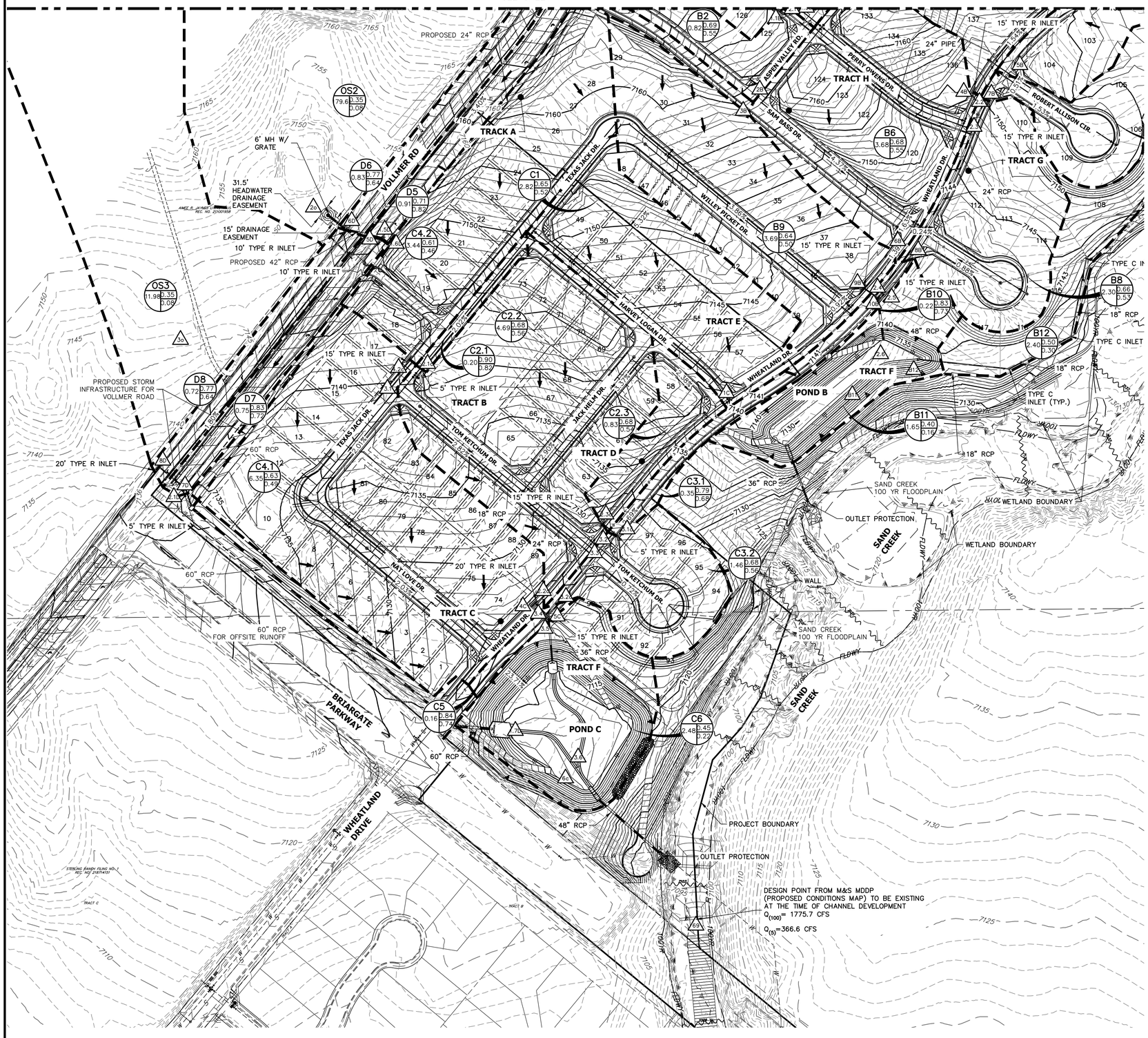
DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1a	6.9	14.7
3a	8.3	20.5
5a	9.5	26.1
7a	10.4	29.9
2a	6.4	13.3
1.1	13.0	18.7
4a	6.6	15.2
1.2	23.5	48.1
6a	10.7	18.5
1.3	43.6	94.5
8a	11.3	20.0
1.4	44.4	96.2
9A	21.6	103.0
1.1b	5.5	12.5
1.2b	3.5	7.4
2.1	8.7	17.5
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
6b	10.3	26.5
9b	12.1	30.3
5b	4.3	8.9
7b	7.3	14.9
2.2	16.3	32.9
2.3	23.5	47.3
8b	5.0	13.1
2.4	35.6	77.6
10b	5.7	14.3
2.5	42.5	91.5
11b	0.9	3.7
12b	1.5	4.1
2.6	46.1	102.6
1c	5.4	11.4
2.3c	7.1	14.9
2.1C	0.8	1.6
2.2C	9.8	20.1
4.2c	5.9	13.2
3.1	6.5	11.7
4C	18.9	41.9
3.1c	1.2	2.4
3.2	7.9	12.6
3.2c	3.6	7.9
3.3	14.3	24.1
3.4	31.5	63.1
5C	4.1	8.8
3.5	34.5	69.7
6C	2.5	8.8
3.6	41.4	78.9
1o	0.8	6.0
1d	2.4	6.0
1.1d	3.2	11.6
2d	2.5	6.1
1.2d	5.7	17.7
3d	0.6	1.2
4d	1.0	1.1
1.3d	0.5	2.2
1.4d	6.4	19.2
2o	27.1	190.9
6d	2.5	4.6
5d	3.1	6.1
1.5d	29.2	195.0
1.6d	32.6	205.3
3o	1.7	12.6
8d	2.5	14.4
7d	2.8	4.7
2.1d	3.5	16.1
1.7d	36.0	220.9
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A4	3.56	55%	0.53	0.66	14.0	6.8	14.2
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.95	53%	0.52	0.65	12.5	7.7	16.2
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
B7	1.28	60%	0.57	0.69	8.9	3.1	6.4
B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.35	65%	0.49	0.63	12.1	12.0	25.8
C4.2	3.44	59%	0.46	0.61	12.7	5.9	13.2
C5	0.16	81%	0.74	0.84	7.2	0.6	1.0
C6	2.48	21%	0.22	0.45	6.8	2.5	8.8
D1	1.83	39%	0.39	0.58	16.7	2.4	6.0
D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.75	79%	0.72	0.83	5.0	2.8	5.4
D8	0.72	69%	0.64	0.77	5.0	2.4	4.8
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OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
3/23/22
SHEET 2 OF 2

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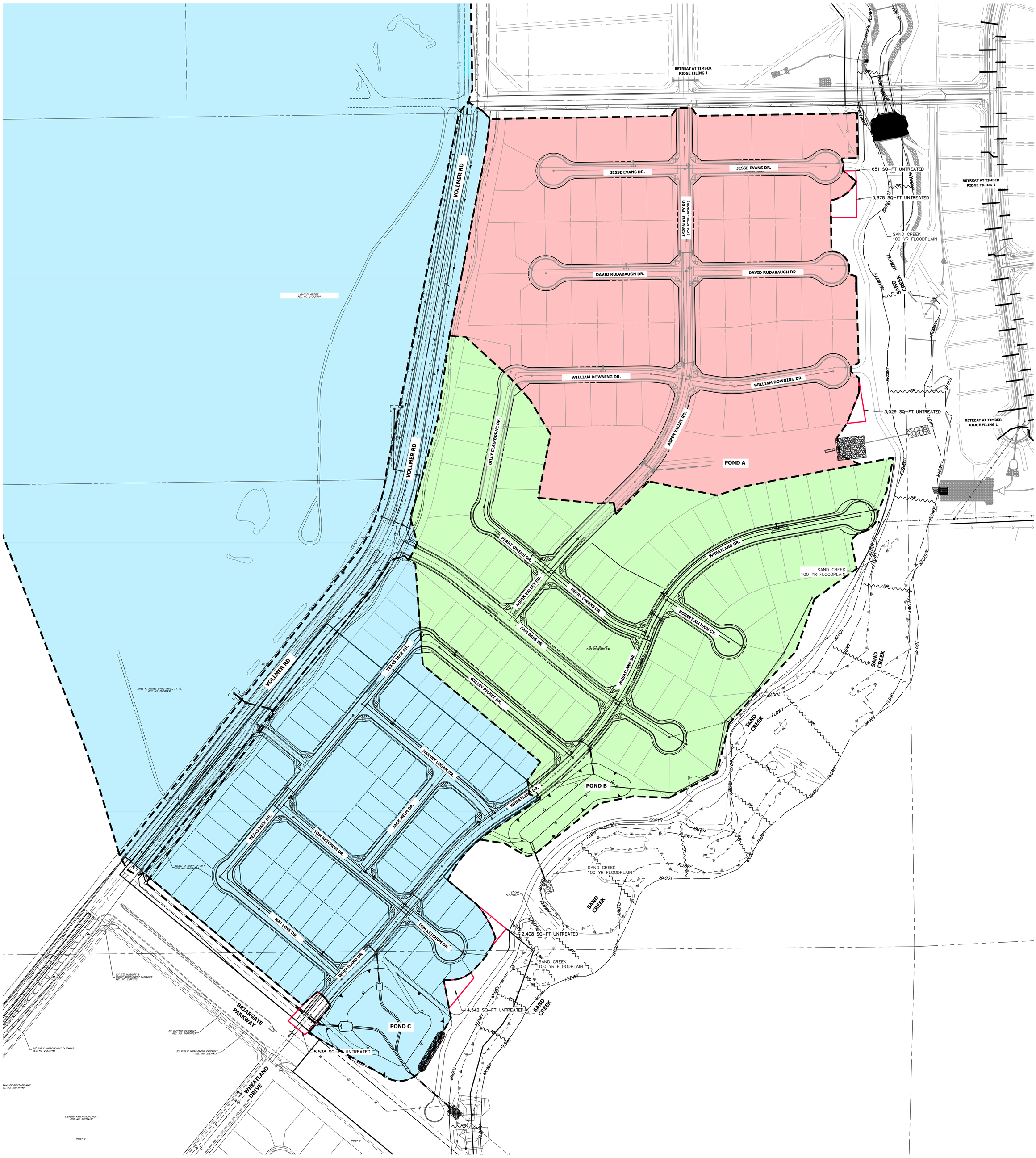
WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



POND A 29.82 ACRES, 46.5% IMPERVIOUS

POND B 27.86 ACRES, 50.0% IMPERVIOUS

POND C 224.42 ACRES, 10.3% IMPERVIOUS

NOTE:

1. **A SEPARATE PLAN FOR STERLING RANCH ROAD AND BRIARGATE PKWY WILL BE PROVIDED IN A THE SEPARATE FDR REQUIRED FOR CONSTRUCTION OF THESE ROADWAYS.**
2. **A TOTAL OF 20,046 SQ-FT ON SITE IS LEFT UNTREATED.**
3. **POND C TREATS THE IMPROVEMENTS TO VOLLMER ROAD AND THE OFFSITE TRIBUTARY AREA**

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

WQ – PONDS
HOMESTEAD NORTH
JOB NO. 25188.00
03-23-2022
SHEET 1 OF 1

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NEW DOC

MASTER DEVELOPMENT DRAINAGE REPORT
FOR
STERLING RANCH FILING NOS. 1&2
AND
FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 1

EL PASO COUNTY, COLORADO

DECEMBER 2017

Prepared for:

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

Prepared by:

CIVIL CONSULTANTS, INC.
20 Boulder Crescent, Suite 110
Colorado Springs, CO 80903
(719) 955-5485

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JAN 04 2018

Project #09-002
DSD Project # SF-16-013

Keep

SF-16-013

5-year and 0.96 for the 100-year. Developed runoff of Q5=16.1 cfs and Q100=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 (Q5=13.3 cfs and Q100=20.0 cfs) will combine with flows from PR5 and be routed east via a 30" RCP (PR6, Q5=16.8 cfs and Q100=29.4 cfs) to Detention Pond 4 (DP 10). Flows will outfall into a concrete lined forebay.

DP2, 5.39 acres, consists of Basin B future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=8.0 cfs and Q100=19.3 cfs has been calculated for DP2. The surface runoff is routed via overlot grading and proposed swales to a temporary sediment basin at DP2 which will be collected by a temporary 36" FES. The flows will be routed east via a 36" RCP (PR2, Q5=8.0 cfs and Q100=19.3 cfs) to DP5.

DP5, 0.80 acres, consists of Basin G future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin H (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 Q5=4.2 cfs and Q100=19.7 cfs has been calculated for DP5. The surface runoff is routed via overlot grading and curb and gutter to DP5 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=4.2 cfs and Q100=14.7 cfs) will combine with flows from PR2 and be routed east via a 36" RCP (PR3, Q5=11.6 cfs and Q100=27.6 cfs) to DP6.

DP6, 4.68 acres, consists of Basin J and K future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin L (Dines Boulevard) and Basin I (Wheatland Drive) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=14.1 cfs and Q100=26.7cfs has been calculated for DP6. The surface runoff is routed via overlot grading and curb and gutter to DP6 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=12.1 cfs and Q100=17.2 cfs) will combine with flows from PR3 and be routed east via a 36" RCP (PR4, Q5=21.8 cfs and Q100=42.1 cfs) to Detention Pond 4 (DP 10). Flows will outfall into a concrete lined forebay.

DP9, 9.73 acres, consists of Basin R future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=12.5 cfs and Q100=30.4 cfs has been calculated for DP9. The surface runoff is routed via overlot grading and swales to a temporary sediment basin at DP9 which will be collected by a 30" FES. The flow will routed south via a 30" RCP (PR10, Q5=12.5 cfs and Q100=30.4 cfs) to Detention Pond 4 (DP 10). Flows will outfall into a concrete lined forebay.

DP10, 1.97 acres, consists of Basin S (**Detention Pond 4**) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. The combined upstream developed runoff of Q5=50.0 cfs and Q100=102.9 cfs has been calculated for DP10. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 27.5 acres, and provide 0.46 ac-ft of water quality storage and 2.90 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 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 DP10 will over top the emergency spillway and outfall into Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet. The peak release rate from pond 4 (PR11, Q5=2.7 cfs and Q100=36.2 cfs ~30" RCP) will combine with offsite flows from PR18 (Q5=16.2 cfs and Q100=125.9 cfs). The summed flows (PR12, Q5=18.9 cfs and Q100=162.1 cfs) will outfall, via a 54" RCP at DP11 and into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

DP23 which will be collected by a 10' CDOT type R sump inlet. The flow will combine with flow from PR25 and will be routed east via a 36" RCP (PR26, Q5=3.2 cfs and Q100=27.7 cfs) to Detention Pond 8 (DP 27). Flows will outfall into a concrete lined forebay. In the event of clogging or total inlet failure, flows at DP23 will over top the curb and gutter and outfall into the Detention Pond 8 (DP 27).

DP26, 1.32 acres, consists of Basin TT future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=2.0 cfs and Q100=4.9 cfs has been calculated for DP26. The surface runoff is routed via overlot grading and swales to a temporary sediment basin at DP26 which will be collected by an 18" FES. The flow will routed south via an 18" RCP (PR28) to Detention Pond 8 (DP 27). Flows will outfall into a concrete lined forebay.

DP27, 2.17 acres, consists of Basin UU (**Detention Pond 8**) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. The combined upstream developed runoff of Q5=42.3 cfs and Q100=112.8 cfs has been calculated for DP27. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 29.0 acres, and provide 0.48 ac-ft of water quality storage and 3.00 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP27 will over top the emergency spillway and outfall into Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet. The peak release rate from pond 8 (PR29, Q5=2.9 cfs and Q100=41.7 cfs) will outfall, via a 30" RCP 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 Chapter 6-Volume II. Refer to the Detention Basin Design sheets located within the appendix of this report.

Design Points Tributary to Detention Pond W-5 (Prelim. Drainage Map Sheet 1)–Filing No. 2

DP28, 33.3 acres, consists of Basin OS3 off-site Barbarick Subdivision with runoff coefficients of 0.36 for the 5-year and 0.55 for the 100-year and Basin YY future Sterling Ranch residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of Q5=25.8 cfs and Q100=60.2 cfs has been calculated for DP28. Per the "Final Drainage Report for Barbarick Subdivision Portions of Lots 1, 2 and Lots 3, 4", prepared by Matrix Design Group, dated June 6, 2016, a combined onsite flow of Q5=11.4 cfs and Q100=85.4 cfs was calculated up to the detention pond on the south boundary line of the Barbarick Subdivision. The reduction of flow, form previous reports is attributed to a reduction of Sterling Ranch Subdivision flow contributing to the OS3 basin. The release rate from the detention pond combined with Basin YY are Q5=25.8 cfs and Q100=60.2 cfs. The surface runoff shall be collected by a temporary sediment basin and 36" FES and routed south via 36" RCP (PR32) to PR34. In the event of clogging, flow will be routed via historic drainage patterns to DP33. Historic flows produced by Basin OS3 will be accounted for in the calculations for detention/water quality for Pond W5. The drainage report was prepared by Matrix Design Group, 2016 for the Barbarick Subdivision and has been attached at the end of the reference section of this report. The Final Drainage Report for Filing No. 2 will address the revisions from the previous report to the new Matrix report.

DP29, 12.58 acres, consists of Basin XX future residential lots and streets with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin JP-1 future school site with runoff coefficients of 0.39 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=17.3 cfs and Q100=41.7 cfs has been calculated for DP29. The surface runoff will be routed via overlot grading and curb and gutter to a temporary sediment basin at DP29 which will be collected by a 36" FES. The flow will be routed west via

a 36" RCP (PR33) and will combine with flow from PR32. The combined flows in PR34 (Q5=41.4 cfs and Q100=97.8 cfs) will be routed south and west via a 48" RCP to PR35.

DP30, 2.46 acres, consists of Basin III future open space area with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin JP-7A (Sterling Ranch Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=6.5 cfs and Q100=13.0 cfs has been calculated for DP30. The surface runoff is routed via overlot grading and curb and gutter to DP30 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=6.5 cfs and Q100=11.1 cfs) will routed south via a 24" RCP (PR34A) and will combine with flows from PR34 and PR34B. The combined flows (Q5=53.1 cfs and Q100=117.8 cfs) will be routed west via a 48" RCP (PR35) to PR39.

DP31, 4.64 acres, consists of Basin JJJ future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin JP-7A (Sterling Ranch Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=8.4 cfs and Q100=19.8 cfs has been calculated for DP31. The surface runoff is routed via overlot grading and curb and gutter to DP31 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=8.2 cfs and Q100=14.2 cfs) will routed south via a 24" RCP (PR34B) and will combine with flows from PR34 and PR34A. The combined flows (PR35, Q5=53.1 cfs and Q100=117.8 cfs) will be routed west via a 48" RCP to PR39.

DP32, 17.0 acres, consists of Basin OS2 off-site Barbarick Subdivision with runoff coefficients of 0.49 for the 5-year and 0.62 for the 100-year. Developed runoff of Q5=30.4 cfs and Q100=80.8 cfs has been calculated for DP32 Per the "Final Drainage Report for Barbarick Subdivision Portions of Lots 1, 2 and Lots 3, 4", prepared by Matrix Design Group, dated June 6, 2016, a combined onsite flow of Q5=3.13 cfs and Q100=11.6 cfs was calculated up to the sand filter pond on the south boundary line of the Barbarick Subdivision. The release rate from the sand filter pond combined with Lots 1 and 2 west of the sand filter pond are Q5=30.4 cfs and Q100=80.8 cfs The surface runoff shall be collected by a temporary sediment basin and 42" FES. In the event of clogging, flow will be routed via historic drainage patterns to DP33. The flow will be routed south via 42" RCP (PR36) to PR38. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of Q5=30.4 cfs and Q100=80.8 cfs. Historic flows produced by Basin OS2 will be accounted for in the calculations for detention/water quality for Pond W5. The Final Drainage Report for Filing No. 2, will address the revisions from the previous report to the new Matrix report.

DP33, 9.68 acres, consists of Basin AAA future residential lots and streets with runoff coefficients of 0.49 for the 5-year and 0.65 for the 100-year. Developed runoff of Q5=17.3 cfs and Q100=38.5 cfs has been calculated for DP33. The surface runoff will be routed via overlot grading and curb and gutter to a temporary sediment basin at DP33 which will be collected by a 30" FES. The flow will be routed west via a 30" RCP (PR37) and will combine with flows from PR36. The combined flows (PR38, Q5=45.9 cfs and Q100=115.2 cfs) will be routed south via a 48" RCP to PR39. The combined flows of PR35 and PR38 (PR39, Q5=98.5 cfs and Q100=232.0 cfs) will be routed south via a 66" RCP to PR57.

DP40, 13.89 acres, consists of Basin CCC future residential lots and streets with runoff coefficients of 0.49 for the 5-year and 0.62 for the 100-year. Developed runoff of Q5=25.5 cfs and Q100=54.2cfs has been calculated for DP40. The surface runoff is routed via overlot grading and curb and gutter to a temporary sediment basin at DP40 which will be collected by a 36" FES. The flow will be routed west via a 36" RCP (PR46) and will combine with flow from PR47. The combined flows in PR48 (Q5=26.0 cfs and Q100=61.7 cfs) will be routed south via a 42" RCP to PR52.

DP44, 4.24 acres, consists of Basin HHH undisturbed gas line easements and minimal rear residential lots with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. Developed runoff of Q5=1.2 cfs and Q100=9.1 cfs has been calculated for DP44. The surface runoff is routed via historic drainage patterns and overlot grading to a temporary sediment basin at DP44 which will be collected by an 18" FES. The

calculated for DP50. In the undeveloped condition, runoff of Q5=2.0 cfs and Q100=15.0 cfs are routed via historic drainage patterns and proposed swales to DP50. The surface runoff will be collected by a 36" FES. The flows will routed south via a 36" RCP (PR64) to PR65. The accumulated flow in PR65 (Q5=32.0 cfs and Q100=309.7 cfs) will be routed south to PR67. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of Q5=2.0 cfs and Q100=15.0 cfs.

DP53, 5.37 acres, consists of Basin JP-12 a future commercial parcel with runoff coefficients of 0.81 for the 5-year and 0.88 for the 100-year. Developed runoff of Q5=19.8 cfs and Q100=36.1 cfs has been calculated for DP53. In the undeveloped condition, runoff of Q5=1.4 cfs and Q100=10.0 cfs are routed via historic drainage patterns and proposed swales to DP53. The surface runoff will be collected by a 30" FES. The flows will routed south via a 30" RCP (PR66) to PR67. The accumulated flow in PR67 (Q5=39.1 cfs and Q100=322.5 cfs) will be routed via a 72" RCP south to Sand Creek. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of Q5=1.4 cfs and Q100=10.0 cfs. The summed flows at DP68 (PR74, Q5=42.2 cfs and Q100=472.2 cfs) will outfall into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS. A riprap apron will be constructed to dissipate energy and prevent local scour at the outlet.

DP54, 1.21 acres, consists of Basin RP-7D (Marksheffel Road) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and DP51 flowby. Undeveloped runoff of Q5=0.4 cfs and Q100=3.5 cfs has been calculated for DP54. Undeveloped flows will be routed to a temporary sediment basin via overlot grading as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek. Erosion control will be provided.

DP55, 1.28 acres, consists of Basin RP-7C (Marksheffel Road) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and DP51 flowby. Undeveloped runoff of Q5=0.4 cfs and Q100=4.9 cfs has been calculated for DP55. Undeveloped flows will be routed to a temporary sediment basin via overlot grading as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek. Erosion control will be provided.

Basin SSS, 1.21 acres, consists of the backyards of future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of Q5=1.1 cfs and Q100=3.8 cfs has been calculated for this basin. Developed flows will be sheet flow into Sand Creek. Erosion control will be provided.

There will be bank stabilization improvements to the Sand Creek Drainage Channel with the development of the STERLING RANCH FILING NOS. 1&2 site (Roadways and tracts) to maintain the integrity of roadways and ponds. However, channel improvements for Sand Creek (checks, drops, etc...) will be installed in accordance with the Subdivision Improvement Agreement.

DETENTION PONDS

Detention Pond 4, has combined upstream developed runoff of Q5=50.0 cfs and Q100=102.9 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 27.5 acres, and provide 0.46 ac-ft of water quality storage and 2.90 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook.

Detention Pond 8, has combined upstream developed runoff of Q5=42.3 cfs and Q100=112.8 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 29.0 acres, and provide 0.48 ac-ft of water quality storage and 3.00 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook.

Detention Pond W-5, has combined upstream developed runoff of Q5=233.2 cfs and Q100=518.2 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 175.6 acres, and provide 2.90 ac-ft of water quality storage and 17.16 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. Design and calculations will be addressed in the Filing No. 2 Final Drainage Report. See Sand Creek Channel Study-Future Hydrologic Conditions Map in the appendix. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

Detention Pond B-B, has combined upstream developed runoff of Q5=4.7 cfs and Q100=15.0 cfs. The proposed temporary Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approximately 5.98 acres, and provide 0.04 ac-ft of water quality storage and 0.48 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 v3.05 workbook.

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 offsite. The pond is designed to treat approx 5.87 acres, and provide 0.092 ac-ft of water quality storage and 0.638 ac-ft of 100-year storage. The outlet structure, 18" filter layer(minimum), underdrain and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.07 workbook.

Conceptual Detention Pond W-4, has combined upstream developed runoff of Q5=72.9 cfs and Q100=368.4 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated offsite. The pond is designed to treat approx 352.2 acres, and provide 1.73 ac-ft of water quality storage and 6.63 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. Design and calculations will be addressed in the Filing No. 2 Final Drainage Report. See Sand Creek Channel Study-Future Hydrologic Conditions Map in the appendix. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS. The Conceptual Detention Pond W-4 is subject to El Paso County approval for the site shown.

The detention ponds 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 Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet.

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 1 Onsite Grading &

STERLING RANCH

PRELIMINARY OVERALL UTILITY EXHIBIT

1" = 200'

0 100 200 400

Scale in Feet

EXISTING 12" CMP
FUTURE STERLING RANCH
BRIARGATE PARKWAY
12" PVC WATER
24" RCP
24" RCP
PROPOSED FIRE STATION
VACANT
18" RCP
EXIST MVEA
PROPOSED COMMERCIAL
VOLLMER ROAD
30" RCP
WHEATLAND DRIVE
16" PVC WATER TO WATER TANK
TEMPORARY POND B-B
18" CMP
8" PVC WATER
12" PVC SANITARY
EXIST 24" CULVERT
16" PVC WATER
12" PVC SANITARY
8" PVC WATER
8" PVC SANITARY
12" PVC SANITARY
16" PVC WATER
42" RCP
FSD POND W-9
30" RCP
18" RCP
54" RCP
EXISTING SINGLE FAMILY RESIDENTIAL WILD RIDGE SUBDIVISION FILING NO. 2
EXISTING 24" CMP
EXISTING TELEPHONE MAIN
EXISTING 2-24" CMP
EXISTING 24" CMP
54" RCP
18" RCP
30" RCP
36" RCP
36" RCP
54" RCP
30" RCP
36" RCP
POND 4
54" RCP
30" RCP
12" PVC SANITARY
16" PVC WATER
60" RCP
100YR FLOODPLAIN
TEMPORARY SEDIMENT BASIN
EX SAND CREEK
DINES BLVD
PROPOSED TEMPORARY MAINTENANCE & ACCESS EASEMENT REC. #_____
EX SAND CREEK
FUTURE STERLING RANCH
EXISTING 3.5'x5.5' HECMP
30" RCP
30" RCP
FILING NO. 2
FILING NO. 1
PROP TRAIL
EXISTING INDUSTRIAL
EX 6" GAS MAIN (PLAINS ALL AMERICAN PIPELINE)
BARBARICK SUBDIVISION
PONDS BY OTHERS
EXISTING SINGLE FAMILY RESIDENTIAL HIGHLAND PARK FILING NO. 2
EXISTING GAS MAIN
EX. 18" CMP'S & ACCESS ROAD TO BE REMOVED UPON DEVELOPMENT OF PARCEL'S
12" PVC SANITARY
16" PVC WATER
EXISTING POND
30" RCP
36" RCP
18" RCP
POND 8
30" RCP
30" RCP
30" RCP
PROP TRAIL
30" RCP
36" RCP
100YR FLOODPLAIN
24" RCP
30" RCP
EXISTING TELEPHONE MAIN
PROPOSED 150' GAS EASEMENT
PROPOSED ELEMENTARY SCHOOL
EXISTING 20' CSU GAS ESMT - TO BE ABANDONED AND RELOCATED WITHIN PROPOSED ROW'S
16" PVC WATER
12" PVC SANITARY
FILING NO. 1
FILING NO. 2
CONCEPTUAL POND W-4
VOLLMER ROAD
30" RCP
18" RCP
EX (2)-20" GAS MAINS (EL PASO GAS)
"FUTURE"
EX 6" GAS MAIN (PLAINS ALL AMERICAN PIPELINE)
36" RCP
12" PVC WATER
15" PVC SANITARY
8" PVC WATER
STERLING RANCH ROAD
66" RCP
18" RCP
24" RCP
30" RCP
48" RCP
24" RCP
24" RCP
48" RCP
12" PVC WATER
48" RCP
EXISTING 2-48" CMP
EXISTING FIBER OPTICS
EXISTING GAS MAIN
MARKSHEFFEL ROAD
66" RCP
36" RCP
12" PVC WATER
36" RCP
"FUTURE"
FUTURE STERLING RANCH
PROPOSED TEMPORARY MAINTENANCE & ACCESS EASEMENT REC. #_____
8" PVC SANITARY
12" PVC WATER
EX SAND CREEK
SAN SEWER FORCE MAIN
PROPOSED COMMERCIAL
42" RCP
18" RCP
18" RCP
48" RCP
48" RCP
8" PVC SANITARY
100'
15" SANITARY
12" FORCE MAIN
PROPOSED SPECIAL USE
72" RCP
48" RCP
30" RCP
54" RCP
DUAL 42" RCP
66" RCP
18" RCP
160' ROW
"FUTURE"
78" RCP
42" RCP
12" PVC SANITARY
16" PVC WATER
SAN SEWER FORCE MAIN
EXISTING SINGLE FAMILY RESIDENTIAL PAWNEE RANCHEROS FILING NO. 2
84" RCP
24" RCP
72" RCP
PROPOSED LIFT STATION
POND W-5
30" RCP
48" RCP
72" RCP
100YR FLOODPLAIN
PROPOSED 150' GAS ESMT
EX (2)-20" GAS MAINS (EL PASO GAS)
84" RCP
EX SAND CREEK
EX 6" GAS MAIN (PLAINS ALL AMERICAN PIPELINE)

LEGEND

- FORCE MAIN SANITARY SEWER
- SANITARY SEWER
- WATER MAIN
- STORM SYSTEM (FILING 1)
- STORM INLETS (FILING 1)
- FILING 1 DETENTION FACILITY/DITCH
- STORM SEWER (FUTURE FILING 2)
- STORM INLETS (FUTURE FILING 2)
- FILING 2 DETENTION FACILITY/DITCH

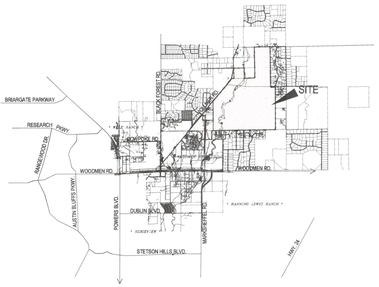
UTILITY PROVIDER

GAS – COLORADO SPRINGS UTILITIES
ELECTRIC – MOUNTAIN VIEW ELECTRIC ASSOC.
WATER – STERLING RANCH DISTRICT
SANITARY – WOODMEN HILLS DISTRICT
STORM SEWER – EL PASO COUNTY
CABLE – QWEST

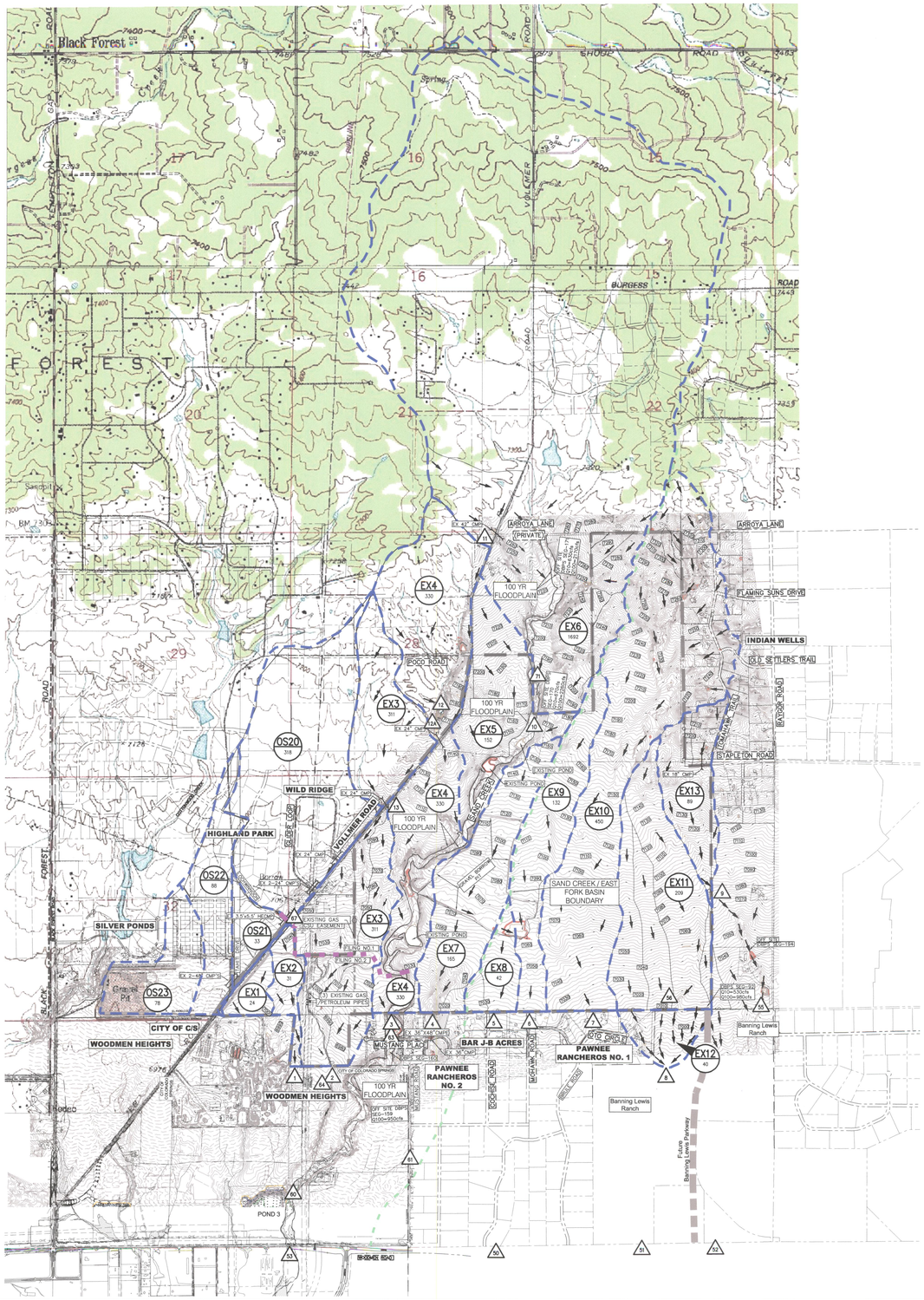
STERLING RANCH
PRELIMINARY OVERALL UTILITY EXHIBIT

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

File: O:\09002A\Sterling Ranch District\dwg\Eng Exhibits\FDP\Utility Plan_OVERALL.dwg Plotstamp: 12/27/2017 4:56 PM



STERLING RANCH
N.T.S.



HISTORIC CONDITION

BASIN SUMMARY

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

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

HISTORIC CONDITION

DESIGN POINTS

DESIGN POINT	SQ. MI.	Q_5 (CFS)	Q_{100} (CFS)	SQ. MI.	DBPS Q_{100}	DBPS DP/ID
1	0.09	5	84			
2	0.49	49	341	0.74	465	64
3	0.52	139	2610	4.33	2552	63
4	0.26	12	197			
5	0.07	4	64			
6	0.21	11	149			
7	0.70	48	474			
8	0.39	18	305			
9	0.14	6	114			
10	2.64	122	2245	3.27	2245	71
11	0.09	5	83			
12A	0.01	3	16			
12	0.27	10	200			
13	0.17	6	126			
				0.48	//	55
				0.53	1210	56
				5.38	2629	60

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

1" = 1000'

0 250 500 1000 2000
Scale in Feet

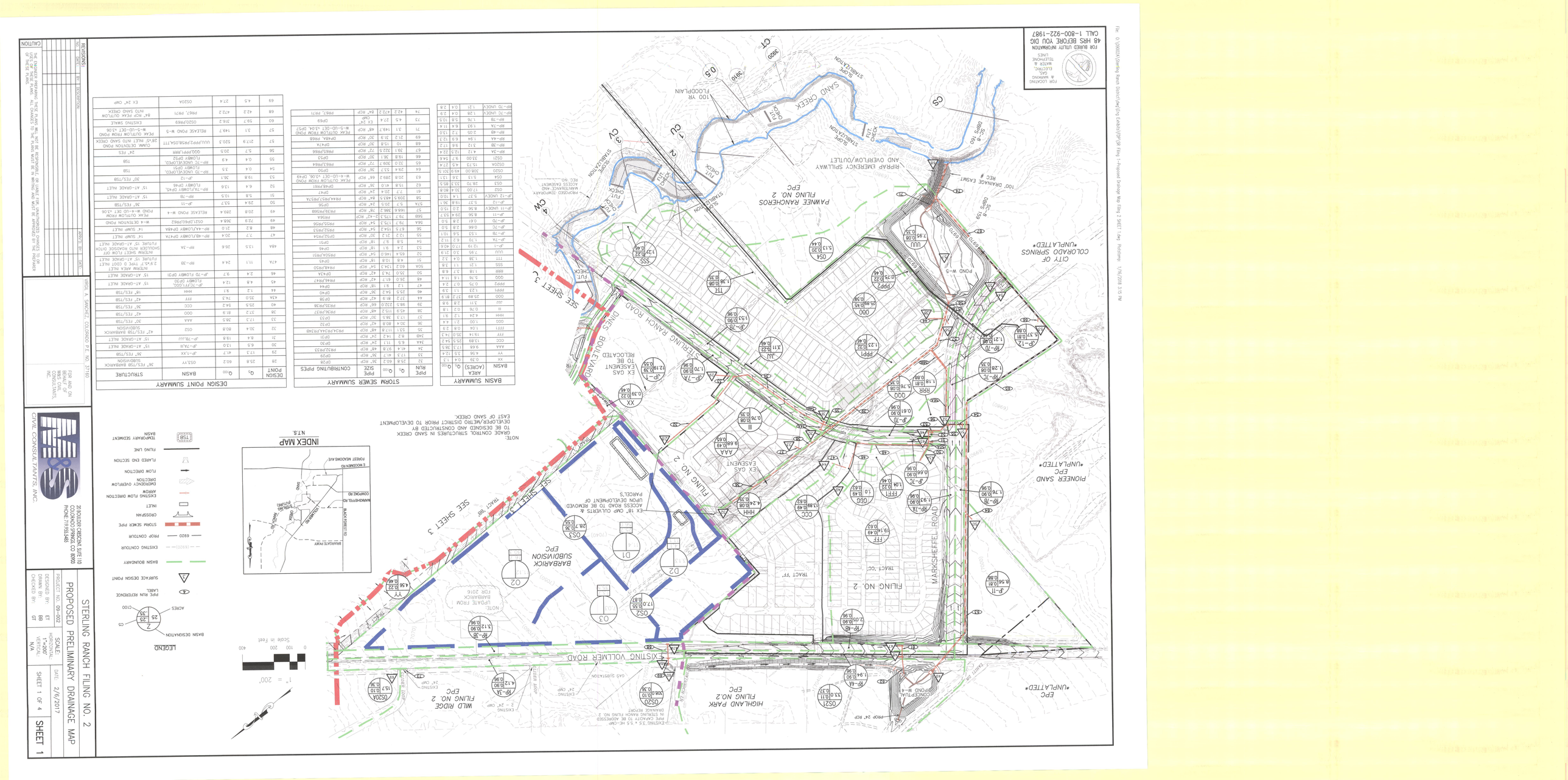
LEGEND

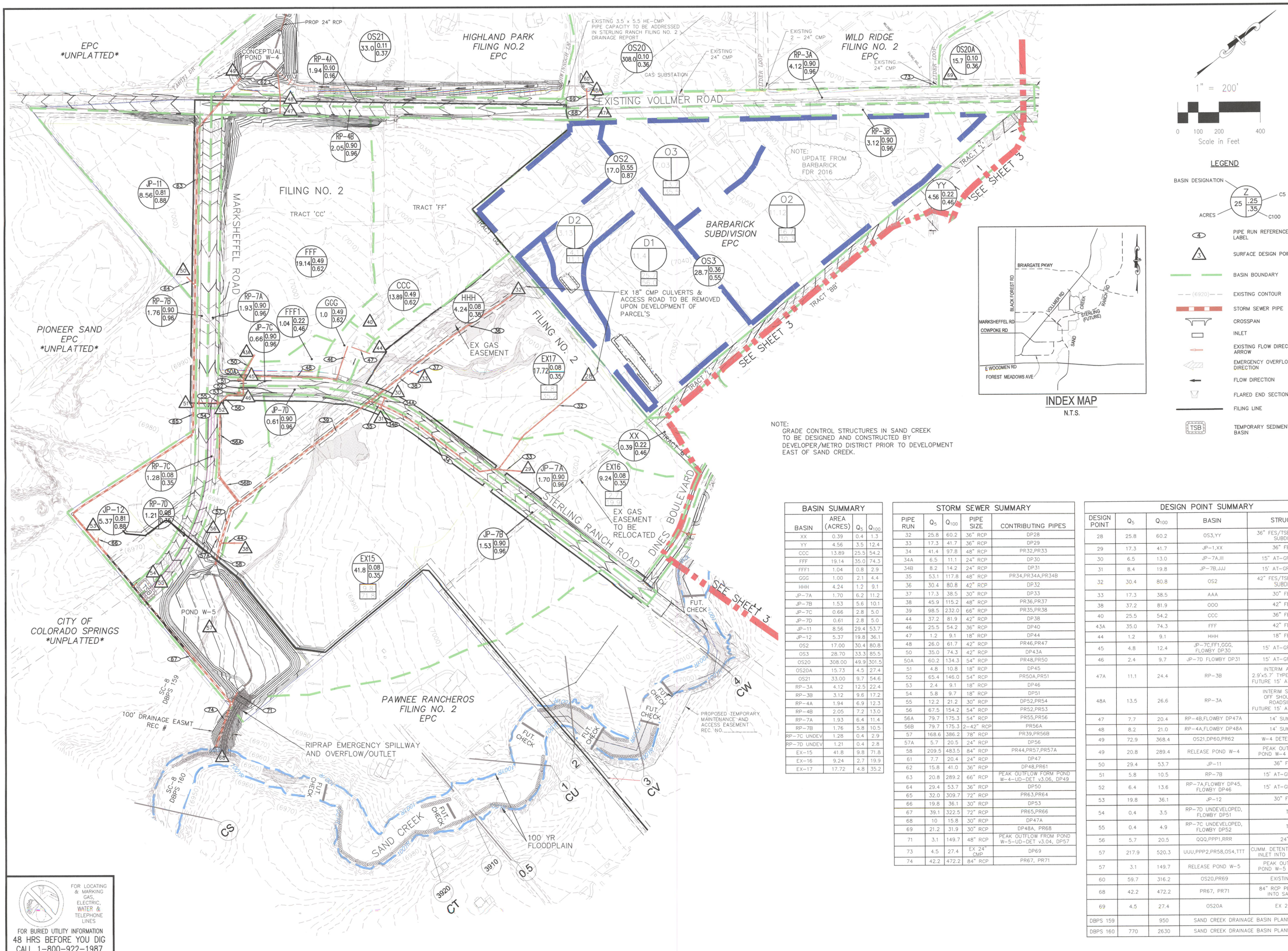
- EX1 (23.2) — EXISTING MODP BASIN ACREAGE
- E1 — EXISTING FLOW-RELEASE POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- FILING NO.1 & NO.2 DIVISION LINE
- PROPERTY BOUNDARY
- 6920 — EXISTING CONTOUR
- CULVERT PIPE

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

STERLING RANCH
HISTORIC – DRAINAGE MAP

PROJECT NO. 09-002		FILE: O:\\dwg\Eng Exhibits\MODP HISTORIC	
DESIGNED BY: VAS	SCALE	DATE: 2/6/17	
DRAWN BY: VAS	HORIZ: 1"=1000'		
CHECKED BY: VAS	VERT: N/A	SHEET 1 OF 1	


DESIGN POINT SUMMARY
DESIGN POINT
Q_5
Q_{100}
BASIN
STRUCTURE
STORM SEWER SUMMARY
PIPE RUN
Q_5
Q_{100}
PIPE SIZE
CONTRIBUTING PIPES
BASIN SUMMARY
BASIN
AREA (ACRES)
Q_5
Q_{100}
NOTE:
GRADE CONTROL STRUCTURES IN SAND CREEK TO BE DESIGNED AND CONSTRUCTED BY DEVELOPER/METRO DISTRICT PRIOR TO DEVELOPMENT EAST OF SAND CREEK.
INDEX MAP
N.T.S.
LEGEND
BASIN DESIGNATION
PIPE RUN REFERENCE LABEL
SURFACE DESIGN POINT
BASIN BOUNDARY
STORM SEWER PIPE
CROSSPAN
INLET
EXISTING FLOW DIRECTION
EMERGENCY OVERFLOW DIRECTION
PROP CONTOUR
EXISTING CONTOUR
FLOW DIRECTION
FLARED END SECTION
RIPRAP LINE
TEMPORARY SEDIMENT BASIN
SAND CREEK
FILING NO. 2
PIONEER SAND EPC *UNPLATTED*
CITY OF COLORADO SPRINGS *UNPLATTED*
PAWNEE RANCHERS FILING NO. 2 EPC
HIGHLAND PARK FILING NO.2 EPC
WILD RIDGE FILING NO. 2 EPC
BARBARICK SUBDIVISION EPC
MARKSHEFFEL ROAD
EXISTING VOLLMER ROAD
STERLING RANCH ROAD
BOULEVARD
SEE SHEET 2
SEE SHEET 3
SEE SHEET 4
FUT. CHECK
EX CHECK
EX GAS EASEMENT
EX 18" CMP CULVERTS & ACCESS ROAD TO BE REMOVED UPON DEVELOPMENT OF PARCELS
PROP 24" RCP
EX 24" CMP
EXISTING 2 - 24" CMP
EXISTING 24" CMP
EXISTING 24" RCP
EXISTING 36" RCP
EXISTING 42" RCP
EXISTING 48" RCP
EXISTING 54" RCP
EXISTING 60" RCP
EXISTING 72" RCP
EXISTING 84" RCP
EXISTING 96" RCP
EXISTING 108" RCP
EXISTING 120" RCP
EXISTING 132" RCP
EXISTING 144" RCP
EXISTING 156" RCP
EXISTING 168" RCP
EXISTING 180" RCP
EXISTING 192" RCP
EXISTING 204" RCP
EXISTING



INDEX MAP
N.T.S.

