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PRELIMINARY DRAINAGE REPORT
FOR
FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD

Prepared for:
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Job No. 1183.20

PCD Project No.
PUD SP-227

PRELIMINARY DRAINAGE REPORT FOR FOURSQUARE AT STERLING RANCH PRELIMINARY PLAN / PUD

ENGINEER'S STATEMENT:

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

______________________________________ ____________________

Marc A. Whorton Colorado P.E. #37155 Date

OWNER'S/DEVELOPER'S STATEMENT:

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

Business Name: CLASSIC SRJ LAND, LLC

By: ____________________________________

Title: ____________________________________

Address: 2138 Flying Horse Club Drive

Colorado Springs, CO 80921

EL PASO COUNTY:

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

______________________________ ____________________

For County Engineer, / ECM Administrator Date

Conditions:

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PURPOSE

The purpose of this Preliminary Drainage Report is to address on-site and off-site drainage quantities and patterns for the proposed development, compare to approved MDDP and identify general drainage improvements and facilities required to minimize impacts to the adjacent properties.

GENERAL DESCRIPTION

Classic SRJ Land, LLC (Classic Homes) has recently purchased the remaining portion of the Sterling Ranch property east of Sand Creek from the Jim Morley. This is one of the three initial development proposals east of Sand Creek and will be known as **Foursquare at Sterling Ranch Preliminary Plan/PUD.** This PUD consists of development area northwest of the intersection of Briargate Pkwy. and Sterling Ranch Road per the proposed roadway plats, prepared by JR Engineering. The total PUD area is **36.76 acres** and includes the proposed tract for Pond FSD-16. It is located in portions of sections 33 and 34, township 12 south, range 65 west of the sixth principal meridian. The site is bounded on the north, east and west by proposed and future Sterling Ranch East residential development, west and south by the proposed extension of Briargate Pkwy. The site is in the upper portion of both the Sand Creek and East Fork Sand Creek Drainage Basins. Urban single family residential development with a total of **158 lots** is proposed within this PUD.

The average soil condition reflects Hydrologic Group "A" (Blakeland loamy sand and Columbine gravelly sandy loam) with also some presence of Hydrologic Group "B" (Pring coarse sandy loam) as determined by the "Web Soil Survey of El Paso County Area," prepared by the Natural Resources Conservation Service (see map in Appendix). The majority of the site does exhibit Group "A" soils, however, given that significant overlot grading (import fill) that will take place throughout the site and DCM 5.3.4 which states NOT to use Group "A" soils if overlot grading will occur, thus, Group "B" soils will be used in all hydrologic calculations.

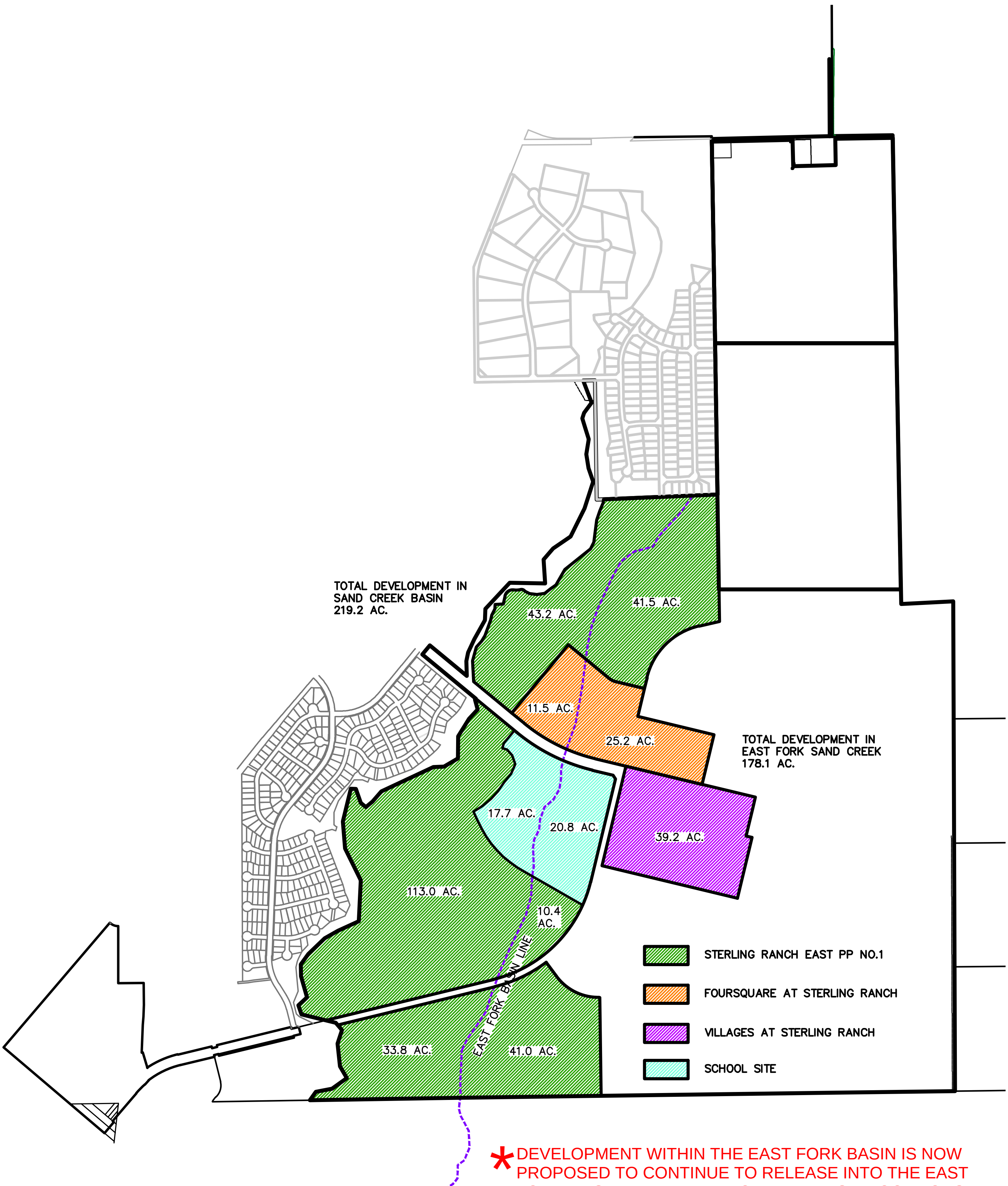
This is for SCS calculations in disturbed areas, not pre-development conditions which shall be based on the pre-development soils

developed runoff

EXISTING DRAINAGE CONDITIONS

The Foursquare at Sterling Ranch Preliminary Plan / PUD property is located in the upper portion of the Sand Creek drainage basin on the south edge of Black Forest. However, the easterly portion of the site lies within the East Fork tributary of Sand Creek. *(See following exhibit and reference the Sterling Ranch MDDP Amendment No. 2, submitted with the Sterling Ranch East Preliminary Plan No. 1 submittal)* Nearly the entire site is mainly covered with native grasses with few or no trees. Some minor disturbance due to utility installation has also taken place within the utility esmt. corridors traversing the site for the future Briargate Pkwy. Other land disturbance including some grading operations by the previous land owner has also taken place just north of the future Briargate Pkwy. alignment and within the parcel south of Briargate Pkwy. and northwest of Sterling Ranch Road. The Sand Creek channel exists approximately 500 feet west of the property. All required improvements to the Sand Creek channel within the Sterling Ranch property are described in a separate report prepared by JR Engineering, "Final Design Report for Sand Creek Restoration", dated September 2022. Please reference this report for all Sand Creek improvement requirements and associated wetland mitigation plans and permitting within jurisdictional waters.

Two public roadway crossings of Sand Creek are also proposed to serve as direct access for the Sterling Ranch development east of Sand Creek (Extension of Briargate Parkway and Sterling Ranch Road). These crossings are currently covered under a 404 permit (Action No. SPA-2015-00428-SCO) with the previous land owner dated February 2016. JR Engineering, LLC is also coordinating a CLOMR/LOMR for this stretch of Sand Creek. This entre site was also studied as a part of the "Master Development Drainage Plan for Sterling Ranch", prepared by M&S Civil Consultants, approved November 2018 which includes modeling of this property as well as the large acreage north up to the top of the Sand Creek Basin. An MDDP Amendment, prepared by Classic Consulting, submitted along with the Sterling Ranch East Preliminary Plan No. 1 (currently under review) discusses the removal of the East Fork Sand Creek basin transfer, combining Ponds FSD-16A and FSD-16B into one facility and a few other minor internal sub-basin transfers. Both the original MDDP and the Amendment propose developed flows within Sand Creek that are



*DEVELOPMENT WITHIN THE EAST FORK BASIN IS NOW PROPOSED TO CONTINUE TO RELEASE INTO THE EAST FORK AT SAME PRE-DEVELOPMENT BASIN LOCATIONS

STERLING RANCH EAST INITIAL DEVELOPMENT PHASE
BASIN DEVELOPMENT EXHIBIT

significantly lower than both the DBPS and FEMA currently show. These flows are as follows: At Arroya Lane crossing (DP-77) Q_{10} = 581 cfs Q_{100} = 1468 cfs and Sterling Ranch south property line (DP-63) Q_{10} = 713 cfs Q_{100} = 1912 cfs. However, the focus of this report is not on Sand Creek, but the residential development proposed east of Sand Creek. As mentioned earlier, eastern portions of this site lie within the East Fork of Sand Creek. The following descriptions represent the pre-development flow design points for the property consistent with the approved MDDP for Sterling Ranch, yet differentiate Sand Creek main tributary basins verses the East Fork basins. The nomenclature is similar to the MDDP for easy comparison:

Sand Creek Main

The Retreat at TimberRidge development exists north of this property and was recently approved by County Staff. The following basins are off-site basins (outside the proposed Preliminary Plan area but within the overall Sterling Ranch East ownership) accounted for in the Retreat at TimberRidge development and are not tributary to the proposed development:

Basin TR-12 (Q_5 = 2 cfs, Q_{100} = 9 cfs) consists of 4.7 ac. of future large lot residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site into the future Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and future downstream storm facilities. **Basin TR-20 (Q_5 = 10 cfs, Q_{100} = 32 cfs)** consists of 23.2 ac. of future large lot residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site directly into an existing stock pond within the future Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-4 (Q_5 = 2 cfs, Q_{100} = 9 cfs)** consists of 4.4 ac. of future urban residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site into the future Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-5 (Q_5 = 5 cfs, Q_{100} = 17 cfs)** consists of 13.7 ac. of future urban residential area that currently is undeveloped and sheet flows in a southwesterly direction directly into a temporary sediment basin constructed with the Retreat at TimberRidge Filing No.

2 project. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-6 (Q_5 = 1 cfs, Q_{100} = 4 cfs)** consists of a small future urban residential area of 1.5 ac. that currently is undeveloped and sheet flows in a southwesterly direction off-site into the Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-7 (Q_5 = 1 cfs, Q_{100} = 5 cfs)** consists of a 2.6 ac. basin that sheet flows towards the Retreat property but then captured by a temporary swale and routed to the west into another temporary sediment basin constructed by the Retreat development.