1" = 200'

0 100 200 400

Scale in Feet

LEGEND

BASIN DESIGNATION
Z
25 .25 .35
ACRES C5 C100

4 PIPE RUN REFERENCE LABEL

3 SURFACE DESIGN POINT

BASIN BOUNDARY

(6920) EXISTING CONTOUR

STORM SEWER PIPE

CROSSPAN

INLET

EXISTING FLOW DIRECTION ARROW

EMERGENCY OVERFLOW DIRECTION

FLOW DIRECTION

FLARED END SECTION

FILING LINE

TSB TEMPORARY SEDIMENT BASIN

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

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
XX	0.39	0.4	1.3
YY	4.56	3.5	12.4
CCC	13.89	25.5	54.2
FFF	19.14	35.0	74.3
FFF1	1.04	0.8	2.9
GGG	1.00	2.1	4.4
HHH	4.24	1.2	9.1
JP-7A	1.70	6.2	11.2
JP-7B	1.53	5.6	10.1
JP-7C	0.66	2.8	5.0
JP-7D	0.61	2.8	5.0
JP-11	8.56	29.4	53.7
JP-12	5.37	19.8	36.1
OS2	17.00	30.4	80.8
OS3	28.70	33.3	85.5
OS20	308.00	49.9	301.5
OS20A	15.73	4.5	27.4
OS21	33.00	9.7	54.6
RP-3A	4.12	12.5	22.4
RP-3B	3.12	9.6	17.2
RP-4A	1.94	6.9	12.3
RP-4B	2.05	7.2	13.0
RP-7A	1.93	6.4	11.4
RP-7B	1.76	5.8	10.5
RP-7C UNDEV	1.28	0.4	2.9
RP-7D UNDEV	1.21	0.4	2.8
EX-15	41.8	9.8	71.8
EX-16	9.24	2.7	19.9
EX-17	17.72	4.8	35.2

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES
32	25.8	60.2	36" RCP	DP28
33	17.3	41.7	36" RCP	DP29
34	41.4	97.8	48" RCP	PR32,PR33
34A	6.5	11.1	24" RCP	DP30
34B	8.2	14.2	24" RCP	DP31
35	53.1	117.8	48" RCP	PR34,PR34A,PR34B
36	30.4	80.8	42" RCP	DP32
37	17.3	38.5	30" RCP	DP33
38	45.9	115.2	48" RCP	PR36,PR37
39	98.5	232.0	66" RCP	PR35,PR38
44	37.2	81.9	42" RCP	DP38
46	25.5	54.2	36" RCP	DP40
47	1.2	9.1	18" RCP	DP44
48	26.0	61.7	42" RCP	PR46,PR47
50	35.0	74.3	42" RCP	DP43A
50A	60.2	134.3	54" RCP	PR48,PR50
51	4.8	10.8	18" RCP	DP45
52	65.4	146.0	54" RCP	PR50A,PR51
53	2.4	9.1	18" RCP	DP46
54	5.8	9.7	18" RCP	DP51
55	12.2	21.2	30" RCP	DP52,PR54
56	67.5	154.2	54" RCP	PR52,PR53
56A	79.7	175.3	54" RCP	PR55,PR56
56B	79.7	175.3	2-42" RCP	PR56A
57	168.6	386.2	78" RCP	PR39,PR56B
57A	5.7	20.5	24" RCP	DP56
58	209.5	483.5	84" RCP	PR44,PR57,PR57A
61	7.7	20.4	24" RCP	DP47
62	15.8	41.0	36" RCP	DP48,PR61
63	20.8	289.2	66" RCP	PEAK OUTFLOW FORM POND W=4-UD=DET v3.06, DP49
64	29.4	53.7	36" RCP	DP50
65	32.0	309.7	72" RCP	PR63,PR64
66	19.8	36.1	30" RCP	DP53
67	39.1	322.5	72" RCP	PR65,PR66
68	10	15.8	30" RCP	DP47A
69	21.2	31.9	30" RCP	DP48A, PR68
71	3.1	149.7	48" RCP	PEAK OUTFLOW FROM POND W=5-UD=DET v3.04, DP57
73	4.5	27.4	EX 24" CMP	DP69
74	42.2	472.2	84" RCP	PR67, PR71

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
28	25.8	60.2	OS3,YY	36" FES/TSB BARBARICK SUBDIVISION
29	17.3	41.7	JP-1,XX	36" FES/TSB
30	6.5	13.0	JP-7A,III	15" AT-GRADE INLET
31	8.4	19.8	JP-7B,JJJ	15' AT-GRADE INLET
32	30.4	80.8	OS2	42" FES/TSB BARBARICK SUBDIVISION
33	17.3	38.5	AAA	30" FES/TSB
38	37.2	81.9	OOO	42" FES/TSB
40	25.5	54.2	CCC	36" FES/TSB
43A	35.0	74.3	FFF	42" FES/TSB
44	1.2	9.1	HHH	18" FES/TSB
45	4.8	12.4	JP-7C,FF1,GGG, FLOWBY DP30	15' AT-GRADE INLET
46	2.4	9.7	JP-7D FLOWBY DP31	15' AT-GRADE INLET
47A	11.1	24.4	RP-3B	INTERIM AREA INLET 2.9'x5.7' TYPE D CDOT INLET FUTURE 15' AT-GRADE INLET
48A	13.5	26.6	RP-3A	INTERIM SHEET FLOW OFF SHOULDER INTO ROADSIDE DITCH FUTURE 15' AT-GRADE INLET
47	7.7	20.4	RP-4B,FLOWBY DP47A	14' SUMP INLET
48	8.2	21.0	RP-4A,FLOWBY DP48A	14' SUMP INLET
49	72.9	368.4	OS21,DP60,PR62	W-4 DETENTION POND
49	20.8	289.4	RELEASE POND W-4	PEAK OUTFLOW FROM POND W-4 UD Det.v3.06
50	29.4	53.7	JP-11	36" FES/TSB
51	5.8	10.5	RP-7B	15' AT-GRADE INLET
52	6.4	13.6	RP-7A,FLOWBY DP45, FLOWBY DP46	15' AT-GRADE INLET
53	19.8	36.1	JP-12	30" FES/TSB
54	0.4	3.5	RP-7D UNDEVELOPED, FLOWBY DP51	TSB
55	0.4	4.9	RP-7C UNDEVELOPED, FLOWBY DP52	TSB
56	5.7	20.5	QQQ,PPP1,RRR	24" FES
57	217.9	520.3	UUU,PPP2,PR58,OS4,TTT	CUMM. DETENTION POND 28'x5' INLET INTO SAND CREEK
57	3.1	149.7	RELEASE POND W-5	PEAK OUTFLOW FROM POND W-5 UD Det v3.06
60	59.7	316.2	OS20,PR69	EXISTING SWALE
68	42.2	472.2	PR67, PR71	84" RCP PEAK OUTFLOW INTO SAND CREEK
69	4.5	27.4	OS20A	EX 24" CMP
DBPS 159		950	SAND CREEK DRAINAGE BASIN PLANNING STUDY	
DBPS 160	770	2630	SAND CREEK DRAINAGE BASIN PLANNING STUDY	

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STERLING RANCH FILING NO. 1
PROPOSED FINAL DRAINAGE MAP

PROJECT NO. 09-002
DESIGNED BY: ET
DRAWN BY: BB
CHECKED BY: GT
DATE: 6/1/2017
SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A
SHEET 2 OF 4
SHEET 2

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

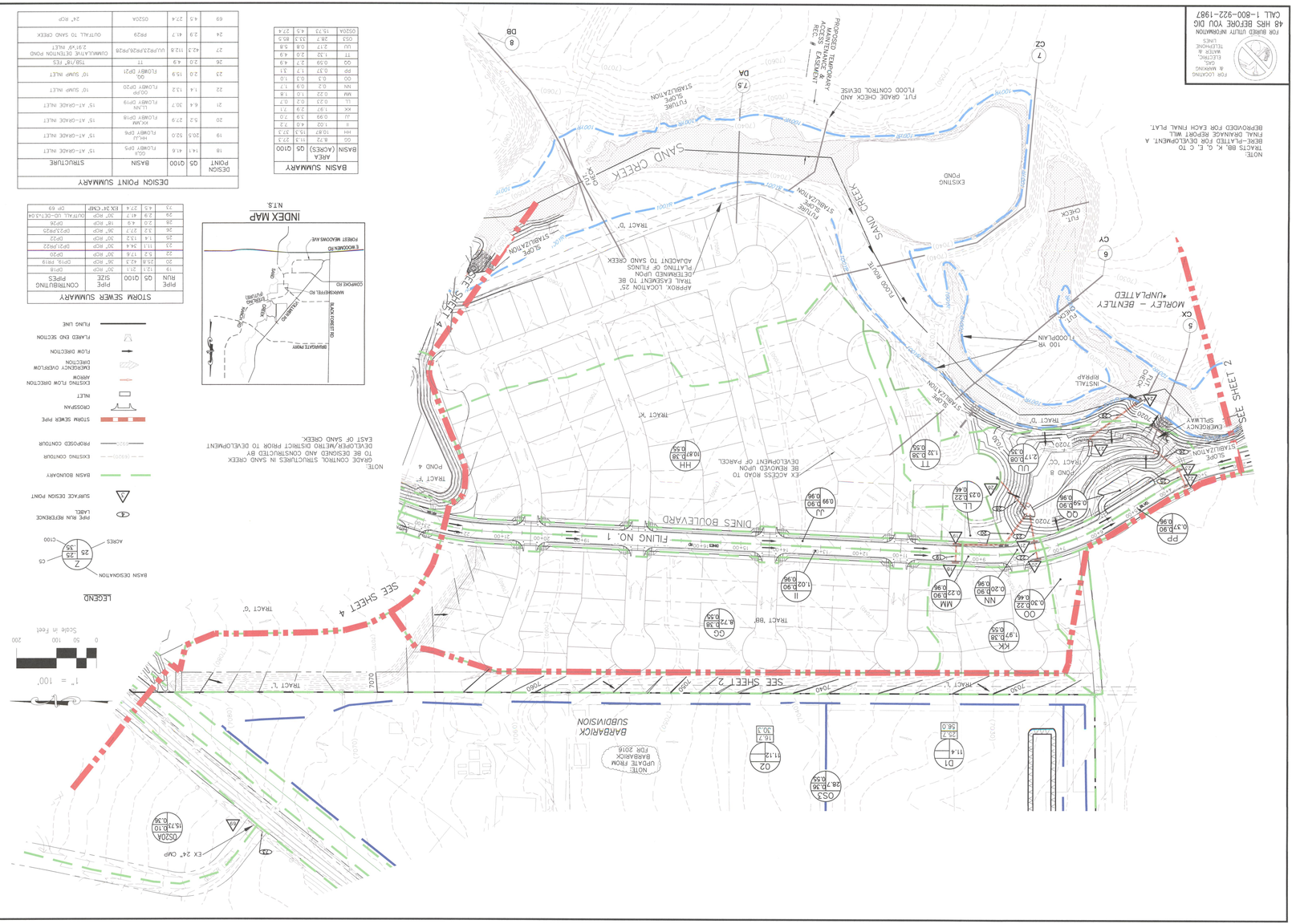
FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.
VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

REVISIONS:
NO. | DATE: | BY: | DESCRIPTION:
APPVD: | BY: | DATE:

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

CAUTION

File: O:\09002A\Sterling Ranch District\dwg\Eng Exhibits\TDP\SR Filing 1-Proposed Drainage Map Filing 1 SHEET2.dwg Plotstamp: 1/16/2018 2:29 PM



BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5	Q100
CC	8.72	11.3	27.5
HH	10.87	15.3	37.3
II	1.02	4.0	7.2
JJ	0.99	3.9	7.0
KK	1.97	2.9	7.1
LL	0.21	0.2	0.7
MM	0.22	1.0	1.8
NN	0.2	0.9	1.7
OO	0.3	0.3	1.0
PP	0.37	1.7	3.1
QQ	0.39	2.7	4.9
TT	1.32	2.9	4.9
UU	2.17	0.8	4.9
OS2OA	15.73	4.5	27.4
OS3	28.7	33.3	85.5

DESIGN POINT SUMMARY			
DESIGN POINT	Q5	Q100	STRUCTURE
18	14.1	41.6	15" AT-GRADE INLET
19	20.5	52.0	15" AT-GRADE INLET
20	5.2	27.9	15" AT-GRADE INLET
21	6.4	30.7	15" AT-GRADE INLET
22	1.4	11.2	10" SUMP INLET
23	2.0	15.9	10" SUMP INLET
24	2.9	41.7	OUTFALL TO SAND CREEK
26	2.0	4.9	TSB/18" FES
27	43.3	113.8	CUMMULATIVE DETENTION POND 2.9'X9' INLET
69	4.5	27.4	24" RCP

STORM SEWER SUMMARY				
PIPE RUN	Q5	Q100	PIPE SIZE	CONTRIBUTING PIPES
18	14.1	41.6	15" RCP	DP5
19	20.5	52.0	18" RCP	DP6
20	5.2	27.9	30" RCP	DP7
21	6.4	30.7	30" RCP	DP8
22	1.4	11.2	30" RCP	DP9
23	2.0	15.9	30" RCP	DP10
24	2.9	41.7	30" RCP	DP11
26	2.0	4.9	18" RCP	DP26
27	43.3	113.8	42"X84" RCP	DP5,DP6,DP7,DP8,DP9,DP10,DP11,DP22,DP23,DP25
69	4.5	27.4	EX 24" CMP	OUTFALL

REVISIONS:			
NO	DATE	BY	DESCRIPTION

CAUTION
THE ENGINEER PREPARING THESE PLANS MUST BE RESPONSIBLE TO INSURE THAT UNAUTHORIZED CHANGES TO AND USES OF THESE PLANS WILL NOT BE MADE IN MEETING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

APPROVED BY: DATE:

VIRGIL A. SANDEZ, COLORADO P.E. NO. 31160
FOR AND ON BEHALF OF CIVIL CONSULTANTS, INC.

CIVIL CONSULTANTS, INC.
21 SOUTH CASCADE, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

STERLING RANCH FILING NO.1
PROPOSED FINAL DRAINAGE MAP

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

File: O:\09002\Sterling Ranch District\dwg\Dwg Exhibits\DP\DP Dwg 1-Drainage Map SHEET 3.dwg Plotdate: 7/2/2018 3:03 PM

DESIGN POINT SUMMARY
DESIGN POINT | DS | Q100 | STRUCTURE
BASIN | TC | 46.8 | 10" RCP
BASIN | TC | 9.6 | 10" RCP
BASIN | TC | 9.6 | 10" RCP
BASIN | TC | 9.6

FINAL DRAINAGE REPORT
FOR
STERLING RANCH FILING NO. 2

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

June 2021
Project No. 25188.01

Prepared By:
JR Engineering, LLC
5475 Tech Center Drive
Colorado Springs, CO 80919
719-593-2593

PCD File No. SF-20-015

DRAINAGE FACILITY DESIGN

General Concept

The proposed stormwater conveyance system was designed to convey the developed Sterling Ranch Filing No. 2 runoff to the proposed full spectrum water quality and detention pond W5 via storm sewer. Pond W4 will be utilized to detain and treat large portions of offsite area. The proposed ponds were designed to release at less than historic rates to minimize adverse impacts downstream. Treated water will outfall directly into the Sand Creek Drainageway, where it will eventually outfall into Fountain Creek. All Ponds will be owned and maintained by Sterling Ranch Metro District. A proposed drainage map is presented in Appendix E showing locations of the pond and channel outfall locations.

To maintain the integrity of Pond W5, there will be bank stabilization improvements to the Sand Creek Drainage Channel with the development of the Sterling Ranch Filing No. 2 site. The pond release location will be protected with riprap. However, channel improvements for Sand Creek (checks, drops, etc.) will be installed in accordance with the construction plans performed by Matrix Design Group. JR Engineering is coordinating with Matrix Design Group. The flows discharged from Pond W5 will outfall into the reach of Sand Creek designed by Matrix. The discharge point from Sterling Ranch Filing No. 2 into Sand Creek is shown on the Matrix Design Plans in Appendix D. The rerouting of flows to ponds W4 and W5 outfall location should cause no negative impacts to downstream reaches of Sand Creek. Per the DBPS, Reach SC-9, the recommended improvements to the channel include selective rip rap linings, grade control check structures, and drop structure improvements that are anticipated to stabilize the channel to prevent further degradation, scour and meandering. Full Spectrum Detention in ponds W4 and W5 will reduce peak flows within the channel there-by adding to the integrity of the Sand Creek Channel.

The report is in compliance with the M&S 2018 MDDP. The total net outflow of the site into Sand Creek is 320.3 cfs at design point 4.8, as shown in the proposed drainage map in Appendix E. The diversion outfall for pond W5/W4 is in continuity with the approved MDDP. W4 and W5 correspond to pond FSD9 and FSD6 within the approved M&S 2018 MDDP. The MDDP shows the total net allowable release rate of these ponds to be 441.6 cfs at the junction structure and outfalls into Sand Creek.

Pond W4 and pond W5 350.74 acres and 173.97 acre have 524.71 acre tributary area. The existing drainage basins have a total net area of 569.9 acres. The total net existing runoff for the site is 473.2 cfs. In the proposed condition, the site will release a total of 320.3 cfs. No adverse downstream impacts are anticipated, with the proposed runoff being less than the existing runoff.

Specific Details

Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume (WQCV), and consider the need for Industrial Commercial BMP's.

Step 1, Reducing Runoff Volumes: The development of the project site is a proposed single-family development with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes.

Step 2, Stabilize Drainageways: Sterling Ranch Filing No. 2 utilizes storm sewer throughout the project site. This storm sewer directs the on-site development flows to the full spectrum detention Pond W5 that releases at or below historic rates into the Sand Creek Drainageway. Measures shall be implemented to prevent any negative impacts to the drainageway. Riprap at the outfall locations will be utilized to prevent any erosion. An emergency overflow spillway rundown has been designed from Pond W5 down into the Sand Creek Drainageway. The overflow channel will help protect and stabilize the drainageway by reducing channel degradation and erosion. The channel utilizes 4 foot deep "VH Soil Riprap" base with a minimum 4 inch overlay of topsoil, seed and mulch. A detailed analysis of the Sand Creek Drainageway is currently being conducted by Matrix Design Group. This report will cover stabilization measures and channel improvements needed for this reach of the Sand Creek Drainageway. The portions of Sand Creek to the south of the historic confluence point are to be stabilized per the Sand Creek Stabilization at Aspen Meadows Subdivision Filing No. 1 plans by Matrix Design Group, April 2020.

Step 3, Treat the WQCV: Water Quality treatment is provided in two proposed full spectrum water quality detention ponds: Pond W4 and Pond W5. Pond W5 will receive all runoff generated within Sterling Ranch Filing No. 2 as well as future Sterling Ranch Phase 2 and Copper Chase at Sterling Ranch, a school site and a small portion of offsite areas. Pond W4 will receive runoff generated from portions of Vollmer Road and a large portion of offsite areas to the north and west of Vollmer road. In general, the runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structures have been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. All flows released from the ponds will be reduced to less than historic rates into the Sand Creek Drainageway. These ponds will facilitate pollutant removal for the site, while also reducing peak stormwater rates into the Sand Creek Drainageway.

Step 4, Consider the need for Industrial and Commercial BMP's: future commercial sites are proposed within this development. Site specific storm water quality and erosion control plans will be required for each commercial tract prior to development. A site specific storm water quality and erosion control plan and narrative have also been prepared in conjunction with this final drainage report. Site specific temporary source control BMPs as well as permanent BMP's will be detailed in this plan and narrative to protect receiving waters.

Water Quality

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full spectrum water quality and detention are provided for all developed basins. For this site, two detention ponds have been proposed. The WQCV for each pond shall be released within 40 hours and the EURV shall be released within 72 hours. The table below provides the volumes required for each pond, along with their respective release rates for the 5-year and 100-year storm. Both ponds will utilize forebays, trickle channels, and outlet structures to dissipate energy and treat flows. The outlet structure for these ponds shall

reduce the release rates for all storm events to less than historic rates to minimize adverse impacts to downstream stormwater facilities. A broad crested weir is provided as an emergency spillway for each pond. The emergency spillway provided for Pond W5 will convey flows directly into the Sand Creek Drainageway. The emergency spillway provided for Pond W4 shall convey flows to the existing roadside swale along Vollmer Road. Both spillways will utilize riprap aprons to prevent scour at the outlets. Pond and outlet structure calculations and sizing can be found in Appendix C. The detention ponds 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. Pond W5 corresponds to pond FSD6 from the MMDP (Q_5=7.6 cfs, Q_{100}=149.7 cfs) and is releasing less than the MDDP values in the proposed design.

Table 3. Pond Volumes & Release Rates

	REQUIRED VOLUME (AC-FT)	VOLUME PROVIDED (AC-FT)	WQCV (AC-FT)	EURV (AC-FT)	5-YEAR RELEASE (CFS)	100-YEAR RELEASE (CFS)
POND W5	18.376	18.441	3.32	11.843	3.40	139.3
INTERIM POND W4	7.506	7.506	2.220	3.714	20.7	285.0

Per the MDDP, Pond W4 is sized to maximize the area on the site & could be potentially enlarged in the future if more land is purchased. A preliminary design for the ultimate configuration of Pond W4 has been used to calculate potential volume. Upon future development, an expansion of Pond W4 will need to be finalized. The pond is designed to treat approximately 352.2 acres and provide approximately 2.281 ac-ft of water quality storage. Modifications will be required to ensure the outlet structure complies with local and El Paso County criteria. A preliminary pond sizing for the ultimate condition can be found in the appendix. Pond W4 corresponds to pond FSD9 from the MMDP (Q_5=24.9 cfs, Q_{100}=290 cfs) and is releasing less than the MDDP values in the proposed design. The ultimate emergency overflow path will be through Marksheffel and a section can be found within Appendix B demonstrating the ability to pass 319.2 cfs. The interim emergency overflow path will be via an emergency overflow inlet and the existing ditch along Vollmer Road.

Erosion Control Plan

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate must be submitted with each Final Drainage Report. The Erosion Control Plan for Sterling Ranch Filing No. 2 has been submitted with this report.

Operation & Maintenance

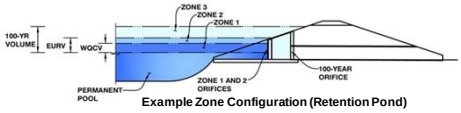
In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. All proposed drainage structures within the any platted County ROW will be owned and maintained by El Paso County. All proposed drainage structures within the property or tracts will be owned and maintained by the Sterling Ranch Metro District. Vegetation in the natural and improved portions of Sand Creek Drainageway is the responsibility of Sterling Ranch Metro District. This includes all mowing, seeding and weed control activities. An Inspection & Maintenance Plan has been submitted concurrently with this final drainage report that details the required maintenance activities and intervals to ensure proper function of all stormwater infrastructures in the future. The full spectrum detention ponds will be owned & maintained by Sterling Ranch Metro District.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: STERLING RANCH FILING NO. 2

Basin ID: POND W5



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	173.97	acres
Watershed Length =	3,888	ft
Watershed Length to Centroid =	1,814	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	57.10%	percent
Percentage Hydrologic Soil Group A =	85.0%	percent
Percentage Hydrologic Soil Group B =	15.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	3.288	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	11.714	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	9.031	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	11.873	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	14.194	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	18.106	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	21.364	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	25.580	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	34.562	acre-feet		inches
Approximate 2-yr Detention Volume =	7.768	acre-feet		
Approximate 5-yr Detention Volume =	10.244	acre-feet		
Approximate 10-yr Detention Volume =	12.566	acre-feet		
Approximate 25-yr Detention Volume =	14.965	acre-feet		
Approximate 50-yr Detention Volume =	16.434	acre-feet		
Approximate 100-yr Detention Volume =	18.217	acre-feet		

Define Zones and Basin Geometry

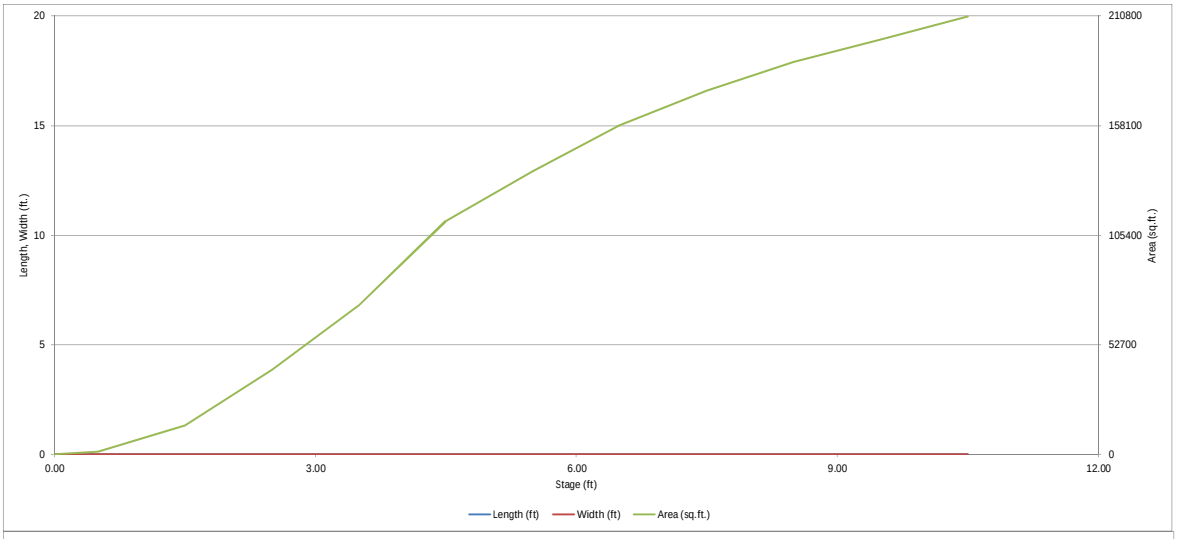
Zone 1 Volume (WQCV) =	3.288	acre-feet
Zone 2 Volume (EURV - Zone 1) =	8.426	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.502	acre-feet
Total Detention Basin Volume =	18.217	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

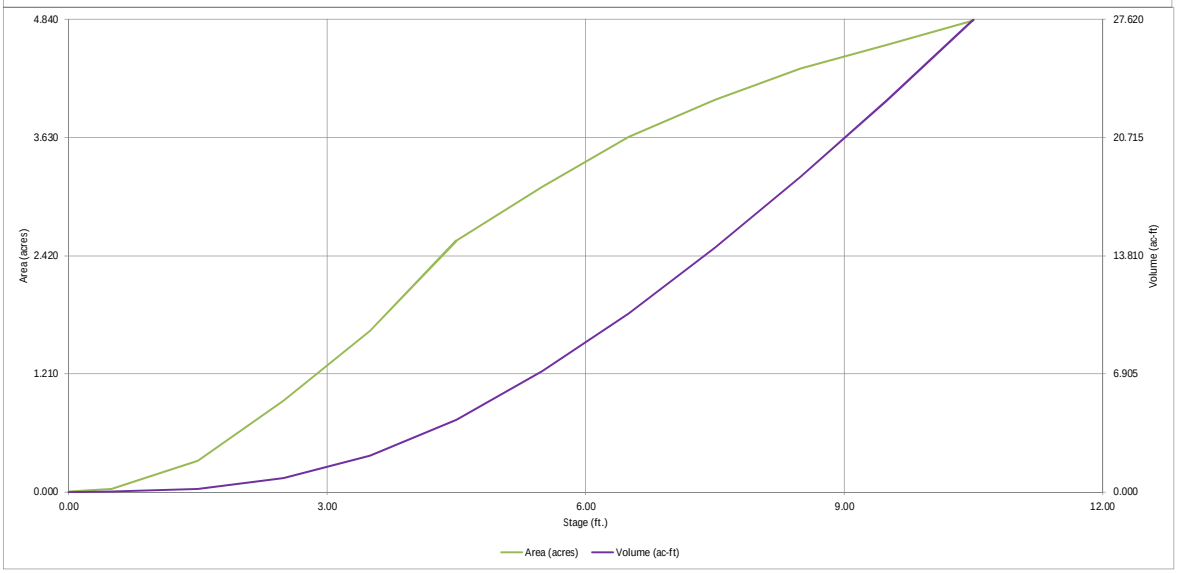
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
ELEV:6962	--	0.50	--	--	--	1,328	0.030	337	0.008
ELEV:6963	--	1.50	--	--	--	13,823	0.317	7,912	0.182
ELEV:6964	--	2.50	--	--	--	40,724	0.935	35,186	0.808
ELEV:6965	--	3.50	--	--	--	71,720	1.646	91,408	2.098
ELEV:6966	--	4.50	--	--	--	112,095	2.573	183,315	4.208
ELEV:6967	--	5.50	--	--	--	136,106	3.125	307,416	7.057
ELEV:6968	--	6.50	--	--	--	158,377	3.636	454,657	10.437
ELEV:6969	--	7.50	--	--	--	174,976	4.017	621,334	14.264
ELEV:6970	--	8.50	--	--	--	188,903	4.337	803,273	18.441
ELEV:6971	--	9.50	--	--	--	199,637	4.583	997,543	22.900
ELEV:6972	--	10.50	--	--	--	210,510	4.833	1,202,617	27.608

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



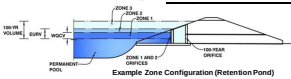


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: STERLING RANCH FILING NO. 2

Basin ID: POND W5



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.13	3.311	Orifice Plate
Zone 2 (EURV)	6.88	8.532	Rectangular Orifice
Zone 3 (100-year)	8.49	6.532	Weir&Pipe (Restrict)
Total (all zones)		18.376	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)		Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches		Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)		WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	6.88	ft (relative to basin bottom at Stage = 0 ft)		Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches		Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches		Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.15	4.00					
Orifice Area (sq. inches)	12.55	12.55	25.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected			Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Height =	N/A	N/A	inches				
Vertical Orifice Width =			inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	7.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.30	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.48	N/A	
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	84.00	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	42.00	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	12.96	N/A	ft²
Outlet Pipe Diameter =	54.00	N/A	inches	Outlet Orifice Centroid =	1.88	N/A	feet
Restrictor Plate Height Above Pipe Invert =	41.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.12	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.50	ft (relative to basin bottom at Stage = 0 ft)		Spillway Design Flow Depth=	1.74	feet
Spillway Crest Length =	48.00	feet		Stage at Top of Freeboard =	12.24	feet
Spillway End Slopes =	10.00	H:V		Basin Area at Top of Freeboard =	4.83	acres
Freeboard above Max Water Surface =	2.00	feet		Basin Volume at Top of Freeboard =	27.61	acre-ft

Calculated Parameters for Spillway

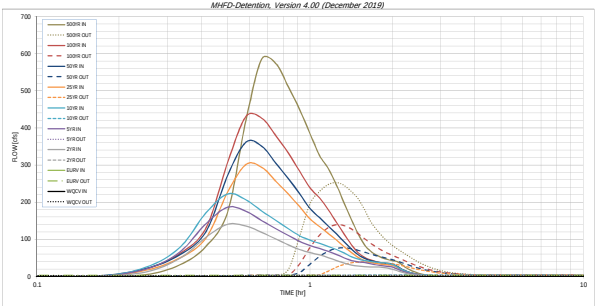
Routed Hydrograph Results

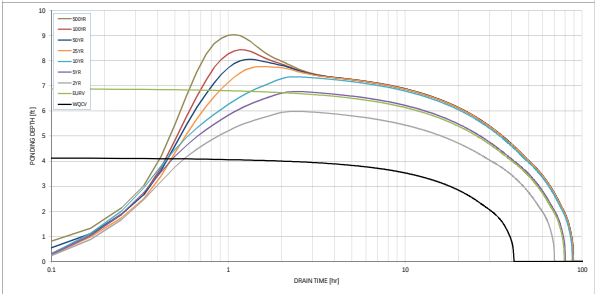
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

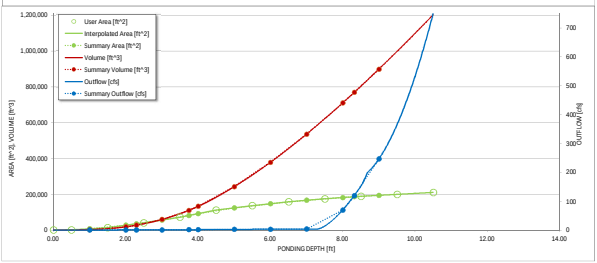
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	3.311	11.843	9.121	11.991	14.334	18.244	21.510	25.732	34.734
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	9.121	11.991	14.334	18.244	21.510	25.732	34.734
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.6	2.9	5.1	54.6	85.6	128.5	217.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.31	0.49	0.74	1.25
Peak Inflow Q (cfs) =	N/A	N/A	140.5	186.5	222.1	301.6	361.5	431.2	586.0
Peak Outflow Q (cfs) =	1.7	3.4	3.0	3.4	5.1	38.8	77.3	139.3	252.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	1.0	0.7	0.9	1.1	1.2
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.9	1.6	2.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	70	63	71	78	76	75	73	70
Time to Drain 99% of Inflow Volume (hours) =	40	76	67	77	84	84	83	82	81
Maximum Ponding Depth (ft) =	4.13	6.88	5.98	6.77	7.35	7.76	8.05	8.43	9.04
Area at Maximum Ponding Depth (acres) =	2.23	3.78	3.37	3.73	3.96	4.10	4.19	4.31	4.47
Maximum Volume Stored (acre-ft) =	3.320	11.847	8.616	11.396	13.666	15.319	16.522	18.138	20.774

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
5.00 min	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.14	4.42
	0:15:00	0.00	0.00	12.01	19.62	24.38	16.41	21.13	20.11	30.88
	0:20:00	0.00	0.00	48.30	65.33	77.56	49.45	58.16	61.60	81.16
	0:25:00	0.00	0.00	105.72	142.54	171.74	104.07	121.39	131.21	174.25
	0:30:00	0.00	0.00	140.48	186.46	222.13	227.64	272.80	308.13	422.01
	0:35:00	0.00	0.00	135.46	175.22	206.03	301.61	361.54	431.24	585.96
	0:40:00	0.00	0.00	118.36	150.07	175.68	293.61	350.26	425.82	573.28
	0:45:00	0.00	0.00	100.92	128.44	150.65	256.40	304.92	378.98	510.45
	0:50:00	0.00	0.00	84.87	110.40	128.43	222.14	263.81	332.30	449.36
	0:55:00	0.00	0.00	72.36	94.33	109.32	187.66	222.42	282.99	384.40
	1:00:00	0.00	0.00	64.06	83.13	97.59	154.96	182.98	238.59	325.88
	1:05:00	0.00	0.00	58.14	75.08	88.94	134.19	158.26	211.50	290.49
	1:10:00	0.00	0.00	50.72	67.68	80.67	115.60	135.72	179.70	246.12
	1:15:00	0.00	0.00	42.71	59.08	72.46	97.95	114.30	145.50	197.99
	1:20:00	0.00	0.00	35.76	50.04	63.10	80.42	93.20	113.95	153.88
	1:25:00	0.00	0.00	30.54	42.87	53.10	64.63	74.31	85.95	114.90
	1:30:00	0.00	0.00	27.71	39.21	46.68	51.11	58.33	64.24	85.13
	1:35:00	0.00	0.00	26.36	37.32	42.89	42.74	48.57	51.51	67.73
	1:40:00	0.00	0.00	25.60	34.28	40.22	37.77	42.78	44.23	57.57
	1:45:00	0.00	0.00	25.13	31.06	38.26	34.61	39.11	39.26	50.51
	1:50:00	0.00	0.00	24.76	28.74	36.93	32.45	36.59	35.99	45.78
	1:55:00	0.00	0.00	22.48	27.05	35.35	31.03	34.94	33.68	42.43
	2:00:00	0.00	0.00	19.58	25.23	32.57	30.03	33.77	32.06	40.11
	2:05:00	0.00	0.00	15.52	20.27	25.90	24.54	27.57	25.96	32.36
	2:10:00	0.00	0.00	11.36	14.69	18.66	17.66	19.83	18.68	23.23
	2:15:00	0.00	0.00	8.25	10.65	13.46	12.75	14.30	13.52	16.79
	2:20:00	0.00	0.00	5.94	7.66	9.70	9.23	10.34	9.85	12.22
	2:25:00	0.00	0.00	4.23	5.34	6.86	6.50	7.28	6.96	8.63
	2:30:00	0.00	0.00	2.91	3.63	4.77	4.51	5.04	4.82	5.97
	2:35:00	0.00	0.00	1.96	2.50	3.30	3.19	3.57	3.40	4.20
	2:40:00	0.00	0.00	1.21	1.65	2.12	2.10	2.34	2.23	2.75
	2:45:00	0.00	0.00	0.65	0.97	1.20	1.24	1.38	1.31	1.60
	2:50:00	0.00	0.00	0.28	0.47	0.55	0.60	0.66	0.63	0.76
	2:55:00	0.00	0.00	0.09	0.15	0.16	0.19	0.20	0.19	0.22
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
	1.00	7,576	0.174	2,563	0.059	0.42
	2.00	27,274	0.626	18,186	0.418	0.59
WQCV	2.29	35,075	0.805	27,227	0.625	0.79
	3.00	58,222	1.291	59,422	1.364	1.11
EURV	3.74	81,410	1.869	109,783	2.520	1.34
	4.00	91,907	2.110	132,314	3.038	1.41
	5.00	124,100	2.849	242,364	5.564	2.48
	6.00	147,241	3.380	378,252	8.683	3.03
	7.00	166,676	3.826	535,920	12.303	3.48
	8.00	181,939	4.177	710,562	16.312	69.54
100-YR	8.32	186,396	4.279	769,496	17.665	119.49
	9.00	194,270	4.460	899,066	20.640	246.08

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

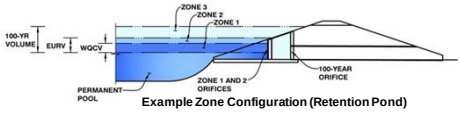
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: STERLING RANCH FILING NO. 2

Basin ID: POND W4 Interim



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	350.74	acres
Watershed Length =	9,241	ft
Watershed Length to Centroid =	4,488	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	12.00%	percent
Percentage Hydrologic Soil Group A =	40.0%	percent
Percentage Hydrologic Soil Group B =	60.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	2.281	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	3.710	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.802	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.573	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.859	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	20.281	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	26.707	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	36.815	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	54.041	acre-feet	inches
Approximate 2-yr Detention Volume =	2.353	acre-feet	
Approximate 5-yr Detention Volume =	3.495	acre-feet	
Approximate 10-yr Detention Volume =	6.059	acre-feet	
Approximate 25-yr Detention Volume =	8.184	acre-feet	
Approximate 50-yr Detention Volume =	9.066	acre-feet	
Approximate 100-yr Detention Volume =	12.211	acre-feet	

Define Zones and Basin Geometry

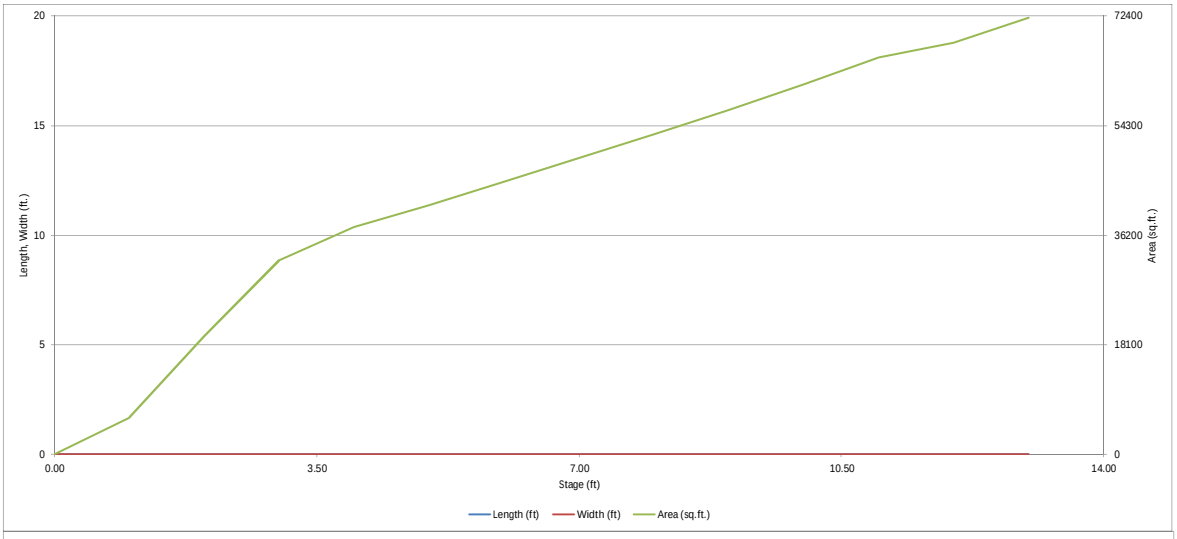
Zone 1 Volume (WQCV) =	2.281	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.429	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	8.500	acre-feet
Total Detention Basin Volume =	12.211	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

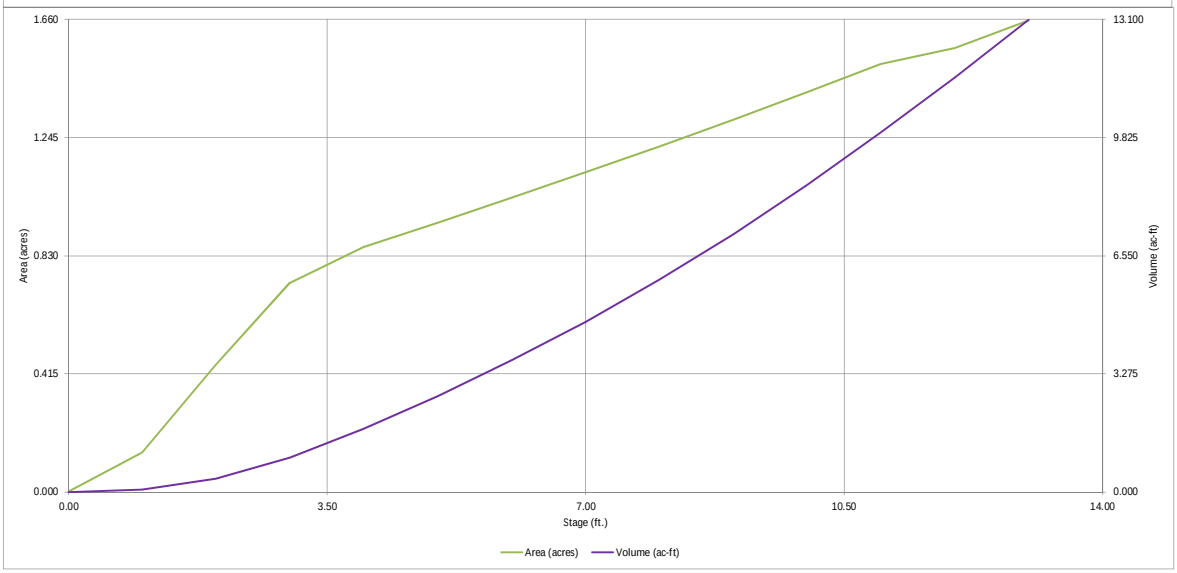
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
ELEV:7014	--	1.00	--	--	--	5,983	0.137	3,001	0.069
ELEV:7015	--	2.00	--	--	--	19,453	0.447	15,719	0.361
ELEV:7016	--	3.00	--	--	--	31,989	0.734	41,440	0.951
ELEV:7017	--	4.00	--	--	--	37,508	0.861	76,189	1.749
ELEV:7018	--	5.00	--	--	--	41,177	0.945	115,531	2.652
ELEV:7019	--	6.00	--	--	--	45,017	1.033	158,628	3.642
ELEV:7020	--	7.00	--	--	--	48,960	1.124	205,617	4.720
ELEV:7021	--	8.00	--	--	--	52,863	1.214	256,528	5.889
ELEV:7022	--	9.00	--	--	--	56,926	1.307	311,423	7.149
ELEV:7023	--	10.00	--	--	--	61,139	1.404	370,455	8.504
ELEV:7024	--	11.00	--	--	--	65,528	1.504	433,789	9.958
	--	12.00	--	--	--	67,956	1.560	500,531	11.491
	--	13.00	--	--	--	72,155	1.656	570,586	13.099

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



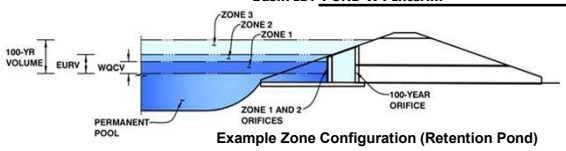


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **STERLING RANCH FILING NO. 2**

Basin ID: **POND W4 Interim**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.61	2.281	Orifice Plate
Zone 2 (EURV)	6.07	1.429	Orifice Plate
Zone 3 (100-year)	12.46	8.500	Weir&Pipe (Restrict)
Total (all zones)		12.211	

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

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	4.722E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.99	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	6.80	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.66	3.33					
Orifice Area (sq. inches)	6.80	6.80	6.80					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.07	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	8.57	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	10.31	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.46	N/A	
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	144.31	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	72.15	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.58	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	22.35	N/A	ft^2
Outlet Pipe Diameter =	66.00	N/A	inches	Outlet Orifice Centroid =	2.60	N/A	feet
Restrictor Plate Height Above Pipe Invert =	58.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.47	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.20	feet
Spillway Crest Length =	74.00	feet	Stage at Top of Freeboard =	12.20	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.58	acres
Freeboard above Max Water Surface =	1.50	feet	Basin Volume at Top of Freeboard =	11.80	acre-ft

Calculated Parameters for Spillway

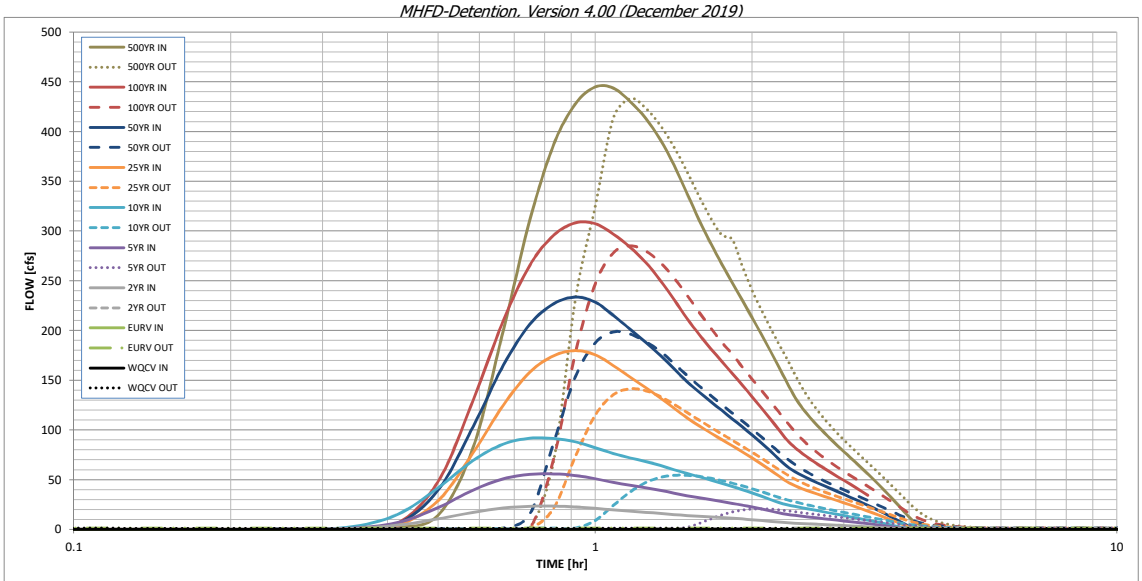
Routed Hydrograph Results

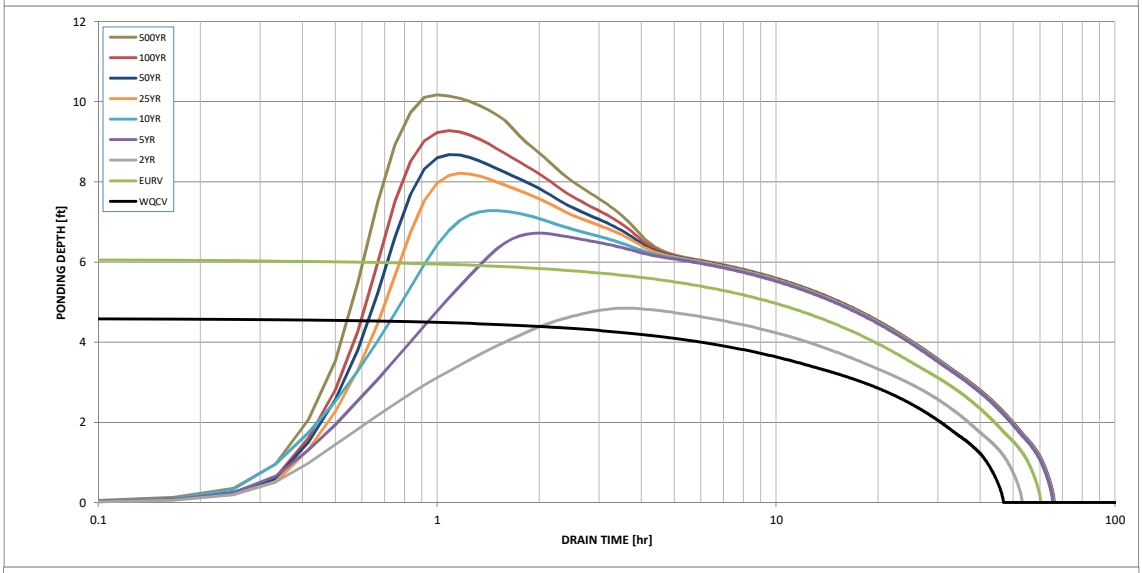
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

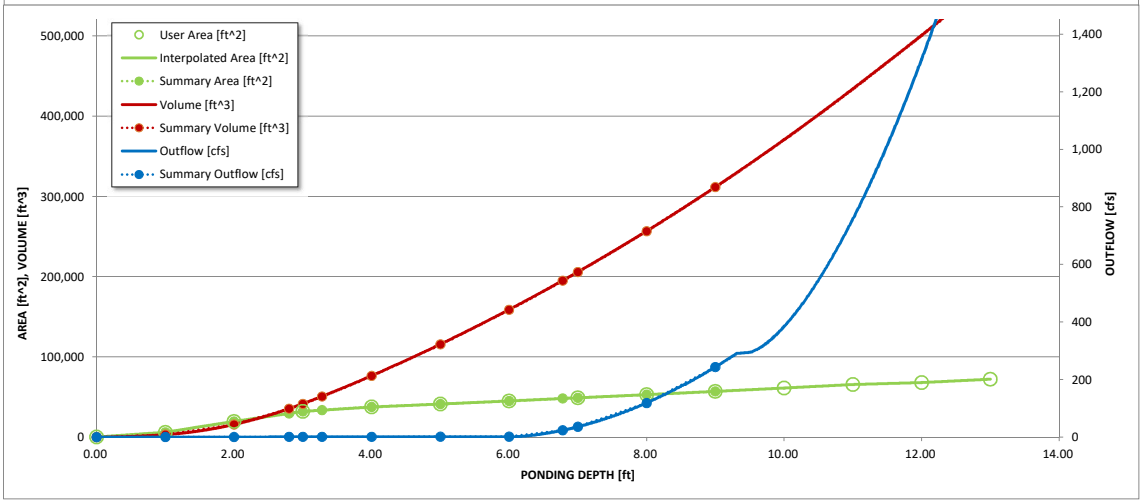
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	2.281	3.710	2.802	6.573	10.859	20.281	26.707	36.815	54.041
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.802	6.573	10.859	20.281	26.707	36.815	54.041
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.7	30.4	64.6	150.7	203.5	280.5	416.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.09	0.18	0.43	0.58	0.80	1.19
Peak Inflow Q (cfs) =	N/A	N/A	23.4	55.7	91.6	179.7	233.5	308.1	444.7
Peak Outflow Q (cfs) =	1.1	1.4	1.2	20.7	54.4	141.3	198.4	285.0	433.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.8	0.9	1.0	1.0	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	1.0	1.4	2.0	2.1
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) =	42	53	48	55	51	44	40	35	27
Time to Drain 99% of Inflow Volume (hours) =	**45**	57	51	61	59	55	53	50	46
Maximum Ponding Depth (ft) =	4.61	6.07	4.85	6.72	7.28	8.21	8.68	9.28	10.17
Area at Maximum Ponding Depth (acres) =	0.91	1.04	0.93	1.10	1.15	1.23	1.28	1.33	1.42
Maximum Volume Stored (acre-ft) =	2.290	3.714	2.511	4.398	5.039	6.146	6.736	7.506	8.745

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.05
	0:15:00	0.00	0.00	0.13	0.22	0.27	0.19	0.26	0.23	0.41
	0:20:00	0.00	0.00	0.70	1.03	1.91	0.80	0.98	0.99	1.99
	0:25:00	0.00	0.00	4.05	6.62	14.64	3.93	5.22	5.86	14.30
	0:30:00	0.00	0.00	10.59	21.88	41.83	28.88	39.54	48.08	81.91
	0:35:00	0.00	0.00	17.09	39.51	69.21	76.76	103.22	129.56	199.96
	0:40:00	0.00	0.00	21.42	50.84	85.74	124.91	164.83	209.85	311.38
	0:45:00	0.00	0.00	23.26	55.39	91.58	158.09	206.35	265.79	387.19
	0:50:00	0.00	0.00	23.43	55.73	91.37	174.59	226.89	295.75	427.74
	0:55:00	0.00	0.00	22.60	54.20	87.99	179.69	233.50	308.15	444.73
	1:00:00	0.00	0.00	21.09	50.99	82.12	175.52	228.49	307.36	443.68
	1:05:00	0.00	0.00	19.58	47.22	76.30	164.74	215.25	296.89	430.21
	1:10:00	0.00	0.00	18.33	44.40	71.93	153.13	201.32	283.81	413.28
	1:15:00	0.00	0.00	17.16	41.96	68.16	142.50	188.13	268.44	391.95
	1:20:00	0.00	0.00	16.00	39.30	64.26	132.29	174.98	250.51	366.18
	1:25:00	0.00	0.00	14.87	36.45	60.01	122.00	161.53	231.17	338.13
	1:30:00	0.00	0.00	13.96	33.90	56.25	112.10	148.57	212.08	310.76
	1:35:00	0.00	0.00	13.21	31.96	52.94	104.00	137.94	195.94	287.45
	1:40:00	0.00	0.00	12.50	30.03	49.64	96.86	128.39	181.69	266.65
	1:45:00	0.00	0.00	11.83	28.10	46.33	90.29	119.57	168.78	247.80
	1:50:00	0.00	0.00	11.16	26.19	43.06	83.95	111.08	156.61	230.01
	1:55:00	0.00	0.00	10.46	24.30	39.85	77.88	102.92	144.90	212.87
	2:00:00	0.00	0.00	9.73	22.42	36.66	71.85	94.85	133.46	196.17
	2:05:00	0.00	0.00	8.94	20.50	33.43	65.81	86.82	122.23	179.75
	2:10:00	0.00	0.00	8.12	18.55	30.15	59.74	78.80	111.18	163.53
	2:15:00	0.00	0.00	7.29	16.62	27.00	53.67	70.78	100.15	147.40
	2:20:00	0.00	0.00	6.67	15.07	24.72	47.94	63.30	89.82	132.66
	2:25:00	0.00	0.00	6.21	14.10	23.11	43.84	58.01	82.20	121.64
	2:30:00	0.00	0.00	5.79	13.19	21.64	40.65	53.80	76.06	112.54
	2:35:00	0.00	0.00	5.42	12.32	20.22	37.96	50.19	70.67	104.47
	2:40:00	0.00	0.00	5.06	11.50	18.86	35.48	46.87	65.80	97.17
	2:45:00	0.00	0.00	4.71	10.71	17.53	33.22	43.83	61.30	90.40
	2:50:00	0.00	0.00	4.37	9.94	16.25	31.01	40.87	57.03	84.03
	2:55:00	0.00	0.00	4.04	9.19	15.00	28.84	37.99	53.02	78.06
	3:00:00	0.00	0.00	3.72	8.47	13.79	26.71	35.19	49.23	72.44
	3:05:00	0.00	0.00	3.41	7.76	12.62	24.62	32.42	45.47	66.87
	3:10:00	0.00	0.00	3.10	7.07	11.48	22.54	29.69	41.74	61.34
	3:15:00	0.00	0.00	2.80	6.38	10.35	20.48	26.97	38.01	55.82
	3:20:00	0.00	0.00	2.50	5.70	9.23	18.42	24.26	34.28	50.31
	3:25:00	0.00	0.00	2.20	5.03	8.12	16.37	21.55	30.56	44.81
	3:30:00	0.00	0.00	1.91	4.36	7.01	14.32	18.86	26.85	39.32
	3:35:00	0.00	0.00	1.62	3.69	5.91	12.27	16.16	23.14	33.84
	3:40:00	0.00	0.00	1.34	3.02	4.81	10.23	13.47	19.43	28.38
	3:45:00	0.00	0.00	1.06	2.36	3.72	8.20	10.79	15.74	22.93
	3:50:00	0.00	0.00	0.78	1.72	2.65	6.18	8.13	12.05	17.51
	3:55:00	0.00	0.00	0.52	1.11	1.69	4.19	5.51	8.43	12.27
	4:00:00	0.00	0.00	0.38	0.70	1.15	2.44	3.26	5.30	7.97
	4:05:00	0.00	0.00	0.30	0.56	0.93	1.47	2.05	3.46	5.40
	4:10:00	0.00	0.00	0.25	0.46	0.76	0.94	1.34	2.31	3.71
	4:15:00	0.00	0.00	0.22	0.37	0.62	0.64	0.91	1.52	2.50
	4:20:00	0.00	0.00	0.18	0.30	0.50	0.44	0.62	0.97	1.64
	4:25:00	0.00	0.00	0.15	0.24	0.39	0.33	0.45	0.58	1.03
	4:30:00	0.00	0.00	0.13	0.19	0.30	0.25	0.32	0.32	0.61
	4:35:00	0.00	0.00	0.11	0.14	0.22	0.18	0.22	0.18	0.38
	4:40:00	0.00	0.00	0.09	0.11	0.16	0.14	0.16	0.13	0.30
	4:45:00	0.00	0.00	0.07	0.09	0.12	0.10	0.12	0.10	0.23
	4:50:00	0.00	0.00	0.05	0.07	0.09	0.08	0.09	0.08	0.19
	4:55:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.06	0.14
	5:00:00	0.00	0.00	0.03	0.04	0.05	0.04	0.05	0.05	0.11
	5:05:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.07
	5:10:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.05
	5:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.03
	5:20:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	20	0.000	0	0.000	0.00
	1.00	5,983	0.137	3,001	0.069	0.23
	2.00	19,453	0.447	15,719	0.361	0.45
WQCV	2.80	29,482	0.677	35,293	0.810	0.62
EURV	3.00	31,989	0.734	41,440	0.951	0.66
	3.28	33,534	0.770	50,614	1.162	0.70
	4.00	37,508	0.861	76,189	1.749	0.99
	5.00	41,177	0.945	115,531	2.652	1.22
	6.00	45,017	1.033	158,628	3.642	1.40
100-YR	6.78	48,093	1.104	194,941	4.475	23.63
	7.00	48,960	1.124	205,617	4.720	35.75
	8.00	52,863	1.214	256,528	5.889	118.13
	9.00	56,926	1.307	311,423	7.149	243.29

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

STERLING RANCH
PONDS W4 & W5 TRIBUTARY AREA EXHIBIT

LEGEND

- MDDP BASINS
- POND W4 TRIBUTARY AREA
- POND W5 TRIBUTARY AREA
- HISTORIC DBPS SC/EFSC BNDRY LINE
- PROPOSED SC/EFSC BNDRY LINE
- BASIN DIVERSION AREA (EAST FORK SAND CREEK TO SAND CREEK) * ~267.3 AC

MDDP BASIN

DBPS BASIN

77
MDDP 1,468 CFS
DBPS 2,262 CFS
FEMA 2,600 CFS

71
MDDP 1,612 CFS
DBPS 2,260 CFS

63
MDDP 1,385 CFS
DBPS 2,630 CFS
FEMA 2,600 CFS

61
MDDP 1,620.1 CFS
FEMA 2,600 CFS

POND FSD 17B

POND FSD 17A
Q100 OUT = 86.1 CFS

POND FSD 18
Q100 OUT = 69.6 CFS

POND 1
Q100 OUT = 103.1 CFS

POND 4
/FSD 12
Q100 OUT = 200.3 CFS

POND FSD 16
Q100 OUT = 156.4 CFS

POND FSD 14B

POND FSD 14A
Q100 OUT = 142.2 CFS

POND 8/
FSD 13
Q100 OUT = 47.2 CFS

POND W-4/
FSD 9

POND W-5/
FSD 6
Q100 OUT = 149.7 CFS

Q100 OUT = 289.90 CFS

POND FSD 11B
Q100 OUT = 69.5 CFS

ASPEN VALLEY RD.
WHEATLAND DR.
VOLLMER ROAD
WHEATLAND DRIVE
BRIARGATE PARKWAY
STERLING RANCH ROAD
DINES BLVD
BYNUM DRIVE
BEAVERHEAD CIRCLE
ALZADA DRIVE
MARKSHEFFEL ROAD

HOMESTEAD AT STERLING RANCH FILING NO. 1
HOMESTEAD AT STERLING RANCH FILING NO.2
BRANDING IRON AT STERLING RANCH FILING NO.2
BRANDING IRON AT STERLING RANCH FILING NO. 1
AMENDED PLAT BARBARICK SUBDIVISION
UNPLATTED REC. NO. 217051682
PAWNEE RANCHEROS FILING NO. 2 PLAT BOOK U-2 PAGE 45
BAR J-B ACRES SECOND FILING PLAT BOOK A-2, PAGE 56
PAWNEE RANCHEROS FILING NO. 1 PLAT BOOK I-2, PAGE 28

400 200 0 400 800
ORIGINAL SCALE: 1" = 400'

PONDS W4 & W5 TRIBUTARY AREA EXHIBIT
STERLING RANCH
JOB NO. 25188.00
04-14-2021
SHEET 1 OF 1

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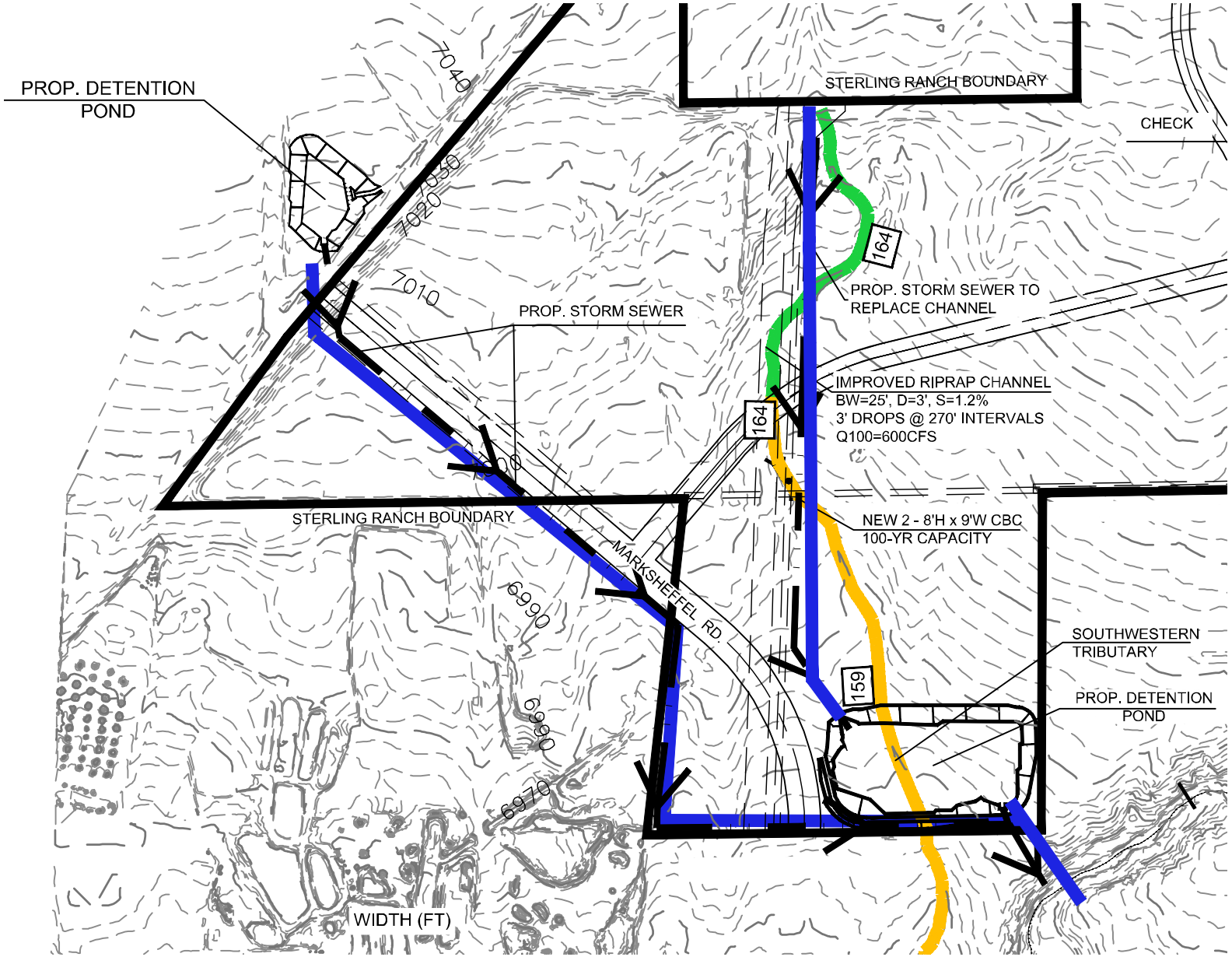
X:\2510000.all\2518800\Drawings\Presentations\2021-4-14 Ponds W4 & W5 Tributary Area.dwg, 24x36 Title Portrait, 6/23/2021 12:23:00 PM, FC



SOUTHWEST TRIBUTARY
SHEET 3 OF 5

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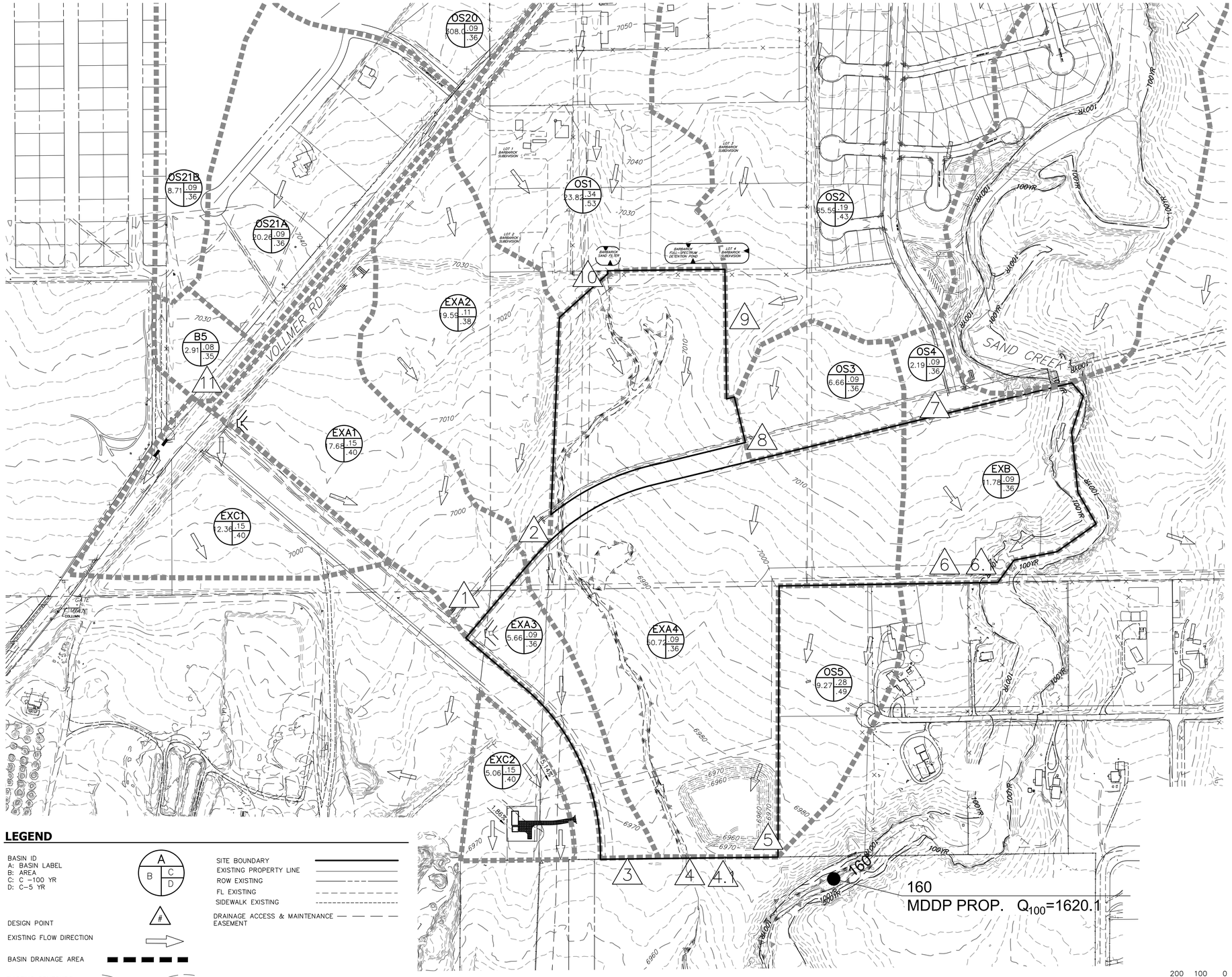
APPENDIX E

DRAINAGE MAPS & PLANS

STERLING RANCH

EXISTING DRAINAGE MAP



DESIGN POINT		
DP	Q5 Total	Q100 Total
1	7.2	12.1
2	5.4	9.0
3	1.4	2.3
4	10.6	17.8
5	7.5	23.4
6	3.0	5.0
7	0.5	0.9
8	1.8	3.1
9	37.3	62.6
10	23.9	40.1
4.1	45.6	76.5
6.1	3.0	5.1
11	56.9	215.3

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EXA1	17.68	9%	0.15	0.40	25.4	7.2	12.1
EXA2	19.59	5%	0.11	0.38	31.5	5.4	9.0
EXA3	5.66	2%	0.09	0.36	26.4	1.4	2.3
EXA4	50.72	2%	0.09	0.36	33.2	10.6	17.8
EXC1	12.36	2%	0.09	0.36	22.0	3.3	5.5
EXC2	5.06	2%	0.09	0.36	20.6	1.4	2.3
EXB	11.78	2%	0.09	0.36	23.8	3.0	5.0
OS1	23.82	45%	0.34	0.53	22.4	23.9	40.1
OS2	85.59	18%	0.19	0.43	34.1	37.3	62.6
OS3	6.66	2%	0.09	0.36	20.3	1.8	3.1
OS4	2.19	2%	0.09	0.36	26.6	0.5	0.9
OS5	9.27	9%	0.28	0.49	22.8	7.5	23.4
B5	2.91	26%	0.79	1.19	5.0	11.8	19.9
OS20	308.00	9%	0.13	0.40	68.9	61.0	310.0
OS21A	20.26	12%	0.13	0.40	53.5	4.2	7.1
OS21B	8.71	12%	0.13	0.40	24.5	3.1	5.3

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING CONTOURS 6100

SITE BOUNDARY
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

200 100 0 200 400
ORIGINAL SCALE: 1" = 200'

STERLING RANCH FILING 2
EXISTING DRAINAGE MAP
JOB NO. 25188.00
04/19/21
SHEET 1 OF 1

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DESIGN POINT		
DP	Q5 Total	Q100 Total
1	4.4	9.4
2	1.9	3.9
3	11.1	24.7
4	3.7	7.4
5	4.1	19.6
6	3.3	6.7
6A	2.2	4.1
7	27.5	60.6
8	3.0	12.5
9	1.9	4.8
10	9.2	17.3
11	9.5	19.9
12	1.9	9.5
13	15.7	34.6
14	16.0	37.9
15	5.4	11.7
16	4.4	9.6
17	1.4	4.7
18	4.3	14.0
19	38.8	85.4
20	7.1	13.4
21	7.4	15.2
22	2.7	15.4
23	8.8	15.8
24	11.5	20.6
25	61.0	310.0
26	4.2	21.9
27	6.3	11.7
28	6.9	14.4
29	3.1	16.3
30	0.9	6.4
31	2.0	15.0
32	1.4	10.0
1.0	6.0	10.3
1.1	12.6	19.7
1.2	17.6	28.2
1.3	25.9	46.9
1.3A	5.0	8.7
1.4	52.5	105.9
1.5	55.1	103.9
1.6	56.4	107.7
1.7	17.3	25.3
1.8	68.8	125.0
2.0	23.2	74.5
2.1	38.1	106.6
2.2	56.9	138.7
2.3	9.6	17.2
2.4	63.7	151.9
2.5	96.6	250.7
2.6	97.8	250.4
2.7	162.0	336.8
2.8	189.8	424.4
2.9	14.2	22.5
3.0	189.8	424.4
3.1	14.2	22.5
3.2	187.5	428.2
4.0	18.4	26.1
4.1	56.2	264.7
4.2	12.7	26.0
4.3	49.1	291.2
4.4	3.1	3.1
4.5	51.1	51.1
4.6	56.5	245.8
4.7	58.4	248.6
4.8	59.8	320.3
OS2	13.8	39.1
OS3	17.6	48.9
OS4	2.6	8.5
D1	3.31	6.10
D2	1.63	2.97

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	2.06	66%	0.51	0.65	9.7	4.4	9.4
A2	0.82	69%	0.53	0.66	9.1	1.9	3.9
A3	6.76	60%	0.47	0.62	15.0	11.1	24.7
A4	1.51	77%	0.60	0.71	10.2	3.7	7.4
A5	1.70	76%	0.59	0.70	9.9	4.1	8.3
A6	1.37	75%	0.58	0.70	10.0	3.3	6.6
A6A	0.53	95%	0.81	0.88	5.0	2.2	4.1
A7	19.00	65%	0.45	0.59	18.3	27.5	60.6
A8	1.48	63%	0.56	0.70	13.9	3.0	6.3
A9	0.61	79%	0.73	0.83	8.7	1.9	3.7
A10	2.61	86%	0.79	0.88	7.9	9.2	17.3
A11	2.89	83%	0.76	0.86	8.7	9.5	18.1
A12	3.87	8%	0.13	0.38	11.9	1.9	9.5
A13	9.65	65%	0.45	0.59	14.0	15.7	34.6
A14	11.76	55%	0.39	0.55	15.3	16.0	37.9
A15	2.91	54%	0.52	0.68	14.9	5.4	11.7
A16	2.34	56%	0.54	0.69	14.7	4.4	9.6
A17	1.76	24%	0.21	0.44	13.7	1.4	4.7
A18	5.27	21%	0.24	0.47	16.4	4.3	14.0
A19	31.85	67%	0.45	0.59	25.8	38.8	85.4
A20	1.83	89%	0.81	0.89	8.0	6.6	12.2
A21	1.93	90%	0.82	0.90	8.7	6.8	12.6
A22	8.68	5%	0.11	0.37	23.3	2.7	15.4
B1	2.98	100%	0.90	0.96	17.6	8.8	15.8
B2	3.89	100%	0.90	0.96	17.6	11.5	20.6
B3	1.53	100%	0.90	0.96	9.4	5.8	10.4
B4	1.50	100%	0.90	0.96	9.4	5.7	10.2
B5	2.91	5%	0.08	0.35	13.1	0.9	6.4
C1	8.01	95%	0.81	0.88	9.9	2.0	15.0
C2	5.06	95%	0.81	0.88	7.9	1.4	10.0
OS20	308.00	9%	0.13	0.40	68.9	61.0	310.0
OS21A	20.26	12%	0.13	0.40	53.5	4.2	21.9
OS21B	8.71	12%	0.13	0.40	24.5	3.1	16.3
OS2	17.00	70%	0.49	0.62	36.0	13.8	39.1
OS3	28.70	70%	0.49	0.62	52.6	17.6	48.9
OS4	5.08	15%	0.20	0.40	29.5	2.6	8.5
D1	0.45	95%	0.81	0.88	7.0	1.7	3.1
D2	0.43	95%	0.81	0.88	7.0	1.6	3.0

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- A = BASIN DESIGNATION
  B = AREA IN ACRES
  C = 5-YR RUNOFF COEFFICIENT
  D = 100-YR RUNOFF COEFFICIENT
- 1 DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
6/23/21
SHEET 1 OF 7

70 35 0 70 140
ORIGINAL SCALE: 1" = 70'

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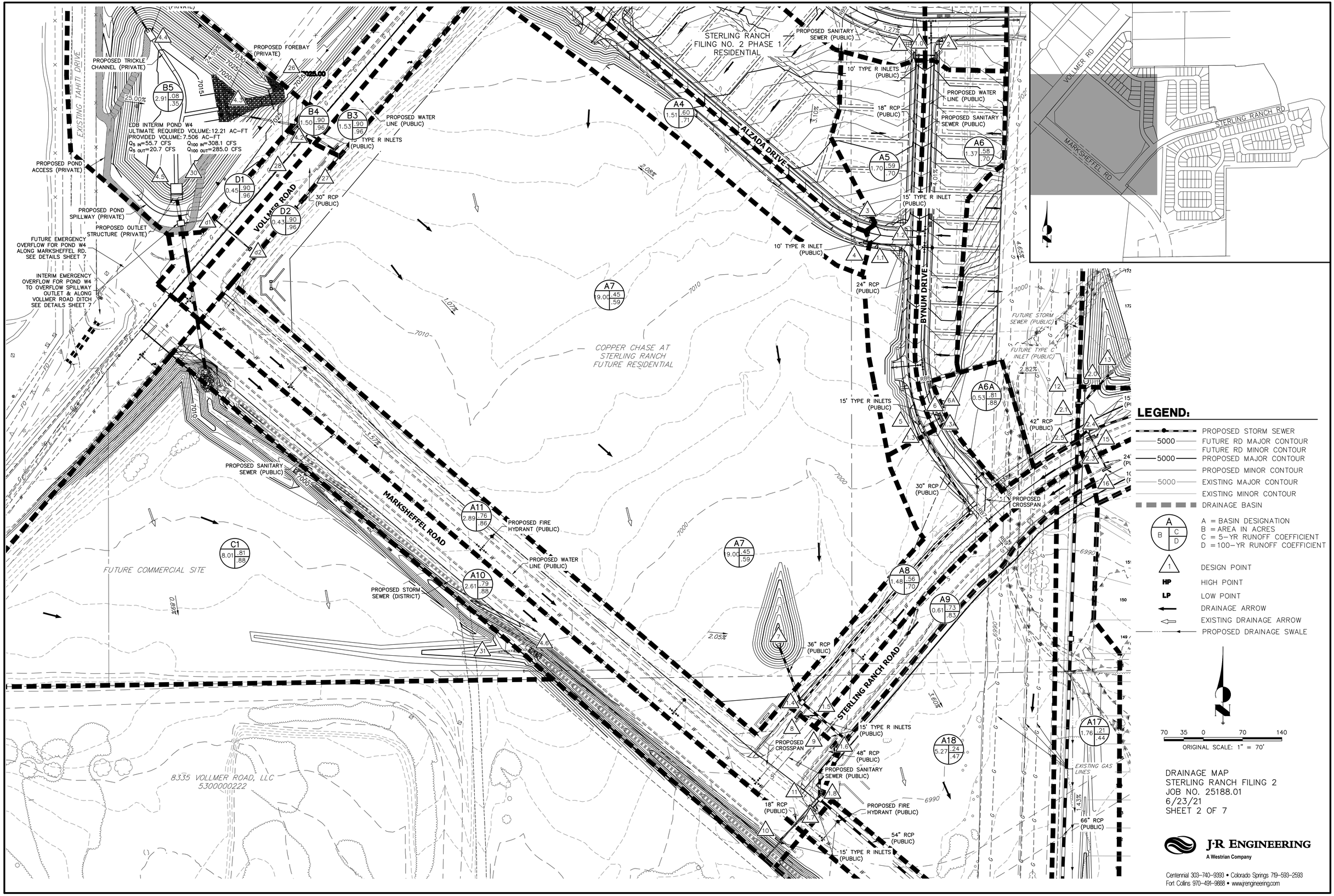

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- A = BASIN DESIGNATION
  B = AREA IN ACRES
  C = 5-YR RUNOFF COEFFICIENT
  D = 100-YR RUNOFF COEFFICIENT
- 1 DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

70 35 0 70 140
ORIGINAL SCALE: 1" = 70'

DRAINAGE MAP
STERLING RANCH FILING 2

JOB NO. 25188.01
6/23/21
SHEET 2 OF 7

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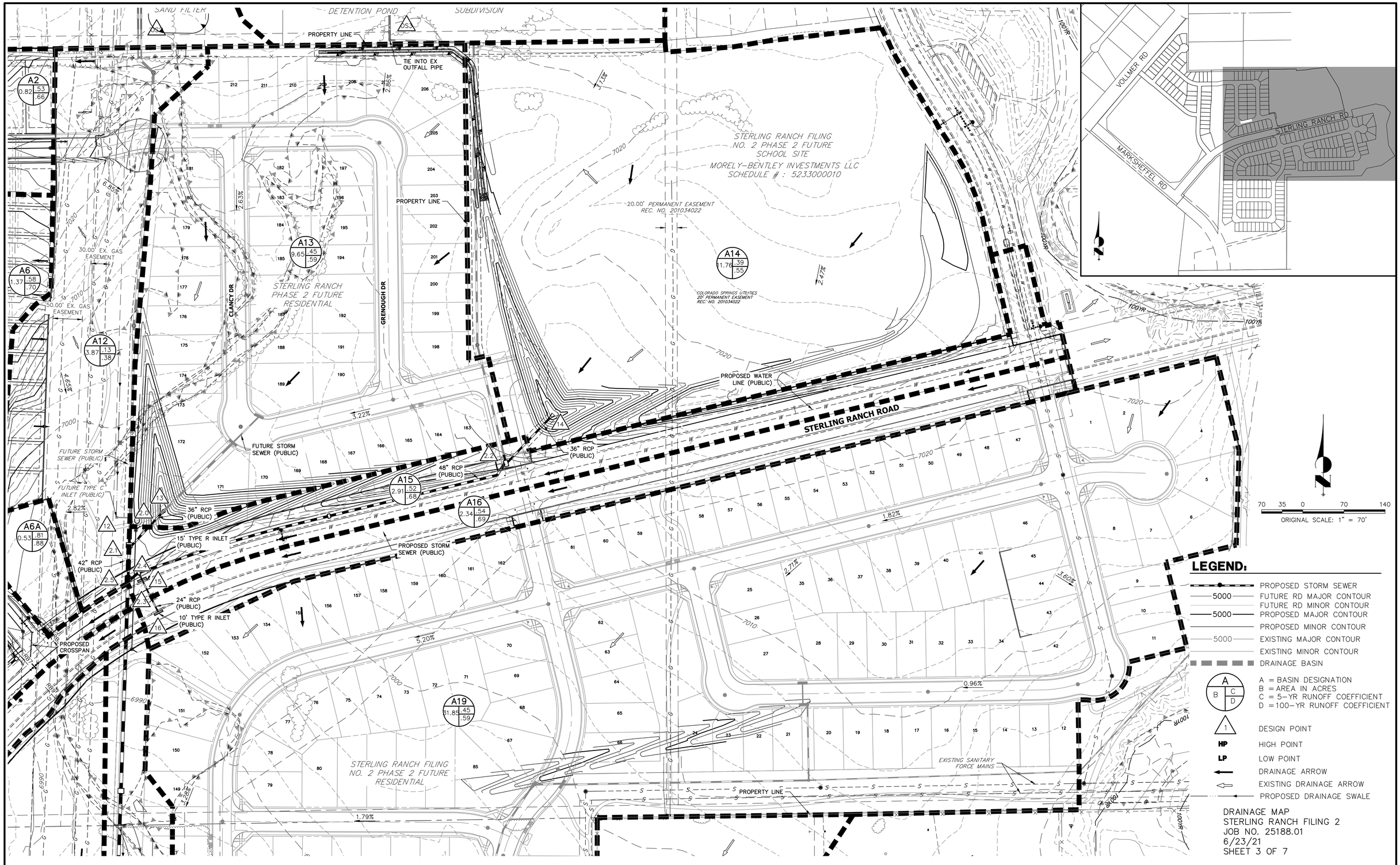