The following basin is tributary to the proposed Preliminary Plan / PUD area and also within the Sand Creek main basin boundary:

Basin EX-7 (Q_5 = 46 cfs, Q_{100} = 105 cfs) consists of approximately 152.8 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP and the east basin line defines the westerly edge of the East Fork basin. The sheet flows become more concentrated towards the south end of the basin as the topography becomes steeper and more defined south of the proposed Sterling Ranch Road crossing. The existing flows exit the property along the south Sterling Ranch boundary within the well-defined natural channel at **Design Point 4**. Given the difference in hydrologic modeling (SWMM 5.1 vs. HEC-HMS) these flows are fairly consistent with the flows determined by the MDDP at DP-4 (Q_5 = 21.5 cfs, Q_{100} = 107.4 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review) and the construction of Pond FSD-11B, nearly all of the tributary area for this existing basin will be captured and treated. Thus, the downstream natural channel corridor through the existing rural lots within the Pawnee Rancheros Filing 2 Subd. and south of Mustang Place, just east of Mustang Road will continue to handle these off-site flows adequately.

Basin EX-7A (Q_5 = 1 cfs, Q_{100} = 5 cfs) consists of a small basin of only 2.4 ac. that sheet flows in a southerly direction. The MDDP included this small basin as a part of Basin EX-7. However, a more detailed look at this area finds that the larger basin EX-7 seems to all be tributary to the defined natural channel while Basin EX-7A appears to sheet flow off-site towards the Mustang Place culde-sac. These minor sheet flows ultimately combine with the pre-developed flows from Basin EX-7 south of Mustang Place within the natural channel. Again, with the construction of the Pond FSD-11B, the majority of the tributary area for this existing basin will be captured and treated. Thus, the downstream natural channel corridor will continue to handle these off-site flows adequately.

Sand Creek East Fork

Basin EX-8 (Q_5 = 5 cfs, Q_{100} = 23 cfs) consists of approximately 32.2 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP and the north portion of the west basin line defines the westerly edge of the East Fork basin. This basin incorporates the majority of MDDP basins EX-8. The flows seem to remain as sheet flows as they exit the property along the south boundary at **Design Point 5**. Again, these flows seem consistent with the flows determined by the MDDP at DP-5 (Q_5 = 1.7 cfs, Q_{100} = 20.5 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), the majority of the tributary area to this basin will be routed towards Pond FSD-11B. The remaining large lot rear yard sheet flows from Basin EF-A will be treated by runoff reduction techniques through long buffer areas and then continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-8A (Q_5 = 2 cfs, Q_{100} = 9 cfs) consists of a small basin of 6.6 ac. that sheet flows in a southerly direction. The MDDP included this small basin as a part of Bain EX-8. However, a more detailed look at this area finds that the larger basin EX-8 seems to sheet flow through properties east of Cochise Road while Basin EX-8A sheet flows off-site directly down the Cochise Road corridor. These off-site flows seem to ultimately combine further south within the Cochise Road corridor. Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), the majority of the tributary area to this basin will be routed towards Pond FSD-11B. The remaining large lot rear yard sheet flows from Basin EF-A will be treated by runoff reduction techniques through long buffer areas and then continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-9 (Q_5 = 59 cfs, Q_{100} = 122 cfs) consists of approximately 139.3 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP with the northern portion of the west basin line defining the westerly edge of the East Fork basin. The flows seem to remain as sheet flows as they exit the property along the south boundary at **Design Point 6**. Again, these flows seem consistent with the flows determined by the MDDP at DP-6 (Q_5 = 23.9 cfs, Q_{100} = 125.2 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), the majority of the tributary area to this basin will be routed towards Pond FSD-11B. The remaining large lot rear yard sheet flows from Basin EF-A will be treated by runoff reduction techniques through long buffer areas and then continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-9A (Q_5 = 7 cfs, Q_{100} = 19 cfs) consists of a smaller basin of 21.8 ac. that sheet flows in a southerly direction. The MDDP included this basin as a part of Basin EX-10A. However, a more detailed look at this area finds that the larger basin EX-10A seems to be tributary to Oto Circle east of the high point in the road while Basin EX-9A appears to sheet flow off-site west of the high point, towards the intersection of Brule Road and Oto Circle. These sheet flows seem to ultimately combine with the pre-developed flows from Basin Ex-10A further south and east of Brule Road. Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), much of the upstream tributary area to this basin will be routed towards Ponds FSD-11B and FSD-14B. The remaining undeveloped property will continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-10 (Q_5 = 105 cfs, Q_{100} = 222 cfs) consists of approximately 265.9 acres of property at the extreme top of the Sand Creek East Fork Basin. The off-site northern portion of this basin is within the Black Forest, heavily treed area. The off-site eastern portion of the basin contains existing 5 ac. lot development (Indian Wells Subd. Filing 1). The flows from this large basin sheet flow in a southerly direction across the northern portion of the Sterling Ranch property and enter Basin EX-10A.

Basin EX-10A (Q_5 = 46 cfs, Q_{100} = 103 cfs) consists of approximately 153.5 acres of property that sheet flows in a southerly direction through the Sterling Ranch property. The combined flows from both basins EX-10 and EX-10A seem to remain as sheet flow traveling in a southerly direction towards **Design Point 7 (Q_5 = 110 cfs, Q_{100} = 249 cfs)** At this location the flows exit the property along the south boundary. Again, these flows are fairly consistent with the flows determined by the MDDP at DP-7 (Q_5 = 57.1 cfs, Q_{100} = 277.9 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), much of the upstream tributary area to this basin will be routed internally elsewhere. The remaining undeveloped property will continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-13 (Q_5 = 36 cfs, Q_{100} = 85 cfs) consists of approximately 94.8 acres of property at the extreme eastern edge of the Sterling Ranch property. The off-site northern portion of this basin contains existing 5 ac. lot development (Indian Wells Subd. Filing 1). The flows from this basin sheet flow in a southeasterly direction towards the eastern boundary of the Sterling Ranch property. To be consistent with the MDDP, the flows then seem to run along the eastern property boundary and enter Basin EX-11 near the Southeast corner of the property.

Basin EX-11 (Q_5 = 54 cfs, Q_{100} = 129 cfs) consists of approximately 214.3 acres of property that sheet flows across the southeastern corner of the Sterling Ranch property. The combined flows from both basins seem to remain as sheet flow traveling in a southerly direction towards **Design Point 56**. **(Q_5 = 60 cfs, Q_{100} = 160 cfs)** At this location the flows exit the property along the south boundary. Again, these flows are fairly consistent with the flows determined by the MDDP at DP-

56 (Q_5 = 42.5 cfs, Q_{100} = 202.9 cfs). No development is proposed within this basin at this time. Thus, the downstream corridor will not be affected.

PROPOSED DRAINAGE CONDITIONS

As described in the General Description of the report, this proposed Preliminary Plan / PUD development contains 36.72 acres due north of the two major roadways that are being final platted and constructed separately (Briargate Pkwy. and Sterling Ranch Rd.). A single full spectrum detention (FSD) facility is planned with this development. It will be designed to handle these proposed lots, future adjacent development and portions of the other Sterling Ranch East Preliminary Plan No. 1 development. (PCD No. SP-22-004 – currently under review) 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 (TR-12, TR-20, TR-4, TR-5 and TR-6) 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) Basin TR-12 (4.7 Ac.) is currently routed through the Retreat at TimberRidge development and then directly into Sand Creek. Upon development of Retreat at TimberRidge Filing 3, this basin is planned to be captured by the public storm system and then formally treated downstream in the Retreat at TimberRidge Pond 2. Basin TR-20 (23.2 Ac.) is currently tributary to the existing stock pond within the Retreat at TimberRidge development, which outfalls into a storm system directly into Sand Creek. Upon future development within this basin, formal stormwater quality treatment must take place on-site with the release into the existing storm system directly to Sand Creek. Basins TR-4 (4.4 Ac.), TR-5 (13.7 Ac.) and TR-6 (1.5 Ac.) are all currently accounted for and routed through the Retreat at TimberRidge development for formal treatment. Upon future development within these basins, formal treatment is still planned to be handled in the downstream Retreat at TimberRidge Pond 2.

Include the area to the east

show on plan

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 2.1 Ac. 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 76.6 Ac. of 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.

constructed?

Basin TR-W (Q_5 = 3 cfs, Q_{100} = 5 cfs) consists of 1.4 Ac. 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-E1. **Basin P1-E1 (Q_5 = 50 cfs, Q_{100} = 97 cfs)** consists of 30.4 Ac. 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

CLASSIC CONSULTING ENGINEERS & SURVEYORS extension of Sterling Ranch Road at **Design Point 2 (Q_5 = 53 cfs, Q_{100} = 103 cfs)**. These developed flows 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-E2 (Q_5 = 41 cfs, Q_{100} = 80 cfs) consists of 21.8 Ac. of the proposed urban residential at the north end of this Preliminary Plan, again just east of Sand Creek and tributary to a proposed downstream storm system within the northerly extension of Sterling Ranch Road at **Design Point 3 (Q_5 = 41 cfs, Q_{100} = 80 cfs)**. These developed flows will then combine with the upstream developed flows from Design Points 1 & 2 and be routed in a large diameter storm system further south within Sterling Ranch Road.

Address how flows are conveyed in the interim condition

Basin P1-C (Q_5 = 23 cfs, Q_{100} = 46 cfs) consists of 8.9 Ac. 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. Any by-pass flows will continue south as curb and gutter flow and combine with Basin P1-A5 developed flows to Design Point 7. The total developed flow at this northerly pipe outlet location into Pond FSD-16 is represented by **Design Point 4 (Q_5 = 218 cfs, Q_{100} = 379 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 31.4 Ac. of site development for the 158 urban residential lots proposed within this Villages at Sterling Ranch PUDSP. This basin also includes a small portion of the Sterling Ranch East Preliminary Plan No. 1 (PCD No. SP-22-004 – currently under review) just east of Sand Creek, north of Briargate Pkwy. This basin will contain multiple designed low points planned for public Type R sump inlets with all the captured flows being routed to **Design Point 5 (Q_5 = 53 cfs, Q_{100} = 102 cfs).** This location represents the easterly pipe outlet into Pond FSD-16. The design of the required concrete forebay, impact structure, trickle channel at this outfall and individual inlet and pipe sizing will be provided with the Final Drainage Report. For further drainage basin details reference sheet 7 of 7. 100% of the Foursquare at Sterling Ranch site will have stormwater quality treatment through Pond FSD-16, constructed with this development and off-site Pond FSD-14A, constructed with Sterling Ranch East Filing No. 1.

Verify

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 6 (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 previously mentioned Sterling Ranch MDDP Amendment, 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):

State that this is ultimate design. Address interim in FDR.

Update per MHFD sheet redlines

<u>Detention Pond FSD-16</u> (Full Spectrum EDB)

Total Tributary Acreage: 220.9 ac.

3.6 Ac.-ft. WQCV

7.2 Ac.-ft. EURV

12.4 Ac.-ft. 100-yr. Storage

23.2 Ac.-ft. Total

Total Peak In-flow (SWMM Model): Q_5 = 323 cfs, Q_{100} = 499 cfs

Pond Peak Design Release (MHFD Sheet): Q_5 = 24.2 cfs, Q_{100} = 150.5 cfs

Pre-development Release (MHFD Sheet): Q_5 = 57.3 cfs, Q_{100} = 256.4 cfs

(Ownership and maintenance by the Sterling Ranch 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 September 2022. These referenced design plans provide a 48" RCP outfall pipe at this location with an allowable release rate of (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_{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 September 2022 for these design documents. The developer acknowledges that construction timing for the Sand Creek channel improvements, including Pond W3 and the two culvert crossings of Briargate Parkway and Sterling Ranch Road is key for the development of the Foursquare at Sterling Ranch. The final drainage report will further discuss this off-site construction timing/sequencing and any interim facilities that may be needed.