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- A = BASIN DESIGNATION
  B = AREA IN ACRES
  C = 5-YR RUNOFF COEFFICIENT
  D = 100-YR RUNOFF COEFFICIENT
- 1 DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
6/23/21
SHEET 3 OF 7

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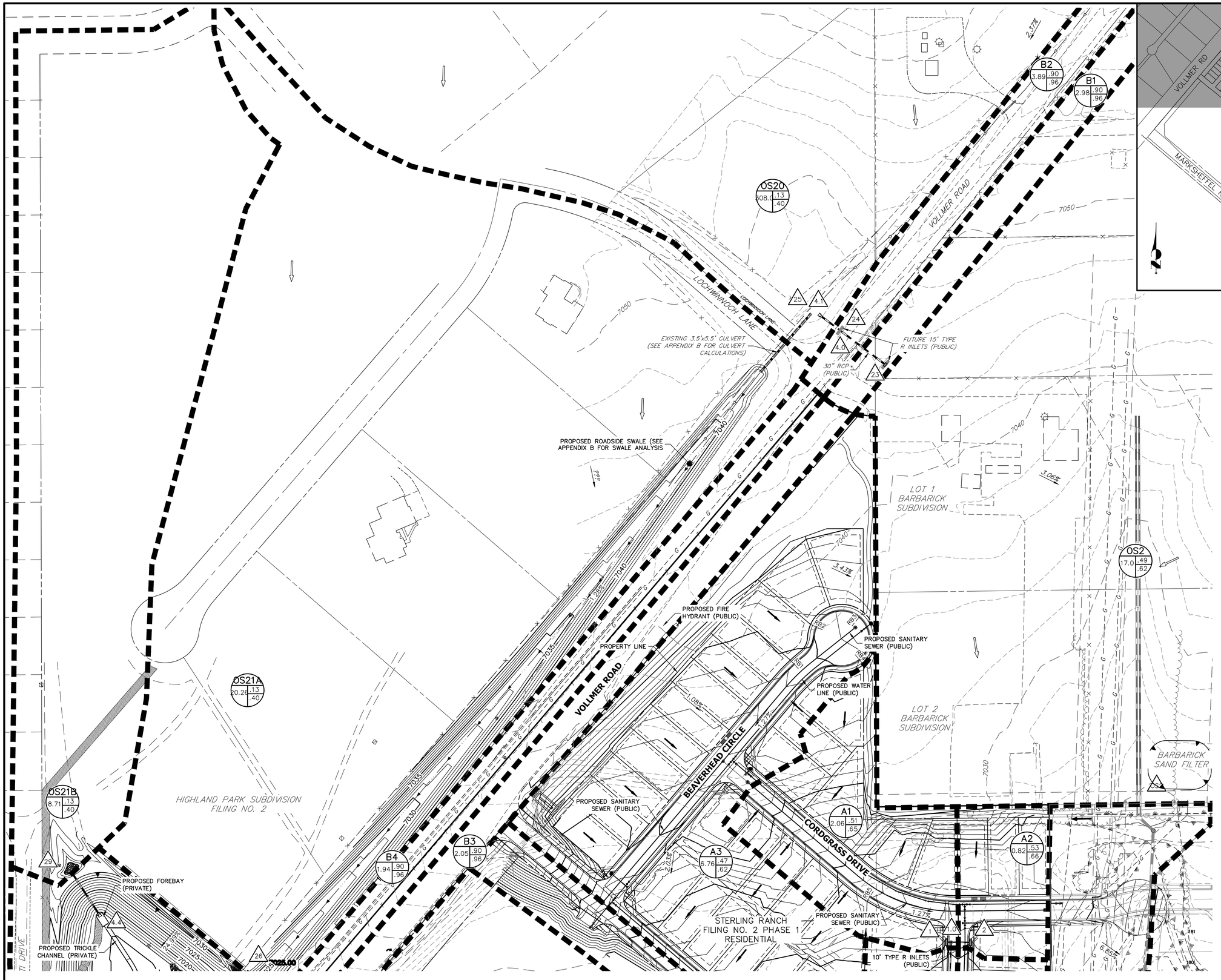

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN

A = BASIN DESIGNATION
B = AREA IN ACRES
C = 5-YR RUNOFF COEFFICIENT
D = 100-YR RUNOFF COEFFICIENT

1 DESIGN POINT

HP HIGH POINT

LP LOW POINT

DRAINAGE ARROW

EXISTING DRAINAGE ARROW

PROPOSED DRAINAGE SWALE

70 35 0 70 140

ORIGINAL SCALE: 1" = 70'

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
6/23/21
SHEET 4 OF 7

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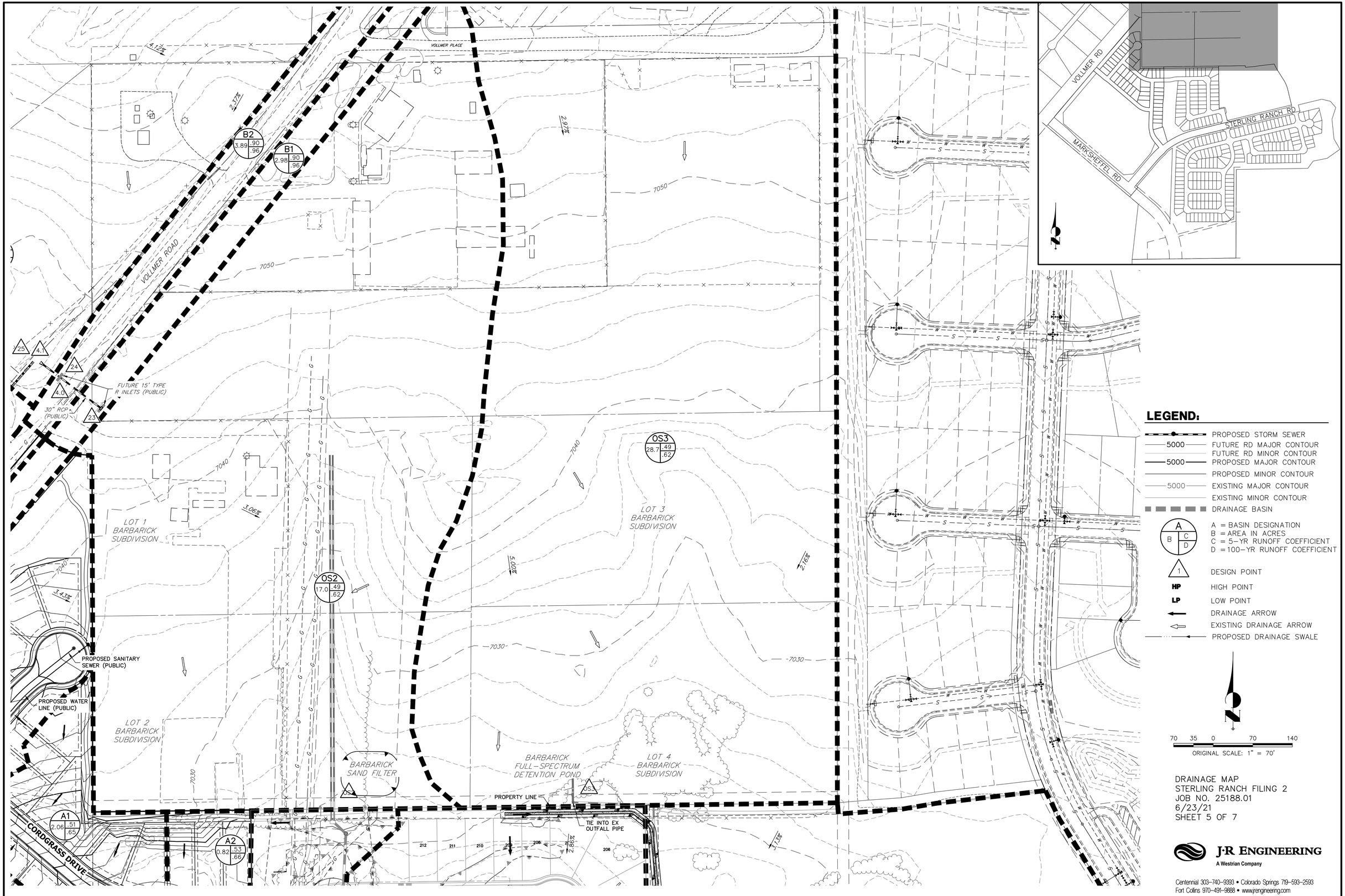

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- A = BASIN DESIGNATION
  B = AREA IN ACRES
  C = 5-YR RUNOFF COEFFICIENT
  D = 100-YR RUNOFF COEFFICIENT
- 1 DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

70 35 0 70 140

ORIGINAL SCALE: 1" = 70'

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
6/23/21
SHEET 5 OF 7

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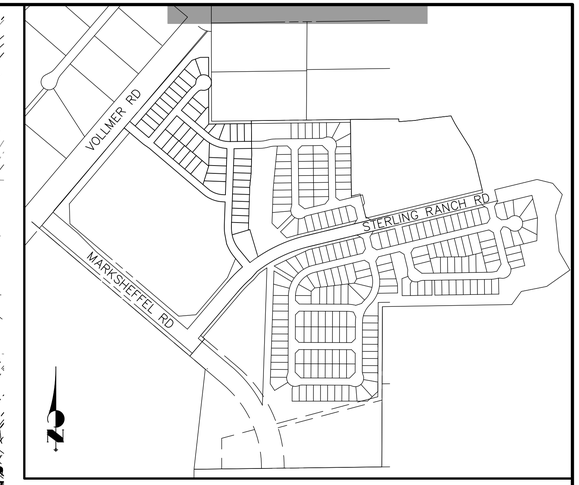

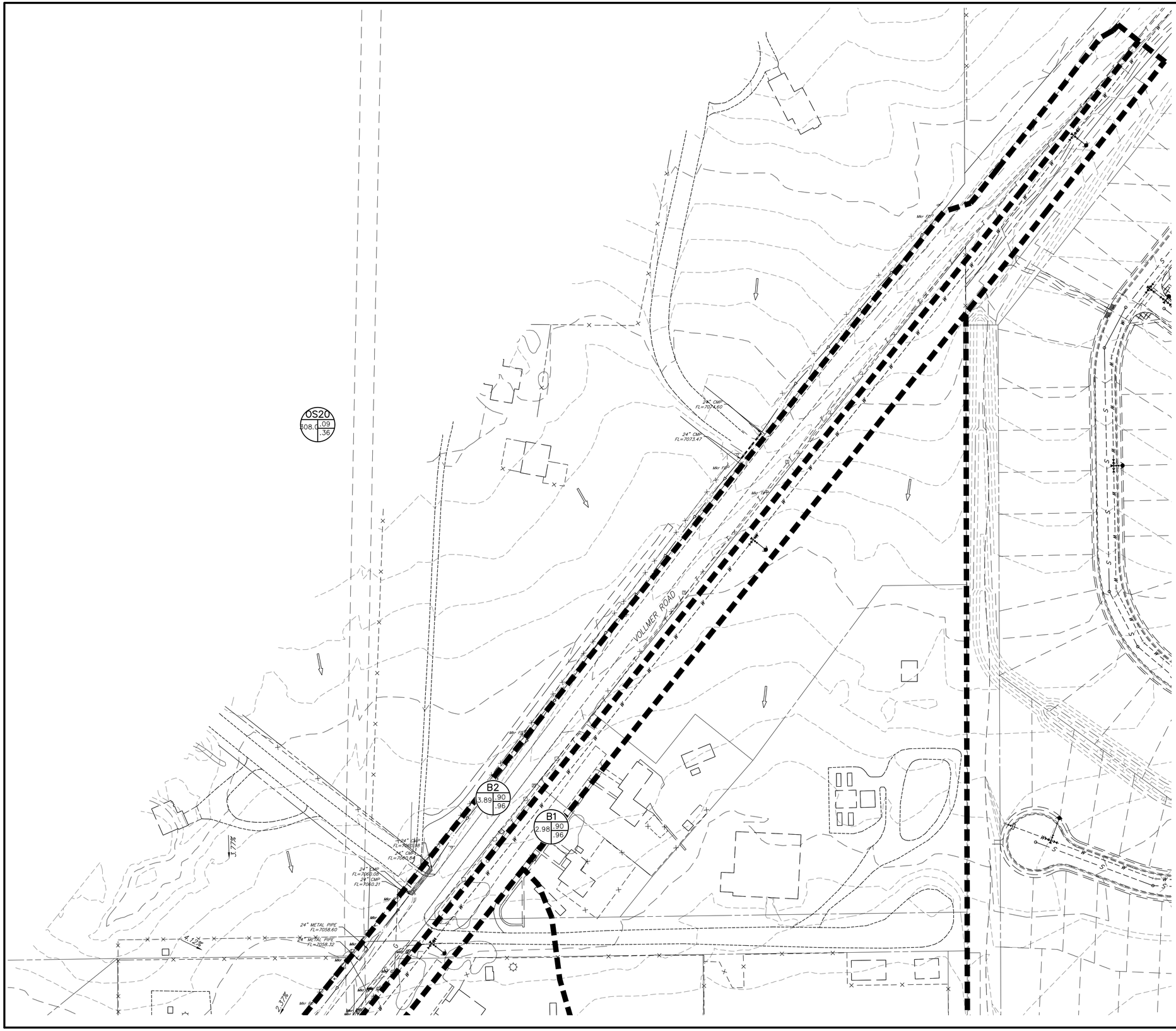

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- A = BASIN DESIGNATION
  B = AREA IN ACRES
  C = 5-YR RUNOFF COEFFICIENT
  D = 100-YR RUNOFF COEFFICIENT
- 1 DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

70 35 0 70 140

ORIGINAL SCALE: 1" = 70'

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
4/16/21
SHEET 6 OF 6

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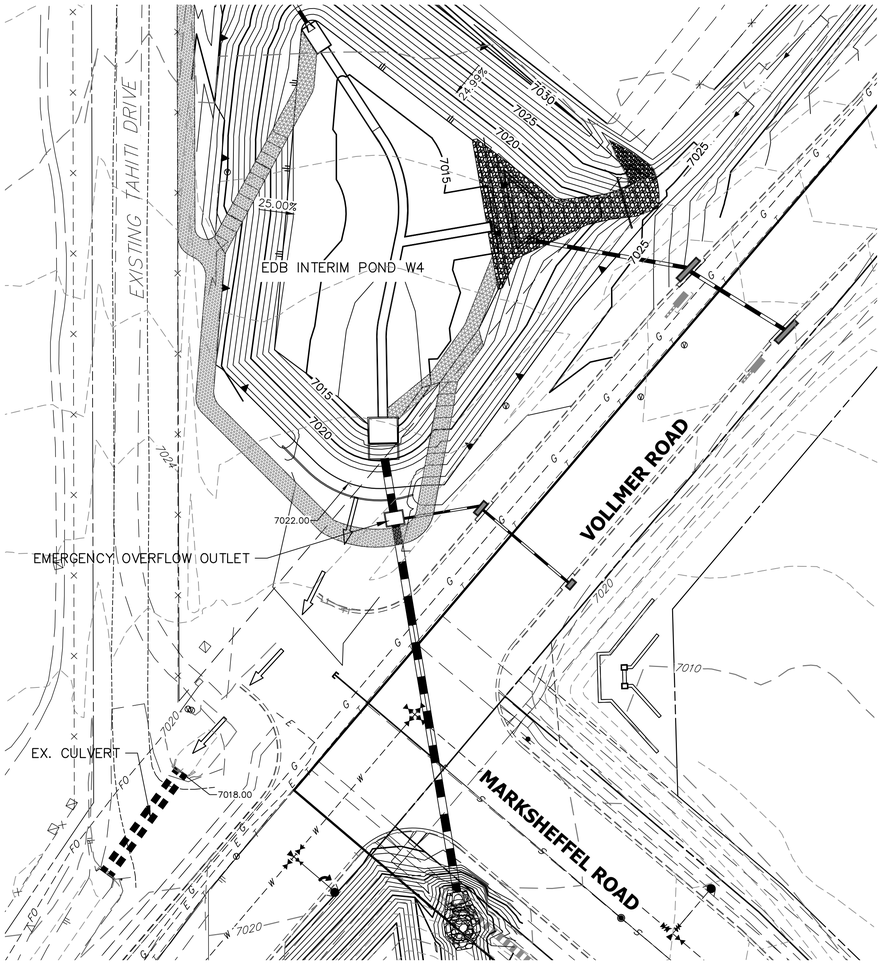
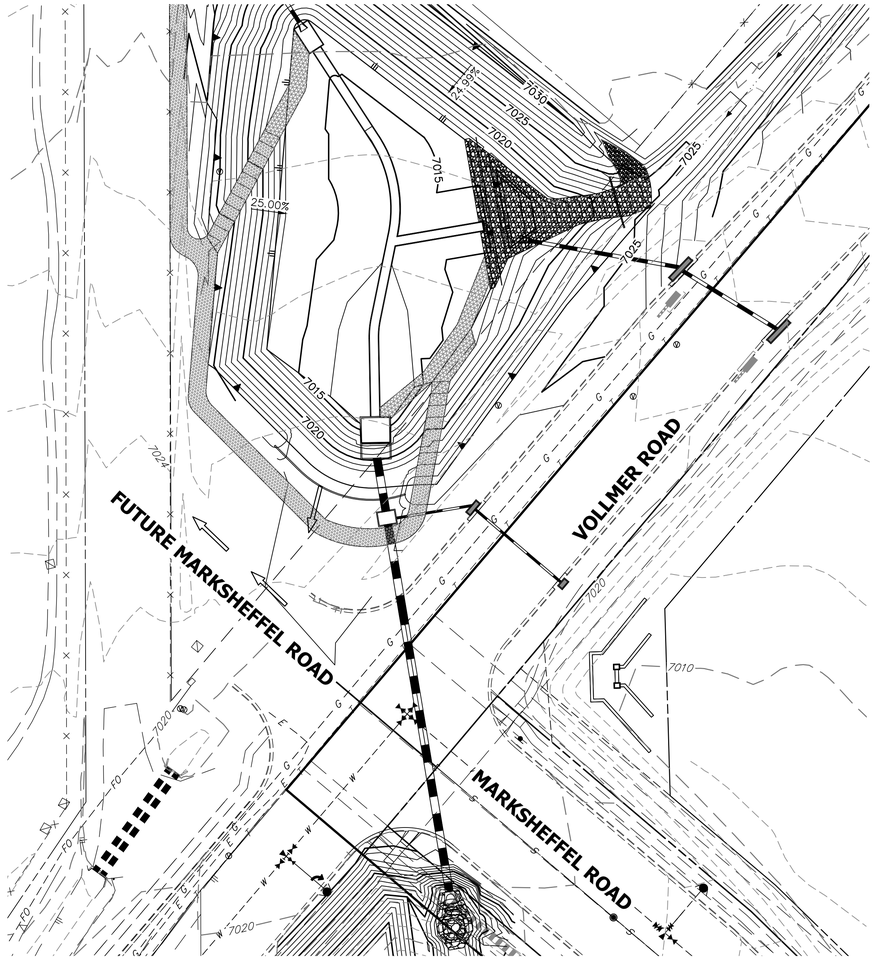
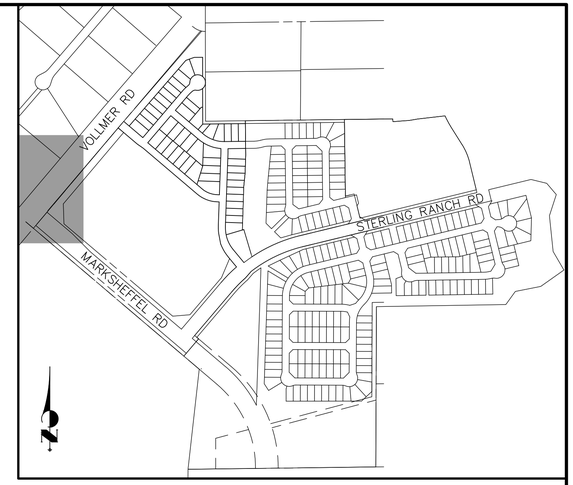


POND W4 EMERGENCY OVERFLOW INTERIM CONDITION



POND W4 EMERGENCY OVERFLOW ULTIMATE CONDITION



50 25 0 50 100

ORIGINAL SCALE: 1" = 50'

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
6/23/21
SHEET 7 OF 7

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STERLING RANCH MDDP AMENDMENT NO. 2 & PRELIMINARY DRAINAGE REPORT FOR STERLING RANCH EAST PRELIMINARY PLAN NO. 1

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Job No. 1183.22

PCD Project No.

STERLING RANCH MDDP AMENDMENT NO. 2

PURPOSE

This portion of the report represents the second amendment to the Sterling Ranch MDDP, originally prepared by M&S Civil Consultants, Inc., approved June 2018. Amendment No. 1 was prepared by JR Engineering, LLC, dated October, 2021. All existing basin hydrology, concept routing and pond locations remain the same except for the following proposed changes:

1. As described in the Sterling Ranch MDDP Amendment No. 1, Ponds FSD-16A and FSD-16B are proposed to be combined into one full-spectrum facility located at the northeast corner of Briargate Pkwy. and Sterling Ranch Road.

2. Rather than divert significant surface routed flows from the East Fork Sand Creek basin to the Sand Creek main basin, this report proposes to continue to release surface flows into the East Fork Sand Creek basin matching as close to pre-development conditions as possible.

3. Small portions of original MDDP basins SCE-7 and SCE-10 are now proposed to be tributary to Pond FSD-14B with the outfall in a southerly direction instead of towards Pond W3.

DETAILED DESCRIPTION

The original MDDP basins SC3-16A and SC3-16B had total acreages of 168.1 Ac. and 50.7 Ac., respectively for a total of 218.8 Ac. The following proposed basins represent this same area tributary to the single Pond FSD-16, including the tributary basins from Briargate Pkwy.:

P1-A	12.7 Ac.	P1-B	35.5 Ac.	P1-C	10.7 Ac.
P1-D	31.4 Ac.	P1-E	52.2 Ac.	P1-F	76.7 Ac.
TR-W	1.4 Ac.	TR-V	2.1 Ac.	P1-A1	5.0 Ac.

P1-A2 6.4 Ac.	P1-A3 1.8 Ac.	P1-A4 2.0 Ac.
P1-A5 4.3 Ac.	P1-A6 2.8 Ac.	**Total 245.0 Ac.**

This single proposed full spectrum facility is planned to be designed as a pond and useable park (play fields in the base). Based on construction phasing of the Preliminary Plan, the facility may also be built in phases with associated orifice plates to be switched out based on development. The anticipated first phase of development tributary to this facility is the Briargate Pkwy. improvements (reference "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021 and "Sterling Ranch Road and Briargate Pkwy. Street Plans", prepared by JR Engineering, LLC, dated October 2021 for inlet and pipe sizes through this corridor) along with a small portion of the Sterling Ranch East Preliminary Plan No. 1 north of Briargate (42 lots) and the Sterling Ranch East Preliminary Plan/PUD No. 2 development. The outfall for this facility will continue to be the planned 48" RCP storm system as designed by JR Engineering, LLC as described in the plans mentioned above.

The original MDDP as approved in 2018 proposed for a fairly significant inter-basin transfer of approximately 267 acres from East Fork Sand Creek into Sand Creek main basin. (See Excerpt below) While this transfer was still kept within the overall Sand Creek basin, there was concern of surface water rights for the immediate downstream properties just south of Sterling Ranch with this approved concept. In an effort to address this concern, this MDDP Amendment proposes to continue to release surface flows as close to pre-development condition as possible within the same historic basin location. (See Basin Exhibit below) These flows will either be treated in a formal full spectrum facility or provide WQCV runoff reduction prior to being released. Also, given the size of the historic basins and natural sheet flow characteristics at these outfall locations, this MDDP Amendment proposes a level spreader design at these locations. These facilities will help better disburse the developed flows in a historic sheet flow manner. Pre-development Design Point 6 that is currently within the East Fork basin would be the location for one of these planned facilities. Upon future Sterling Ranch East residential

(Excerpt from 2018 Sterling Ranch MDDP, M&S Civil Consultants, Inc.)

Step 2 **Implement BMPs that provide a water quality capture volume with slow release.** – Using Full Spectrum Detention Facilities which will incorporate water quality capture volumes that are intended to slowly drain in 40 hours and excess urban runoff volumes that are intended to drain within 72 hours. All storage facilities will be designed to meet State Statue SB15-212/ §37-92-602(8).

Step 3 **Stabilize streams.** – With the full spectrum detention facility in place, the runoff from the developments will be reduced to predevelopment conditions. The developed discharge from the sites will be less than existing and therefore is not anticipated to have negative effects on downstream drainage ways.

Step 4 **Consider need for Industrial and Commercial BMPs.** – No industrial land uses are proposed with this development. The proposed commercial development area will implement a Stormwater Management Plan (SWMP) incorporation proper housekeeping procedures. Onsite drainage will be routed through private Full Spectrum Detention (FSD) basins to minimize introduction of contaminates to the county's public drainage systems.

INTERBASIN TRANSFER EAST FORK SAND CREEK TO MAIN STEM SAND CREEK

It should be noted that the proposed development plan for the ~1444 acre of Sterling Ranch redistributes a small percentage of the historic watershed between the Sand Creek and East Fork of Sand Creek watershed.

Based upon the survey and contour mapping, prior to development approximately 682 acres of Sterling Ranch runoff was collected by the Sand Creek watershed with the remaining 762 acres was directed to the East Fork of Sand Creek.

After development approximately 267 acres will be redirected from the East Fork Sand Creek into the Sand Creek Basin, resulting in 949 acres of Sterling Ranch directed to the Sand Creek Basin with the remaining 495 acres directed to East Fork Sand Creek.

This modification is driven primarily by maximizing the area of land that can be delivered to the sanitary sewer lift station. It should be noted that the East Fork of Sand Creek is still tributary to the Main Branch of Sand Creek, and thus this transfer is between minor watersheds, not major watershed, and that the development as planned will still function to limit discharged runoff into Sand Creek and East Tributary to the historic flow rates. An exhibit was added to the appendix, which also accompanies the deviation request that shows this basin diversion.

It should be noted that the Developed Conditions Map (provided in the appendix) illustrated the diverted acreage based upon the DPBS mapped boundary(as mapped within the SCDBPS) and diversion based upon the actual field contour data.

Drainage Basin Descriptions

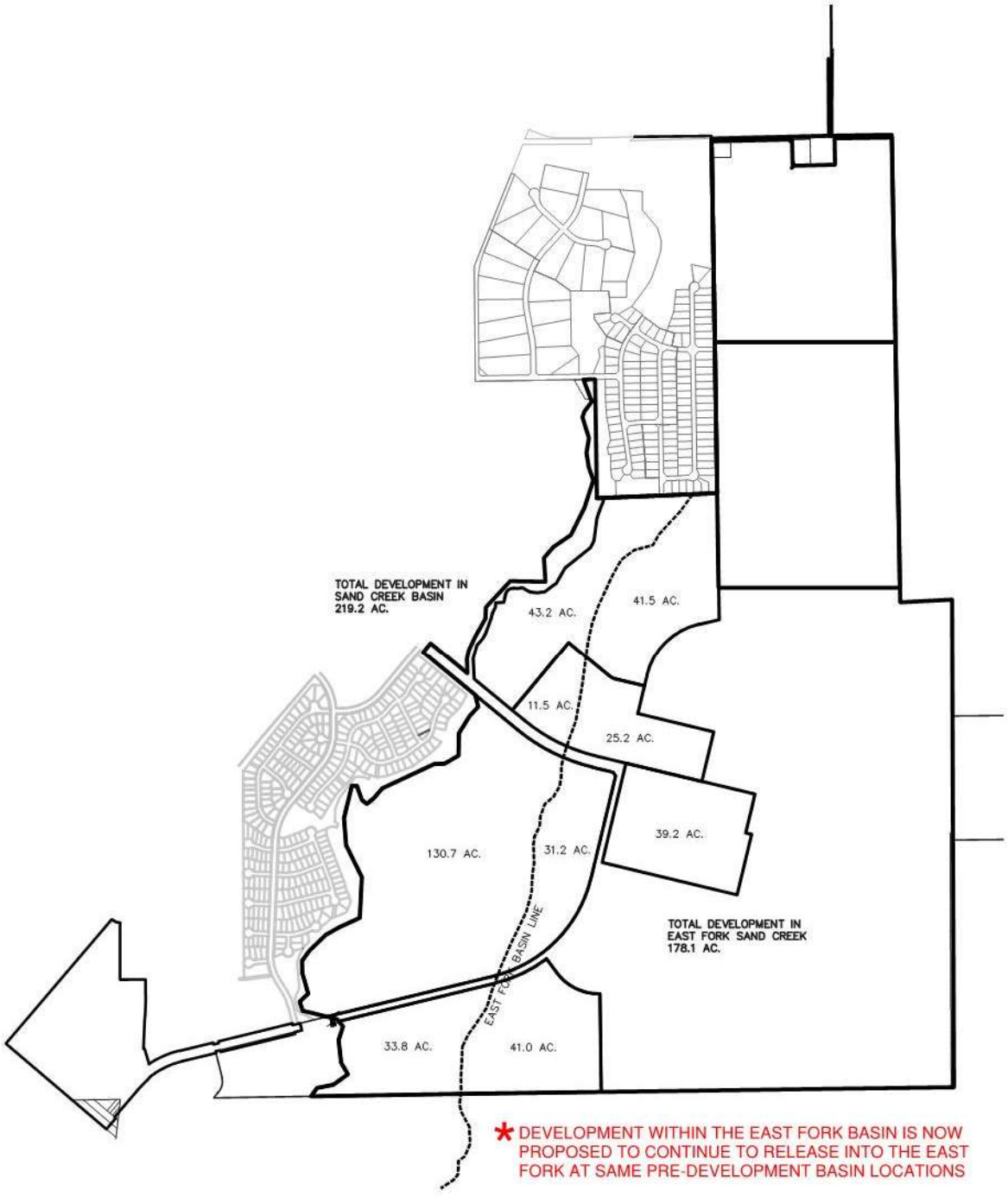
Developed Sand Creek (Main Stem) Basin Flows

Basin SC3-82 (Q5 = 33.2 cfs, Q100 = 132.3 cfs) which is located north of Sterling Ranch and Burgess Road to the east Basin SC3-81, assumes that the 117.8 is primarily undeveloped, pine forested land. In this undeveloped condition runoff from the basin continues south overland into Basin SC3-74.

Basin SC3-74 (Q5 = 36.5 cfs, Q100 = 140.7cfs) is a 119.7 acre area of 5 and 10-acre lots covered with a mixture of native prairie grasses and pine trees land located north of Sterling Ranch and south of Burgess Road to the west and north of Basins SC3-73 and SC3-75. Runoff from Basins SC3-74 and SC3-82, combine at DP-74 (Q5 = 65.3 cfs, Q100 = 262.8 cfs), which is equivalent to the anticipated existing modeled flow rates of Q5 = 65.3 cfs, Q100 = 262.8 cfs.

Basin SC3-73 (Q5 = 26.4 cfs, Q100 = 102.0 cfs) is a 90.0 acre area of 5 to 40 acres lots covered with a mixture of native prairie grasses and pine trees land located north of Sterling Ranch to the northeast of Vollmer Road. Runoff from the Basin SC3-73 will combine with runoff from DP-74 and will continue overland towards DP-75.

Basin SC3-81 (Q5 = 70.2 cfs, Q100 = 275.7 cfs) which is located north of Sterling Ranch (approx 1 mile) between Shoup and Burgess Roads, assumes that the 262.9 acre area of primarily undeveloped, pine forested, land. In this undeveloped condition runoff from the basin continues south overland into Basin SC3-75.



STERLING RANCH EAST INITIAL DEVELOPMENT PHASE
BASIN DEVELOPMENT EXHIBIT

CLASSIC CONSULTING ENGINEERS & SURVEYORS

development further to the east within Basin EX10A, additional level spreader facilities will also be planned.

The original MDDP as approved in 2018 proposed Basin SC3-14B to be 34.7 Ac. The proposed Sterling Ranch East Preliminary Plan/PUD No. 3 (submitted concurrently but separate submittal) development area encompasses additional property further to the east than originally depicted as Basin SC3-14B. The proposed basins that better represent the total tributary area for Pond FSD-14B are the proposed basins found in this report as P4-A (25.8 Ac.) and P4-B (37.3 Ac.). Thus, the total area is 63.1 Ac. Future basins SCE-7 and SCE-10 will be reduced by this same amount. The proposed Pond FSD-14B has been upsized accordingly to handle this additional developed flow. The outfall for this facility was originally planned to connect directly to the 48" RCP storm system within Sterling Ranch Road with an ultimate outfall location into Pond W3 and direct release into Sand Creek main channel. As mentioned in the previous paragraph, the outfall for this facility is now planned to head towards the south property line within a future pipe system. Ultimately, upon full build-out of this Preliminary Plan, a level spreader facility will be installed along the south property line as shown on the drainage map. In the interim, until full build-out, a temporary plunge pool may be installed just south of the pond to help dissipate these released treated flows. The release quantity from Pond FSD-14B will approximate the pre-developed flows for this original Basin EX-9.

PROPOSED DRAINAGE CONDITIONS

As described in the General Description of the report, this proposed Preliminary Plan development contains 321+ acres that is geographically separated by two major roadways that are being final platted and constructed separately (Briargate Pkwy. and Sterling Ranch Rd.). Multiple full spectrum detention (FSD) facilities are planned with this overall Sterling Ranch East Preliminary Plan No. 1 development. They will be designed to handle these proposed lots, future adjacent development and the two other Sterling Ranch East Preliminary Plan/PUD Development Plans No. 2 and No. 3. (Submitted concurrently but under separate County file

numbers) Development of these urban lots proposed will consist of overlot grading and utility installation for the planned roadways and lots. Per the El Paso County ECM, Section I.7.1.B, all urban lots are required to provide Water Quality Capture Volume (WQCV). Thus, the proposed FSD facilities within this development will provide WQCV along with an Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume with an outlet control device. Frequent and infrequent inflows are released at rates approximating undeveloped conditions. This concept provides some mitigation of increased runoff volume by releasing a portion of the increased runoff at a low rate over an extended period of time, up to 72 hours. This means that frequent storms, smaller than the 2-year event, will be reduced to very low flows near or below the sediment carrying threshold value for downstream drainage ways. Also, by incorporating an outlet structure that limits the 100-year runoff to the undeveloped condition rate, the discharge hydrograph for storms between the 2 year and the 100-year event will approximate the hydrograph for the undeveloped conditions and will help effectively mitigate the effects of development. As reasonably possible, WQCV will be provided for all new roads and urban lots.

This report will generally describe overall anticipated developed basins tributary to each of the proposed FSD facilities. Each of these developed basins will then be detailed further in final drainage reports prepared and submitted along with Final Plats and CD's. This final design will include sizing of all inlets, storm systems and finalized FSD facilities including all required appurtenances. It is anticipated that Type-R at-grade and sump inlets ranging from 5' to 15' will be utilized in all street drainage and HGL's will be provided for all RCP storm system design.

The following developed basin descriptions will start at the north end of the project and move south and describe how this development proposes to handle both the off-site and on-site drainage conditions both from an interim standpoint based on construction phasing and the ultimate buildout scenario of the entire Sterling Ranch East ownership:

The following represent the basins and design points north of Briargate Pkwy.:

As described earlier, these first several basins are all at the north end of the Sterling Ranch East overall property and are tributary to the adjacent Retreat at TimberRidge development and are consistent with what that approved report anticipated. (Reference "Final Drainage Report for Retreat at TimberRidge Filing No. 1", prepared by CCES, approved November 2020 and "Final Drainage Report for Retreat at TimberRidge Filing No. 2", prepared by CCES, dated March 2022)

The following basins are all contained within basin SC3-16A as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:

Basin TR-V (Q_5 = 2 cfs, Q_{100} = 6 cfs) consists of rear yards of the adjacent Retreat at TimberRidge Filing No. 2 development. These flows are currently captured in a natural swale along the common property line and routed south and then west towards a temporary sediment basin at the end of Bison Valley Trail that was constructed with the TimberRidge development. With the development of this portion of the proposed Sterling Ranch East Preliminary Plan No. 1, these flows will likely remain being captured by the natural swale along the westerly property line but then be directed into **Basin P1-F (Q_5 = 111 cfs, Q_{100} = 215 cfs).** This basin represents the anticipated future urban residential basin tributary to a future downstream storm system within the northerly extension of Sterling Ranch Road. **Design Point 1 (Q_5 = 112 cfs, Q_{100} = 219 cfs)** represents the anticipated total developed flow at this location upon full build-out. In the interim, before development within this basin, the historic flow patterns may be captured in a temporary sediment basin located just east of Design Point 1. This facility will help mitigate the historic flows from the large upstream basin (EX-10) prior to and during the construction of the extension of Sterling Ranch Road, Pond FSD-16 and the northerly portion of this proposed Preliminary Plan area. The final drainage report(s) for this portion of the development will describe any temporary sediment basins and collection points for these pre-development flows for safe routing further downstream.

Basin TR-W (Q_5 = 3 cfs, Q_{100} = 5 cfs) consists of rear yards and a small portion of the Bison Valley Trail roadway within the adjacent Retreat at TimberRidge Filing No. 2 development.

These flows are currently captured in a natural swale along the common property line and routed westerly towards a temporary sediment basin at the end of Bison Valley Trail that was constructed with the TimberRidge development. With the development of the proposed Sterling Ranch East – Phase 1, these temporary facilities will be removed and allowed to flow directly into Basin P1-E. **Basin P1-E (Q_5 = 83 cfs, Q_{100} = 161 cfs)** consists of the proposed urban residential at the north end of this Preliminary Plan, just east of Sand Creek and tributary to a proposed downstream storm system within the northerly extension of Sterling Ranch Road. **Design Points 2&3 (Q_5 = 42 cfs, Q_{100} = 81 cfs)** represent the anticipated split of flows from this large developed basin. The total developed flow will then combine with the upstream developed flows from Design Point 1 and be routed in a large diameter storm system further south within Sterling Ranch Road.

Basin P1-C (Q_5 = 21 cfs, Q_{100} = 43 cfs) consists of the anticipated tributary area for the Sterling Ranch Road ROW extension north of Briargate Pkwy. and adjacent development. These proposed developed flows will be collected in various at-grade inlets within the roadway, combine with the upstream pipe flows described above and then routed towards the proposed Pond FSD-16. The total developed flow at this pipe outlet location into Pond FSD-16 is represented by **Design Point 4 (Q_5 = 186 cfs, Q_{100} = 374 cfs)**. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report.

Basin P1-D (Q_5 = 53 cfs, Q_{100} = 102 cfs) represents the urban residential basin that is made up of the entire Sterling Ranch East Preliminary Plan/PUD No. 2 area and a small portion of this proposed Preliminary Plan area just east of Sand Creek, north of Briargate Pkwy. This basin is tributary to **Design Point 5 (Q_5 = 53 cfs, Q_{100} = 102 cfs)** and a public storm system stub will be provided to connect to the system within Sterling Ranch Road.

Basins P1-A1 (Q_5 = 11 cfs, Q_{100} = 21 cfs), **Basin P1-A2 (Q_5 = 12 cfs, Q_{100} = 23 cfs), Basin P1-A3 (Q_5 = 5 cfs, Q_{100} = 9 cfs)** and **Basin P1-A4 (Q_5 = 5 cfs, Q_{100} = 10 cfs)** all represent tributary area

within the Briargate Pkwy. roadway extension between Vollmer and Sterling Ranch Road. These basins have been studied in the "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021. Reference this report as well as the "Sterling Ranch Road and Briargate Pkwy. Street Plans", prepared by JR Engineering, LLC, dated October 2021 for inlet and pipe sizes through this corridor. These final designed facilities are shown and labeled on the drainage map. However, the designed storm outfall alignment into the Pond FSD-16 will need to be adjusted as the intent of this report is to combine these flows with the previously described Design Point 5 developed flows along the proposed low point in Briargate Pkwy. just east of Sterling Ranch Road into one single outfall into Pond FSD-16 and represented by Design Point 7.

Design Point 6 (Q_5 = 17 cfs, Q_{100} = 33 cfs) is the location of the proposed low-point in Briargate Pkwy. just east of Sterling Ranch Road, with the following two basins being tributary to this sump condition. The emergency overflow release is planned to be around the corner and south down Sterling Ranch Road. **Basin P1-A5 (Q_5 = 10 cfs, Q_{100} = 19 cfs)** and **Basin P1-A6 (Q_5 = 7 cfs, Q_{100} = 14 cfs)** consist of the anticipated area within the ROW tributary to this low- point. The collected flows will then be routed via a storm system and combine with the previously described basins further west in Briargate Pkwy. and Design Point 5.

Design Point 7 (Q_5 = 117 cfs, Q_{100} = 229 cfs) represents the total developed flows at this pipe outlet location into Pond FSD-16. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report.

The following basins are all contained within basin SC3-16B as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:

Basin P1-B (Q_5 = 55 cfs, Q_{100} = 108 cfs) consists of the anticipated tributary area for the future Sterling Ranch East urban residential area outside of this proposed Preliminary Plan. These anticipated future developed flows will be routed towards a downstream storm system. The total developed flow at this pipe system outlet location into Pond FSD-16 is represented by

Design Point 8 (Q_5 = 55 cfs, Q_{100} = 108 cfs). The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report. In the interim, before development within this basin, the historic flow patterns and quantities will continue to sheet flow in a southerly direction towards the proposed pond and Briargate Pkwy. The final drainage report(s) will describe any temporary sediment basins and collection points for these pre-development flows for safe routing around the development area and further downstream.

Basin P1-A (Q_5 = 6 cfs, Q_{100} = 19 cfs) consists of the anticipated tributary area from the adjacent future residential lots (rear yards only) along with the actual pond area itself. The developed sheet flows from this basin will sheet flow directly into the adjacent FSD-16 Pond where they will be formally treated.

As described in the MDDP Amendment portion of this report, the two FSD ponds planned in the 2018 MDDP (FSD16A and FSD16B) are now proposed to be combined into one facility (FSD-16) northeast of the intersection of Briargate Pkwy. and Sterling Ranch Road. The total anticipated developed flows entering this facility are as follows. (See Appendix for MHFD-Detention pond design sheets):

Detention Pond FSD-16 (Full Spectrum EDB)

Total Tributary Acreage: 245.0 ac.

4.822 Ac.-ft. WQCV required

11.124 Ac.-ft. EURV required with 4:1 max. slopes

10.310 Ac.-ft. 100-yr. Storage

26.256 Ac.-ft. Total

Total Peak In-flow: Q_5 = 271 cfs, Q_{100} = 590 cfs

Pond Peak Design Release: Q_5 = 24 cfs, Q_{100} = 157 cfs

Pre-development Release: Q_5 = 52 cfs, Q_{100} = 244 cfs

(Ownership and maintenance by the Sterling Ranch East Metro District)

This facility will release into a large diameter downstream storm system within Briargate Pkwy. just east of the Sterling Ranch Road intersection. Please reference the "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021 and the "Sterling Ranch Road and Briargate Pkwy. Storm Plans", prepared by JR Engineering, LLC, dated December 2021. These referenced design plans provide a 48" RCP outfall pipe at this location with an allowable release rate of (Q_5 = 9.2 cfs, Q_{100} = 156.6 cfs). The 2018 MDDP presents a combined total release rate for the originally planned two ponds (FSD16A and FSD16B) of (Q_5 = 8.8 cfs, Q_{100} = 174.9 cfs). As designed on the JR Engineering storm plans, this storm system will run in a southeasterly direction within the Sterling Ranch Roadway towards the crossing of Sand Creek. At this location, the pipe system will outfall into the planned Detention Pond W3. Reference the "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021 for these design documents.