Sand Creek and

As shown on Drainage Map 2 of 7, the proposed development site straddles two existing basins within the East Fork Sand Creek. (Basin EX-9 and EX-10A) Upon development of Foursquare at Sterling Ranch and the construction of Briargate Parkway, Sterling Ranch Road and Pond FSD-16, all the area within these two basins north of Briargate Parkway and Sterling Ranch Road will be routed via the proposed 48" RCP storm system within Sterling Ranch Road and ultimately enter Sand Creek at the crossing with Sterling Ranch Road. These developed flows are no longer tributary to the East Fork Sand Creek. The remaining portion of these basins south and east of the newly constructed major roadways, along with historic basins EX-8, EX-8A and EX-9A will continue to sheet flow in a southerly direction within the East Fork Sand Creek Drainage Basin towards the south property line of the overall Sterling Ranch property. The ultimate intent for the overall Sterling Ranch development east of Sand Creek is to maintain the pre-developed release rates and locations to the greatest extent possible. As further development takes place within the Sterling Ranch East Preliminary Plan No. 1 (PCD No. SP-22-004 – currently under review) and the Villages at Sterling Ranch (PCD No. PUDSP-226 – currently under review), more developed flows will be routed from the East Fork Sand Creek into Sand Creek. However, as presented on Drainage Map 6 of 7, the release into the East Fork Sand Creek will be re-balanced with the construction of Pond FSD-14B and the use of level spreaders along the south boundary line. Release into Sand Creek is re-balanced with the construction of Ponds FSD-14A and FSD-11B. All three of these facilities are planned to be full spectrum detention ponds.

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 September 2022. Reference this report as well as the "Sterling Ranch Road and Briargate Pkwy. Street Plans", prepared by JR Engineering, LLC, dated September 2022 for inlet and pipe sizes through this corridor. These final designed facilities are shown and labeled on the drainage map. However, as described in the referenced Sterling Ranch MDDP Amendment, these final storm plans will be adjusted prior to formal storm sewer approval to show these developed flows now being routed south down Sterling Ranch Road.

Design Point 7 (Q_5 = 20 cfs, Q_{100} = 39 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. **Basin P1-A5 (Q_5 = 13 cfs, Q_{100} = 25 cfs)** and **Basin P1-A6 (Q_5 = 7 cfs, Q_{100} = 14 cfs)** consist of 5.7 Ac. and 2.8 Ac. respectively, 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 then south down Sterling Ranch Road. The anticipated storm system at this point is a 42" RCP. The emergency overflow release for this low point in Briargate Pkwy. is planned to be maximum ponding of 1.0' and then around the corner and south down Sterling Ranch Road. Final design of the roadway in this area will allow for a median break for this emergency release from the north side of the road.

Address allowable criteria for a Principal Arterial ("The depth of water shall not exceed 8 inches at the gutter flow line with no curb overtopping.")

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 Quality Capture Volume (WQCV) and Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume that will release the more frequent storms at a slower rate to help minimize the effects of development of the property. The proposed detention/SWQ facilities are to be private facilities with ownership and maintenance by the Sterling Ranch Metropolitan District.

SAND CREEK CHANNEL IMPROVEMENTS

As mentioned previously, the Sand Creek channel exists westerly and outside of this property. All required improvements to the Sand Creek channel adjacent to this property are described in a separate report prepared by JR Engineering, "Final Design Report for Sand Creek Restoration", dated September 2022. Please reference this report for all adjacent creek improvement requirements and associated wetland mitigation plans and permitting within jurisdictional waters. CORE Consultants is the wetland consultant working with JR Engineering, LLC on this stretch of Sand Creek. They are coordinating the effort with the Corps. of Eng. for the required 404 permitting for all the proposed channel improvements. The two public roadway crossings of Sand Creek (Briargate Pkwy. and Sterling Ranch Road) are currently covered under a 404 permit (Action No. SPA-2015-00428-SCO) with the previous land owner dated February 2016. JR Engineering, LLC is also coordinating a CLOMR/LOMR for this stretch of Sand Creek that is west of the site and defined as Reach SC-8 (south of Briargate Pkwy.) and SC-9 north of Briargate Pkwy.).

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. General on-site and off-site basin design used for detention/SWQ basin sizing was calculated using the EPA Storm Water Management Model method (SWMM) Ver. 5.1. Rain Gage inputs based on City of Colorado Springs 2-hr. design storm distributions. Basin imperviousness of the particular land uses in accordance with Table 6-6. The Horton infiltration method used in basin modeling. Mile High Flood District (MHFD)-Detention spreadsheet Ver. 4.05 used for Preliminary Detention/SWQ design. (See Appendix)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

At this point, this site generally adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Proposed urban lot impervious area (roof tops, patios, etc.) will sheet flow across landscape areas (yards) and open space areas to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets or detention facilities. This will minimize directly connected impervious areas within the project site. Water quality reduction will be employed for specific areas that are anticipated not able to be captured and routed to a SWQ facility.

2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through the front and rear yards, developed flows will travel via curb and gutter within the public streets of the development and eventually public storm systems. These collected flows are then routed directly to the proposed extended detention basin (full-spectrum facility). Sand Creek improvements and restoration plans are being proposed for this entire reach as described in "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV and excess urban runoff volume (EURV) in the proposed Full-Spectrum permanent Extended Detention Basin designed per current El Paso County drainage criteria.

4. **Consider need for Industrial and Commercial BMPs**: No industrial uses are proposed within this development. A site-specific storm water quality and erosion control plan and narrative will be submitted along with the grading and erosion control plan. Details such as site-specific sediment and erosion control construction BMP's as well as temporary and permanent BMP's were detailed in this plan and narrative to protect receiving waters. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

FLOODPLAIN STATEMENT

No portion of this site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Numbers 08041C 0533G and 08041C 0535G with effective dates of December 7, 2018 and the previously mentioned LOMR 08-08-0541P with an effective date of July 23, 2009. (See Appendix).

DRAINAGE AND BRIDGE FEES

This site lies entirely within the Sand Creek Drainage Basin boundaries.

Fees are calculated using the following impervious acreage method approved by El Paso County. The final fee estimate will be included in the Final Drainage Report(s), however, the following represent fee estimates based on the Sterling Ranch East Preliminary Plan/PUD submittal with a total area of 35.76 acres with the following different land uses proposed:

16.59 Ac.	Open Space / Pond Tracts
20.17 Ac.	Less than 6000 SF lot size
36.76 Ac.	**Total**

The percent imperviousness for this subdivision is calculated as follows:

Fees for Open Space / Pond Tracts

(Per El Paso County Percent Impervious Chart: 7**%**)

16.59 Ac. x 7% = **1.16 Impervious Ac.**

Fees for less than 6000 SF lots

(Per El Paso County Percent Impervious Chart: 65**%)**

20.17 Ac. x 65% = **13.11 Impervious Ac.**

Total Impervious Acreage: 14.27 Imp. Ac.

The following calculations are based on the 2022 Sand Creek drainage/bridge fees:

ESTIMATED FEE TOTALS:

Bridge Fees

\$ 8,923.00 x 14.27 Impervious Ac.	=	**\$ 127,331.21**

Drainage Fees

\$ 21,814.00 x 14.27 Impervious Ac.	=	**\$ 311,285.78**

SUMMARY

The proposed Sterling Ranch East Preliminary Plan/PUD No. 2 is within the Sand Creek Drainage Basin. Recommendations are made within this report concerning necessary improvements that will be required as a result of development of this property. The points of storm water release from the proposed site are required to be at or below the calculated historic flow quantities. The development of the proposed site does not significantly impact any downstream facility or property to an extent greater than that which currently exists in the pre-development conditions. All drainage facilities within this report were sized according to the Drainage Criteria Manuals and the full-spectrum storm water quality requirements.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Marc A. Whorton, P.E.
Project Manager

maw/118320/PDR.doc

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

2. "Urban Storm Drainage Criteria Manual Volume 1, 2 & 3" Urban Drainage and Flood Control District, dated January 2016.

3. "Sand Creek Drainage Basin Planning Study," Kiowa Engineering Corporation, dated March 1996.

4. "2018 Sterling Ranch MDDP", M&S Civil Consultants, Inc., June 2018

5. "Final Drainage Report for Retreat at TimberRidge Filing No. 1", Classic Consulting, approved November, 2020.

6. "Final Drainage Report for Retreat at TimberRidge Filing No. 2", Classic Consulting, dated March, 2022

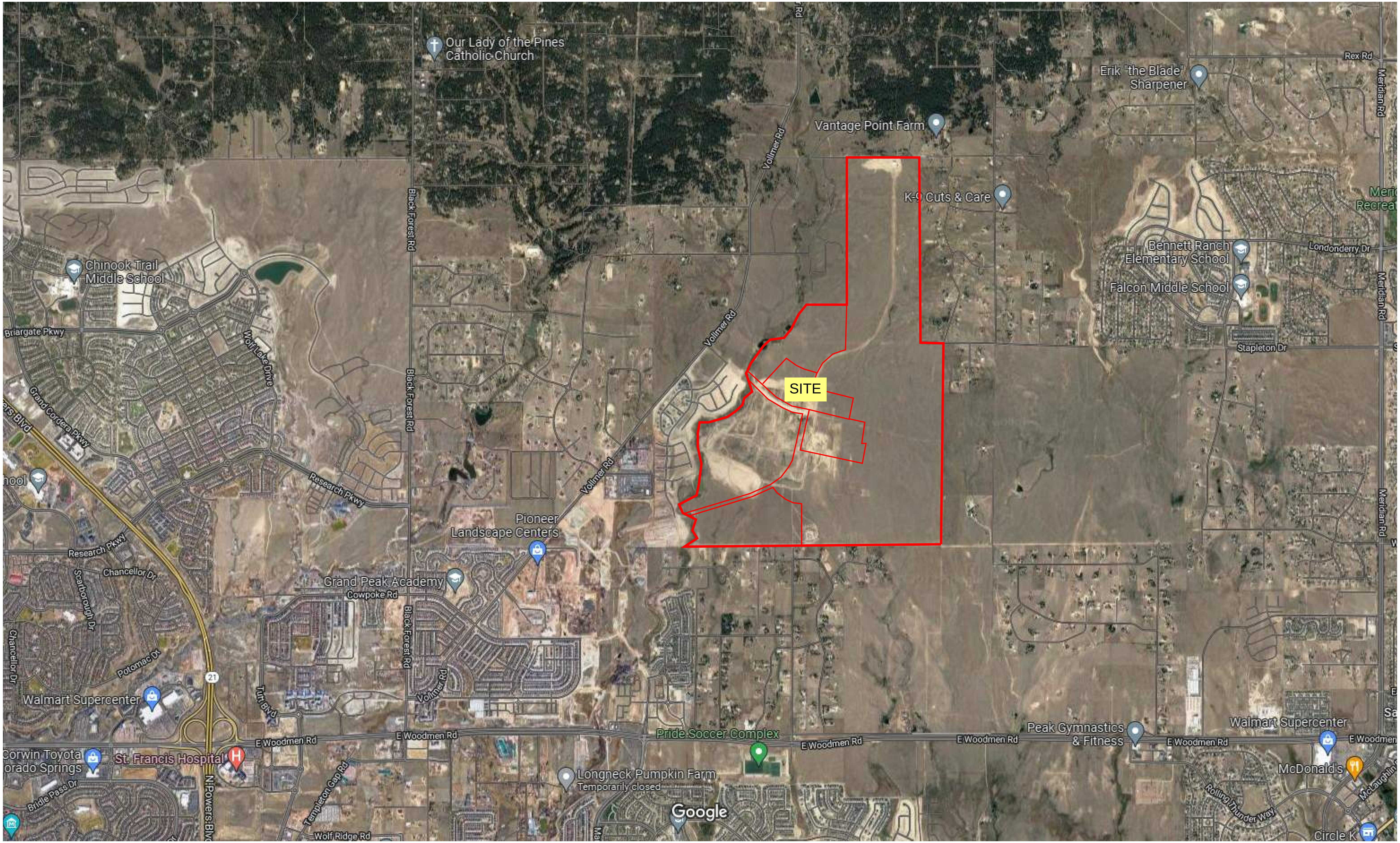
7. "Final Design Report for Sand Creek Restoration", JR Engineering, LLC, dated September 2022