Basin SC-4 (Q_5 = 8 cfs, Q_{100} = 27 cfs) consists of the anticipated rear yards of the lots adjacent to the creek that will continue to sheet flows directly towards the Sand Creek corridor. At this time, these rear yards are not able to be captured and routed to a formal stormwater quality facility. However, given the minimal unconnected impervious area and sizeable receiving pervious are within this basin, the WQCV reduction = 100% with 0 untreated WQCV. (See Appendix)

The following represent the basins and design points south of Briargate Pkwy. and west of Sterling Ranch Road *all contained within basin SC3-14A as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:*

Basin P2-S1 (Q_5 = 68 cfs, Q_{100} = 133 cfs) consists of the anticipated basin for the proposed middle school site. These developed flows will be routed internally within the school site

property towards **Design Point 9** where a storm stub will be provided. This storm stub will then outfall into the proposed downstream storm system within Sterling Ranch Road.

Basin P2-B (Q_5 = 90 cfs, Q_{100} = 176 cfs) consists of the anticipated basin for this large urban residential area. These developed flows will be captured in multiple public storm systems on-site and routed towards the two storm stubs provided as shown at Design Points 10 and 11. **Design Points 10&11 (Q_5 = 45 cfs, Q_{100} = 88 cfs)** represent the anticipated split of flows from this basin. The total developed flow will then combine with the upstream developed flows from Design Point 9 and be routed in a large diameter storm system further south/west within Sterling Ranch Road.

Basin P2-A (Q_5 = 10 cfs, Q_{100} = 33 cfs) consists of the better portion of the proposed park area. The developed sheet flows from this area are anticipated to sheet flow directly into the adjacent FSD-14A Pond where they will be formally treated.

Basin SC-3 (Q_5 = 14 cfs, Q_{100} = 32 cfs) consists of portions of the proposed linear park/open space along with the anticipated rear yards of the lots adjacent to the creek. This area will continue to sheet flow directly towards the Sand Creek corridor. At this time, these rear yards are anticipated to not be captured and routed to a formal stormwater quality facility. However, given the minimal unconnected impervious area and sizeable receiving pervious are within this basin, the WQCV reduction = 100% with 0 untreated WQCV. (See Appendix)

Basins P2-B1 (Q_5 = 7 cfs, Q_{100} = 13 cfs), **Basin P2-B2 (Q_5 = 5 cfs, Q_{100} = 10 cfs), Basin P2-B3 (Q_5 = 7 cfs, Q_{100} = 13 cfs)**, **P2-B4 (Q_5 = 4 cfs, Q_{100} = 8 cfs)**, **Basin P2-B5 (Q_5 = 5 cfs, Q_{100} = 9 cfs), Basin P2-B6 (Q_5 = 3 cfs, Q_{100} = 6 cfs), P2-B7 (Q_5 = 6 cfs, Q_{100} = 12 cfs)**, **Basin P2-B8 (Q_5 = 3 cfs, Q_{100} = 7 cfs), Basin P2-B9 (Q_5 = 5 cfs, Q_{100} = 11 cfs)**and **Basin P2-B10 (Q_5 = 5 cfs, Q_{100} = 10 cfs)** all represent tributary area within the Sterling Ranch Road roadway extension between Dines Blvd. and Briargate Pkwy. These final designed facilities (Type R curb inlets) are shown and labeled on the drainage map. These basins have been studied in the "Drainage Letter for Sterling Ranch

Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021. Please reference this report along with the "Sterling Ranch Road and Briargate Pkwy. Storm Plans", prepared by JR Engineering, LLC, dated December 2021 and the "Sterling Ranch Road and Briargate Pkwy. Street Plans", prepared by JR Engineering, LLC, dated October 2021. These referenced design plans provide for separate storm outfalls from each of the at-grade inlet locations within Sterling Ranch Road to daylight into a temporary graded channel on the north side of the roadway. This channel then routes the developed roadway flows towards FSD-14A Pond. The ultimate design proposed to handle these roadway flows along with the adjacent development of Basins PS-S1, P2-A and P2-B (as described above) will be a large diameter storm sewer located behind the curb within a proposed open space tract along the north side of Sterling Ranch Road. (See Drainage Map) All the designed curb inlets within this stretch of Sterling Ranch Road will then connect into this proposed storm system.

The original MDDP basin SC3-14A included the entire Sand Creek channel including both the in-line stock pond and the proposed Detention Pond W3. Thus, there is about a 30+ acre difference in area from this original basin vs. the actual development area tributary to the proposed FSD-14A Pond. The total anticipated developed flows entering this facility are as follows. (See Appendix for MHFD-Detention pond design sheets):

Detention Pond FSD-14A (Full Spectrum EDB)

Total Tributary Acreage: 130.8 ac.

2.770 Ac.-ft. WQCV required

6.512 Ac.-ft. EURV required with 4:1 max. slopes

5.636 Ac.-ft. 100-yr. Storage

14.918 Ac.-ft. Total

Total Peak In-flow: Q_5 = 163 cfs, Q_{100} = 345 cfs

Pond Peak Design Release: Q_5 = 19 cfs, Q_{100} = 129 cfs

Pre-development Release: Q_5 = 29 cfs, Q_{100} = 135 cfs

(Ownership and maintenance by the Sterling Ranch East Metro District)

The allowable release rate from this facility per the 2018 MDDP equals (Q_5 = 7.5 cfs, Q_{100} = 142.4 cfs). This facility is planned to release directly into the adjacent in-line Pond W3. Please reference "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021 for this pond design along with the adjacent Sand Creek improvements proposed in this area.

The following represent the basins and design points south of Briargate Pkwy. and east of Sterling Ranch Road *contained within basins SC3-14B, SCE-7 and SCE-10 as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:*

Basin P4-B (Q_5 = 63 cfs, Q_{100} = 123 cfs) consists of the anticipated basin for the proposed Villages at Sterling Ranch East PUD site. These developed flows will be collected via a public storm system on-site and then routed towards **Design Point 14** at the south edge of the site where a 48" RCP storm stub will be provided. This storm stub will then outfall in a southerly direction through future Sterling Ranch residential development towards Pond FSD-14B.

Basin P4-A (Q_5 = 41 cfs, Q_{100} = 80 cfs) consists of the anticipated tributary area for the future Sterling Ranch East urban residential area outside of this proposed Preliminary Plan. These anticipated future developed flows will be routed towards a downstream storm system represented by **Design Point 15.** These future developed flows then combine with the previously described developed flows from Design Point 14 and are routed into Pond FSD-14B.

Design Point 16 (Q_5 = 97 cfs, Q_{100} = 189 cfs) represents the total anticipated developed flows into Pond FSD-14B. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report. In the interim, before development within this future basin P4-A, the developed flows from the Villages site may be routed via a temporary channel towards Pond FSD-14B. The final drainage report(s) will further describe any temporary conveyance facilities for these developed flows.

The original MDDP basin SC3-14B only included 34.7 acres tributary to Pond FSD-14B. The entire proposed Villages at Sterling Ranch East PUD site along with the planned future residential area due south is now proposed to be tributary to Pond FSD14-B. This total acreage equals 63.1 acres. The planned outfall for this facility as presented in the 2018 MDDP was to the west and into the previously mentioned 48" RCP outfall within Sterling Ranch Road from Pond FSD-16. However, based on this proposed MDDP Amendment, the ultimate outfall for this facility is now planned to be a 42"-48" RCP storm system routed in a southerly direction towards the south property line of the overall Sterling Ranch East ownership. At this location, a level spreader is proposed to evenly allow the developed, treated flows to exit the property within the Pre-development Basin EX-9 at DP6. The allowed release from Pond FSD-14B and the spreader facility will be equal to or less than the pre-developed flows at this location of (Q_5 = 57 cfs, Q_{100} = 124 cfs).

The total anticipated developed flows entering this facility are as follows. (See Appendix for MHFD-Detention pond design sheets):

Detention Pond FSD-14B (Full Spectrum EDB)

Total Tributary Acreage: 63.1 ac.

1.336 Ac.-ft. WQCV required

3.141 Ac.-ft. EURV required with 4:1 max. slopes

2.719 Ac.-ft. 100-yr. Storage

7.196 Ac.-ft. Total

Total Peak In-flow: Q_5 = 97 cfs, Q_{100} = 189 cfs

Pond Peak Design Release: Q_5 = 11 cfs, Q_{100} = 95 cfs

Pre-development Release: Q_5 = 57 cfs, Q_{100} = 124 cfs

(Ownership and maintenance by the Sterling Ranch East Metro District)

The following represent the basins and design points south of Sterling Ranch Road *contained within basin SC3-11B as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:*

Basin P3-A (Q_5 = 82 cfs, Q_{100} = 160 cfs) consists of the anticipated basin for the proposed urban residential at the south end of the overall Sterling Ranch East project. These developed flows will be collected via a public storm system on-site and then routed towards **Design Point 17** at the southwest edge of the site where a 48"-54" RCP storm stub will be provided. This storm stub will then outfall directly into the proposed Pond FSD-11B. The Sterling Ranch East Phase 1 Preliminary Plan in this area proposes RR-5 zoning adjacent to the south overall boundary. The lots presented in this area are all at least 1/2 ac. in size and typically 100' wide and 225' deep. **Basin EF-A (Q_5 = 7 cfs, Q_{100} = 20 cfs)** consists of rear portion of these proposed large lots along with a 75'+ wide buffer/utility corridor immediately adjacent to the south property line. This basin will be allowed to continue to sheet flow in a southerly direction off-site. At this time, these rear yards and buffer corridor are anticipated to not be captured and routed to a formal stormwater quality facility. However, given the minimal unconnected impervious area and sizeable receiving pervious are within this basin, the WQCV reduction = 100% with 0 untreated WQCV. (See Appendix) **Basin P3-C (Q_5 = 1 cfs, Q_{100} = 5 cfs)** consists of a small portion of the 75'+ wide buffer/utility corridor immediately adjacent to the south property line. This basin will be allowed to continue to sheet flow in a southerly direction off-site. No impervious development is anticipated within this basin and thus no formal stormwater quality feature is required for this small basin.

Basin P3-S2 (Q_5 = 25 cfs, Q_{100} = 50 cfs) consists of the anticipated basin for the proposed elementary school site. These developed flows will be routed internally within the school site property towards **Design Point 18** where a 36" RCP storm stub will be provided. This storm stub will then also outfall directly into the proposed Pond FSD-11B.

Basin SC-1 (Q_5 = 2 cfs, Q_{100} = 6 cfs) is a small basin due west of the elementary school site that consists of mainly the eastern slope of the Sand Creek channel. No impervious development is

proposed other than the required maintenance access road/trail as presented on the Sand Creek channel plans. At this time, this area is not anticipated to be captured and routed to a formal stormwater quality facility. However, given the minimal unconnected impervious area and sizeable receiving pervious are within this basin, the WQCV reduction = 100% with 0 untreated WQCV. (See Appendix)

The 2018 MDDP presented a total inflow to this facility of (Q_5 = 81.3 cfs, Q_{100} = 213.7 cfs) and an allowable release rate of (Q_5 = 4.5 cfs, Q_{100} = 69.6 cfs). The outlet pipe for this pond will outfall directly into Sand Creek just south of the Sterling Ranch Road crossing. Reference the "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021 for the Sand Creek channel design documents. The total anticipated developed flows entering this facility are as follows. (See Appendix for MHFD-Detention pond design sheets):

<u>Detention Pond FSD-11B</u> (Full Spectrum EDB)

Total Tributary Acreage: 64.5 ac.

1.387 Ac.-ft. WQCV required

3.266 Ac.-ft. EURV required with 4:1 max. slopes

2.792 Ac.-ft. 100-yr. Storage

7.445 Ac.-ft. Total

Total Peak In-flow: Q_5 = 98 cfs, Q_{100} = 201 cfs

Pond Peak Design Release: Q_5 = 8 cfs, Q_{100} = 68 cfs

Pre-development Release: Q_5 = 18 cfs, Q_{100} = 80 cfs

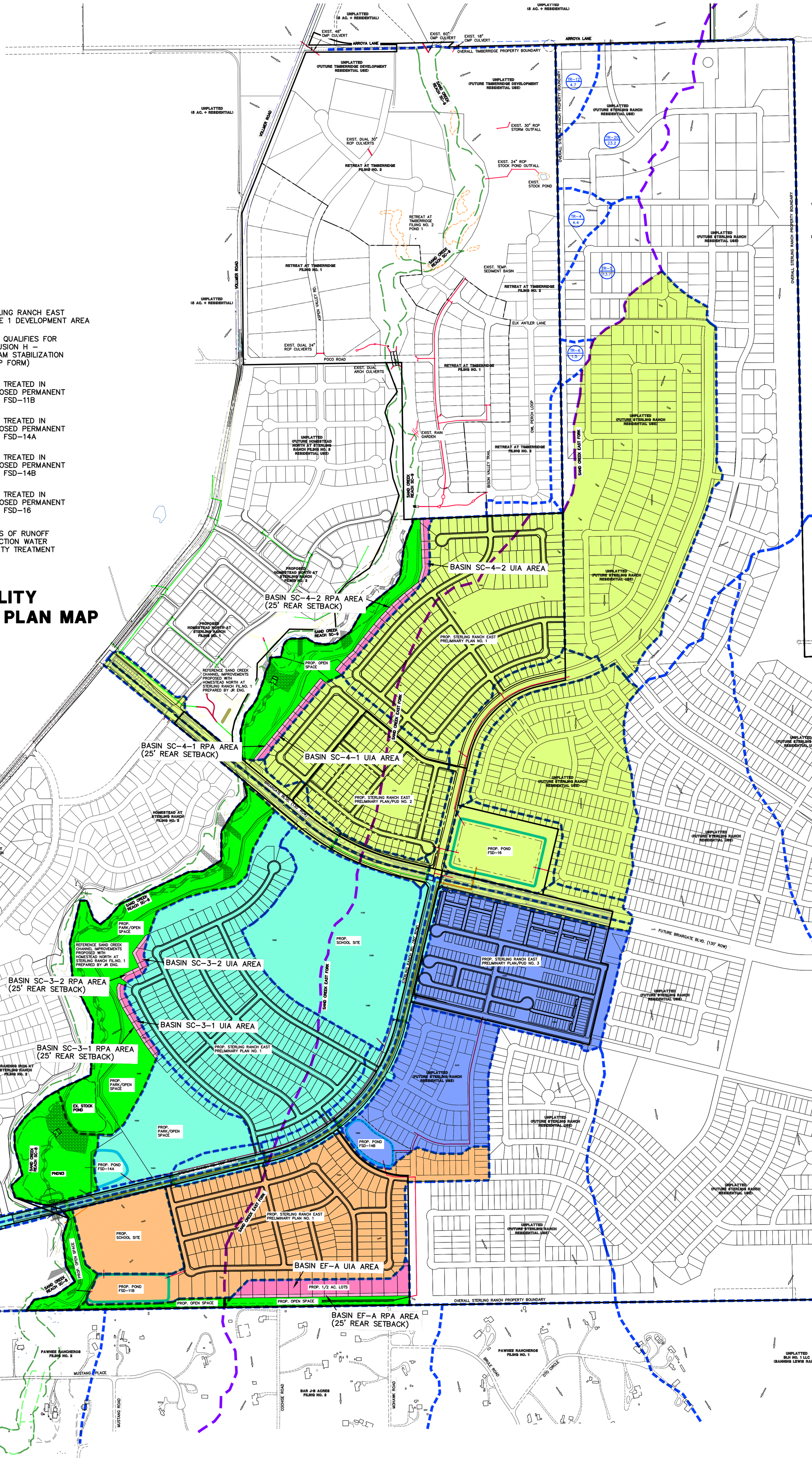
(Ownership and maintenance by the Sterling Ranch East Metro District)

DETENTION / STORMWATER QUALITY FACILITES

As required, storm water quality measures will be utilized in order to reduce the amount of sediment, debris and pollutants that are allowed to enter Sand Creek. These features include but are not limited to Full Spectrum Detention Basins and temporary sediment basins. Site Planning and design techniques for urban areas that require detention will provide a Water

WATER QUALITY TREATMENT PLAN MAP

	STERLING RANCH EAST PHASE 1 DEVELOPMENT AREA
61.1 AC.	AREA QUALIFIES FOR EXCLUSION H – STREAM STABILIZATION (PBMP FORM)
64.5 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–11B
130.8 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–14A
63.1 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–14B
245.0 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–16
10.3 AC.	AREAS OF RUNOFF REDUCTION WATER QUALITY TREATMENT



Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: May 31, 2022
Project: Sterling Ranch East Preliminary Plan No. 1
Location: BASINS NOT TRIBUTARY TO PERMANENT SWQ FACILITY

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.53 inches
Depth of Average Runoff Producing Storm, d_6 = 0.42 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA							
Area ID	EF-A	SC-3-1	SC-3-2	SC-4-1	SC-4-2							
Downstream Design Point ID	SC	SC	SC	SC	SC							
Downstream BMP Type	None	None	None	None	None							
DCIA (ft^2)	--	--	--	--	--							
UIA (ft^2)	40,000	26,790	19,924	30,053	48,697							
RPA (ft^2)	37,188	17,918	12,924	21,985	28,692							
SPA (ft^2)	--	--	--	--	--							
HSG A (%)	0%	0%	0%	0%	0%							
HSG B (%)	100%	100%	100%	100%	100%							
HSG C/D (%)	0%	0%	0%	0%	0%							
Average Slope of RPA (ft/ft)	0.020	0.040	0.030	0.040	0.040							
UIA:RPA Interface Width (ft)	800.00	700.00	400.00	800.00	1000.00							

CALCULATED RUNOFF RESULTS

Area ID	EF-A	SC-3-1	SC-3-2	SC-4-1	SC-4-2							
UIA:RPA Area (ft^2)	77,188	44,708	32,848	52,038	77,389							
L / W Ratio	0.12	0.09	0.21	0.08	0.08							
UIA / Area	0.5182	0.5992	0.6066	0.5775	0.6292							
Runoff (in)	0.00	0.00	0.00	0.00	0.00							
Runoff (ft^3)	0	0	0	0	0							
Runoff Reduction (ft^3)	1433	960	714	1077	1745							

CALCULATED WQCV RESULTS

Area ID	EF-A	SC-3-1	SC-3-2	SC-4-1	SC-4-2							
WQCV (ft^3)	1628	1090	811	1223	1982							
WQCV Reduction (ft^3)	1628	1090	811	1223	1982							
WQCV Reduction (%)	100%	100%	100%	100%	100%							
Untreated WQCV (ft^3)	0	0	0	0	0							

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	SC											
DCIA (ft^2)	0											
UIA (ft^2)	165,464											
RPA (ft^2)	118,707											
SPA (ft^2)	0											
Total Area (ft^2)	284,171											
Total Impervious Area (ft^2)	165,464											
WQCV (ft^3)	6,734											
WQCV Reduction (ft^3)	6,734											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	284,171
Total Impervious Area (ft^2)	165,464
WQCV (ft^3)	6,734
WQCV Reduction (ft^3)	6,734
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

DETENTION POND CALCULATIONS

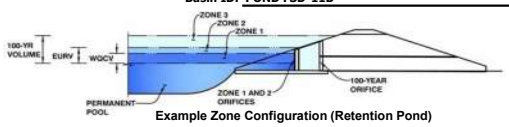
CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-11B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	64.50	acres
Watershed Length =	2,500	ft
Watershed Length to Centroid =	1,250	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	66.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.387	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.653	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.293	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	5.841	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.157	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	8.754	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	10.141	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.816	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	17.305	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	3.614	acre-feet		
Approximate 5-yr Detention Volume =	4.839	acre-feet		
Approximate 10-yr Detention Volume =	6.156	acre-feet		
Approximate 25-yr Detention Volume =	6.628	acre-feet		
Approximate 50-yr Detention Volume =	6.900	acre-feet		
Approximate 100-yr Detention Volume =	7.445	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.387	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.266	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.792	acre-feet
Total Detention Basin Volume =	7.445	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

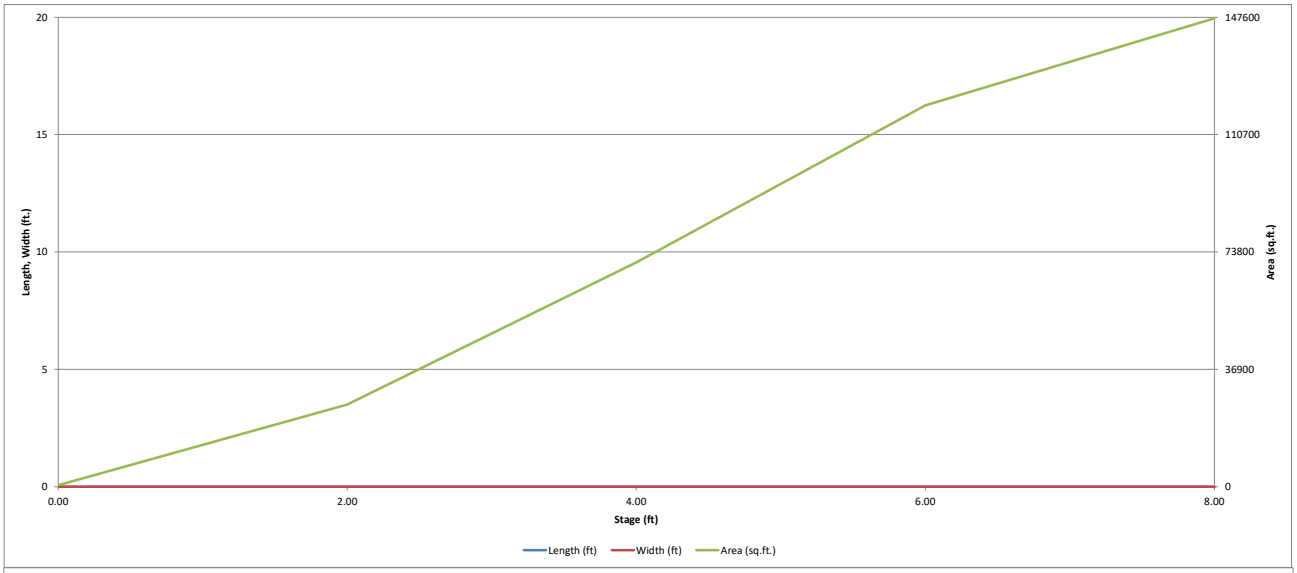
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

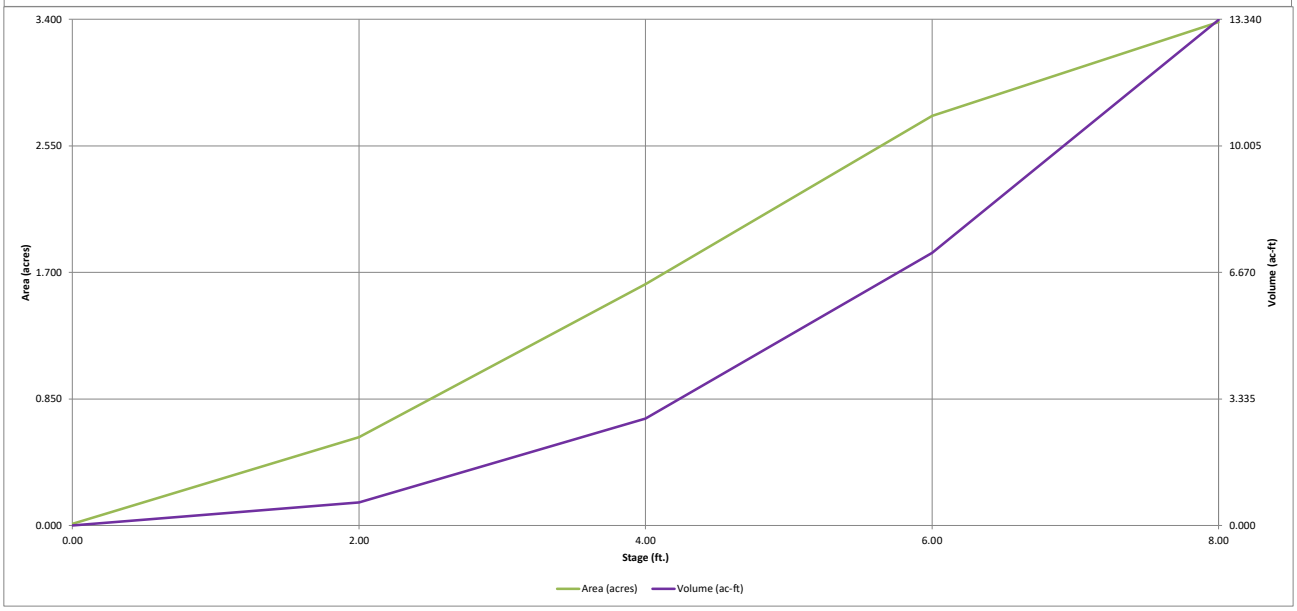
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	525	0.012		
7004	--	2.00	--	--	--	25,865	0.594	26,390	0.606
7006	--	4.00	--	--	--	70,579	1.620	122,834	2.820
7008	--	6.00	--	--	--	119,914	2.753	313,327	7.193
7010	--	8.00	--	--	--	147,297	3.381	580,538	13.327

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



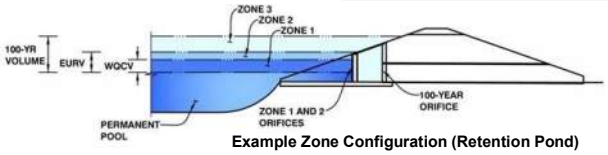


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-11B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.94	1.387	Orifice Plate
Zone 2 (EURV)	4.97	3.266	Orifice Plate
Zone 3 (100-year)	6.10	2.792	Weir&Pipe (Restrict)
Total (all zones)		7.445	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.00	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	20.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.70	3.40					
Orifice Area (sq. inches)	7.00	7.50	16.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.00	N/A	feet
Overflow Weir Front Edge Length =	10.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.48	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	31.64	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	15.82	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	7.07	N/A	ft^2
Outlet Pipe Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	1.50	N/A	feet
Restrictor Plate Height Above Pipe Invert =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.95	feet
Spillway Crest Length =	70.00	feet	Stage at Top of Freeboard =	8.45	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	3.38	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	13.33	acre-ft

Calculated Parameters for Spillway

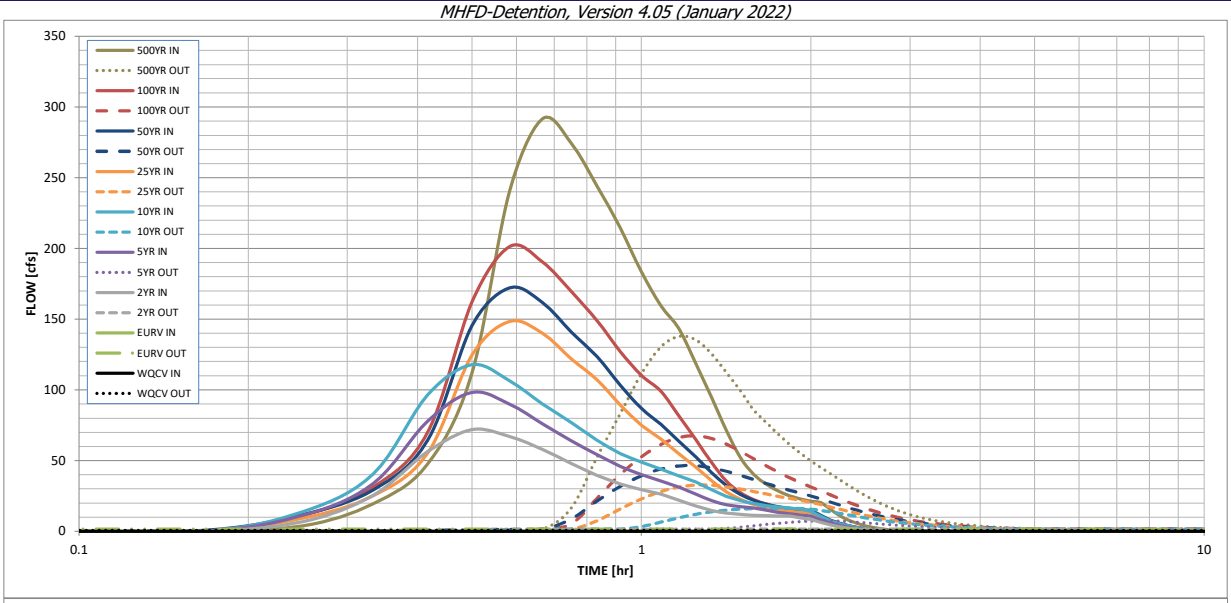
Routed Hydrograph Results

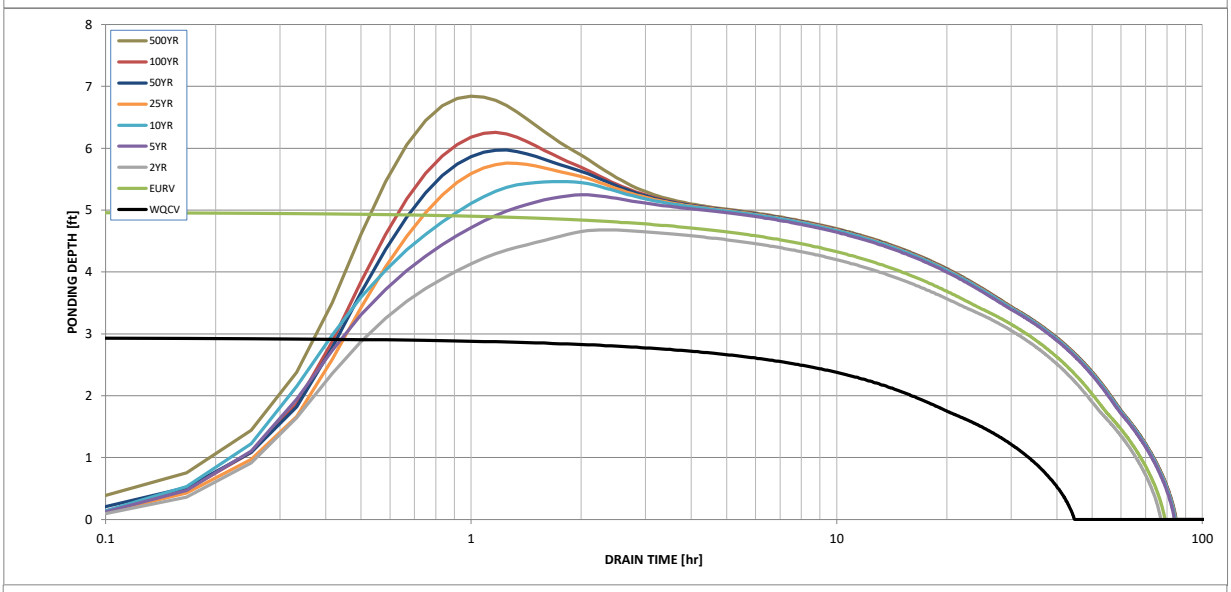
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

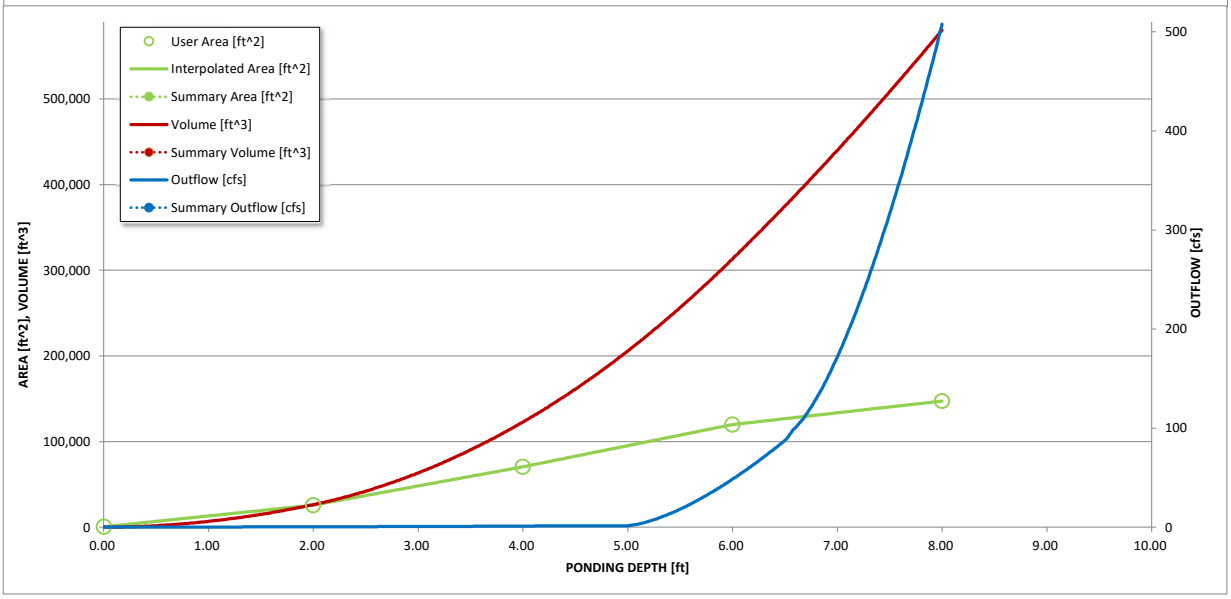
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	1.387	4.653	4.293	5.841	7.157	8.754	10.141	11.816	17.305
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.293	5.841	7.157	8.754	10.141	11.816	17.305
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	6.6	18.4	28.0	50.1	63.0	80.0	130.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.29	0.43	0.78	0.98	1.24	2.02
Peak Inflow Q (cfs) =	N/A	N/A	71.9	98.3	117.8	148.3	172.1	201.3	291.7
Peak Outflow Q (cfs) =	0.7	1.6	1.5	7.5	16.4	32.7	46.4	67.5	137.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.7	0.8	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	1.0	1.4	2.1	2.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	41	69	67	72	70	68	67	64	59
Time to Drain 99% of Inflow Volume (hours) =	**43**	74	73	79	78	77	77	76	73
Maximum Ponding Depth (ft) =	2.94	4.97	4.68	5.25	5.46	5.76	5.97	6.26	6.84
Area at Maximum Ponding Depth (acres) =	1.08	2.17	2.01	2.32	2.45	2.61	2.74	2.83	3.02
Maximum Volume Stored (acre-ft) =	1.391	4.658	4.053	5.264	5.789	6.522	7.111	7.891	9.616

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.08	3.82
	0:15:00	0.00	0.00	6.87	11.21	13.87	9.31	11.72	11.35	19.51
	0:20:00	0.00	0.00	25.39	33.68	40.41	25.06	29.22	31.19	47.45
	0:25:00	0.00	0.00	56.34	77.94	96.43	55.11	64.21	69.80	112.10
	0:30:00	0.00	0.00	71.88	98.26	117.80	124.61	145.55	162.31	240.92
	0:35:00	0.00	0.00	66.99	89.81	106.30	148.33	172.14	201.33	291.73
	0:40:00	0.00	0.00	57.88	76.05	90.13	140.06	161.83	190.39	274.50
	0:45:00	0.00	0.00	48.02	64.06	76.98	121.99	140.88	169.62	244.42
	0:50:00	0.00	0.00	39.64	54.32	64.57	107.14	123.71	149.12	214.64
	0:55:00	0.00	0.00	33.54	46.00	55.09	89.45	103.35	127.24	183.36
	1:00:00	0.00	0.00	29.45	40.14	48.97	74.98	86.79	110.24	159.34
	1:05:00	0.00	0.00	26.22	35.53	44.00	65.21	75.61	98.94	143.14
	1:10:00	0.00	0.00	21.95	31.20	39.15	54.80	63.62	81.42	118.39
	1:15:00	0.00	0.00	17.87	26.33	34.74	45.24	52.60	64.61	94.62
	1:20:00	0.00	0.00	14.68	21.62	29.41	35.74	41.51	48.63	71.17
	1:25:00	0.00	0.00	12.82	18.84	24.77	27.89	32.34	35.43	52.02
	1:30:00	0.00	0.00	11.88	17.41	21.70	22.52	26.06	27.35	40.34
	1:35:00	0.00	0.00	11.38	16.51	19.66	18.96	21.85	22.46	33.19
	1:40:00	0.00	0.00	11.11	14.88	18.21	16.71	19.16	19.23	28.41
	1:45:00	0.00	0.00	10.91	13.42	17.19	15.17	17.31	17.01	25.12
	1:50:00	0.00	0.00	10.75	12.40	16.47	14.18	16.12	15.50	22.87
	1:55:00	0.00	0.00	9.50	11.65	15.55	13.48	15.27	14.42	21.24
	2:00:00	0.00	0.00	8.27	10.79	14.06	13.01	14.70	13.77	20.26
	2:05:00	0.00	0.00	6.29	8.22	10.59	10.02	11.30	10.61	15.58
	2:10:00	0.00	0.00	4.50	5.83	7.46	7.07	7.96	7.50	10.99
	2:15:00	0.00	0.00	3.20	4.15	5.30	5.04	5.66	5.39	7.88
	2:20:00	0.00	0.00	2.26	2.90	3.75	3.57	4.01	3.84	5.61
	2:25:00	0.00	0.00	1.55	1.96	2.58	2.46	2.76	2.65	3.86
	2:30:00	0.00	0.00	1.03	1.31	1.75	1.68	1.89	1.81	2.64
	2:35:00	0.00	0.00	0.65	0.87	1.14	1.13	1.27	1.21	1.76
	2:40:00	0.00	0.00	0.36	0.52	0.67	0.69	0.77	0.73	1.06
	2:45:00	0.00	0.00	0.16	0.26	0.32	0.35	0.39	0.37	0.53
	2:50:00	0.00	0.00	0.06	0.09	0.11	0.12	0.14	0.13	0.18
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

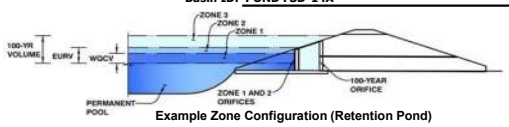
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-14A



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	130.80	acres
Watershed Length =	4,500	ft
Watershed Length to Centroid =	2,250	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	2.770	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	9.282	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	8.609	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	11.740	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	14.406	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	17.668	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	20.486	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	23.901	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	35.063	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	7.197	acre-feet		
Approximate 5-yr Detention Volume =	9.650	acre-feet		
Approximate 10-yr Detention Volume =	12.301	acre-feet		
Approximate 25-yr Detention Volume =	13.252	acre-feet		
Approximate 50-yr Detention Volume =	13.799	acre-feet		
Approximate 100-yr Detention Volume =	14.917	acre-feet		

Define Zones and Basin Geometry

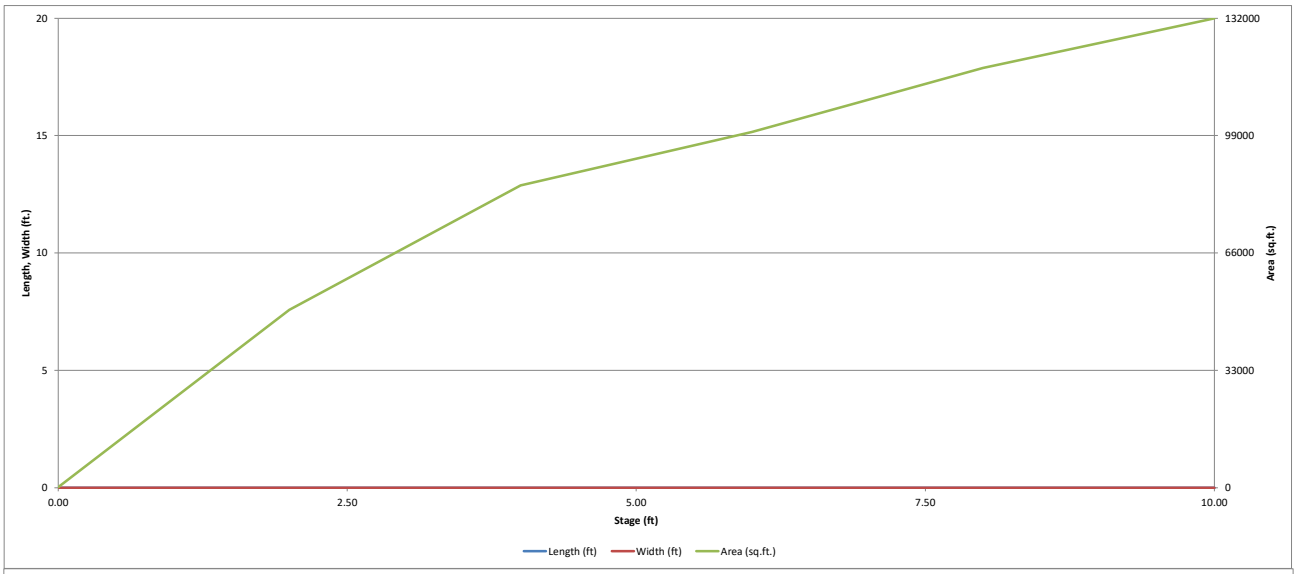
Zone 1 Volume (WQCV) =	2.770	acre-feet
Zone 2 Volume (EURV - Zone 1) =	6.512	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.636	acre-feet
Total Detention Basin Volume =	14.917	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

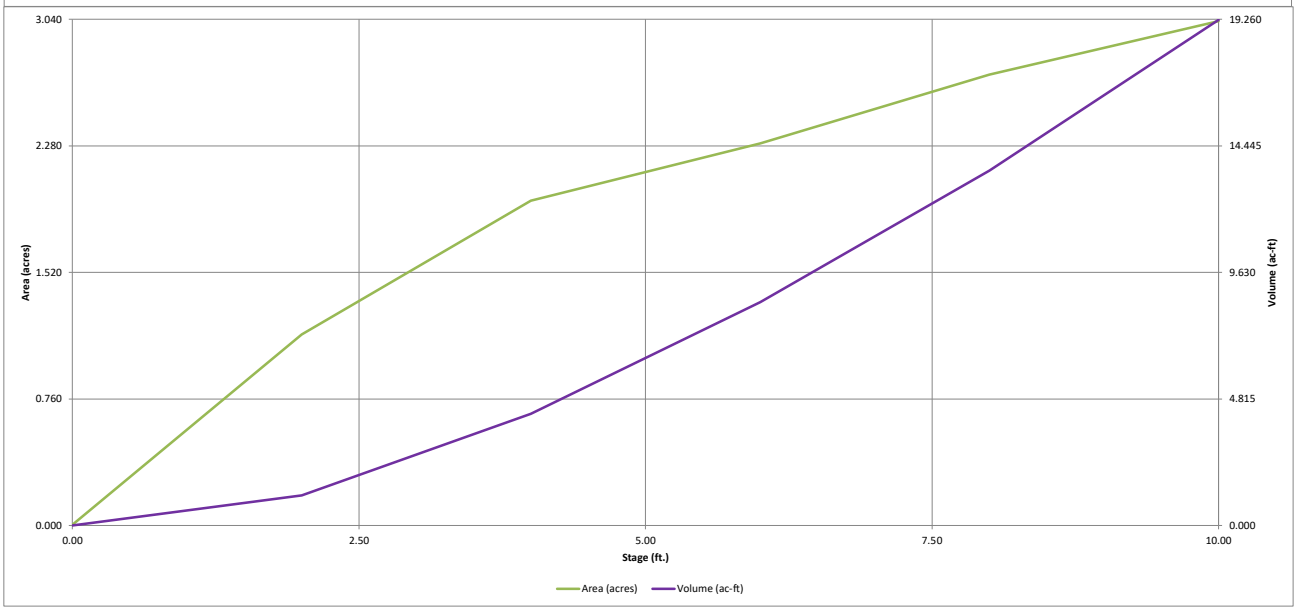
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	200	0.005		
7014	--	2.00	--	--	--	50,000	1.148	50,199	1.152
7016	--	4.00	--	--	--	85,000	1.951	185,199	4.252
7018	--	6.00	--	--	--	100,000	2.296	370,199	8.499
7020	--	8.00	--	--	--	118,000	2.709	588,199	13.503
7022	--	10.00	--	--	--	132,000	3.030	838,199	19.242

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



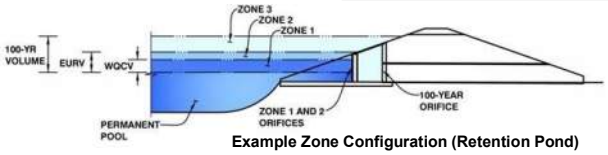


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-14A



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.17	2.770	Orifice Plate
Zone 2 (EURV)	6.34	6.512	Orifice Plate
Zone 3 (100-year)	8.52	5.636	Weir&Pipe (Restrict)
Total (all zones)		14.917	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.126E-01	ft^2
Depth at top of Zone using Orifice Plate =	6.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	26.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	16.22	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.20	4.40					
Orifice Area (sq. inches)	16.22	16.22	16.22					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.50	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	9.01	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	79.10	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	39.55	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	8.78	N/A	ft^2
Outlet Pipe Diameter =	42.00	N/A	inches	Outlet Orifice Centroid =	1.61	N/A	feet
Restrictor Plate Height Above Pipe Invert =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.37	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.07	feet
Spillway Crest Length =	100.00	feet	Stage at Top of Freeboard =	10.57	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	3.03	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	19.24	acre-ft

Calculated Parameters for Spillway

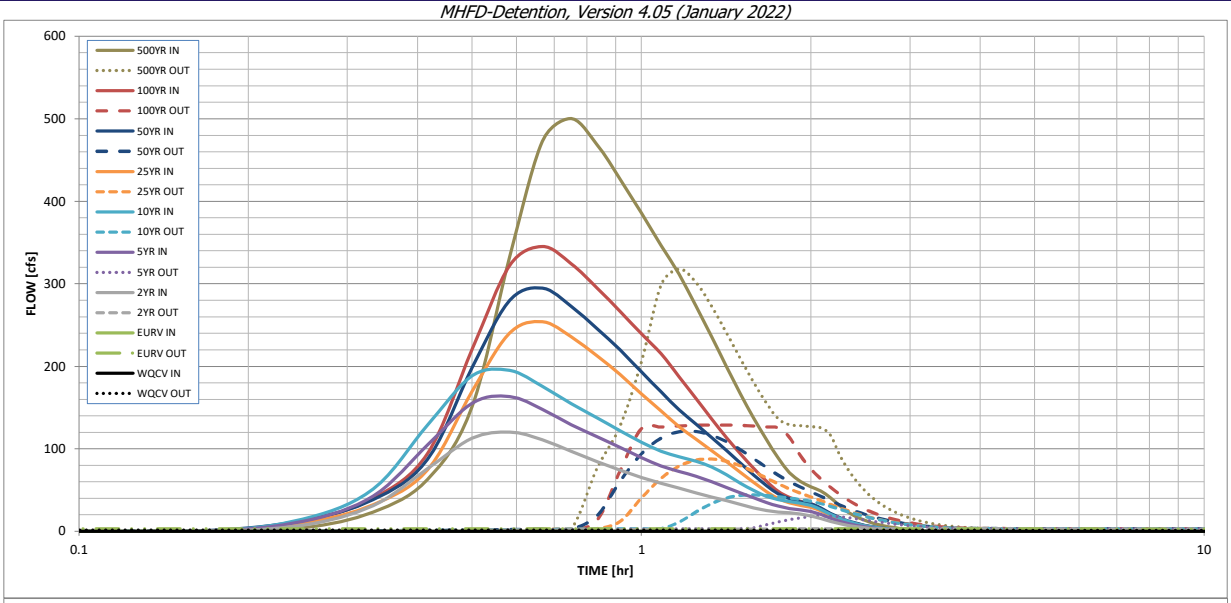
Routed Hydrograph Results

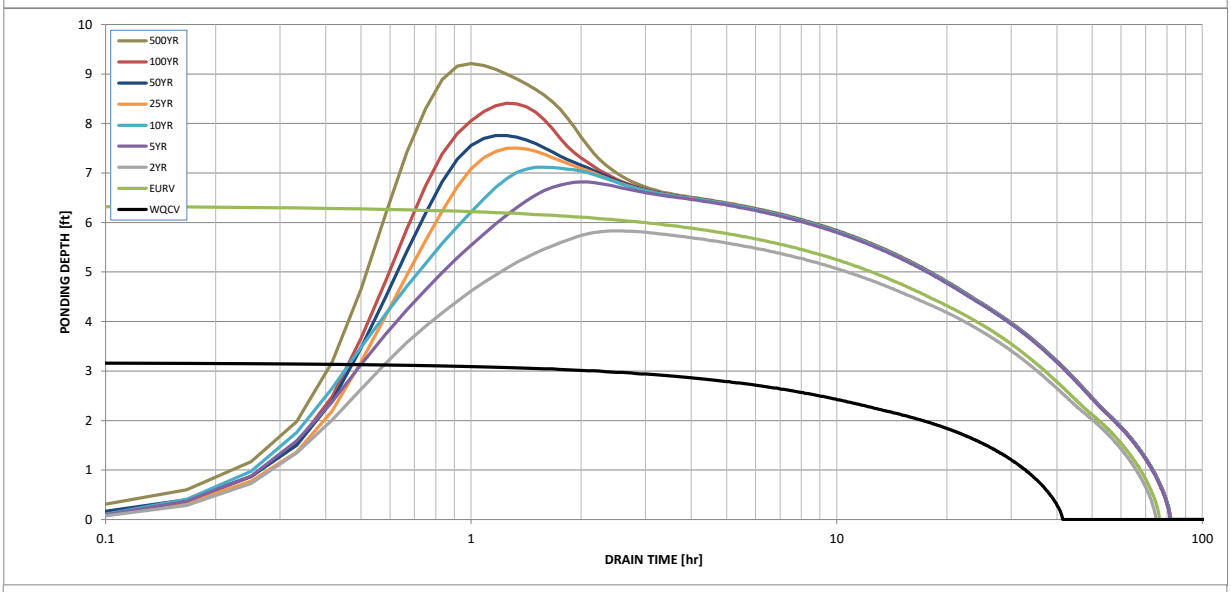
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

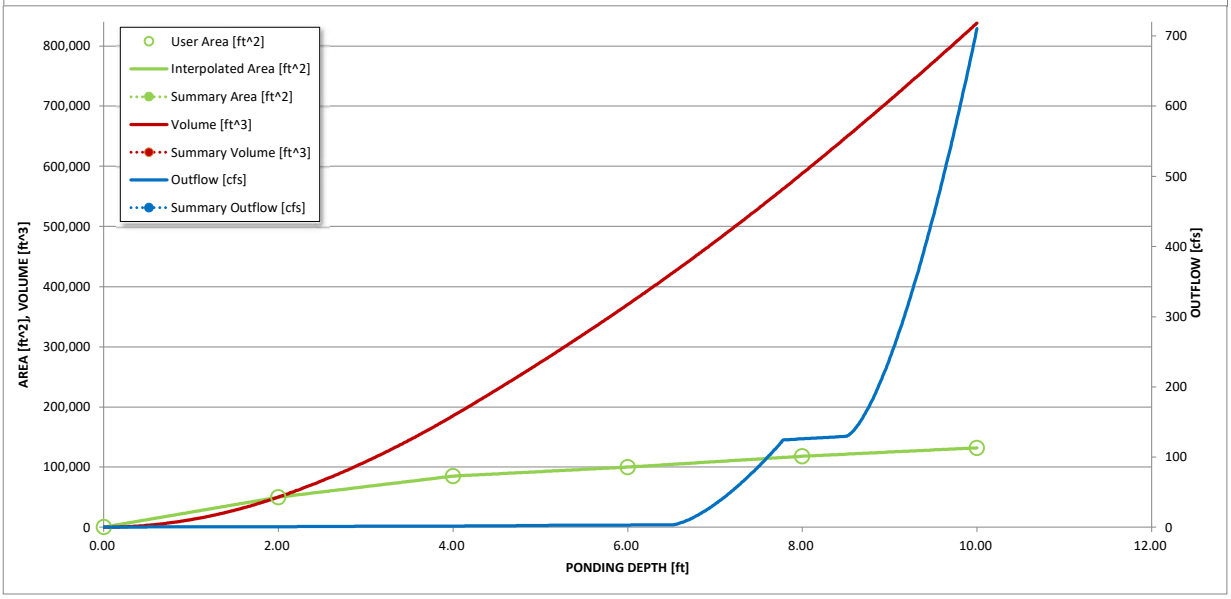
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	2.770	9.282	8.609	11.740	14.406	17.668	20.486	23.901	35.063
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	8.609	11.740	14.406	17.668	20.486	23.901	35.063
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	10.4	29.4	45.4	83.2	104.6	134.7	219.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.22	0.35	0.64	0.80	1.03	1.68
Peak Inflow Q (cfs) =	N/A	N/A	120.4	163.4	195.0	254.2	294.7	345.0	500.4
Peak Outflow Q (cfs) =	1.5	3.2	3.0	18.6	44.1	87.6	121.1	128.9	317.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	1.0	1.1	1.2	1.0	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	1.1	1.5	1.6	1.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	67	72	70	68	67	65	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	73	71	77	77	76	75	74	72
Maximum Ponding Depth (ft) =	3.17	6.34	5.83	6.82	7.12	7.51	7.76	8.41	9.21
Area at Maximum Ponding Depth (acres) =	1.62	2.37	2.27	2.47	2.53	2.61	2.66	2.77	2.90
Maximum Volume Stored (acre-ft) =	2.770	9.291	8.111	10.451	11.199	12.175	12.832	14.600	16.899

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.08	4.10
	0:15:00	0.00	0.00	7.34	11.99	14.85	9.97	13.01	12.20	23.15
	0:20:00	0.00	0.00	31.15	42.58	51.34	32.27	38.23	40.05	62.65
	0:25:00	0.00	0.00	75.83	104.57	128.91	74.63	87.15	94.34	150.88
	0:30:00	0.00	0.00	112.78	155.26	188.30	169.61	198.29	220.11	332.99
	0:35:00	0.00	0.00	120.41	163.39	195.05	240.34	279.90	322.30	472.85
	0:40:00	0.00	0.00	110.81	147.76	175.58	254.22	294.73	345.04	500.39
	0:45:00	0.00	0.00	96.96	129.27	154.76	235.64	272.59	324.43	469.02
	0:50:00	0.00	0.00	84.57	114.87	137.59	212.75	245.96	295.05	426.65
	0:55:00	0.00	0.00	74.18	101.73	121.89	189.94	219.80	266.52	385.70
	1:00:00	0.00	0.00	65.29	89.30	107.94	166.57	192.99	239.37	346.52
	1:05:00	0.00	0.00	58.31	79.25	97.09	145.75	169.04	215.23	311.87
	1:10:00	0.00	0.00	52.29	72.69	90.30	126.81	147.28	187.41	272.92
	1:15:00	0.00	0.00	46.70	66.78	85.00	111.80	130.02	161.00	235.79
	1:20:00	0.00	0.00	41.63	59.97	78.00	97.70	113.61	136.21	199.86
	1:25:00	0.00	0.00	37.05	53.03	68.47	84.42	98.06	113.63	166.42
	1:30:00	0.00	0.00	32.62	46.42	58.33	71.38	82.74	93.80	137.12
	1:35:00	0.00	0.00	28.50	40.63	49.46	59.17	68.36	76.23	111.23
	1:40:00	0.00	0.00	25.19	34.79	42.45	48.27	55.56	60.80	88.67
	1:45:00	0.00	0.00	23.36	30.49	38.49	39.50	45.33	48.41	71.06
	1:50:00	0.00	0.00	22.53	27.72	36.08	34.54	39.54	41.15	60.59
	1:55:00	0.00	0.00	20.81	25.79	33.99	31.34	35.77	36.47	53.77
	2:00:00	0.00	0.00	18.59	24.05	31.45	29.25	33.27	33.18	48.96
	2:05:00	0.00	0.00	15.45	20.39	26.52	24.82	28.19	27.65	40.81
	2:10:00	0.00	0.00	12.08	15.90	20.65	19.29	21.87	21.01	30.99
	2:15:00	0.00	0.00	9.28	12.13	15.73	14.55	16.48	15.51	22.86
	2:20:00	0.00	0.00	7.13	9.29	11.97	11.04	12.47	11.57	17.04
	2:25:00	0.00	0.00	5.48	7.09	9.05	8.43	9.50	8.85	12.99
	2:30:00	0.00	0.00	4.16	5.32	6.74	6.32	7.11	6.67	9.76
	2:35:00	0.00	0.00	3.13	3.92	5.02	4.69	5.27	5.00	7.32
	2:40:00	0.00	0.00	2.31	2.86	3.74	3.48	3.91	3.74	5.47
	2:45:00	0.00	0.00	1.67	2.08	2.76	2.61	2.92	2.80	4.09
	2:50:00	0.00	0.00	1.14	1.44	1.93	1.86	2.08	1.99	2.90
	2:55:00	0.00	0.00	0.71	0.95	1.25	1.23	1.38	1.32	1.92
	3:00:00	0.00	0.00	0.39	0.56	0.71	0.74	0.82	0.79	1.14
	3:05:00	0.00	0.00	0.17	0.28	0.33	0.37	0.41	0.39	0.56
	3:10:00	0.00	0.00	0.06	0.09	0.10	0.12	0.13	0.13	0.18
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

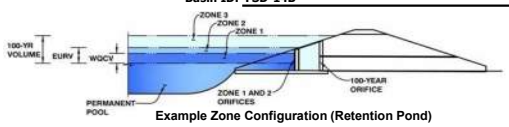
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 3

Basin ID: FSD-14B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	63.10	acres
Watershed Length =	2,500	ft
Watershed Length to Centroid =	1,250	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.336	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.478	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.138	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	5.644	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	6.926	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	8.495	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.849	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.491	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	16.858	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	3.472	acre-feet		
Approximate 5-yr Detention Volume =	4.655	acre-feet		
Approximate 10-yr Detention Volume =	5.934	acre-feet		
Approximate 25-yr Detention Volume =	6.393	acre-feet		
Approximate 50-yr Detention Volume =	6.657	acre-feet		
Approximate 100-yr Detention Volume =	7.196	acre-feet		

Define Zones and Basin Geometry

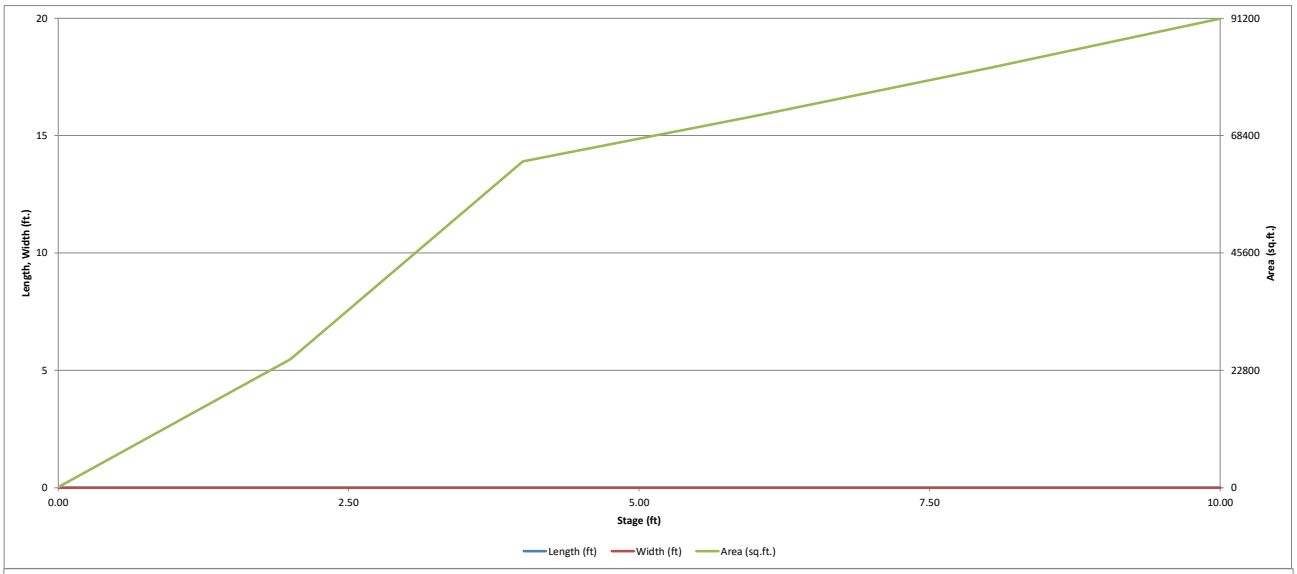
Zone 1 Volume (WQCV) =	1.336	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.141	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.719	acre-feet
Total Detention Basin Volume =	7.196	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

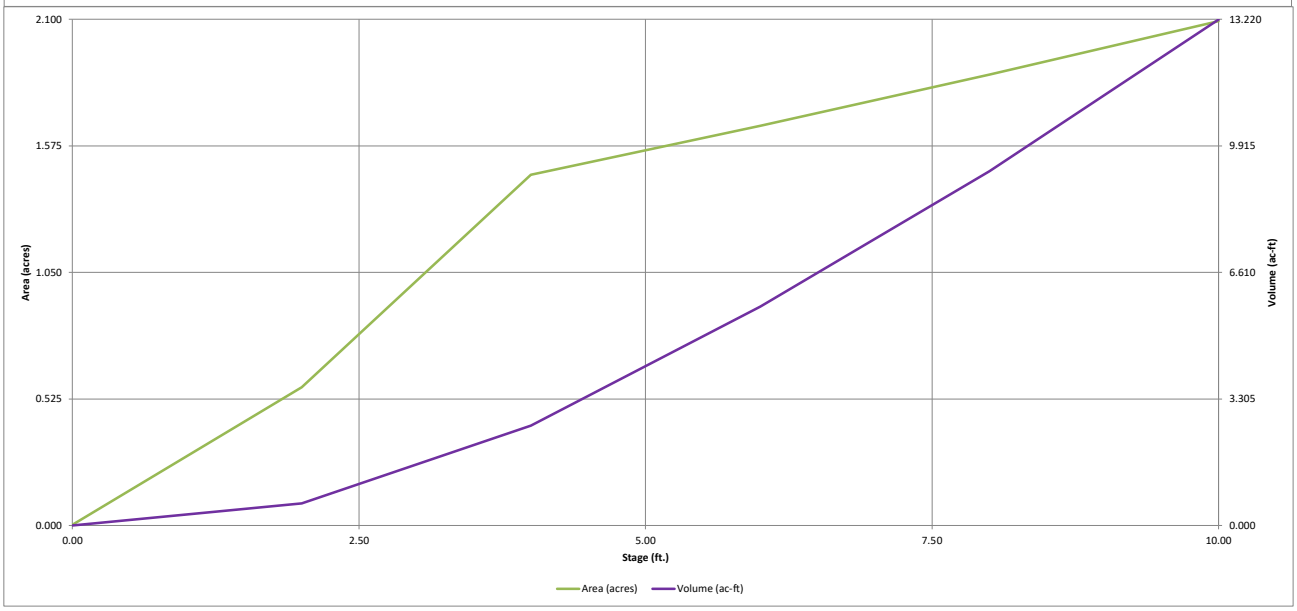
Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
7052	--	2.00	--	--	--	25,000	0.574	25,100	0.576
7054	--	4.00	--	--	--	63,400	1.455	113,500	2.606
7056	--	6.00	--	--	--	72,250	1.659	249,150	5.720
7058	--	8.00	--	--	--	81,500	1.871	402,900	9.249
7060	--	10.00	--	--	--	91,150	2.093	575,550	13.213

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



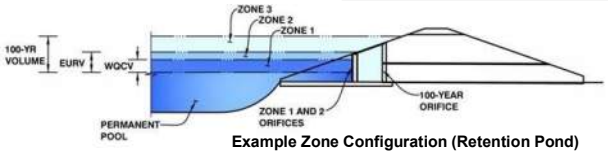


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 3**

Basin ID: **FSD-14B**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.97	1.336	Orifice Plate
Zone 2 (EURV)	5.24	3.141	Orifice Plate
Zone 3 (100-year)	6.87	2.719	Weir&Pipe (Restrict)
Total (all zones)		7.196	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.24	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	21.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.75	3.49					
Orifice Area (sq. inches)	7.29	7.29	10.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.24	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.24	N/A	feet
Overflow Weir Front Edge Length =	16.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.26	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	50.62	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	25.31	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	9.62	N/A	ft^2
Outlet Pipe Diameter =	42.00	N/A	inches	Outlet Orifice Centroid =	1.75	N/A	feet
Restrictor Plate Height Above Pipe Invert =	42.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.02	feet
Spillway Crest Length =	60.00	feet	Stage at Top of Freeboard =	9.02	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	1.98	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	11.22	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

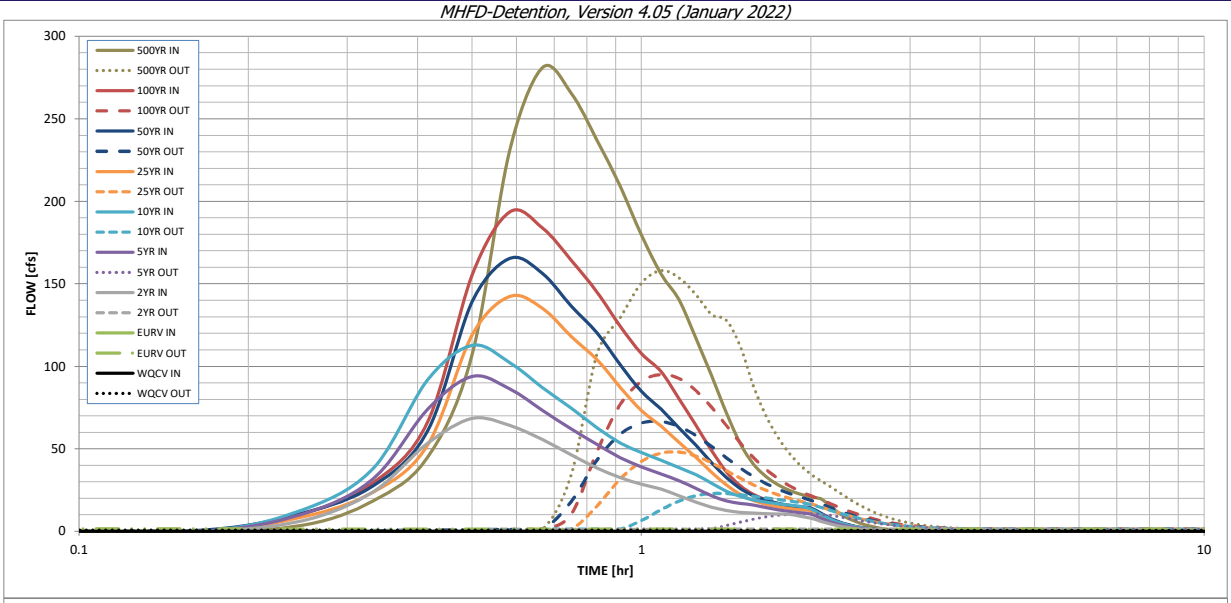
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

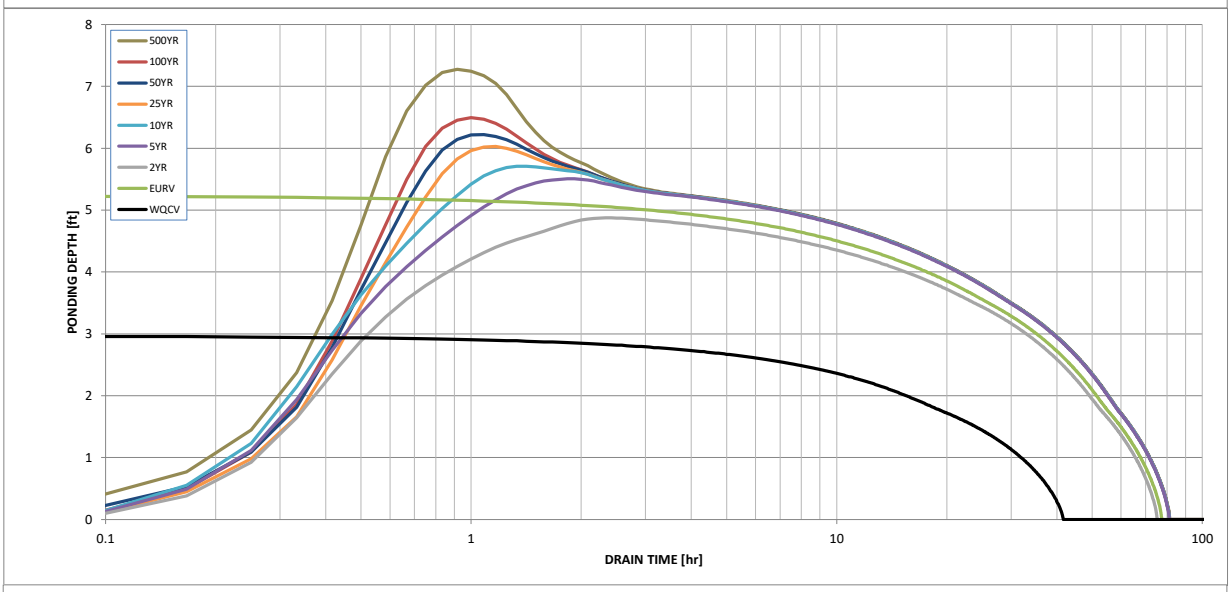
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	1.336	4.478	4.138	5.644	6.926	8.495	9.849	11.491	16.858
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.138	5.644	6.926	8.495	9.849	11.491	16.858
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	6.4	17.9	27.2	48.6	61.1	77.6	126.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		57.0				124.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.30	0.43	0.77	0.97	1.97	2.00
Peak Inflow Q (cfs) =	N/A	N/A	68.4	93.9	112.8	142.4	165.4	193.6	281.0
Peak Outflow Q (cfs) =	0.7	1.5	1.4	10.6	22.9	48.0	66.5	95.0	158.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.8	1.0	1.1	0.8	1.3
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.4	0.9	1.3	1.8	2.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	67	70	69	67	65	63	57
Time to Drain 99% of Inflow Volume (hours) =	**40**	74	72	77	76	75	74	73	71
Maximum Ponding Depth (ft) =	2.97	5.24	4.88	5.51	5.71	6.03	6.22	6.49	7.28
Area at Maximum Ponding Depth (acres) =	1.00	1.58	1.54	1.61	1.63	1.66	1.68	1.71	1.79
Maximum Volume Stored (acre-ft) =	1.340	4.488	3.910	4.903	5.227	5.753	6.087	6.545	7.912

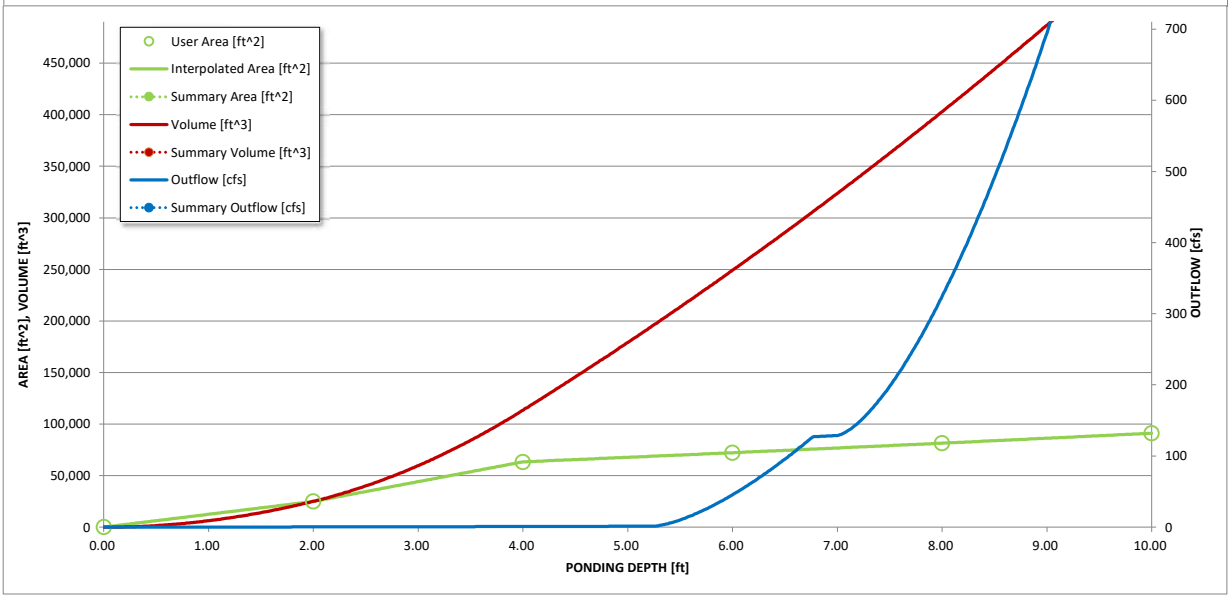
Add a note justifying these changes.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.07	3.60
	0:15:00	0.00	0.00	6.46	10.54	13.05	8.76	11.03	10.68	18.39
	0:20:00	0.00	0.00	23.94	31.77	38.11	23.64	27.59	29.43	44.82
	0:25:00	0.00	0.00	53.28	73.95	91.70	52.12	60.79	66.14	106.78
	0:30:00	0.00	0.00	68.40	93.86	112.76	118.88	139.02	155.14	230.89
	0:35:00	0.00	0.00	64.09	86.25	102.28	142.40	165.44	193.57	281.00
	0:40:00	0.00	0.00	55.59	73.32	87.06	135.11	156.25	183.92	265.56
	0:45:00	0.00	0.00	46.35	62.02	74.67	118.05	136.45	164.34	237.21
	0:50:00	0.00	0.00	38.42	52.81	62.91	104.13	120.35	145.11	209.22
	0:55:00	0.00	0.00	32.49	44.67	53.58	87.34	101.01	124.37	179.48
	1:00:00	0.00	0.00	28.56	39.02	47.69	73.16	84.77	107.68	155.92
	1:05:00	0.00	0.00	25.54	34.71	43.04	63.78	74.04	96.82	140.34
	1:10:00	0.00	0.00	21.57	30.69	38.56	53.92	62.67	80.21	116.85
	1:15:00	0.00	0.00	17.73	26.07	34.36	44.84	52.19	64.17	94.16
	1:20:00	0.00	0.00	14.61	21.49	29.17	35.74	41.56	48.87	71.66
	1:25:00	0.00	0.00	12.59	18.46	24.27	28.08	32.59	36.03	52.90
	1:30:00	0.00	0.00	11.54	16.89	21.11	22.34	25.88	27.45	40.53
	1:35:00	0.00	0.00	11.00	15.97	19.09	18.67	21.53	22.30	33.02
	1:40:00	0.00	0.00	10.71	14.40	17.65	16.36	18.78	19.02	28.14
	1:45:00	0.00	0.00	10.52	12.99	16.63	14.80	16.91	16.73	24.75
	1:50:00	0.00	0.00	10.36	12.00	15.92	13.78	15.68	15.18	22.44
	1:55:00	0.00	0.00	9.18	11.27	15.04	13.07	14.82	14.07	20.78
	2:00:00	0.00	0.00	8.00	10.44	13.62	12.59	14.23	13.37	19.71
	2:05:00	0.00	0.00	6.11	7.99	10.32	9.74	10.99	10.31	15.16
	2:10:00	0.00	0.00	4.41	5.72	7.32	6.92	7.80	7.33	10.76
	2:15:00	0.00	0.00	3.16	4.09	5.23	4.96	5.58	5.29	7.75
	2:20:00	0.00	0.00	2.25	2.90	3.73	3.55	3.98	3.81	5.57
	2:25:00	0.00	0.00	1.57	1.98	2.60	2.47	2.77	2.65	3.88
	2:30:00	0.00	0.00	1.05	1.33	1.78	1.70	1.91	1.83	2.67
	2:35:00	0.00	0.00	0.68	0.90	1.19	1.17	1.31	1.25	1.82
	2:40:00	0.00	0.00	0.40	0.56	0.72	0.73	0.82	0.78	1.13
	2:45:00	0.00	0.00	0.19	0.30	0.37	0.40	0.44	0.42	0.61
	2:50:00	0.00	0.00	0.08	0.12	0.14	0.16	0.18	0.17	0.24
	2:55:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

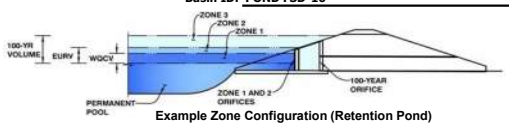
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-16



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	245.00	acres
Watershed Length =	5,800	ft
Watershed Length to Centroid =	2,900	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	60.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	4.822	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	15.946	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	14.895	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	20.580	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	25.471	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	31.662	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	36.887	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	43.326	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	64.093	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	12.261	acre-feet		
Approximate 5-yr Detention Volume =	16.552	acre-feet		
Approximate 10-yr Detention Volume =	21.333	acre-feet		
Approximate 25-yr Detention Volume =	23.070	acre-feet		
Approximate 50-yr Detention Volume =	24.049	acre-feet		
Approximate 100-yr Detention Volume =	26.256	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	4.822	acre-feet
Zone 2 Volume (EURV - Zone 1) =	11.124	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	10.310	acre-feet
Total Detention Basin Volume =	26.256	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

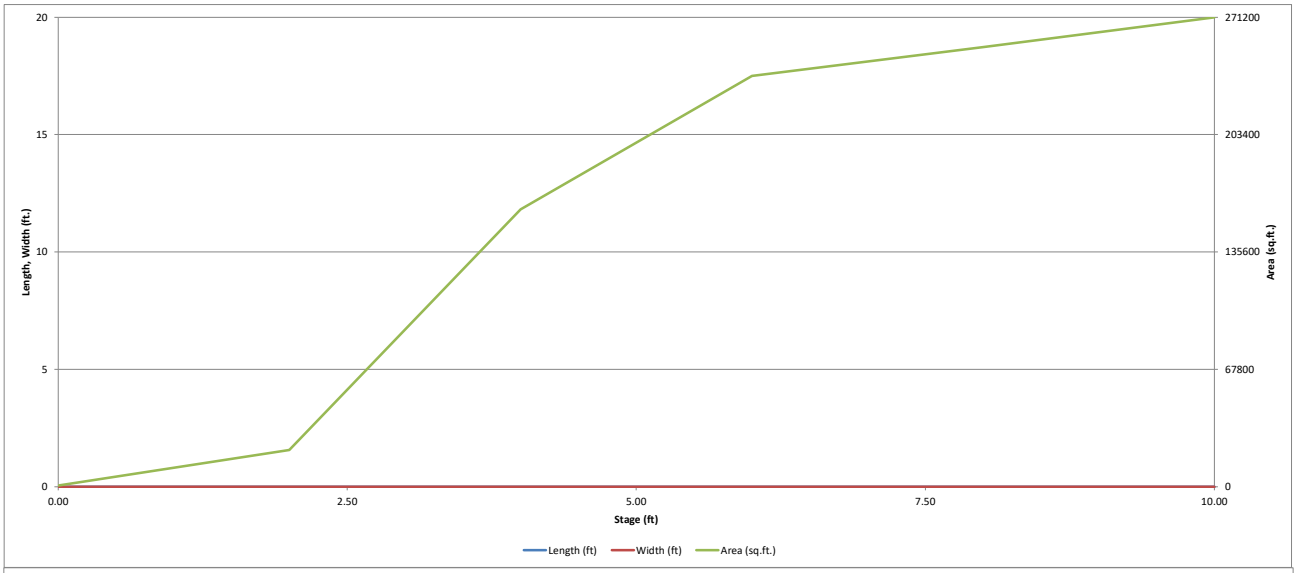
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

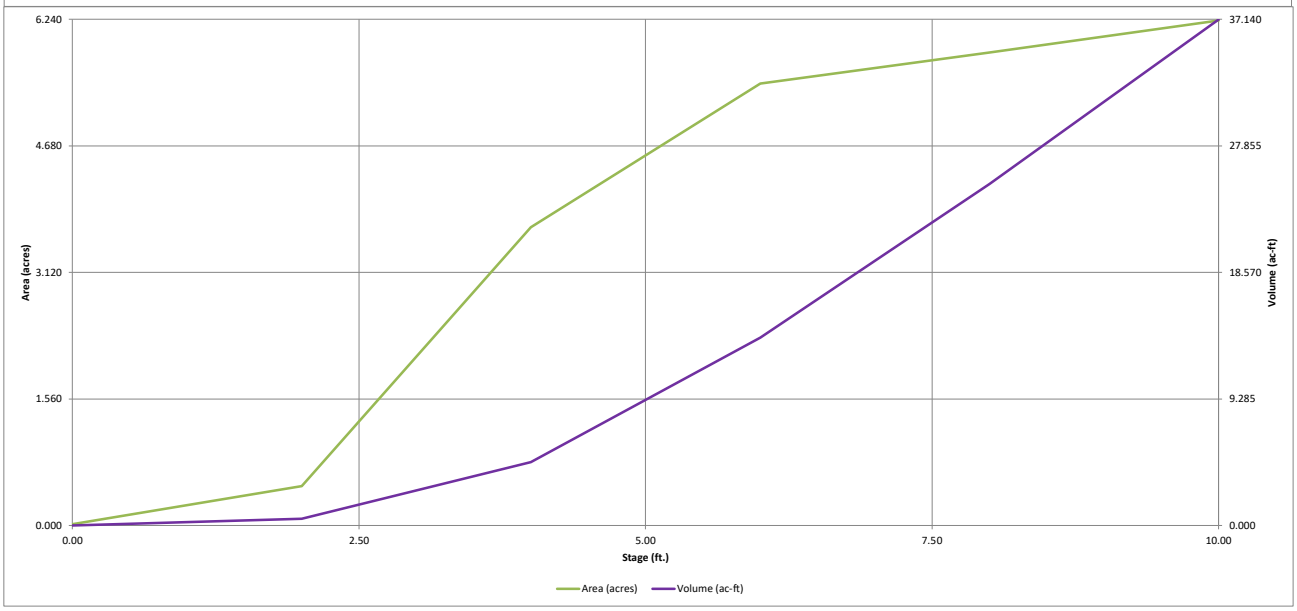
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	683	0.016		
7094	--	2.00	--	--	--	21,230	0.487	21,913	0.503
7096	--	4.00	--	--	--	160,188	3.677	203,330	4.668
7098	--	6.00	--	--	--	237,278	5.447	600,796	13.792
7100	--	8.00	--	--	--	253,964	5.830	1,092,038	25.070
7102	--	10.00	--	--	--	271,164	6.225	1,617,166	37.125

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



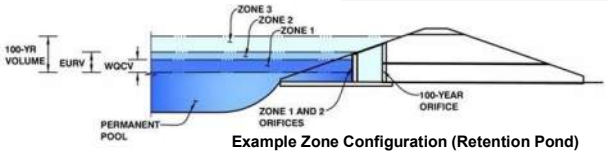


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-16



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.05	4.822	Orifice Plate
Zone 2 (EURV)	6.40	11.124	Orifice Plate
Zone 3 (100-year)	8.21	10.310	Weir&Pipe (Restrict)
Total (all zones)		26.256	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	6.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	26.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.20	4.40					
Orifice Area (sq. inches)	16.00	20.00	80.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.50	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.56	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	79.10	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	39.55	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	12.07	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.93	N/A	feet
Restrictor Plate Height Above Pipe Invert =	44.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.56	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.18	feet
Spillway Crest Length =	150.00	feet	Stage at Top of Freeboard =	11.18	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	6.23	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	37.13	acre-ft

Calculated Parameters for Spillway

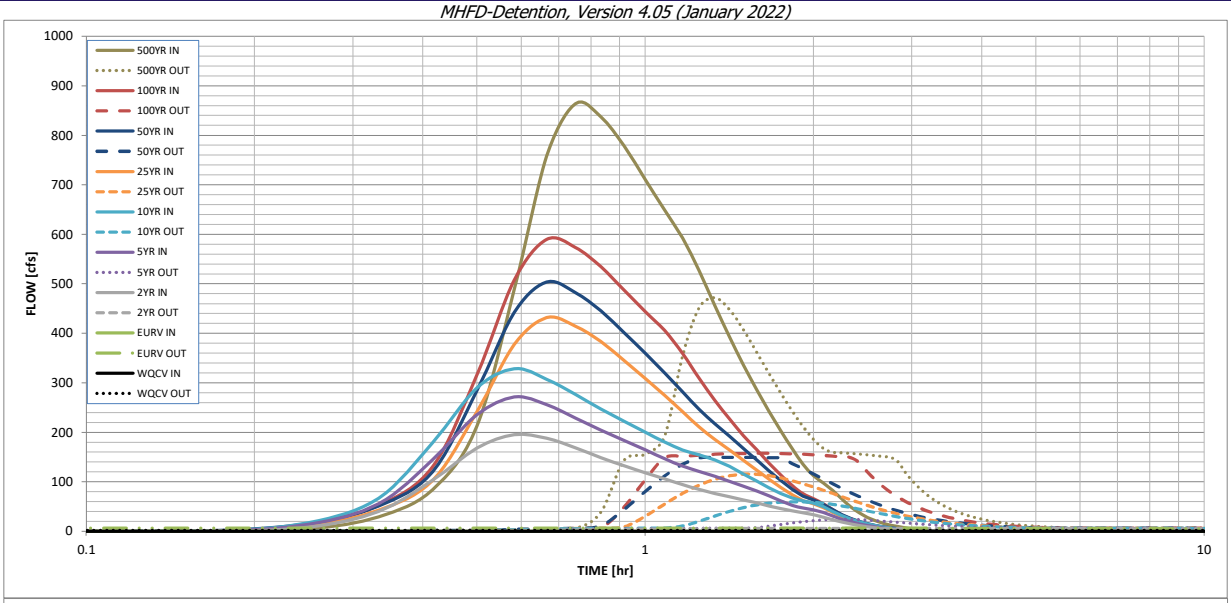
Routed Hydrograph Results

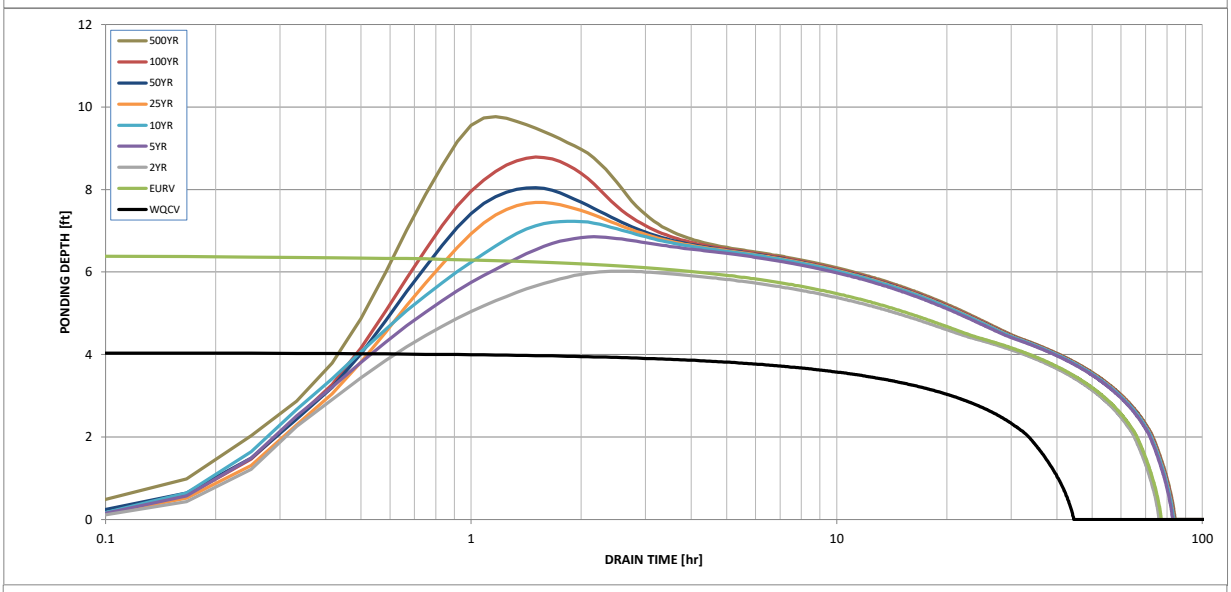
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