8. "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated September 2022

9. "Master Development Drainage Plan Amendment for Sterling Ranch", prepared by JR Engineering, LLC, dated September 2022

APPENDIX

VICINITY MAP



Imagery ©2022 Landsat / Copernicus, Maxar Technologies, USDA/FPAC/GEO, Map data ©2022 2000 ft

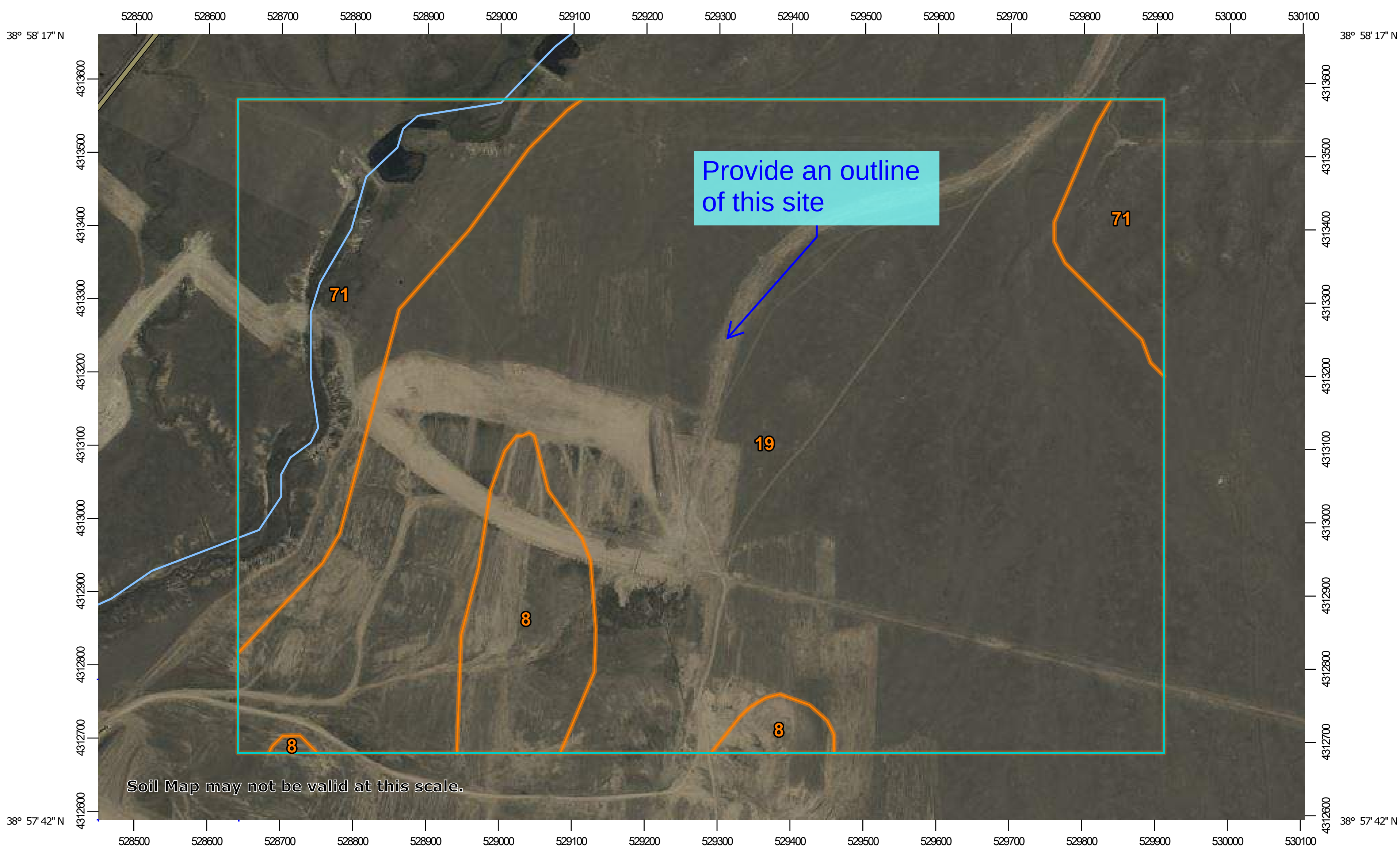
VICINITY MAP

SOILS MAP (S.C.S SURVEY)

Soil Map—El Paso County Area, Colorado

104° 40' 17" W

104° 39' 9" W



104° 40' 17" W

104° 39' 9" W

Map Scale: 1:7,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 350, 700, 1400, 2100

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	17.5	6.2%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	213.6	75.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	50.3	17.9%
Totals for Area of Interest		**281.4**	**100.0%**

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

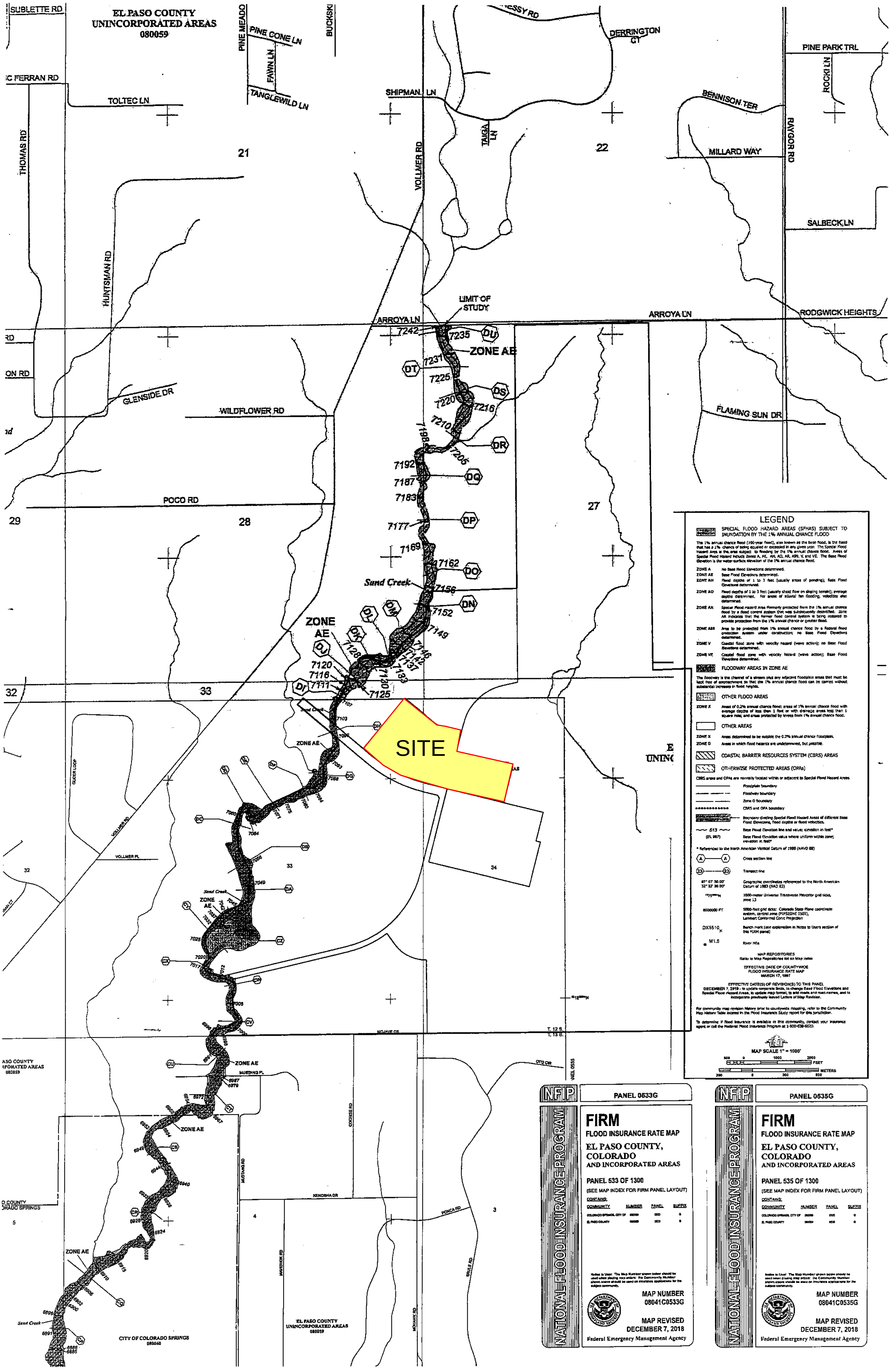
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

F.E.M.A. MAP / LOMR (08-08-0541P)

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS


EL PASO COUNTY
UNINCORPORATED AREAS
080059
SUBLETTE RD
PINE MEADO
PINE CONE LN
FAWN LN
TANGLEWILD LN
BUCKSKI
DERRINGTON CT
PINE PARK TRL
ROCKI LN
C FERRAN RD
TOLTEC LN
SHIPMAN LN
BENNISON TER
TAIGA LN
RAYGOR RD
THOMAS RD
21
22
VOLLMER RD
MILLARD WAY
SALBECK LN
HUNTSMAN RD
LIMIT OF STUDY
ARROYA LN
ARROYA LN
RODGWICK HEIGHTS
GLENSIDE DR
WILDFLOWER RD
FLAMING SUN DR
ZONE AE
POCO RD
29
28
27
Sand Creek
ZONE AE
32
33
SITE
ZONE AE
VOLLMER PL
34
MOJAVE DR
T. 12 S.
T. 13 S.
MUSTANG PL
KENOSHA DR
PONCA RD
CITY OF COLORADO SPRINGS
080060
EL PASO COUNTY
UNINCORPORATED AREAS
080059
LEGEND
SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
FLOODWAY AREAS IN ZONE AE
OTHER FLOOD AREAS
OTHER AREAS
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
OTHERWISE PROTECTED AREAS (OPAs)
MAP SCALE 1" = 1000'
NFIP
PANEL 0533G
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 533 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
MAP NUMBER
08041C0533G
MAP REVISED
DECEMBER 7, 2018
Federal Emergency Management Agency
NATIONAL FLOOD INSURANCE PROGRAM
NFIP
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)
MAP NUMBER
08041C0535G
MAP REVISED
DECEMBER 7, 2018
Federal Emergency Management Agency
NATIONAL FLOOD INSURANCE PROGRAM

REFERENCE MATERIAL

MASTER DEVELOPMENT DRAINAGE PLAN FOR STERLING RANCH

OCTOBER 2018

Prepared for:

Morley-Bentley Investments, LLC
20 Boulder Crescent, 2nd Floor
Colorado Springs, CO 80903
(719) 471-1742

Prepared by:

CIVIL CONSULTANTS, INC.

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

Project #09-002
SKP-18-003
SF-17-024

at DP87 culminating in peak runoff rates within Sand Creek of Q5 = 374.6 cfs, Q100 = 1905.9 cfs.