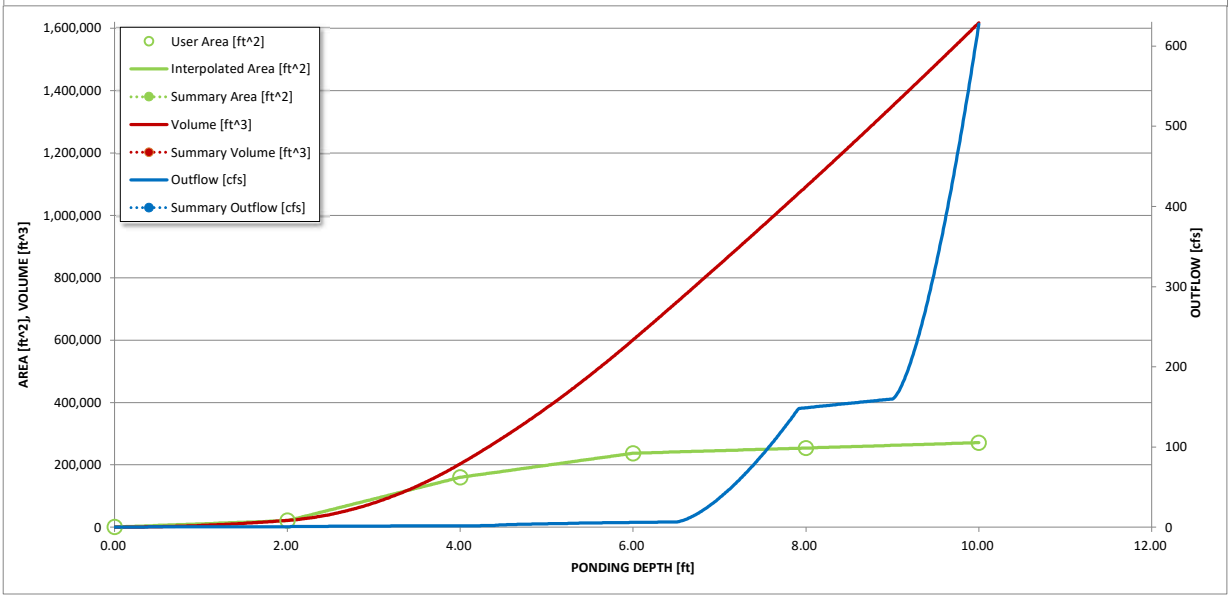
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	4.822	15.946	14.895	20.580	25.471	31.662	36.887	43.326	64.093
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	14.895	20.580	25.471	31.662	36.887	43.326	64.093
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	18.5	52.4	81.6	150.3	189.1	243.5	396.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.21	0.33	0.61	0.77	0.99	1.62
Peak Inflow Q (cfs) =	N/A	N/A	195.2	271.3	328.6	431.7	503.6	589.5	863.9
Peak Outflow Q (cfs) =	2.0	6.5	6.0	24.4	59.3	115.4	149.5	157.6	471.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.8	0.8	0.6	1.2
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.7	1.4	1.8	1.9	2.0
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) =	40	67	66	70	69	67	66	64	59
Time to Drain 99% of Inflow Volume (hours) =	**43**	73	72	77	77	76	75	74	71
Maximum Ponding Depth (ft) =	4.05	6.40	6.02	6.85	7.23	7.69	8.04	8.78	9.76
Area at Maximum Ponding Depth (acres) =	3.72	5.52	5.45	5.61	5.68	5.77	5.84	5.98	6.18
Maximum Volume Stored (acre-ft) =	4.853	15.987	13.901	18.492	20.637	23.214	25.303	29.677	35.637

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.10	4.86
	0:15:00	0.00	0.00	8.69	14.20	17.60	11.82	15.77	14.51	29.18
	0:20:00	0.00	0.00	39.89	55.39	66.84	42.38	50.75	52.57	84.21
	0:25:00	0.00	0.00	103.42	144.47	179.21	102.69	120.50	130.45	212.27
	0:30:00	0.00	0.00	168.01	235.50	289.50	241.38	283.75	315.50	488.55
	0:35:00	0.00	0.00	195.18	271.34	328.62	377.22	442.14	507.75	757.70
	0:40:00	0.00	0.00	187.80	256.08	307.18	431.68	503.60	589.49	863.89
	0:45:00	0.00	0.00	168.48	228.93	276.42	414.47	481.99	573.59	837.24
	0:50:00	0.00	0.00	148.80	204.51	247.24	383.29	445.38	534.38	778.69
	0:55:00	0.00	0.00	132.19	183.80	222.54	345.40	401.50	487.50	711.22
	1:00:00	0.00	0.00	118.44	164.51	200.27	309.18	359.91	444.29	648.86
	1:05:00	0.00	0.00	105.97	146.47	180.40	274.73	320.27	405.65	592.59
	1:10:00	0.00	0.00	94.32	131.79	164.21	241.61	281.95	359.41	526.37
	1:15:00	0.00	0.00	84.51	120.99	154.30	210.51	246.07	308.77	455.64
	1:20:00	0.00	0.00	76.57	110.96	144.41	185.79	217.36	264.64	392.21
	1:25:00	0.00	0.00	69.78	100.67	130.97	163.98	191.74	226.94	336.19
	1:30:00	0.00	0.00	63.52	90.95	115.79	143.33	167.25	193.51	285.93
	1:35:00	0.00	0.00	57.41	81.74	101.40	123.73	143.95	164.56	242.53
	1:40:00	0.00	0.00	51.33	71.63	88.16	105.39	122.19	137.93	202.88
	1:45:00	0.00	0.00	45.72	61.18	76.56	88.73	102.49	113.75	166.96
	1:50:00	0.00	0.00	41.31	52.27	67.34	73.89	84.98	92.48	135.68
	1:55:00	0.00	0.00	37.51	46.96	61.68	62.23	71.36	75.94	112.15
	2:00:00	0.00	0.00	33.64	43.42	56.89	55.51	63.50	65.90	97.69
	2:05:00	0.00	0.00	28.70	38.02	49.47	47.78	54.55	55.66	82.64
	2:10:00	0.00	0.00	23.34	30.89	40.17	38.31	43.68	43.79	65.06
	2:15:00	0.00	0.00	18.40	24.20	31.58	29.53	33.63	33.09	49.17
	2:20:00	0.00	0.00	14.56	19.06	24.82	23.01	26.15	25.09	37.26
	2:25:00	0.00	0.00	11.42	14.95	19.32	17.78	20.16	18.89	28.02
	2:30:00	0.00	0.00	8.93	11.64	14.91	13.73	15.52	14.35	21.24
	2:35:00	0.00	0.00	6.95	8.91	11.32	10.50	11.84	11.00	16.21
	2:40:00	0.00	0.00	5.38	6.74	8.55	7.95	8.94	8.38	12.31
	2:45:00	0.00	0.00	4.10	5.09	6.52	6.05	6.79	6.45	9.47
	2:50:00	0.00	0.00	3.09	3.83	4.99	4.65	5.21	4.98	7.31
	2:55:00	0.00	0.00	2.23	2.77	3.66	3.46	3.88	3.71	5.42
	3:00:00	0.00	0.00	1.50	1.91	2.54	2.45	2.74	2.62	3.82
	3:05:00	0.00	0.00	0.93	1.25	1.62	1.61	1.80	1.72	2.49
	3:10:00	0.00	0.00	0.50	0.73	0.92	0.95	1.06	1.01	1.45
	3:15:00	0.00	0.00	0.21	0.35	0.42	0.46	0.51	0.48	0.69
	3:20:00	0.00	0.00	0.07	0.11	0.12	0.14	0.16	0.15	0.20
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DRAINAGE MAPS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	1.68	0.00	0.00	1.50	0.18	1.28	105.15	0.106
EX10A	1.68	0.00	0.00	1.53	0.15	0.70	52.19	0.087
EX-11	1.68	0.00	0.00	1.54	0.14	0.80	53.86	0.082
EX-13	1.68	0.00	0.00	1.48	0.20	0.50	35.71	0.117
EX-4A	1.68	0.00	0.00	1.52	0.15	0.18	19.26	0.091
EX-5	1.68	0.00	0.00	1.52	0.16	0.11	11.51	0.093
EX-7	1.68	0.00	0.00	1.52	0.15	0.64	46.80	0.090
EX-9	1.68	0.00	0.00	1.52	0.15	0.73	56.96	0.090
TR-12	1.68	0.00	0.00	1.43	0.25	0.03	1.88	0.148
TR-20	1.68	0.00	0.00	1.45	0.22	0.14	10.01	0.131
TR-4	1.68	0.00	0.00	1.42	0.25	0.03	1.78	0.150
TR-5	1.68	0.00	0.00	1.48	0.20	0.07	4.56	0.116
TR-6	1.68	0.00	0.00	1.38	0.30	0.01	0.83	0.177
TR-7	1.68	0.00	0.00	1.43	0.24	0.02	1.01	0.144

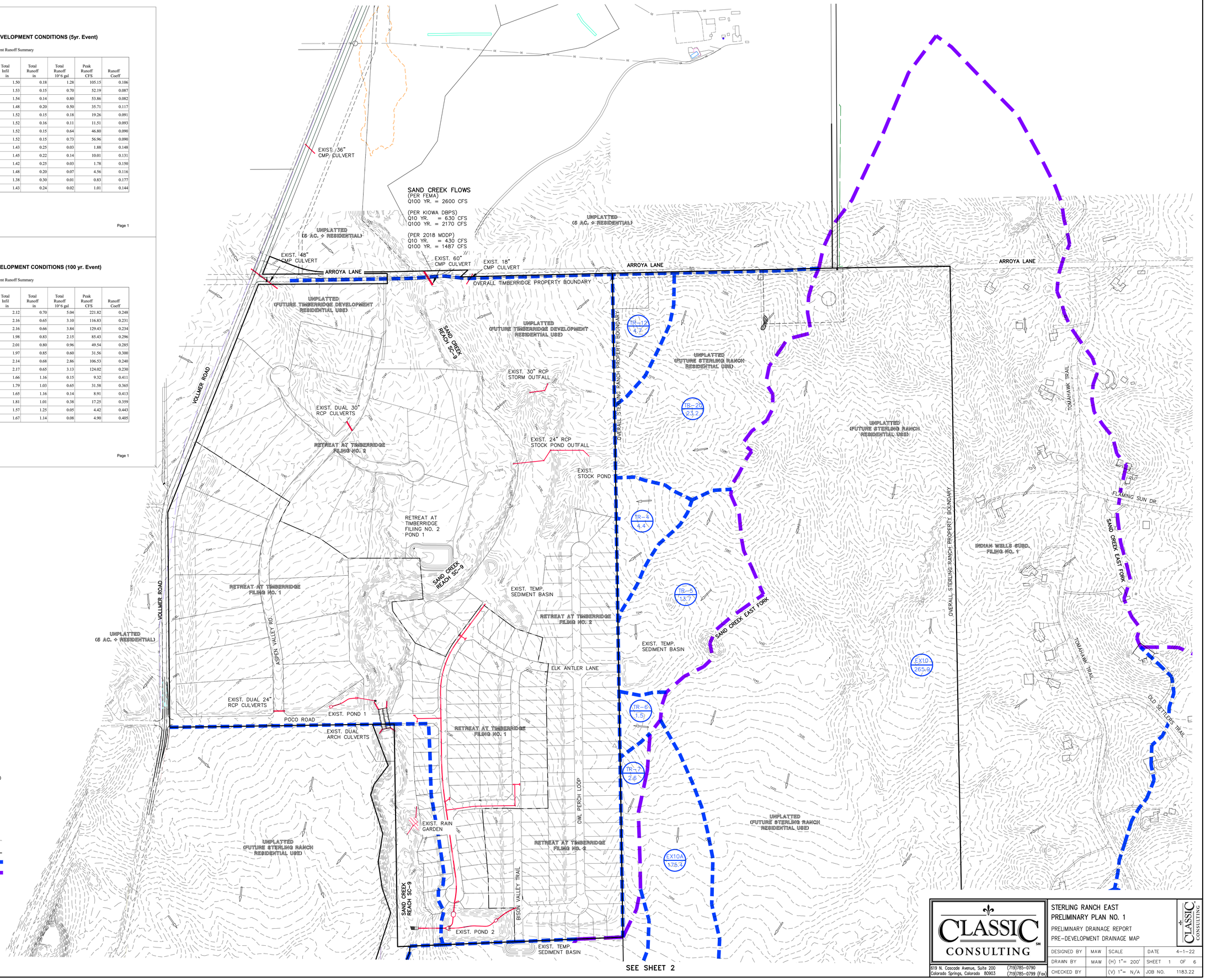
SWMM 5.1 Page 1

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	2.82	0.00	0.00	2.12	0.70	5.04	221.82	0.248
EX10A	2.82	0.00	0.00	2.16	0.65	3.10	116.83	0.231
EX-11	2.82	0.00	0.00	2.16	0.66	3.84	129.43	0.234
EX-13	2.82	0.00	0.00	1.98	0.83	2.15	85.43	0.296
EX-4A	2.82	0.00	0.00	2.01	0.80	0.96	49.54	0.285
EX-5	2.82	0.00	0.00	1.97	0.85	0.60	31.56	0.300
EX-7	2.82	0.00	0.00	2.14	0.68	2.86	106.53	0.240
EX-9	2.82	0.00	0.00	2.17	0.65	3.13	124.02	0.230
TR-12	2.82	0.00	0.00	1.66	1.16	0.15	9.32	0.411
TR-20	2.82	0.00	0.00	1.79	1.03	0.65	31.58	0.365
TR-4	2.82	0.00	0.00	1.65	1.16	0.14	8.91	0.413
TR-5	2.82	0.00	0.00	1.81	1.01	0.38	17.25	0.359
TR-6	2.82	0.00	0.00	1.57	1.25	0.05	4.42	0.443
TR-7	2.82	0.00	0.00	1.67	1.14	0.08	4.90	0.405

SWMM 5.1 Page 1



200 100 0 200 400

SCALE: 1" = 200'

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
SAND CREEK EAST FORK BASIN LINE	
DESIGN POINT	4
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	1 OF 6
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.22

N:\1183.22\REPORTS\PRELIM DRAINAGE REPORT\1183.22PDR HOM2.dwg, 5/25/2022 10:18:29 AM, 1:1

SEE SHEET 1

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
SAND CREEK EAST FORK BASIN LINE	
DESIGN POINT	4
BASIN IDENTIFIER / AREA IN ACRES	BB / 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

N

200 100 0 200 400

SCALE: 1" = 200'

SAND CREEK REACH SC-10

BISON VALLEY

EXIST. POND 2

EXIST. TEMP. SEDIMENT BASIN

INDIAN WELLS SUBD. FILING NO. 1

TOMAHAWK TRAIL

STAPLETON ROAD

BOW VALLEY SUBD.

EX10 265.9

EX-11 94.8

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

OVERALL STERLING RANCH PROPERTY BOUNDARY

HOMESTEAD NORTH AT STERLING RANCH RESIDENTIAL USE)

HOMESTEAD NORTH PLATTED BOUNDARY

CLASSIC OWNERSHIP BOUNDARY

SAND CREEK REACH SC-9

EX-6 26.8

BRIARGATE BLVD. (130' ROW)

REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG.

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

SAND CREEK EAST FORK

EX-7 155.2

EX-9 178.1

EX10A 175.4

EX-11 214.3

HOMESTEAD AT STERLING RANCH FILING NO. 2

EX-8A 44.6

HOMESTEAD AT STERLING RANCH FILING NO. 1

SAND CREEK REACH SC-8

REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG.

CLASSIC OWNERSHIP BOUNDARY

STERLING RANCH RD. (80' ROW)

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

BRANDING IRON AT STERLING RANCH FILING NO. 2

SEE SHEET 3

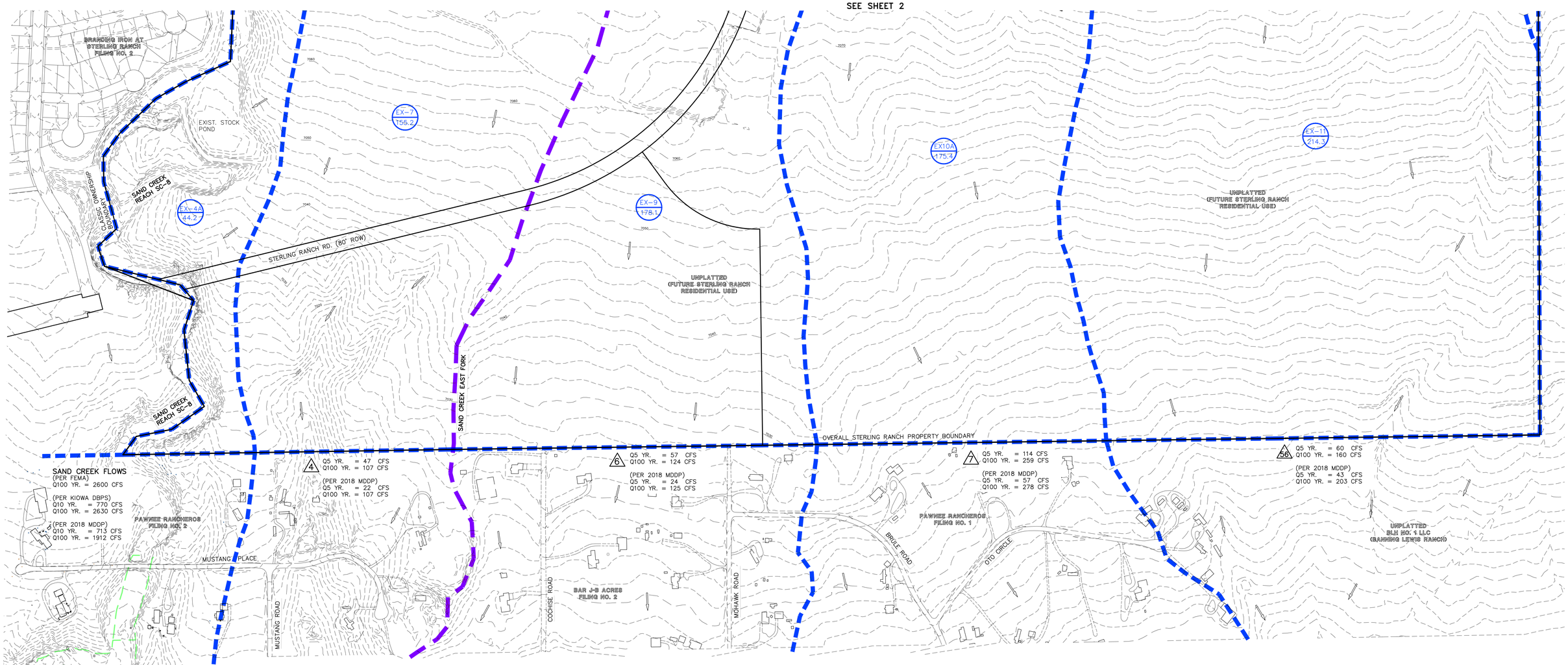
CLASSIC CONSULTING SM
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	2 OF 6
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.22

N:\1183.22\REPORTS\PRELIM DRAINAGE REPORT\1183.22PDR PDM2.dwg, 5/25/2022 10:17:01 AM, kj

SEE SHEET 2



STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	91.92	4.30	46.80	0.639
DP56	98.59	8.23	59.57	1.311
DP6	98.59	4.60	56.96	0.733
DP7	98.59	12.48	114.01	1.989
DPEX-4A	61.64	1.84	19.26	0.183
DPEX-5	53.38	1.29	11.51	0.111
Out10	36.27	0.51	1.78	0.030
Out11	34.38	0.22	0.83	0.012
Out6	36.44	0.54	1.88	0.032
Out7	48.80	1.75	10.01	0.138
Out8	41.34	1.09	4.56	0.073
Out9	35.63	0.30	1.01	0.017

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	92.55	19.10	106.53	2.856
DP56	98.59	37.64	160.10	5.996
DP6	98.59	19.66	124.02	3.131
DP7	98.59	51.21	258.75	8.157
DPEX-4A	62.08	9.61	49.54	0.964
DPEX-5	53.80	6.93	31.56	0.603
Out10	36.62	2.35	8.91	0.139
Out11	34.56	0.91	4.42	0.051
Out6	36.90	2.48	9.32	0.148
Out7	49.14	8.16	31.58	0.648
Out8	42.15	5.53	17.25	0.376
Out9	37.27	1.34	4.90	0.081

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	1.68	0.00	0.00	1.50	0.18	1.28	105.15	0.106
EX10A	1.68	0.00	0.00	1.53	0.15	0.70	52.19	0.087
EX-11	1.68	0.00	0.00	1.54	0.14	0.80	53.86	0.082
EX-13	1.68	0.00	0.00	1.48	0.20	0.50	35.71	0.117
EX-4A	1.68	0.00	0.00	1.52	0.15	0.18	19.26	0.091
EX-5	1.68	0.00	0.00	1.52	0.16	0.11	11.51	0.093
EX-7	1.68	0.00	0.00	1.52	0.15	0.64	46.80	0.090
EX-9	1.68	0.00	0.00	1.52	0.15	0.73	56.96	0.090
TR-12	1.68	0.00	0.00	1.43	0.25	0.03	1.88	0.148
TR-20	1.68	0.00	0.00	1.45	0.22	0.14	10.01	0.131
TR-4	1.68	0.00	0.00	1.42	0.25	0.03	1.78	0.150
TR-5	1.68	0.00	0.00	1.48	0.20	0.07	4.56	0.116
TR-6	1.68	0.00	0.00	1.38	0.30	0.01	0.83	0.177
TR-7	1.68	0.00	0.00	1.43	0.24	0.02	1.01	0.144

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	2.82	0.00	0.00	2.12	0.70	5.04	221.82	0.248
EX10A	2.82	0.00	0.00	2.16	0.65	3.10	116.83	0.231
EX-11	2.82	0.00	0.00	2.16	0.66	3.84	129.43	0.234
EX-13	2.82	0.00	0.00	1.98	0.83	2.15	85.43	0.296
EX-4A	2.82	0.00	0.00	2.01	0.80	0.96	49.54	0.285
EX-5	2.82	0.00	0.00	1.97	0.85	0.60	31.56	0.300
EX-7	2.82	0.00	0.00	2.14	0.68	2.86	106.53	0.240
EX-9	2.82	0.00	0.00	2.17	0.65	3.13	124.02	0.230
TR-12	2.82	0.00	0.00	1.66	1.16	0.15	9.32	0.411
TR-20	2.82	0.00	0.00	1.79	1.03	0.65	31.58	0.365
TR-4	2.82	0.00	0.00	1.65	1.16	0.14	8.91	0.413
TR-5	2.82	0.00	0.00	1.81	1.01	0.38	17.25	0.359
TR-6	2.82	0.00	0.00	1.57	1.25	0.05	4.42	0.443
TR-7	2.82	0.00	0.00	1.67	1.14	0.08	4.90	0.405

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
SAND CREEK EAST FORK BASIN LINE	
DESIGN POINT	4
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

N

200 100 0 200 400

SCALE: 1" = 200'

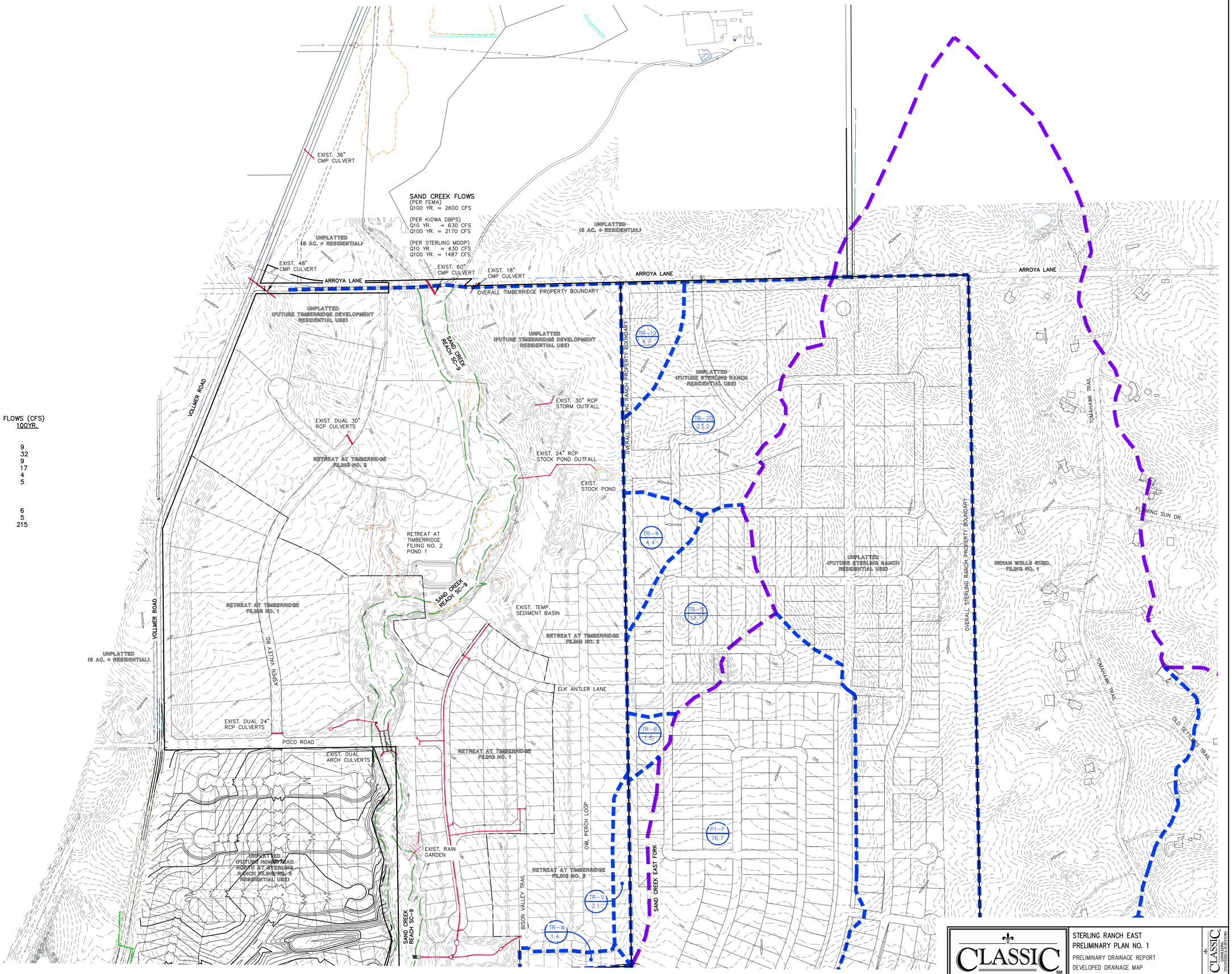
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 3 OF 6
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.22

N:\1183.22\REPORTS\PRELIM DRAINAGE REPORT\1183.22PRE HDM2.dwg, 3/25/2022 10:15:42 AM, 1:1

BASIN ID	PEAK FLOWS (CFS) 5YR.	100YR.
(EXISTING BASINS)		
TR-12	2	9
TR-20	10	32
TR-4	2	9
TR-5	5	17
TR-6	1	4
TR-7	1	5
(PROPOSED BASINS)		
TR-V	2	6
TR-W	3	5
P1-F	111	215



200 100 0 200 400

SCALE: 1" = 200'

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
EAST FORK BASIN BOUNDARY	
DESIGN POINT	15
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
PROPOSED STORM SEWER	
PROPOSED STORM SEWER PER JR ENG. PLANS	
PROPOSED POND OUTFALL PER JR ENG. PLANS	

CLASSIC CONSULTING ENGINEERS & SURVEYORS
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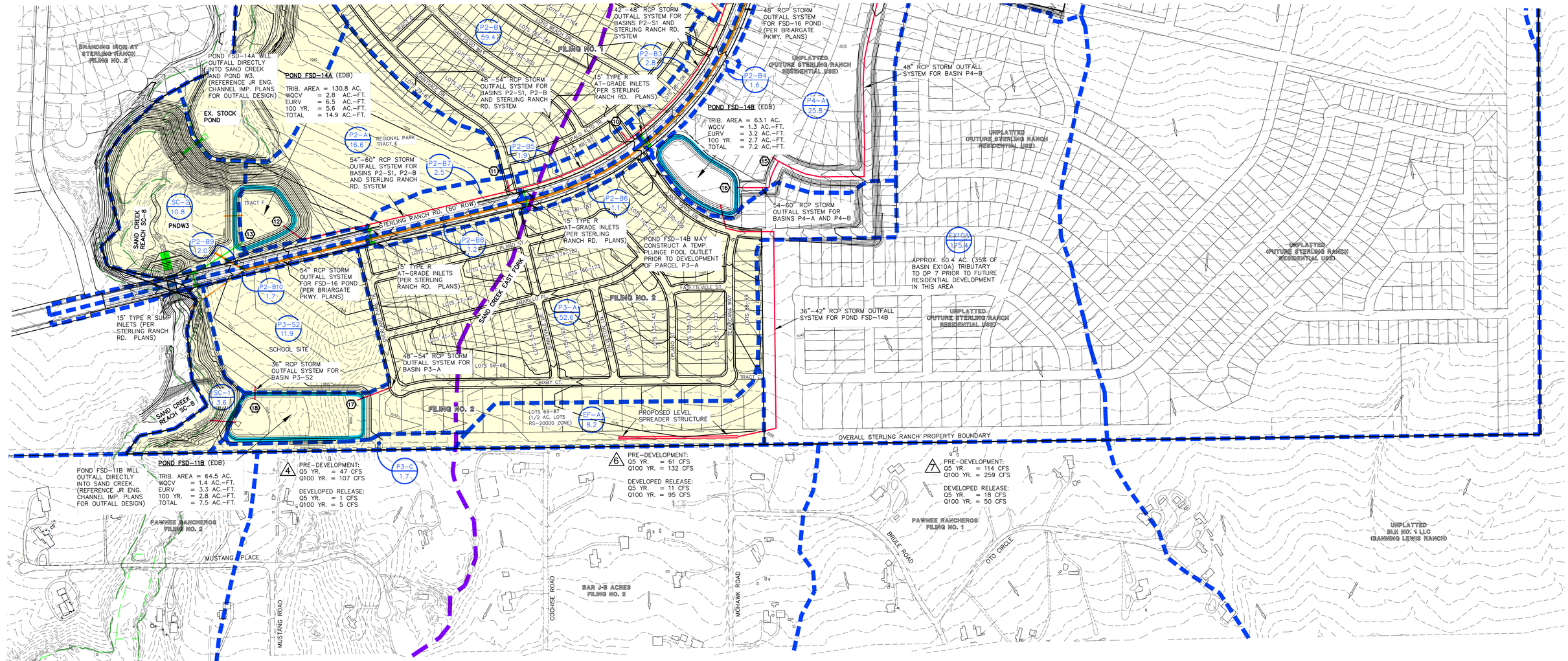
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	4 OF 6
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.22



BASIN ID	PEAK FLOWS (CFS) 5YR.	100YR.
SC-1	1	6
SC-2	6	20
P4-A	41	80
P4-B	63	123
P2-A	10	33
P2-B	90	176
P2-S1	68	133
P2-B1	7	13
P2-B2	5	10
P2-B3	7	13
P2-B4	4	8
P2-B5	5	9
P2-B6	3	6
P2-B7	6	12
P2-B8	3	7
P2-B9	5	11
P2-B10	5	10
P3-A	82	160
P3-C	1	5
P3-S2	25	50
EF-A	7	20
EX10A	18	50
DESIGN POINTS		
10	45	88
11	45	88
12	186	298
13	10	21
15	41	80
16	97	189
17	82	160
18	25	50
POND FSD-14A	200	352
POND FSD-14B	97	189
POND FSD-11B	102	201

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
EAST FORK BASIN BOUNDARY	
DESIGN POINT	15
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
PROPOSED STORM SEWER	
PROPOSED STORM SEWER PER JR ENG. PLANS	
PROPOSED POND OUTFALL PER JR ENG. PLANS	

N

200 100 0 200 400

SCALE: 1" = 200'

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Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 6 OF 6
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.22

FINAL DRAINAGE REPORT
For
Aspen Meadows

Sand Creek
Drainage Basin

Prepared for:
City of Colorado Springs
Engineering Development Review Division Team
30 North Nevada Avenue, Suite 401
Colorado Springs, CO 80903

On Behalf of:

COLA, LLC.
7910 Gateway Boulevard, Suite 102
El Paso, TX 79915

Prepared by:

Matrix DESIGN GROUP
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Colorado Springs, CO 80920
(719) 575-0100
fax (719) 572-0208

January 2019

Project No. 17.886.004

D. Four-Step Process

Per the DCM Chapter 1, Section 4, the City of Colorado Springs require the UDFCD Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing draingeways, and implementing long-term source controls. Stonebridge Development complies with this process in the following ways:

1. Reducing runoff volumes – the runoff reduction worksheet has been completed and can be found in Appendix C. An example of this step would be to provide landscaping in the available open space areas. Majority of runoff generated from this site area is being released/conveyed through overland flow and grassed swales which help to eliminate unnecessary impervious area.
2. These flows eventually discharge into Pond 1 which has been designed to treat the runoff for water quality and release flows at historic rates.
3. The runoff is routed through proposed storm sewer into proposed Pond 1. Downstream from Pond 1, treated release runoff enters existing Sand Creek Channel that conveys flows approximately 2,875 feet downstream, to another existing Detention Facility “Pond 3”.
4. Implementing long-term source controls – source control BMP’s such as temporary sedimentation basins, covering storage/handling areas and implementing containment/control measures, particularly around vehicular activities should be utilized to control potential source contaminants. The specific location(s) of source control areas will be identified within the SWMP as determined by the site superintendent.

E. Detention and Water Quality

Development of the site requires that full spectrum detention be provided to reduce the fully developed flows from the site to pre-project levels. This is due in part to the master planning of the area, as well as consideration of environmental impacts to existing downstream facilities. A full spectrum extended detention basin is proposed to treat the full spectrum of runoff from the single-family development and an extended water quality control volume detention area is proposed to treat runoff to Marksheffel Road. Please refer to Appendix C for UD-detention spreadsheet calculations for Pond 1 and the Marksheffel WQCV treatment pond.

To effectively treat the water quality runoff volume, each pond utilizes a small outlet structure to extend the time required to discharge the full volume of runoff. Treating the water quality volume requires an extended discharge time of 40 hours. This is the time required to achieve removal of a significant amount of total suspended solids (TSS). The ponds will also have low flow trickle channels which drain to a micro pool at the outlet structure, which is in place to promote biological uptake. Pond 1 was designed with a total watershed area of 21.45 Acres and 55.9% imperviousness. The WQCV treatment pond for Marksheffel Road was designed with a watershed of 8.09 Acres (including 5.7 Acres from Sub-basins A12 through A17 and 2.49 Acres from Sub-basins

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RP-7C and RP-7D), and 91.2% watershed imperviousness. The basins and their structures are sized based on pre-development peak flows as calculated by the UD-Detention spreadsheet from UDFCD. The spreadsheets can be found in Appendix C.

The overall volume requirement calculated for the full spectrum EDB, which includes the water quality control volume, the excess urban runoff volume, and detention for storms from the 5-year (20% probability) to the 100-year (1% probability) is 2.32 acre-ft or 101,234 cubic feet. This total detention volume is slightly higher than the value indicated by UD-Detention (2.25 Acre-ft) in order to account for additional flows to Marksheffel Drive from portions of the development along Marksheffel Drive which cannot be diverted to Pond 1. The EURV volume in the lower portion of the detention volume will allow for low and high probability storms to be released to Sand Creek at rates which approximate pre-development conditions. This also reduces the higher probability storms (i.e. less than 2-year (50% probability)) to a level which is at or near the sediment carrying threshold value for the downstream drainageways. The proposed storm sewer drainage facilities will be publicly owned and maintained by the metro district.

The proposed outfall for Pond 1 must discharge the Q100 (1% probability flow) at 90% of the pre-development rate of 7.2 cfs for the development to comply with city requirements. The peak discharge rate is further decreased (overdetained) to 3.7 cfs to account for the portion of Aspen Meadows which adds a flow of approximately 3.5 cfs over the UD-Detention calculation for pre-development flows to Marksheffel Drive. This is a reduction from the pre-project Q100 discharge for the site which is estimated to be approximately 46 cfs.

The emergency overflow for the pond will be at the 5’ stage and will discharge directly to Sand Creek.

Channel Improvements

Sand Creek runs directly adjacent to the proposed Aspen Meadows development, running from the northeast to the southwest. Improvements to this channel are one of the conditions of development and Matrix Design Group, Inc. is designing these improvements under a different project and which will be covered under a separate submittal. Based on previous similar rehabilitation projects a rough estimate of stream rehabilitation for Sand Creek ranges from $705 to $1,340 per linear foot of channel improvement. For the 4,250-foot proposed project this means a range of $2,996,250 to $5,695,000 in projected construction costs. In the future, as the designs are refined, we will be able to narrow the cost estimate window.

VIII. Erosion Control Plan

Per the city of Colorado Springs Drainage Criteria Manual Volume 1, an erosion control plan is required to be included with the drainage analysis. At this time, it is respectfully

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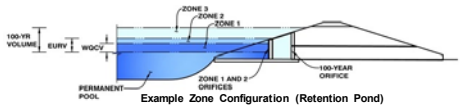
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Aspen Meadows

Basin ID: SINGLE FAMILY AREA OF 21.45 ACRES



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	21.45	acres
Watershed Length =	1,988	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	55.90%	percent
Percentage Hydrologic Soil Group A =	95.3%	percent
Percentage Hydrologic Soil Group B =	4.7%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.399	acre-feet
Excess Urban Runoff Volume (EURV) =	1.420	acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.782	acre-feet
5-yr Runoff Volume (P1 = 1.23 in.) =	1.055	acre-feet
10-yr Runoff Volume (P1 = 1.49 in.) =	1.348	acre-feet
25-yr Runoff Volume (P1 = 1.88 in.) =	1.842	acre-feet
50-yr Runoff Volume (P1 = 2.21 in.) =	2.350	acre-feet
100-yr Runoff Volume (P1 = 2.57 in.) =	2.959	acre-feet
500-yr Runoff Volume (P1 = 3.52 in.) =	4.557	acre-feet
Approximate 2-yr Detention Volume =	0.738	acre-feet
Approximate 5-yr Detention Volume =	0.997	acre-feet
Approximate 10-yr Detention Volume =	1.262	acre-feet
Approximate 25-yr Detention Volume =	1.682	acre-feet
Approximate 50-yr Detention Volume =	1.945	acre-feet
Approximate 100-yr Detention Volume =	2.246	acre-feet

Optional User Override 1-hr Precipitation	
0.95	inches
1.23	inches
1.49	inches
1.88	inches
2.21	inches
2.57	inches
3.52	inches

Stage-Storage Calculation

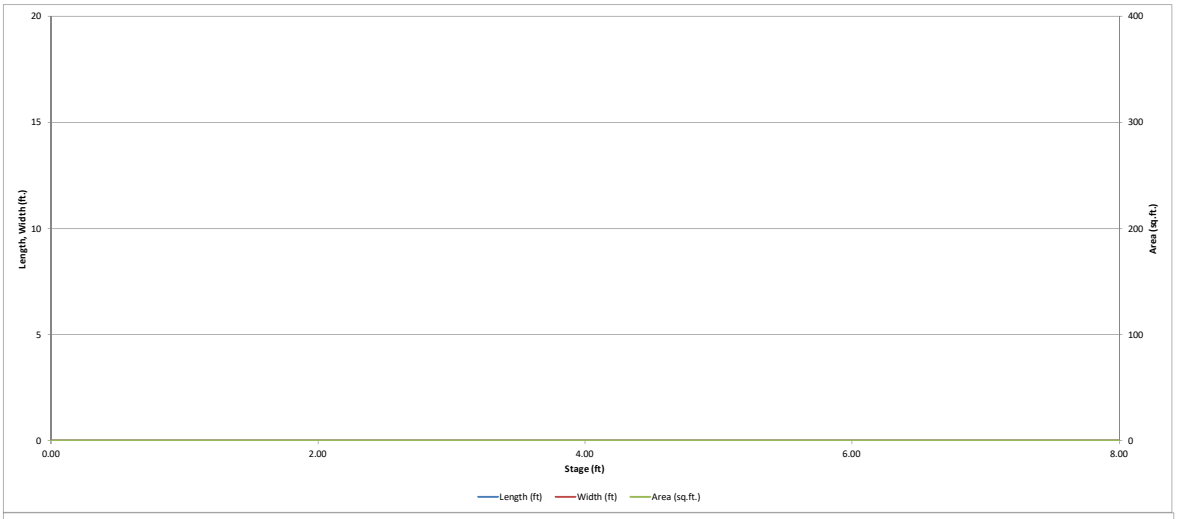
Zone 1 Volume (WQCV) =	0.399	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.021	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.825	acre-feet
Total Detention Basin Volume =	2.246	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

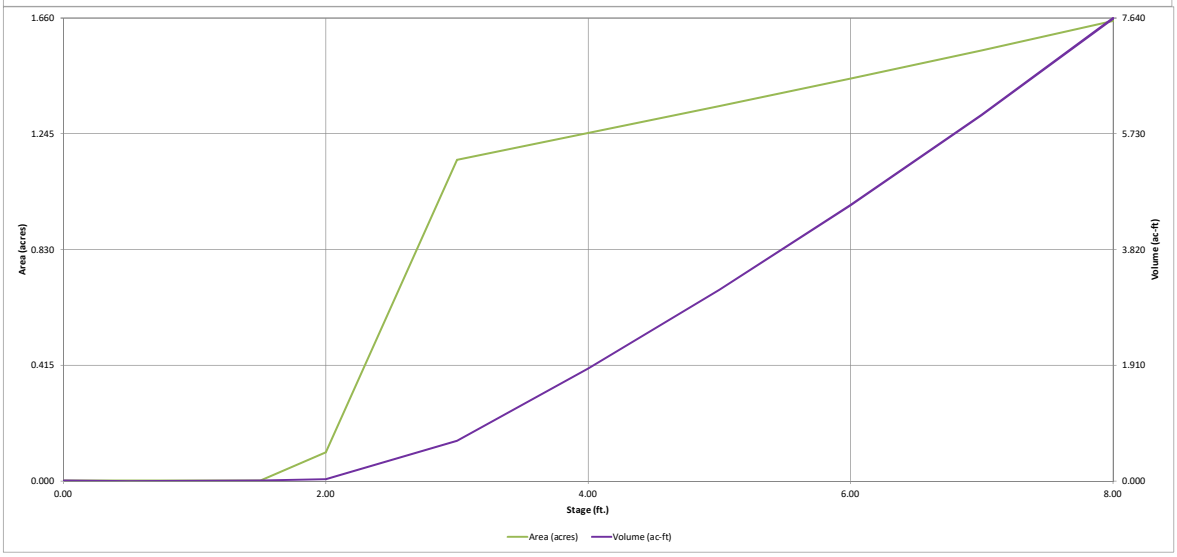
Depth Increment = 0.1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	77	0.002		
	--	0.50	--	--	--	77	0.002	38	0.001
	--	1.50	--	--	--	77	0.002	115	0.003
	--	2.00	--	--	--	4,494	0.103	1,214	0.028
	--	3.00	--	--	--	50,208	1.153	28,609	0.657
	--	4.00	--	--	--	54,337	1.247	80,881	1.857
	--	5.00	--	--	--	58,563	1.344	137,331	3.153
	--	6.00	--	--	--	62,889	1.444	198,057	4.547
	--	7.00	--	--	--	67,315	1.545	263,159	6.041
	--	8.00	--	--	--	71,840	1.649	332,737	7.639
	--		--	--	--				
	--		--	--	--				
	--		--	--	--			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



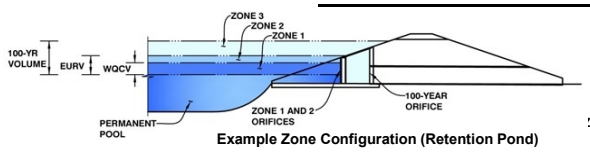


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Aspen Meadows

Basin ID: SINGLE FAMILY AREA OF 21.45 ACRES



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.75	0.399	Orifice Plate
Zone 2 (EURV)	3.65	1.021	Rectangular Orifice
Zone 3 (100-year)	4.31	0.825	Weir&Pipe (Circular)
		2.246	Total

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	6.944E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.73	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.90	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.00	sq. inches (diameter = 1-1/8 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.91	1.82					
Orifice Area (sq. inches)	1.00	1.00	1.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.75	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.65	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	6.67		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.09	N/A	ft^2
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.54	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.54	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	16.97	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	6.30	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.15	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.30	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	8.25	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	0.37	N/A	ft^2
Outlet Orifice Centroid =	0.34	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	11.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

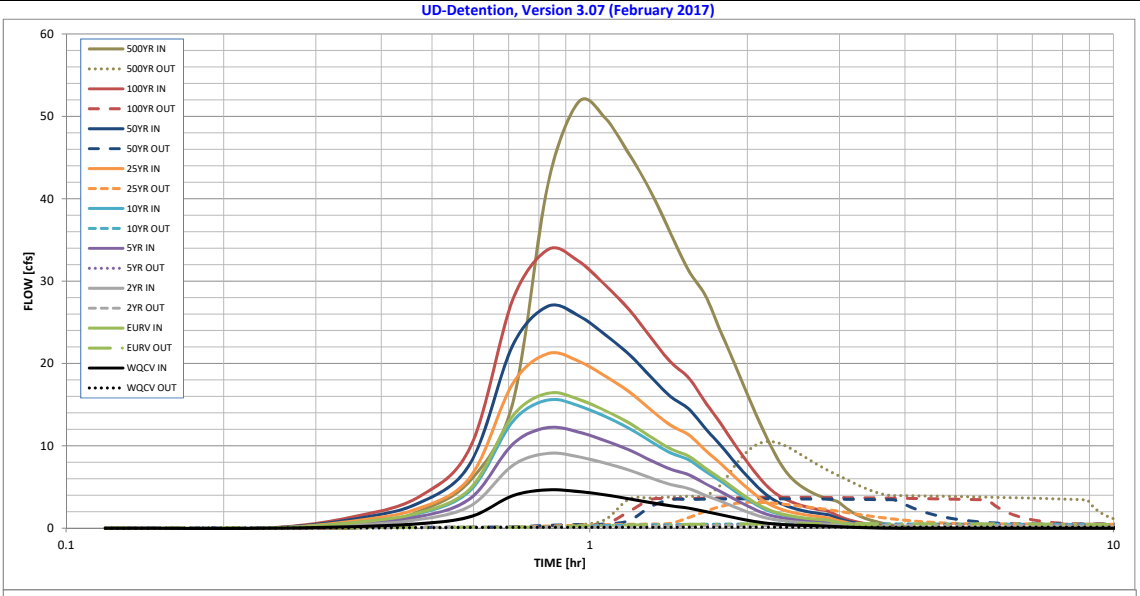
Spillway Design Flow Depth=	0.84	feet
Stage at Top of Freeboard =	6.84	feet
Basin Area at Top of Freeboard =	1.53	acres

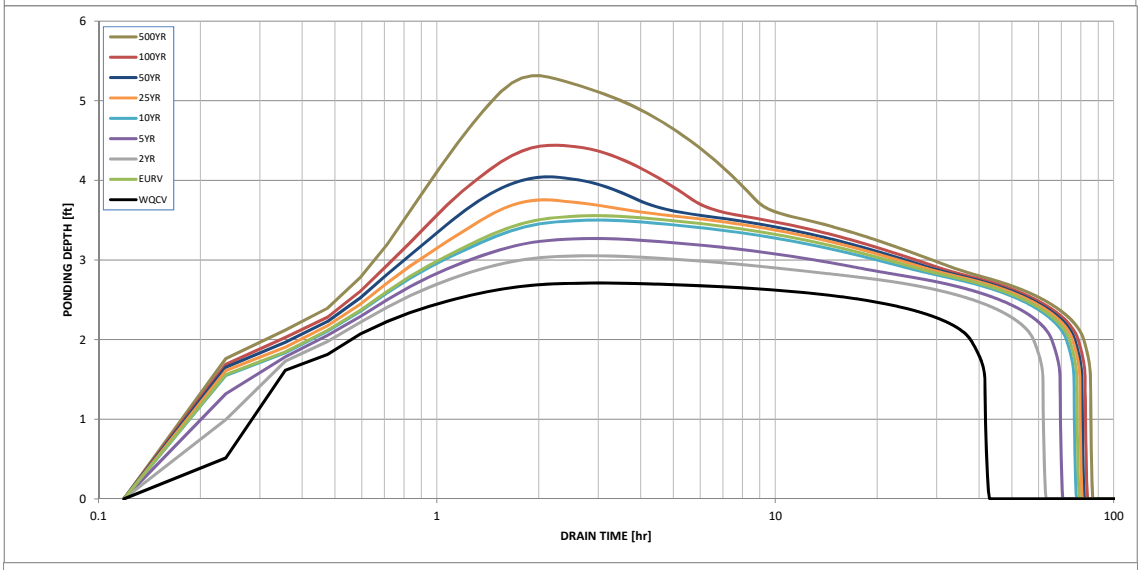
Routed Hydrograph Results

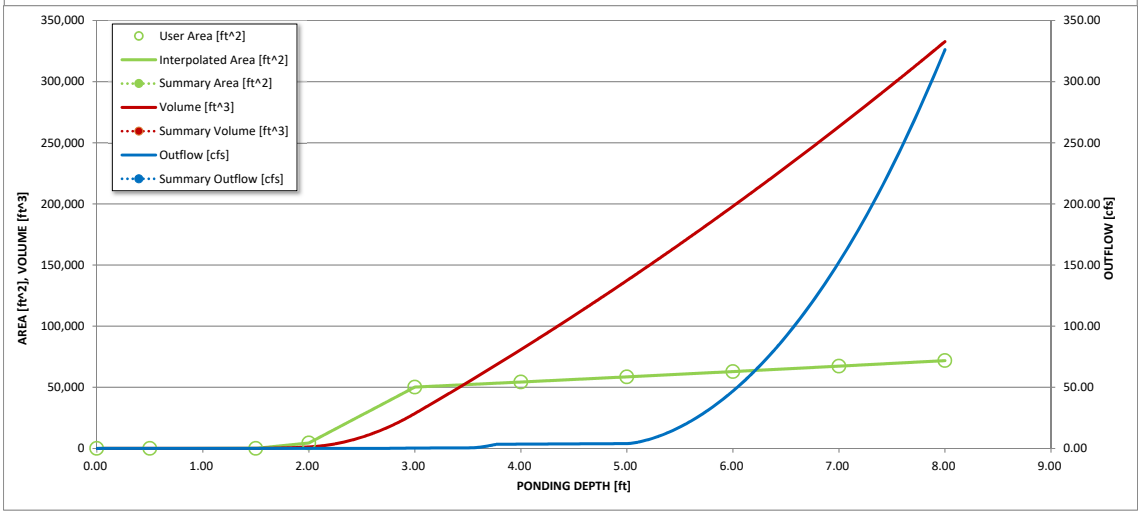
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.95	1.23	1.49	1.88	2.21	2.57	3.52
Calculated Runoff Volume (acre-ft) =	0.399	1.420	0.782	1.055	1.348	1.842	2.350	2.959	4.557
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.399	1.421	0.783	1.056	1.349	1.843	2.352	2.961	4.560
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.03	0.14	0.33	0.82
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.2	0.7	3.1	7.1	17.6
Peak Inflow Q (cfs) =	4.7	16.4	9.1	12.2	15.6	21.2	27.0	33.8	51.7
Peak Outflow Q (cfs) =	0.1	0.6	0.4	0.4	0.5	3.2	3.6	3.7	10.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	6.9	2.2	4.3	1.2	0.5	0.6
Structure Controlling Flow =	Plate	Overflow Grate 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	N/A	N/A	0.4	0.5	0.5	0.5
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) =	40	72	59	65	71	73	72	72	70
Time to Drain 99% of Inflow Volume (hours) =	**42**	76	61	68	75	77	78	78	80
Maximum Ponding Depth (ft) =	2.71	3.56	3.05	3.27	3.50	3.75	4.04	4.44	5.31
Area at Maximum Ponding Depth (acres) =	0.85	1.20	1.16	1.18	1.20	1.22	1.25	1.29	1.38
Maximum Volume Stored (acre-ft) =	0.367	1.305	0.715	0.971	1.245	1.548	1.907	2.415	3.574

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 Outlet Structure Design

Outflow Hydrograph Workbook Filename: _____

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

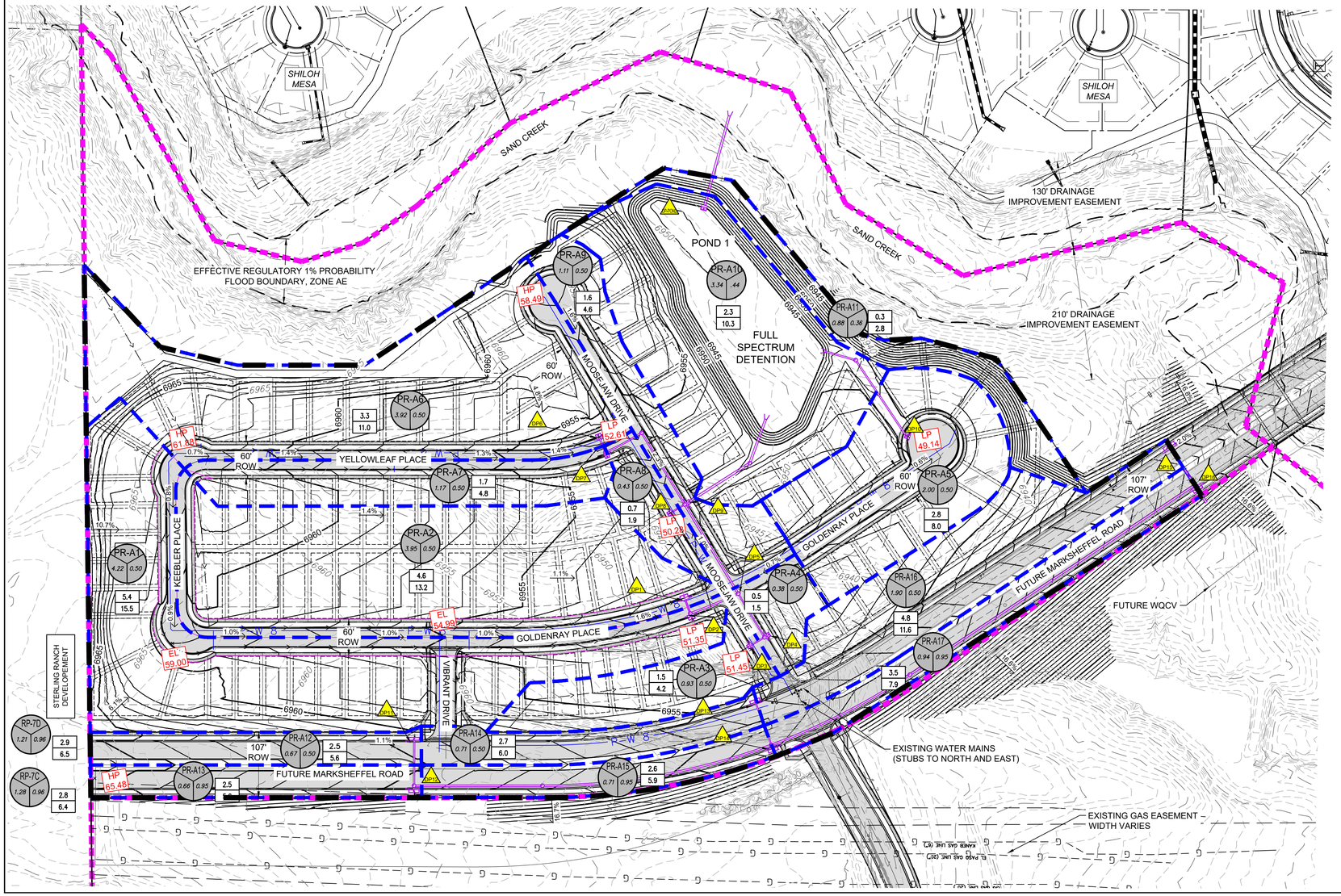
Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
7.13 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:07:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:14:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:21:23	0.21	0.71	0.40	0.54	0.68	0.91	1.15	1.43	2.13
0.702	0:28:31	0.56	1.94	1.08	1.45	1.84	2.49	3.16	3.94	5.94
	0:35:39	1.44	4.97	2.78	3.72	4.73	6.40	8.11	10.13	15.25
	0:42:47	3.96	13.65	7.64	10.23	12.98	17.58	22.25	27.79	41.79
	0:49:55	4.67	16.39	9.10	12.22	15.57	21.20	26.96	33.83	51.71
	0:57:02	4.45	15.68	8.68	11.68	14.89	20.30	25.83	32.45	49.83
	1:04:10	4.05	14.27	7.91	10.63	13.56	18.48	23.51	29.53	45.41
	1:11:18	3.61	12.80	7.07	9.52	12.15	16.58	21.12	26.57	40.92
	1:18:26	3.10	11.10	6.11	8.25	10.54	14.41	18.39	23.18	35.82
	1:25:34	2.71	9.65	5.32	7.17	9.16	12.51	16.00	20.19	31.28
	1:32:41	2.45	8.75	4.82	6.50	8.31	11.35	14.49	18.27	28.22
	1:39:49	2.01	7.28	3.99	5.39	6.90	9.46	12.10	15.27	23.68
	1:46:57	1.64	5.98	3.26	4.42	5.67	7.80	9.99	12.63	19.63
	1:54:05	1.25	4.67	2.52	3.43	4.42	6.10	7.85	9.95	15.57
	2:01:13	0.92	3.53	1.88	2.58	3.34	4.65	6.00	7.65	12.05
	2:08:20	0.67	2.58	1.36	1.87	2.44	3.41	4.43	5.67	9.01
	2:15:28	0.52	1.97	1.05	1.44	1.86	2.59	3.35	4.28	6.75
	2:22:36	0.43	1.61	0.86	1.18	1.52	2.11	2.72	3.46	5.42
	2:29:44	0.37	1.36	0.73	1.00	1.29	1.78	2.30	2.91	4.56
	2:36:52	0.32	1.19	0.64	0.88	1.13	1.56	2.00	2.54	3.96
	2:43:59	0.29	1.07	0.58	0.79	1.01	1.40	1.80	2.28	3.54
	2:51:07	0.27	0.98	0.53	0.73	0.93	1.28	1.65	2.09	3.24
	2:58:15	0.20	0.72	0.39	0.53	0.69	0.95	1.22	1.55	2.42
	3:05:23	0.14	0.53	0.29	0.39	0.50	0.69	0.89	1.12	1.75
	3:12:31	0.11	0.39	0.21	0.29	0.37	0.51	0.65	0.83	1.30
	3:19:38	0.08	0.29	0.16	0.21	0.27	0.38	0.48	0.62	0.97
	3:26:46	0.06	0.21	0.11	0.15	0.20	0.27	0.35	0.45	0.71
	3:33:54	0.04	0.15	0.08	0.11	0.14	0.19	0.25	0.32	0.51
	3:41:02	0.03	0.11	0.06	0.08	0.10	0.14	0.18	0.23	0.37
	3:48:10	0.02	0.07	0.04	0.05	0.07	0.10	0.13	0.16	0.26
	3:55:17	0.01	0.04	0.02	0.03	0.04	0.06	0.08	0.10	0.17
	4:02:25	0.00	0.02	0.01	0.02	0.02	0.03	0.04	0.06	0.10
	4:09:33	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.03	0.04
	4:16:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	4:23:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:38:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:06:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:42:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:49:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:56:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:03:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:10:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:17:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:25:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:32:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:39:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:46:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:53:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:00:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:07:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:14:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:22:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:29:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:36:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:43:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:50:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:57:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:04:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:11:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:19:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:26:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:33:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Point Summary Table									
Design Point	Upstream Area (Acres)	Upstream Q5 (cfs)	Upstream Q100 (cfs)	Subbasins Included	Inlet Name	Inlet Type	Inlet Size (ft)	Outlet Pipe Size/Type	Downstream Design Point
DP1	4.22	4.6	13.2	A2	A2	D 10 R	8	24" RCP/HP	D2
DP2	8.17	10.0	28.7	A1,A2	A1	D 10 R	8	30" RCP/HP	D5
DP3	0.93	1.5	4.2	A3	A3	D 10 R	6	18" RCP/HP	D4
DP4	1.31	2.0	5.7	A3,A4	A4	D 10 R	6	18" RCP/HP	D5
DP5	9.48	12.0	34.4	A1,A2,A3,A4	D5	MH	6	30" RCP/HP	D9
DP6	3.92	3.3	11.0	A6	A6	D 10 R	8	24" RCP/HP	D7
DP7	5.08	5.0	15.9	A6,A7	A5	D 10 R	6	24" RCP/HP	D9
DP8	0.43	0.7	1.9	A8	A7	D 10 R	6	18" RCP/HP	D9
DP9	16.10	19.3	56.8	A1,A2,A3,A4,A6, A7,A8,A9	A8	D 10 R	8	36" RCP/HP	D10
DP10	2.00	2.8	8.0	A5	A5	D 10 R	0	0	0
DP Pond	21.45	24.4	75.1	A1,A2,A3,A4,A5, A6,A7,A8,A9,A10	A9	Detention Outlet Structure	Orifice Plate: 1.02 Sq. In. (Stage 0', .9' & 1.06') Overflow Weir/Grate: L=2', W=2' w/ slope: 0 Overflow Weir/Grate: (Stage: .4' to 6') Structure Outlet Pipe: 18" RCP/HP (10.5" Orifice Plate.		-
Detention Discharge	-	0.4	3.7						Sand Creek
DP11	1.88	5.4	12.1	A12	A12	D 10 R	16	18" RCP/HP	D12
DP12	3.82	10.7	24.0	A12,A13	A13	D 10 R	16	24" RCP/HP	D14
DP13	0.71	2.7	6.0	A14	A14	D 10 R	16	18" RCP/HP	D14
DP14	5.24	16.0	36.0	A12,A13, A14,A15	A15	D 10 R	16	30" RCP/HP	D16
DP15	1.90	4.8	11.6	A16	A16	D 10 R	20	18" RCP/HP	D16
DP16	8.09	24.3	55.4	A12,A13, A14, A15,A16,A17	A17	D 10 R	16	30" RCP/HP	Sand Creek

ASPEN MEADOWS

COLORADO SPRINGS, CO

PROPOSED CONDITIONS MAP



Basin Summary Table			
Aspen Meadows			
Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)
RP-7C	1.28	2.8	6.4
RP-7D	1.21	2.9	6.5
A1	4.22	5.4	15.5
A2	3.95	4.6	13.2
A3	0.93	1.5	4.2
A4	0.38	0.5	1.5
A5	2.00	2.8	8.0
A6	3.92	3.3	11.0
A7	1.17	1.7	4.8
A8	0.43	0.7	1.9
A9	1.11	1.6	4.6
A10	3.34	2.3	10.3
A11	0.88	0.3	2.8
A12	0.67	2.5	5.6
A13	0.66	2.5	5.6
A14	0.71	2.7	6.0
A15	0.71	2.6	5.9
A16	1.90	4.8	11.6
A17	0.94	3.5	7.9

NOTES:
1. Spot elevations subject to change with final grading design and construction.

LEGEND

- SUB-BASIN BOUNDARY
- EXISTING CONTOUR (4900)
- PROPOSED CONTOUR (6970)
- FLOW DIRECTION (XXX)
- LOW POINT AND ELEVATION (LP XX)
- HIGH POINT AND ELEVATION (HP XX)
- SPOT ELEVATION (95.71)
- SWALE
- DESIGN POINT (x)
- SUB BASIN DESIGNATION (XX)
- SUB BASIN RUNOFF COEFFICIENT (XX)
- SUB BASIN AREA (AC.) (X.XX)
- 5-YEAR STORM EVENT PEAK FLOW (CFS) (0.0)
- 100-YEAR STORM EVENT PEAK FLOW (CFS) (0.0)
- PROPERTY LINE
- STORM PIPE

GRAPHIC SCALE

100' 0' 100' 200'

(IN FEET)
1 inch = 100 ft.

Know what's below. Call before you dig.

CONSULTANT:

CIVIL ENGINEER:

Matrix DESIGN GROUP
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

LANDSCAPE ARCHITECT:

Thomas & Thomas Planning-Urban
614 N. Tejon Street
Colorado Springs, CO 80903
Phone (719)578-8777

PROJECT:

ASPEN MEADOWS
FILING NO.1
DEVELOPMENT PLAN
CITY OF COLORADO SPRINGS
JANUARY 2019

OWNER:

COLA, LLC
555 MIDDLE PARKWAY
COLORADO SPRINGS, CO 80921
(719)459-0807

DEVELOPER:

COLA, LLC
555 MIDDLE PARKWAY
COLORADO SPRINGS, CO 80921
(719)459-0807

CITY PLANNING FILE NO: AR DP XXXXXXXXX

ISSUE: JANUARY, 2019

DRAWING INFORMATION:	
PROJECT NO:	17.886.004.000
DRAWN BY:	CRAIG DOLD
CHECKED BY:	JEFF ODOR
APPROVED BY:	JEFF ODOR
SHEET TITLE:	

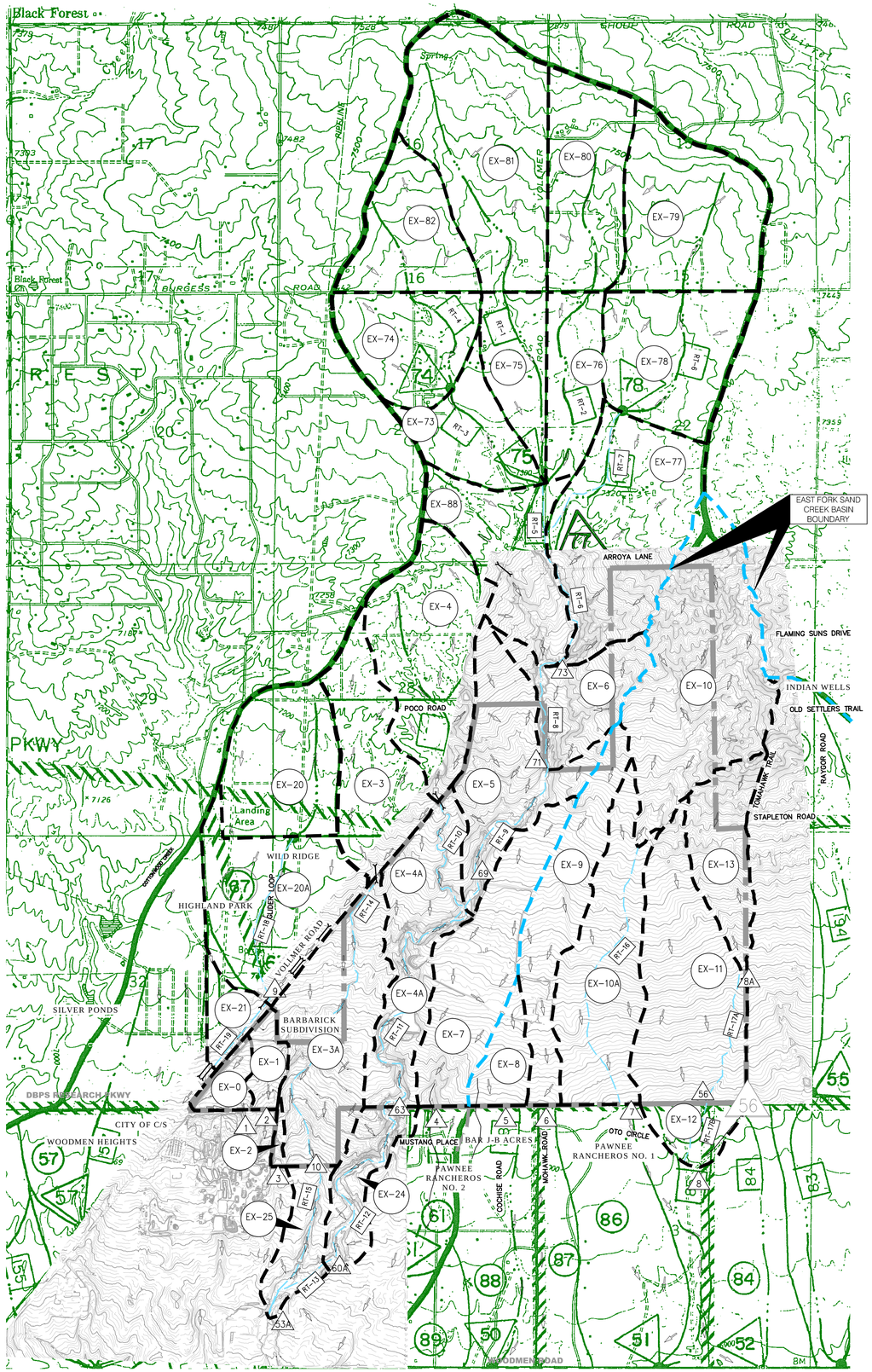
DRAINAGE REPORT MAP

DR02

SHEET 2 OF 3

APPENDIX E

DRAINAGE MAPS



0 600 1200 2400

Scale in Feet

LEGEND

BASIN ID – SC3–77

DESIGN POINT – 87

REACH IDENTIFIER – RT–17A

BASIN BOUNDARY –

EAST FORK SAND CREEK BASIN BOUNDARY –

FLOW DIRECTION –

BASIN SUMMARY

BASIN	CN	AREA (ACRES)	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)
EX–0	62	23.8	0.037	5.0	8.2	13.0	19.6	25.7	32.2
EX–1	62	25.7	0.040	4.8	7.9	12.4	18.7	24.5	30.9
EX–2	62	5.5	0.009	1.1	1.8	2.8	4.3	5.6	7.1
EX–3	62	136.8	0.214	22.0	36.4	57.6	86.9	114.0	143.1
EX–3A	61	188.1	0.294	28.3	47.4	75.7	115.1	152.2	192.6
EX–4	62	192.0	0.300	30.1	49.9	79.1	119.5	157.0	197.3
EX–4A	62	151.5	0.237	24.7	40.8	64.4	97.0	127.2	160.1
EX–5	62	153.9	0.240	24.2	40.0	63.4	95.9	125.9	158.2
EX–6	62	90.2	0.141	15.3	25.5	40.1	60.7	79.9	100.5
EX–7	56	165.0	0.258	11.6	21.5	37.5	60.9	83.1	107.4
EX–8	45	42.0	0.066	0.5	1.7	4.5	9.4	14.5	20.5
EX–9	54	131.9	0.206	12.2	23.9	43.1	70.9	97.0	125.2
EX–10	60	270.7	0.423	32.7	56.0	91.1	140.1	185.9	236.1
EX–10A	41	179.3	0.280	0.6	2.2	7.3	17.4	29.1	43.1
EX–11	43	209.3	0.327	18.0	29.8	47.7	73.4	98.3	126.1
EX–12	51	39.5	0.062	2.2	5.1	10.1	17.7	25.1	33.3
EX–13	55	89.3	0.139	7.7	15.2	27.1	44.2	60.5	78.4
EX–20	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
EX–20A	64	179.7	0.281	32.2	51.9	80.5	119.8	155.9	194.6
EX–21	65	33.3	0.052	8.6	13.5	20.7	30.5	39.4	49.0
EX–24	59	63.1	0.099	9.5	16.6	27.5	42.9	57.4	73.0
EX–25	43	54.4	0.085	0.3	1.5	4.8	10.7	17.2	25.1
EX–73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
EX–74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
EX–75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
EX–76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
EX–77	62	230.6	0.360	34.7	56.9	90.6	137.5	180.9	227.7
EX–78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
EX–79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
EX–80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
EX–81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
EX–82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3
EX–88	62	139.2	0.217	22.2	36.7	58.0	87.6	115.0	144.4

DESIGN POINT SUMMARY (PEAK FLOW)

DESIGN POINT	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)	LOCATION
DP–74	0.371	39.3	65.3	104.8	158.9	209.1	262.8	
DP–75	1.413	141.2	235.1	376.6	566.6	750.9	950.5	
DP–78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP–73	2.528	225.9	380.7	618.0	957.0	1260.4	1582.3	
DP–71	2.669	229.3	388.9	629.7	978.8	1277.3	1637.9	STERLING RANCH NORTHERN BNDRY
DP–69	3.209	253.0	434.8	707.7	1100.0	1453.3	1870.4	
DP–63	3.446	251.4	430.7	713.1	1113.2	1496.2	1911.5	STERLING RANCH SOUTHERN BNDRY
DP–10	0.508	36.5	56.0	106.4	162.9	220.6	287.2	COLORADO SPRINGS/EL PASO BNDRY
DP–9A	0.557	55.3	94.3	150.3	227.7	299.5	380.5	VOLLMER/TAHITI DRIVE
DP–9	0.505	52.8	88.8	142.1	214.2	281.0	351.4	VOLLMER/LOCHWINNOCH LN
DP–8A	0.139	7.7	15.2	27.1	44.2	60.5	78.4	D/S STERLING RANCH EASTERN BNDRY
DP–8	0.528	24.2	45.1	77.8	124.4	169.5	220.9	D/S STERLING RANCH SOUTHERN BNDRY
DP–7	0.703	32.4	57.1	97.3	156.1	213.8	277.9	STERLING RANCH SOUTHERN BNDRY
DP–6	0.206	12.2	23.9	43.1	70.9	97.0	125.2	STERLING RANCH SOUTHERN BNDRY
DP–5	0.066	0.5	1.7	4.5	9.4	14.5	20.5	STERLING RANCH SOUTHERN BNDRY
DP–4	0.258	11.6	21.5	37.5	60.9	83.1	107.4	STERLING RANCH SOUTHERN BNDRY
DP–3	0.009	1.1	1.8	2.8	4.3	5.6	7.1	STERLING RANCH SOUTHERN BNDRY
DP–2	0.040	4.8	7.9	12.4	18.7	24.5	30.9	STERLING RANCH SOUTHERN BNDRY
DP–1	0.037	5.0	8.2	13.0	19.6	25.7	32.2	STERLING RANCH SOUTHERN BNDRY
DP–60A	3.545	247.7	430.2	707.1	1113.0	1496.6	1913.5	FUTURE MARKSHEFFEL X–ING
DP–56	0.466	23.2	42.5	71.9	115.6	157.4	202.9	STERLING RANCH SOUTHERN BNDRY
DP–53A	4.138	262.1	454.0	763.2	1196.5	1609.8	2061.5	SAND CREEK AND POND 3

DESIGN POINT SUMMARY (VOLUME)

DESIGN POINT	AREA (SQ MI)	V_2 (AC–FT)	V_5 (AC–FT)	V_{10} (AC–FT)	V_{25} (AC–FT)	V_{50} (AC–FT)	V_{100} (AC–FT)	LOCATION
DP–74	0.371	5.9	9.0	13.6	19.8	25.5	31.6	
DP–75	1.413	22.7	34.5	51.7	75.4	97.1	120.5	
DP–78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP–73	2.528	40.4	61.5	92.1	134.3	173.1	214.9	
DP–71	2.669	42.5	64.9	97.1	141.6	182.5	226.6	STERLING RANCH NORTHERN BNDRY
DP–69	3.209	50.7	77.4	116.1	169.4	218.6	271.4	
DP–63	3.446	54.1	82.5	123.8	180.8	233.3	289.9	STERLING RANCH SOUTHERN BNDRY
DP–10	0.508	7.6	11.7	17.6	25.8	33.4	41.6	COLORADO SPRINGS/EL PASO BNDRY
DP–9A	0.557	9.3	14.1	21.1	30.7	39.4	48.8	VOLLMER/TAHITI DRIVE
DP–9	0.505	8.4	12.7	19.0	27.6	35.5	44.0	VOLLMER/LOCHWINNOCH LN
DP–8A	0.139	1.3	2.1	3.4	5.2	7.0	8.9	D/S STERLING RANCH EASTERN BNDRY
DP–8	0.528	4.4	7.0	11.1	16.8	22.3	28.4	D/S STERLING RANCH SOUTHERN BNDRY
DP–7	0.703	6.1	10.0	15.9	24.3	32.4	41.3	STERLING RANCH SOUTHERN BNDRY
DP–6	0.206	2.4	4.0	6.3	9.6	12.7	16.0	STERLING RANCH SOUTHERN BNDRY
DP–5	0.066	0.2	0.4	0.8	1.4	1.9	2.6	STERLING RANCH SOUTHERN BNDRY
DP–4	0.258	2.6	4.2	6.7	10.2	13.5	17.2	STERLING RANCH SOUTHERN BNDRY
DP–3	0.009	0.1	0.2	0.3	0.5	0.6	0.8	STERLING RANCH SOUTHERN BNDRY
DP–2	0.040	0.6	0.9	1.4	2.1	2.7	3.4	STERLING RANCH SOUTHERN BNDRY
DP–1	0.037	0.6	0.9	1.3	1.9	2.5	3.1	STERLING RANCH SOUTHERN BNDRY
DP–60A	3.545	55.3	84.4	126.4	184.8	238.5	296.6	FUTURE MARKSHEFFEL X–ING
DP–56	0.466	4.0	6.3	9.9	14.9	19.8	25.1	SAND CREEK AND POND 3
DP–53A	4.138	63.0	96.4	144.7	211.8	273.9	340.9	SAND CREEK AND POND 3

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (SQ MI)	Q_{10} (CFS)	Q_{100} (CFS)
DP–50	0.32	47.0	195.7
DP–51 (BASIN 86)	0.33	17.7	74.1
DP–52	1.67	80.5	456.5
DP–56	0.79	63.6	265.0

Values reported from SCDBPS
(DP 50, 51, 52 Not analyzed as a part of this study)
DBPS Reach 85(Basin91)=Q10=28.8cfs Q100=115.2cfs

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2018 STERLING RANCH MDDP

EXISTING HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09–002
FILE: \dwg\Eng Exhibits\2018–MDDP–ExistCondWSWrkMap.dwg
DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS
SCALE
HORIZ: NTS
VERT: NTS
DATE: 08–22–18

DM1

File: O:\09002A\Sterling Ranch District\dwg\Eng Exhibits\2018 MDDP\2018–MDDP–ExistCondWSWrkMap.dwg Plotstamp: 11/13/2018 1:52 PM

Proposed Conditions Design Point Summary

Design Point	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
DP-74	33.68	94.55	145.74	187.2	251.03	293.76
DP-75	95.13	274.57	427.98	555.2	754.29	887.87
DP-77	144.08	426.57	672.84	877.81	1201.19	1423.89
DP-78	52.82	138.33	210.37	269.64	360.98	422.09
DP-73	147.28	442.59	703.56	919.81	1257.44	1497.12
DP-72	148.02	450.59	718.2	939.53	1285.42	1527.18
DP-71	149.28	472.6	771.35	1012.75	1386.32	1644.06
DP-70	149.57	477.23	780.47	1025.79	1405.32	1666.98
DP-69	146.52	512.38	847.5	1108.89	1497.55	1763.93
DP-87	143.88	533.15	890.76	1170.95	1589.82	1880.39
DP-68	126.27	579.69	994.15	1327.63	1837.13	2160.43
DP-64	89.76	133.15	167.21	194.25	233.42	259.48
DP-63	128.57	480.38	763.81	1005.42	1368.28	1585.19
DP-61	132.9	535.22	851.44	1123.05	1549.17	1859.67
DP-60A	135.75	544.14	863.88	1138.24	1569.79	1882.17
DP-53A	135.8	545.87	866.46	1141.24	1573.95	1887.54
DP-1E	12.41	29.33	43.32	54.71	72.19	83.88
DP-2E	24.93	56.12	81.89	103.16	135.52	157.2
DP-3E	26.73	59.28	86.63	109.01	143.9	176.03
DP-4E	28.34	61.94	91.01	114.79	152.57	184.7
DP-56	24.04	43.91	62.31	79.42	106.6	136.21
DP-8	26.31	47.57	67.39	84.03	107.24	137.04
DP-21	8.07	45.76	92.48	128.9	153.87	200.93
DP-22	8.07	45.78	92.52	128.94	153.88	191.38
DP-25	5.58	12.02	17.2	21.1	26.97	30.9
DP-26	13.62	38.87	59.76	76.84	102.99	120.45
EX_STOCK_POND _1	133.68	512.29	863.82	1143.6	1561.29	1848.83
EX_STOCK_POND_2	149.57	477.23	780.47	1025.79	1405.32	1666.98
FSD14B_Outfall	2.57	20.53	44.05	64.95	98.12	116.66
PNDE7	31.92	68.33	100.59	126.9	176	222.77
PNDW3	126.27	579.69	994.15	1327.63	1837.12	2160.43

Proposed Conditions Basin Summary

Basin	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
SC3-1A	15.4	32.05	44.63	54.22	68.02	77.21
SC3-5A	48.38	75.2	95.88	112.35	135.5	150.82
SC3-5B	60.26	97.13	126.36	149	181.48	203.13
SC3-6A	59.98	84.21	106.32	123.77	149.06	165.69
SC3-6B	30	47.16	60.52	70.92	85.96	95.97
SC3-6C	52.26	84.02	115.61	140.03	174.32	196.64
SC3-7	60.94	87.91	109.28	126.05	150.45	166.71
SC3-8	12.18	56.41	93.96	122.75	166.13	195.44
SC3-9	24.66	73.44	114.01	146.06	193.77	225.81
SC3-10	2.94	14.36	23.62	30.77	41.33	48.66
SC3-11A	1.99	5.36	8.05	10.06	13.08	15.09
SC3-11B	68	99.65	126.13	146.85	176.93	196.96
SC3-11C	1.37	5.83	9.3	11.93	15.66	18.16
SC3-12	47.61	71.53	91.34	106.54	129.44	144.67
SC3-12A	15.01	24.03	31.22	36.66	44.86	50.3
SC3-12B	2.17	6.35	9.82	12.6	16.83	19.66
SC3-13	56.24	80.96	100.72	115.86	138.53	153.6
SC3-13A	2.61	7.62	11.81	15.18	20.28	23.7
SC3-14A	110.65	160.22	203.13	237.5	287.18	320.18
SC3-14B	63.13	90	115.58	136.1	165.72	185.1
SC3-15A	13.21	38.41	59.28	76.32	102.43	119.86
SC3-15B	8.38	12.29	15.45	17.9	21.56	24
SC3-16	180.7	266.34	343.24	404.73	493.4	552.27
SC3-17A	25.63	39.59	50.91	59.5	72.46	81.07
SC3-17B	20.59	32.3	41.97	49.43	60.7	68.19
SC3-18	22.75	32.96	41.34	47.83	57.56	64.05
SC3-18B	1.53	4.45	6.89	8.86	11.91	13.95
SC3-19	28	78.96	120.84	154.22	205.45	239.67
SC3-20	9.29	21.02	30.73	38.5	50.17	57.99
SC3-21	9.77	20.68	29.45	36.03	45.92	52.53
SC3-22	7.15	16.35	24.05	30.08	39.14	45.22
SC3-23	10.92	22.1	31.23	38.2	48.72	55.73
SC3-24A	6.43	15.26	22.51	28.3	37.09	42.98
SC3-24B	1.95	4.78	7.12	8.98	11.76	13.62
SC3-25	5.58	12.02	17.2	21.1	26.97	30.9
SC3-26	1.66	4.37	6.61	8.4	11.13	12.95
SC3-27	14.49	27.87	39.1	48.09	61.8	70.95
SC3-61	5.61	22.4	36.4	47.4	63.67	74.61
SC3-72	9.55	23.84	35.61	44.98	59.19	68.7
SC3-73	12.16	33.03	50.14	63.84	84.94	99.04
SC3-74	22.51	53.27	79.1	99.77	131.03	151.94
SC3-75	11.12	26.37	38.98	49.21	64.91	75.41
SC3-76	10.85	27.09	40.54	51.45	68.18	79.38
SC3-77	8.93	27.11	42.16	54.46	73.59	86.36
SC3-78	32.29	77.46	114.83	144.42	189.21	219.17
SC3-79	32.26	82.54	123.52	156.01	205.95	239.34
SC3-80	22.36	57.34	86.09	109.14	144.5	168.15
SC3-81	26.67	81	125.85	162.22	218.65	256.32
SC3-82	17.01	50.83	79.48	102.02	136.18	158.98
SC3-88	6.28	18.99	29.44	37.84	50.8	59.46
SC3-89	2.86	8.64	13.39	17.14	22.87	26.69
SCE-1	9.82	21.3	30.85	38.58	50.51	58.52
SCE-2	1.42	3.35	4.95	6.27	8.3	9.66
SCE-3	8.5	16.95	25.2	31.78	41.56	48.16
SCE-4	4.16	7.52	10.35	12.67	16.29	18.71
SCE-5	71.73	99.51	125.72	146.92	177.83	198.17
SCE-6	0.18	0.55	1.03	1.42	2	2.39
SCE-7	33.06	46.14	56.71	64.87	77.06	85.19
SCE-8	47.1	61.37	73.41	82.94	97.16	106.61
SCE-9	0.22	0.68	1.27	1.75	2.46	2.94
SCE-10	106.33	165.76	230.7	283.77	358.46	407.13
SCE-11	0.77	2.52	4.75	6.5	8.93	10.51
SCE-13	10.9	25.85	38.21	48.24	63.64	73.94
SCE-14	8	19.04	28.21	35.59	46.77	54.26
SCE-15	13.6	27.2	38.53	47.35	60.67	69.54

The basin line between main and east tributaries should follow the existing contours

Storm drain from DP26 to SC

basin line missing?

Change color of one layer of the green lines

BASIN DIVERTED AREA (EAST FORK TO SAND CREEK)
2018: 267.3 AC
2022: 245.8 AC

SWMM BASIN

SWMM DETENTION POND

SWMM DESIGN POINT

2018 EAST FORK BASIN TRANSFER AREA

2022 EAST FORK BASIN TRANSFER AREA

HISTORIC EAST FORK BASIN BOUNDARY

2018 MDDP PROPOSED EAST FORK BASIN BOUNDARY

2022 EAST FORK BASIN BOUNDARY

2018 MDDP DRAINAGE BASIN BOUNDARY

2022 MODIFIED DRAINAGE BASIN BOUNDARY

800 400 0 800 1600
ORIGINAL SCALE: 1" = 800'

PROPOSED DRAINAGE MAP
SAND CREEK MDDP AMENDMENT
JOB NO. 25188.04
09/09/22
SHEET 1 OF 1

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