Basin SC3-16A (Q5 = 120.4 cfs, Q100 = 351.8 cfs) consists of a 168.1 acre area located within Sterling Ranch, that is located north of Briargate Parkway and east of Sand Creek Channel. This portion of Sterling Ranch is planned to house residential development that ranges from low density rural lots 1 acres in size to medium density urban residential with lots ranging in size from 0.1 to 0.2 acres. Runoff from the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond (FSD16A), at the northwest corner of Briargate Parkway and Sterling Ranch Road. The treated detained flows from the pond will discharge to DP22 at peak flow rates of 8.8 cfs and 128.3 cfs in the 5 and 100 year events respectively.

Basin SC3-16B (Q5 = 53.7 cfs, Q100 = 143.8 cfs) consists of a 50.7 acre area located within Sterling Ranch, that is located north of Briargate Parkway and east of Sand Creek Channel. This portion of Sterling Ranch is planned for a low to medium density residential lots ranging in size from 0.1 to 0.2 acres lots and portions of roadways. Runoff from the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond (FSD16B), at the northeast corner of Briargate Parkway and Sterling Ranch Road. The treated detained flows from the pond will discharge to DP22 at peak flow rates of 0.4 cfs and 28.1 cfs in the 5 and 100 year events respectively. The combined peak flow rates from SC3-16B and FSD14A (DP22, Q5=8.8 cfs and Q100=174.9 cfs) will be conveyed south via storm sewer system to DP21.

Basin SC3-14B (Q5 = 34.3 cfs, Q100 = 94.1 cfs) consists of a 34.7 acre area located within of Sterling. Ranch, that is located between south of Briargate Parkway and east of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch is planned for a low to medium density residential lots ranging in size from 0.1 to 0.33 acres lots and portions of roadways. Runoff from the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond (FSD14B), at the south end of the basin. The treated detained flows from the pond will discharge to DP21 at peak flow rates of 0.3 cfs and 19.3 cfs in the 5 and 100 year events respectively. The combined peak flow rates from DP22 and FSD14B (DP21, Q5=8.8 cfs and Q100=174.9 cfs) will be conveyed to Pond W3 above the intersection of Sand Creek channel and Sterling Ranch Road.

Basin SC3-14A (Q5 = 175.4 cfs, Q100 = 466.3 cfs) consists of a 164.9 acre area located within of Sterling. Ranch, that is located between south of Briargate Parkway and east of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch is planned for a k-8 school site, several single family residential lots ranging in size from 0.2 to 0.33 acres lots as well as portions of park and open space. Runoff from the basin shall be collected and conveyed within street and storm sewer systems and directed to a full spectrum detention pond (FSD14A), at the southwest corner of the basin. The treated detained flows from the pond will discharge to Pond W3 at peak flow rates of 7.5 cfs and 142.2 cfs in the 5 and 100 year events respectively.

Basin SC3-13 (Q5 = 57.8 cfs, Q100 = 136.9 cfs) consists of a 41.0 acre area located within of Sterling. Ranch, that is located just the east of the Barbarick Subdivision and north of Sterling Ranch Road. This portion of Sterling Ranch is planned for residential lots ranging in size from 0.1 to 0.2 acres in size. Runoff from the basin shall be collected by storm sewer systems and conveyed to a full spectrum detention pond (FSD13) located in the south end of the basin, adjacent to sand creek. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 4.2 cfs and 47.2 cfs in the 5 and 100 year events respectively.

Runoff from DP87, DP21 and from FSD Ponds 13, and 14A will combine within the Sand Creek Channel at proposed Regional Pond Detention Facility W3. The purpose of the regional pond is to reduce the post development flow rates within the Sand Creek Channel at the Southern Sterling Ranch boundary to at or below the existing flow rates calculated by this report. The pond is also necessary due to the drainage basin diversion, as discussed in other parts of this report. The total combined discharge reaching the regional facility (Pond W-3) has been calculated at 374.5 cfs and 2204.1 cfs in the 5 and 100 year events respectively.

As conceptually designed the proposed facility will utilize a check/diversion wall located upstream of the existing stock pond and proposed detention facility that will function to divert base flows within the channel to aid in retaining a fixed water surface within the existing stock pond and in larger storm events diverted flows safely around the amenity to the west side to detention Pond W3. A small controlled outlet structure along with an improved downstream embankment will be added to the existing stock pond to stabilize it and retain a fixed maximum water surface elevation. In the larger detention pond eight (8) small 24” storm sewer pipe located within a separate embankment will allow for free flow discharge of 2 year runoff and begin to detain flows of 5 years and larger events. Flows exiting the small storm pipes or overtopping the separated embankment will enter a concrete forebay that conveys drainage to two (2) cell 8’h x10’w concrete box culvert (CBC) under Proposed Sterling Ranch Road to DP68. As the anticipated flow rate leaving the pond is planned to be less than 1,500 cfs, and the proposed culvert crossing is conceptually planned to have an open area of less than 200 ft sq of open area and thus will need to meet the headwater requirements of Table 6-5 of the DCM, which in this concept design is a ratio of about ~1.3. The total combined discharge calculated to leave the regional facility (Pond W-3) has been calculated at 200.3 cfs and 1,350.6 cfs in the 5 and 100 year events respectively, with a maximum 100 year water surface of 7017.3, a

HW/D ratio of ~1.3. The peak detained volume has been estimated at 78.2 ac-ft. A low point in Sterling Ranch Road will be designed adjacent to the facility to provide a safe overflow route. An exhibit showing the concept design and its various elements is included in the appendix of this report.

As previously discussed a Condition Letter of Map Revision and Letter of Map Revision (CLOMR/LOMR) will need to be processed through the Federal Emergency Management Agency (FEMA) to revise the hydrology to the Sand Creek Channel and allow for the remapping of the revised floodplains. It should be noted that the DBPS flow rates for Reach SC-8 (Reach 163) adjacent to this location were estimate to be 2,630 cfs and that the effective FEMA 100 year flow rate is 2,600cfs. A comparison table of the various flow rates is provided later in this text and on the accompanying drainage maps.

The final design of the culvert crossing and final determination of approved rates as well as the final pond design will be discussed within the future Sterling Ranch Channel Design Report and Sand Creek CLOMR/LOMR documents. No deviations for this pond and accompanying outlet structure are anticipated at this time.

It is important to note that the planned discharge outlet pipe for the FSD pond located to the west of the pond W3 will need to be extended to the downstream outlet side of the culvert to ensure that the 100 year water surface elevation with W3 does not affect the functionality of the adjacent FSD and its storm sewer systems.

In regards to timing, the need to construction this facility can be tied to the Sand Creek Channel improvements which is discussed within this report and also within the Subdivision Improvements Agreement. In no case should runoff from the East Fork of Sand Creek be diverted to the Main Branch of the Sand Creek Channel prior to the construction and of this facility.

Basin SC3-11A (Q5 = 7.8 cfs, Q100 = 24.3 cfs) consists of a 10.7 acre area located within of Sterling. Ranch, that is south of Sterling Ranch Road, west of Sand Creek. This portion of Sterling Ranch consists of single family residential for lots ranging in size from 0.2 to 0.3 acres in size and open space associated with the Sand Creek Channel. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond FSD11A. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 0.9 cfs and 12.3 cfs in the 5 and 100 year events respectively just upstream of DP-63. It should be noted that this detention facility may not be necessary if grading can be oriented to force surface runoff to the west.

Basin SC3-11B (Q5 = 81.3 cfs, Q100 = 213.7 cfs) consists of a 76.6 acre area located within of Sterling. Ranch, that is south of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch consists of single family residential planned for lots ranging in size from 0.2 to 0.3 acres in size and a portion of a park site and collector roadways. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems westward to a full spectrum detention pond FSD11B. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 4.5 cfs and 69.5 cfs in the 5 and 100 year events respectively. The runoff from DP68 and from FSD ponds 11A and 11B combine at DP63 at peak flow rates of Q5 = 201.0 cfs, Q100 = 1385.1, which is less than the anticipated existing modeled flow rates of Q5 = 430.7 cfs, Q100 = 1911.5 at DP63. Runoff from DP63 continues south within the Sand Creek Channel toward DP61.

Basin SC3-7 (Q5 = 69.9 cfs, Q100 = 157.2 cfs) consists of a 45.7 acre industrial zoned area, referred to as the Barbarick Subdivision, located outside of Sterling Ranch. Per the Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3and 4 the filing consists of four lots which upon which development will be constructed which will include adding a proposed Extended Detention Basin within Lot 4. This detention basin will provide water quality treatment for portions of Lots 1 & 2, and Lots 3 & 4. The EBD will structure will outfall at the south end of Lot 4 at the Barbarick Subdivision/Sterling Ranch property line. Per the report the proposed total outflow from the EDB pond will be Q5 = 0.3 cfs, Q100 = 45.9** cfs(**which includes pass through flows of 29.4 cfs). A second Sand Filter Basin water quality detention catchment will be provided at the southeast/downstream end of Lot 2. The SFB will outfall at the southeast corner of the Lot 2 at the Barbarick Subdivision/Sterling Ranch property line. Per the report the proposed total outflow the SFB pond will be Q5 = 0.1 cfs, Q100 = 3.6 cfs. At the initial writing of this report, neither EDB nor SFB structure has been fully constructed, and thus the assumption was made to utilize the full un-detained untreated runoff from the offsite development for onsite drainage planning purposes. Thus the downstream facilities planned within Sterling Ranch will account for the total un-detained runoff from the parcel of Q5 = 69.9 cfs, Q100 = 157.2 cfs and will plan to treat the total runoff onsite facilities. This provides a conservative approach for master planning. Runoff discharged from the property will be collected by proposed storm sewer within Sterling Ranch and routed to DP64. These facilities and their effects on drainage will be re-reviewed with subsequent drainage report and shall be implemented into final design and construction.

Basin SC3-6B (Q5=43.4 cfs, Q100=102.7 cfs) consists of a 30.9 acre area located within of Sterling Ranch, that is north of Sterling

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.

<u>Drainage Basin Descriptions</u>

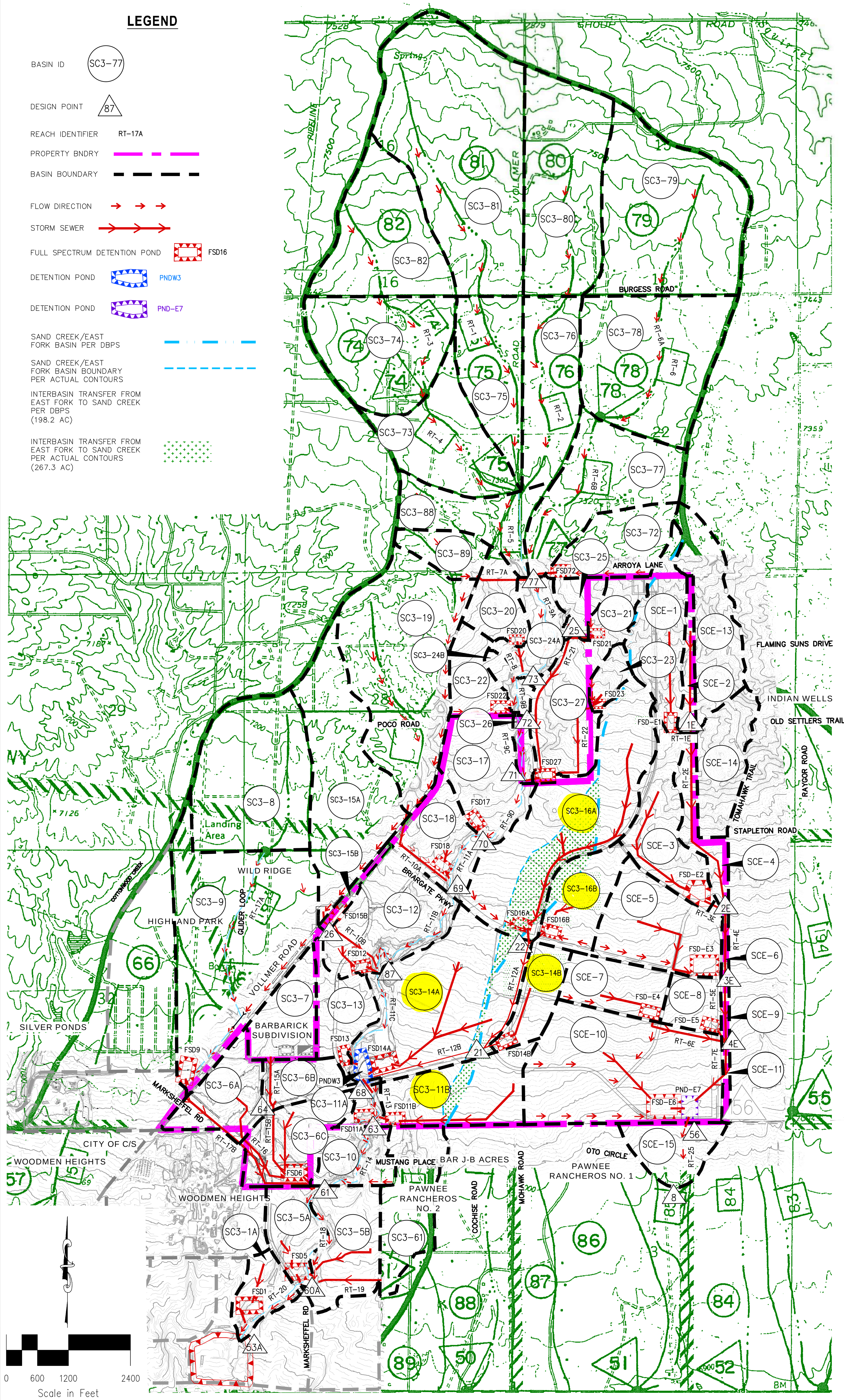
<u>Developed Sand Creek (Main Stem) Basin Flows</u>

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.



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)
SC3-1A	73	27.8	0.044	16.3	23.3	33.0	45.8	57.1	68.9
SC3-5A	84	39.1	0.061	40.6	53.7	71.0	92.4	110.6	129.1
SC3-5B	81	63.0	0.098	53.8	73.0	98.5	130.8	158.6	187.0
SC3-6A	88	49.3	0.077	61.4	79.3	102.2	130.1	153.6	177.1
SC3-6B	85	30.9	0.048	32.9	43.4	57.0	73.9	88.2	102.7
SC3-6C	82	58.0	0.091	53.9	72.5	97.1	128.0	154.5	181.5
SC3-7	88	45.7	0.071	54.0	69.9	90.3	115.2	136.2	157.2
SC3-8	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
SC3-9	66	217.4	0.340	45.8	71.5	108.6	158.9	204.9	254.0
SC3-10	63	36.0	0.056	7.6	12.3	19.4	29.1	38.0	47.7
SC3-11A	70	10.7	0.017	5.3	7.8	11.3	15.9	20.0	24.3
SC3-11B	80	76.6	0.120	59.4	81.3	110.8	148.1	180.5	213.7
SC3-12	81	88.2	0.138	77.8	105.6	142.5	189.1	229.1	270.0
SC3-13	85	41.0	0.064	43.9	57.8	76.0	98.5	117.6	136.9
SC3-14A	79	164.9	0.258	127.6	175.4	239.8	321.9	393.2	466.3
SC3-14B	77	34.7	0.054	24.6	34.3	47.4	64.2	79.0	94.1
SC3-15A	62	139.7	0.218	21.3	35.5	56.3	85.3	112.1	141.0
SC3-15B	87	7.9	0.012	10.8	14.0	18.2	23.3	27.6	31.9
SC3-16A	74	168.1	0.263	84.4	120.4	170.0	234.8	292.2	351.8
SC3-16B	78	50.7	0.079	39.0	53.7	73.6	99.0	121.1	143.8
SC3-17	73	70.6	0.110	41.8	59.6	85.2	119.0	149.1	180.6
SC3-18	81	53.8	0.084	49.3	67.1	91.0	121.2	147.3	174.0
SC3-19	62	184.0	0.287	28.8	47.7	75.7	114.4	150.2	188.8
SC3-20	65	34.2	0.053	9.9	15.5	23.8	35.1	45.5	56.6
SC3-21	66	23.3	0.036	7.0	10.8	16.3	23.7	30.4	37.5
SC3-22	65	33.9	0.053	9.4	14.8	22.5	32.9	42.5	52.6
SC3-23	67	14.5	0.023	5.5	8.3	12.4	18.0	23.0	28.4
SC3-24A	65	35.7	0.056	13.0	20.4	31.1	45.7	59.0	73.2
SC3-24B	65	12.2	0.019	3.4	5.3	8.1	11.8	15.2	18.9
SC3-25	66	19.0	0.030	5.8	8.9	13.4	19.5	25.1	31.0
SC3-26	63	10.0	0.016	2.5	4.0	6.2	9.2	12.1	15.1
SC3-27	71	70.0	0.109	35.1	51.2	73.8	103.7	130.3	158.3
SC3-61	63	65.5	0.102	13.7	22.0	34.4	51.6	67.6	84.8
SC3-72	64	56.2	0.088	12.8	20.2	31.4	46.7	60.9	76.0
SC3-73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
SC3-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
SC3-75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
SC3-76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
SC3-77	62	106.9	0.167	16.6	27.6	43.8	66.2	87.0	109.4
SC3-78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
SC3-79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
SC3-80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
SC3-81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
SC3-82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3
SC3-88	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0
SC3-89	62	27.5	0.043	6.1	10	15.7	23.6	30.8	38.6
SCE-1	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4
SCE-2	64	15.0	0.023	4.4	7.0	10.8	15.9	20.7	25.7
SCE-3	70	67.5	0.105	30.6	45.2	65.9	93.3	118.0	143.9
SCE-4	70	29.5	0.046	13.3	19.6	28.6	40.6	257.8	62.6
SCE-5	87	85.5	0.134	100.4	130.6	169.6	217.4	257.8	298.4
SCE-6	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6
SCE-7	89	44.9	0.070	58.9	75.5	96.6	122.2	143.7	165.2
SCE-8	92	25.5	0.040	38.6	48.4	60.7	75.4	87.7	99.9
SCE-9	64	4.0	0.006	1.5	2.4	3.6	5.3	6.8	8.5
SCE-10	83	174.3	0.272	7.6	189.4	19.4	29.1	398.9	467.5
SCE-11	64	5.8	0.009	2.3	3.6	5.5	8.0	10.3	12.8
SCE-13	63	78.6	0.123	19.6	31.3	48.7	73.1	95.7	120.0
SCE-14	63	52.5	0.082	13.2	21.2	33.3	49.9	65.2	81.7
SCE-15	51	39.7	0.062	2.2	5.1	10.1	17.7	25.1	33.4

DESIGN POINT SUMMARY

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-77	2.343	209.9	351.9	580.6	886.6	1168.4	1467.7	ARROYA LANE X-ING
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP-73	2.471	207.5	354.3	588.5	897.1	1187.2	1506.7	
DP-72	2.543	206.2	352.5	586.7	897.2	1195.3	1518.6	POCO ROAD X-ING
DP-71	2.757	205.9	349.3	610.5	932.4	1226.9	1612.2	STERLING RANCH NORTHERN BNDRY
DP-70	2.867	205.3	349.8	614.0	940.1	1260.6	1636.7	
DP-69	3.238	212.7	366.6	653.7	1010.6	1364.1	1775.7	BRIARGATE PARKWAY X-ING
DP-87	3.594	216.9	374.6	681.9	1072.1	1471.5	1905.9	
DP-68	4.312	214.6	374.5	714.9	1187.6	1674.9	2204.1	UPSTREAM OF POND W3
DP-64	0.119	85.9	112.1	145.9	187.5	222.6	258.0	
DP-63	4.449	154.4	201.0	375.7	815.9	1112.1	1385.1	STERLING RANCH SOUTHERN BNDRY
DP-61	5.356	156.6	223.9	428.0	928.2	1287.3	1620.1	COLORADO SPRINGS/EL PASO BNDRY
DP-60A	5.617	161.6	224.8	439.1	950.4	1320.5	1661.8	MARKSHEFFEL X-ING
DP-53A	5.661	161.6	225.7	441.8	951.1	1326.0	1668.9	SAND CREEK AND POND 3
DP-1E	0.247	23.9	38.3	70.1	132.8	173.0	220.9	
DP-2E	0.486	48.9	76.8	123.0	228.7	319.7	419.4	
DP-3E	0.626	48.5	75.7	122.2	271.1	387.1	500.1	
DP-4E	0.745	48.1	76.2	122.4	286.9	407.3	534.8	
DP-56	1.017	23.1	35.3	71.5	108.3	152.1	196.4	NEAR SE PROP CORNER
DP-8	1.079	24.1	37.2	73.5	111.3	155.4	200.7	BELOW SE PROP CORNER
DP-21	0.396	0.6	8.8	17.8	57.1	116.8	174.9	
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4	
DP-25	0.066	5.9	9.1	16.3	35.1	46.4	58.2	
DP-26	0.012	0.1	1.1	3.2	7.3	9.5	12.0	

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-77	2.343	37.7	57.4	85.9	125.1	161.1	199.9	ARROYA LANE X-ING
DP-78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP-73	2.471	40.0	60.8	91.0	132.5	170.7	211.7	
DP-72	2.543	41.3	62.9	94.0	136.8	176.2	218.5	POCO ROAD X-ING
DP-71	2.757	46.3	70.0	104.3	151.3	194.5	240.8	STERLING RANCH NORTHERN BNDRY
DP-70	2.867	49.5	74.5	110.6	160.1	205.4	254.0	
DP-69	3.238	57.5	86.1	127.4	183.8	235.3	290.6	BRIARGATE PARKWAY X-ING
DP-87	3.594	66.5	98.9	145.6	209.1	267.1	329.1	
DP-68	4.312	81.8	123.7	183.9	264.9	338.0	415.8	UPSTREAM OF POND W3
DP-64	0.119	7.0	9.1	11.8	15.2	18.1	21.1	
DP-63	4.449	85.6	129.5	192.3	276.7	352.8	433.5	STERLING RANCH SOUTHERN BNDRY
DP-61	5.356	103.7	157.8	235.1	338.4	431.3	529.8	COLORADO SPRINGS/EL PASO BNDRY
DP-60A	5.617	111.0	168.6	250.4	359.5	457.7	561.5	MARKSHEFFEL X-ING
DP-53A	5.661	112.0	170.0	252.6	362.6	461.7	566.5	SAND CREEK AND POND 3
DP-1E	0.247	3.1	5.2	8.4	12.7	16.6	20.9	
DP-2E	0.480	6.1	10.4	16.9	25.7	33.7	42.2	
DP-3E	0.620	7.0	13.7	23.4	36.1	47.4	59.3	
DP-4E	0.736	7.6	15.6	27.2	43.0	57.2	72.0	
DP-56	1.017	7.7	16.1	28.6	51.3	71.7	92.9	NEAR SE PROP CORNER
DP-8	1.079	8.0	16.7	26.6	53.0	74.0	95.9	BELOW SE PROP CORNER
DP-21	0.396	6.3	11.3	18.3	27.5	35.6	44.0	
DP-22	0.736	6.3	10.7	16.7	24.6	31.5	38.7	
DP-25	1.017	1.3	1.9	2.8	4.1	5.2	6.4	
DP-26	1.079	0.7	0.9	1.2	1.5	1.8	2.1	

WATER QUALITY & DETENTION POND SUMMARY

FSD1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	16.3	23.3	33.0	45.8	57.1	68.9
ALLOWABLE RELEASE (CFS)	0.1	1.7	3.3	10.9	17.5	25.5
MODELED RELEASE (CFS)	0.1	1.6	3.2	10.9	17.4	25.4
STORED VOLUME (AC-FT)	2.4	2.6	3.0	3.6	1.9	2.2

FSD5						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	40.6	53.7	71.0	92.4	110.6	129.1
ALLOWABLE RELEASE (CFS)	0.1	1.4	2.6	11.3	19.8	30.2
MODELED RELEASE (CFS)	0.1	1.4	2.6	11.2	19.7	30.1
STORED VOLUME (AC-FT)	3.0	3.2	3.8	4.1	4.7	5.2

FSD6						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	196.5	258.5	339.1	438.7	523.3	608.6
ALLOWABLE RELEASE (CFS)	0.5	7.6	14.6	58.4	99.6	149.7
MODELED RELEASE (CFS)	0.5	7.5	14.5	58.2	99.6	149.6
STORED VOLUME (AC-FT)	15.5	16.4	18.7	20.8	23.3	26.0

FSD9						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	64.6	105.6	169.5	252.3	327.1	410.1
ALLOWABLE RELEASE (CFS)	1.7	24.9	49.8	141.1	207.2	290.0
MODELED RELEASE (CFS)	1.7	24.9	49.8	141.1	207.0	289.9
STORED VOLUME (AC-FT)	8.7	8.7	9.6	10.8	12.3	13.8

FSD11A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	5.3	7.8	11.3	15.9	20.0	24.3
ALLOWABLE RELEASE (CFS)	0.1	1.6	3.2	7.5	9.7	12.4
MODELED RELEASE (CFS)	0.2	0.9	3.0	7.5	9.7	12.3
STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6

FSD11B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	59.4	81.3	110.8	148.1	180.5	213.7
ALLOWABLE RELEASE (CFS)	0.3	4.5	8.7	29.6	47.7	69.6
MODELED RELEASE (CFS)	0.3	4.5	8.6	29.5	47.7	69.5
STORED VOLUME (AC-FT)	4.8	4.9	5.5	6.4	7.3	8.2

FSD12						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	77.8	105.6	142.5	189.1	229.1	270.0
ALLOWABLE RELEASE (CFS)	0.9	13.2	26.7	62.0	80.2	103.2
MODELED RELEASE (CFS)	0.9	9.0	26.7	61.9	80.1	103.1
STORED VOLUME (AC-FT)	5.2	5.5	5.8	6.7	7.8	8.9

FSD13						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	43.9	57.8	76.0	98.5	117.6	136.9
ALLOWABLE RELEASE (CFS)	0.4	6.1	12.3	28.6	37.0	47.6
MODELED RELEASE (CFS)	0.4	4.2	12.3	28.6	36.9	47.2
STORED VOLUME (AC-FT)	3.1	3.1	3.3	3.8	4.4	5.0

FSD14A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	127.6	175.4	239.8	321.9	393.2	466.3
ALLOWABLE RELEASE (CFS)	0.5	7.5	14.4	56.2	95.2	142.4
MODELED RELEASE (CFS)	0.5	7.5	14.4	56.2	95.1	142.2
STORED VOLUME (AC-FT)	9.9	10.6	11.9	13.5	15.3	17.3

FSD14B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	24.6	34.3	47.4	64.2	79.0	94.1
ALLOWABLE RELEASE (CFS)	0.0	0.3	0.5	5.7	11.8	19.3
MODELED RELEASE (CFS)	0.0	0.3	0.5	4.5	11.8	19.3
STORED VOLUME (AC-FT)	1.9	2.5	3.3	3.5	3.5	3.8

FSD15B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	10.8	14.0	18.2	23.3	27.6	31.9
ALLOWABLE RELEASE (CFS)	0.1	1.6	3.2	7.3	9.5	12.0
MODELED RELEASE (CFS)	0.1	1.1	3.2	7.3	9.5	12.0
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0

FSD16A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	84.4	120.4	170.0	234.8	292.2	351.8
ALLOWABLE RELEASE (CFS)	0.6	8.8	17.3	56.2	88.4	128.3
MODELED RELEASE (CFS)	0.6	8.8	17.3	56.2	88.3	128.3
STORED VOLUME (AC-FT)	7.6	7.7	8.9	10.4	12.1	13.8

SAND CREEK FLOW COMPARISON CHART

DESIGN POINT	AREA (SQ MI)	Q_{100} (CFS)	DESCRIPTION
DP-77	2.343	1468	PROPOSED CONDITION
	2.91	2262	SAND CREEK DBPS
		2600	FEMA
DP-71	2.757	1612	PROPOSED CONDITION
		2260	SAND CREEK DBPS
DP-63	4.449	1385	PROPOSED CONDITION
	4.33	2630	SAND CREEK DBPS
		2600	FEMA
DP-60A	5.661	1662	PROPOSED CONDITION
	5.38	3295	SAND CREEK DBPS

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (SQ MI)	Q_{10} (CFS) (EXIST)	Q_{100} (CFS) (EXIST)	AREA (SQ MI)	Q_{10} (CFS) (PROP)	Q_{100} (CFS) (PROP)
DP-50	0.32	47.0	195.7	0.32	146.7	370.3
DP-51 (BASIN 86)	0.33	17.7	74.1	0.33	110.0	233.5
DP-52	1.67	80.5	456.5	1.67	1207.9	2123.0
DP-56	0.79	63.6	265.0	0.79	513.0	908.2

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 / Q10=345.7cfs Q100=588.9cfs
(EXISTING) (PROPOSED)

WATER QUALITY & DETENTION POND SUMMARY

FSD16B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	39.0	53.7	73.6	99.0	121.1	143.8
ALLOWABLE RELEASE (CFS)	0.0	0.4	0.7	8.3	17.2	28.2
MODELED RELEASE (CFS)	0.0	0.4	0.7	7.9	17.2	28.1
STORED VOLUME (AC-FT)	3.0	3.9	5.1	5.1	5.3	5.8

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	52.0	67.2	86.3
MODELED RELEASE (CFS)	0.7	8.4	22.4	52.0	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	174.0
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

FSD20						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	9.9	15.5	23.8	35.1	45.5	56.6
ALLOWABLE RELEASE (CFS)	0.4	5.5	11.1	25.7	33.2	42.5
MODELED RELEASE (CFS)	0.4	2.8	10.9	25.7	33.0	42.4
STORED VOLUME (AC-FT)	0.7	0.8	0.8	0.9	1.0	1.2

FSD21						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	7.0	10.8	16.3	23.7	30.4	37.5
ALLOWABLE RELEASE (CFS)	0.3	4.0	8.0	18.3	23.7	30.3
MODELED RELEASE (CFS)	0.3	3.3	8.0	18.3	23.7	30.1
STORED VOLUME (AC-FT)	0.5	0.5	0.5	0.6	0.7	0.8

FSD22						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	9.4	14.8	22.5	32.9	42.5	52.6
ALLOWABLE RELEASE (CFS)	0.4	5.8	11.5	26.5	34.3	43.9
MODELED RELEASE (CFS)	0.4	5.8	11.4	26.5	34.3	43.8
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0

FSD23						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	5.5	8.3	12.4	18.0	23.0	28.4
ALLOWABLE RELEASE (CFS)	0.2	2.4	4.9	11.2	14.5	18.6
MODELED RELEASE (CFS)	0.2	2.0	4.9	11.2	14.5	18.6
STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6

FSD27						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	38.8	57.6	84.1	119.7	159.2	206.3
ALLOWABLE RELEASE (CFS)	1.4	21.1	42.4	97.8	126.4	161.9
MODELED RELEASE (CFS)	1.4	18.4	42.3	97.7	126.2	161.9
STORED VOLUME (AC-FT)	2.7	2.8	2.9	3.2	3.7	4.2

FSD72						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	12.8	20.2	31.4	46.7	60.9	76.0
ALLOWABLE RELEASE (CFS)	0.6	9.6	19.3	44.4	57.4	73.4
MODELED RELEASE (CFS)	0.6	9.3	19.2	44.4	57.4	73.4
STORED VOLUME (AC-FT)	1.0	1.0	1.1	1.1	1.2	1.3

PNDW3						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	214.6	374.5	714.9	1187.6	1674.9	2204.1
MODELED RELEASE (CFS)	154.3	200.3	366.8	799.9	1085.6	1350.6
STORED VOLUME (AC-FT)	2.8	9.5	26.3	41.2	57.2	78.2

FSD-E1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	23.3	35.9	53.8	79.1	102.4	127.4
ALLOWABLE RELEASE (CFS)	0.7	11.0	22.1	50.9	65.7	84.1
MODELED RELEASE (CFS)	0.7	5.4	19.9	48.9	62.8	84.0
STORED VOLUME (AC-FT)	1.3	1.3	1.5	1.8	2.1	2.5

FSD-E2						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	30.6	45.2	65.9	93.3	118.0	143.9
ALLOWABLE RELEASE (CFS)	0.6	9.5	19.2	45.5	59.8	77.6
MODELED RELEASE (CFS)	0.6	3.2	18.5	41.3	58.5	74.7
STORED VOLUME (AC-FT)	2.1	2.3	2.4	2.8	3.3	3.8

FSD-E3						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	100.4	130.6	169.6	217.4	257.8	298.4
ALLOWABLE RELEASE (CFS)	0.9	13.2	26.5	61.6	79.8	102.6
MODELED RELEASE (CFS)	1.0	6.8	25.7	56.0	79.8	101.3
STORED VOLUME (AC-FT)	7.0	7.2	7.7	8.9	10.1	11.4

FSD-E4						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	58.9	75.5	96.6	122.2	143.7	165.2
ALLOWABLE RELEASE (CFS)	0.3	4.4	8.8	23.0	32.2	43.7
MODELED RELEASE (CFS)	0.9	2.8	8.7	21.9	32.2	43.6
STORED VOLUME (AC-FT)	4.2	4.3	4.7	5.4	6.2	6.9

FSD-E5						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	38.6	48.4	60.7	75.4	87.7	99.9
ALLOWABLE RELEASE (CFS)	0.0	0.2	0.4	4.2	8.7	14.3
MODELED RELEASE (CFS)	0.0	0.2	0.5	2.2	5.1	10.0
STORED VOLUME (AC-FT)	3.0	3.7	4.4	4.8	5.0	5.3

FSD-E6						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	141.6	189.4	252.5	331.4	398.9	467.5
ALLOWABLE RELEASE (CFS)	0.2	1.9	3.2	37.4	77.3	125.6
MODELED RELEASE (CFS)	0.2	0.9	3.2	18.3	64.1	123.3
STORED VOLUME (AC-FT)	13.0	17.0	21.9	22.2	22.6	23.7

PND-E7						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	46.5	75.4	121.2	285.2	402.4	548.0
MODELED RELEASE (CFS)	23.1	35.3	71.5	108.3	152.1	196.4
STORED VOLUME (AC-FT)	1.0	1.8	4.6	10.5	17.9	28.0

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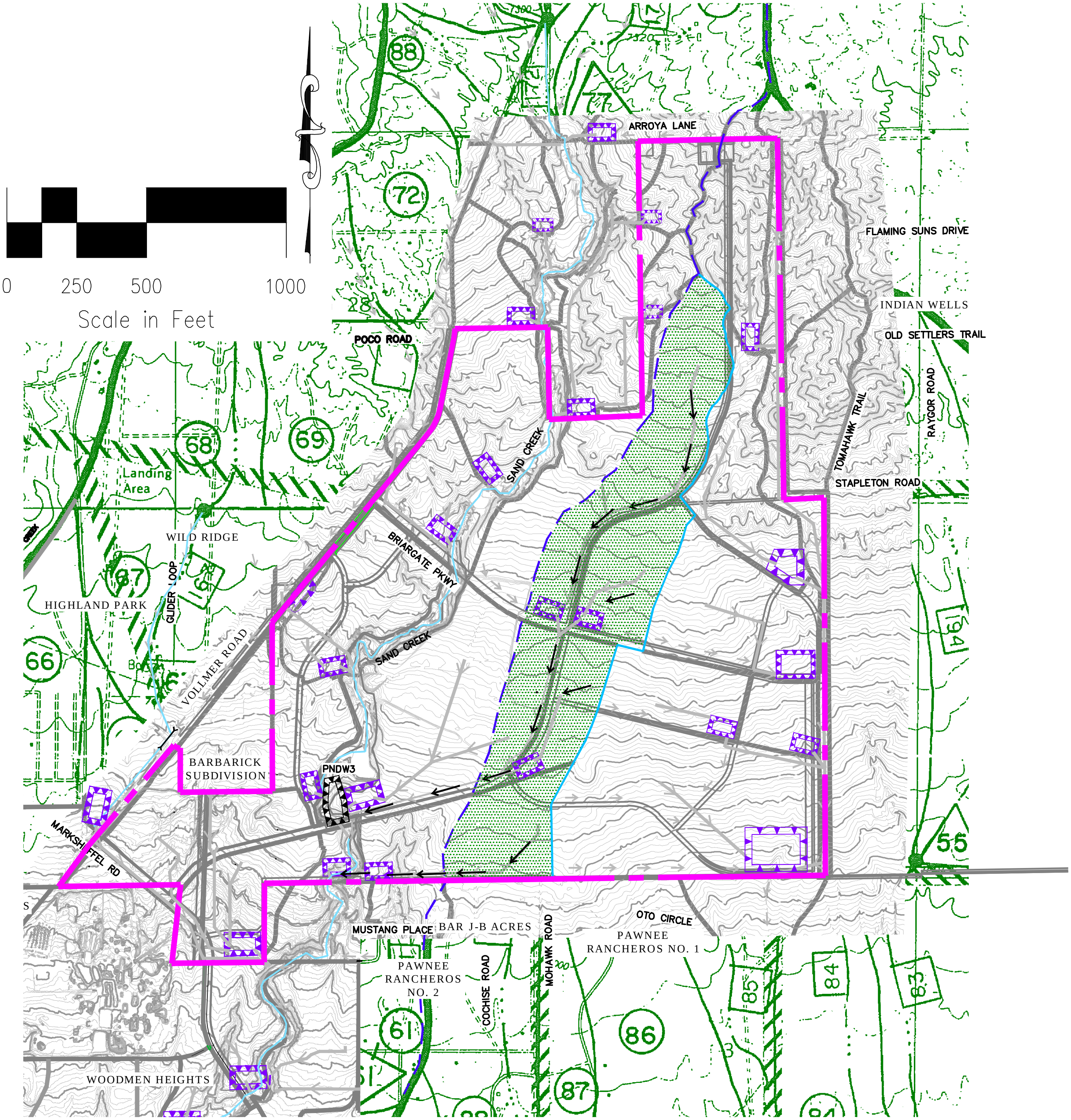
2018 STERLING RANCH MDDP

DEVELOPED HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09-002	FILE: \dwg\Eng Exhibits\2018-MDDP-PROPCOND.dwg		
DESIGNED BY: JD DRAWN BY: JD CHECKED BY: VAS	SCALE HORIZ: 1"=2400' VERT: 1"=2400'	DATE: 10-21-2018	DM2

File: O:\09002A\Sterling Ranch District\dwg\Eng Exhibits\2018 MDDP\2018-MDDP-interimCondSWMap.dwg Plotstamp: 10/24/2018 3:21 PM

STERLING RANCH DRAINAGE DIVERSION EXHIBIT



PROPERTY BNDRY

HISTORIC SC/EFSC BNDRY LINE

PROPOSED SC/EFSC BNDRY LINE

BASIN DIVERSION AREA (EAST FORK SAND CREEK TO SAND CREEK) * ~267.3 AC

PNDW3 POND W3 WILL BE UTILIZED TO AID IN REDUCING CHANNELIZED RUNOFF TO HISTORIC LEVELS.

POTENTIAL LOCATION FOR FULL SPECTRUM DETENTION POND

*ALL DIVERTED RUNOFF SHALL BE DIRECTED TO FULL SPECTRUM DETENTION PONDS PRIOR TO DISCHARGE INTO SAND CREEK CHANNEL. WHENEVER POSSIBLE ADDITIONAL LID BMP'S WILL BE UTILIZED TO REDUCE INCREASES IN RUNOFF VOLUMES.

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SHEET 1 OF 1

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HYDROLOGIC CALCULATIONS

EPA- 600/R-14/413b
Revisied September 2015

Storm Water Management Model User's Manual Version 5.1

by

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September 2015

SWMM MODEL RAIN GAGE INPUT PARAMETERS
(PER DCM CPT. 6)

Table 6-2. Rainfall Depths for Colorado Springs

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

Where Z= 6,840 ft/100

City of Colorado Springs DCM

5-year, 2-hour Storm (Cumulative)

Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.021	0.021	0.021	0.021	0.023	0.023	0.026
10	0.069	0.066	0.062	0.062	0.063	0.063	0.060
15	0.119	0.114	0.111	0.111	0.110	0.105	0.102
20	0.180	0.174	0.164	0.164	0.159	0.153	0.143
25	0.269	0.264	0.254	0.252	0.245	0.236	0.221
30	0.387	0.374	0.359	0.354	0.341	0.324	0.297
35	0.632	0.594	0.531	0.491	0.461	0.414	0.363
40	1.068	0.983	0.839	0.743	0.672	0.572	0.473
45	1.236	1.134	0.956	0.840	0.759	0.633	0.518
50	1.338	1.236	1.050	0.929	0.849	0.719	0.594
55	1.403	1.299	1.110	0.987	0.902	0.768	0.642
60	1.458	1.352	1.161	1.035	0.951	0.815	0.684
65	1.506	1.401	1.209	1.076	0.992	0.855	0.723
70	1.527	1.422	1.232	1.098	1.017	0.884	0.752
75	1.545	1.443	1.253	1.119	1.038	0.905	0.773
80	1.562	1.460	1.274	1.140	1.059	0.926	0.794
85	1.578	1.476	1.295	1.161	1.080	0.947	0.815
90	1.595	1.493	1.313	1.182	1.101	0.968	0.836
95	1.608	1.509	1.329	1.203	1.122	0.989	0.857
100	1.623	1.526	1.344	1.220	1.143	1.010	0.878
105	1.637	1.539	1.361	1.236	1.160	1.031	0.899
110	1.650	1.554	1.377	1.253	1.175	1.047	0.917
115	1.664	1.568	1.394	1.269	1.191	1.064	0.933
120	1.679	1.581	1.407	1.286	1.208	1.080	0.950

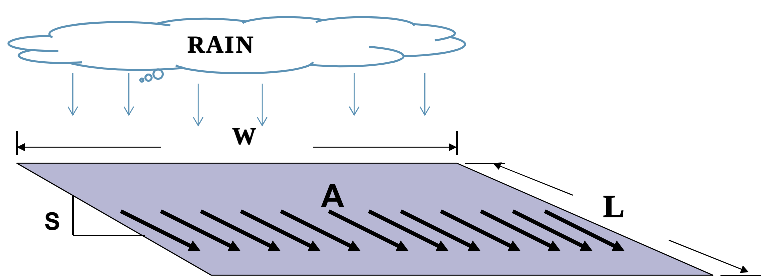
City of Colorado Springs DCM

100-year, 2-hour Storm (Cumulative)

Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.035	0.035	0.035	0.035	0.038	0.038	0.043
10	0.116	0.111	0.103	0.103	0.106	0.106	0.101
15	0.199	0.192	0.186	0.186	0.184	0.176	0.171
20	0.302	0.292	0.275	0.275	0.267	0.257	0.239
25	0.451	0.444	0.426	0.423	0.411	0.396	0.370
30	0.650	0.627	0.602	0.595	0.572	0.544	0.499
35	1.061	0.998	0.892	0.824	0.774	0.696	0.610
40	1.794	1.651	1.409	1.247	1.129	0.960	0.794
45	2.076	1.905	1.605	1.411	1.275	1.063	0.869
50	2.248	2.076	1.764	1.560	1.426	1.207	0.998
55	2.356	2.182	1.865	1.658	1.515	1.290	1.079
60	2.449	2.271	1.950	1.739	1.598	1.368	1.149
65	2.530	2.354	2.031	1.807	1.666	1.436	1.215
70	2.565	2.389	2.069	1.845	1.709	1.484	1.263
75	2.596	2.424	2.104	1.880	1.744	1.520	1.298
80	2.623	2.452	2.139	1.915	1.779	1.555	1.333
85	2.651	2.480	2.175	1.950	1.814	1.590	1.368
90	2.679	2.507	2.205	1.986	1.850	1.625	1.404
95	2.701	2.535	2.233	2.021	1.885	1.661	1.439
100	2.727	2.563	2.258	2.049	1.920	1.696	1.474
105	2.749	2.586	2.286	2.076	1.948	1.731	1.509
110	2.772	2.611	2.313	2.104	1.973	1.759	1.540
115	2.795	2.633	2.341	2.132	2.001	1.787	1.567
120	2.820	2.656	2.364	2.160	2.029	1.814	1.595

SWMM MODEL SUBCATCHMENT INPUT PARAMETERS

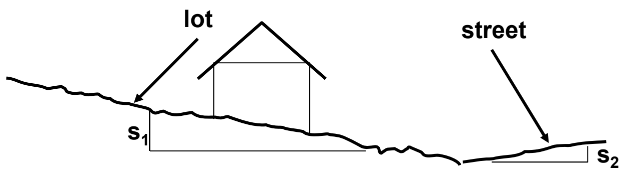
Subcatchment Conceptual Model



Subcatchment represented as a sloped, rectangular plane

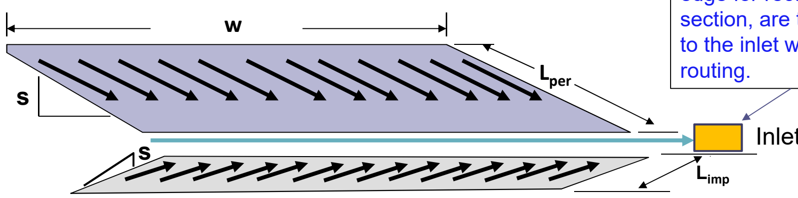
W = width
L = length
S = slope
A = area

Subcatchment Conceptual Model



Pervious and Impervious areas are processed independently and are then combined.
Both have the same tributary width (W).

Flows calculated at edge for rectangular section, are transferred to the inlet without flow routing.



You can set them up as separate subcatchments.

9

Width Parameter

NEVER use default value

Approx. Width = (Area) ÷ (Length)

Length = average overland sheet flow length of runoff

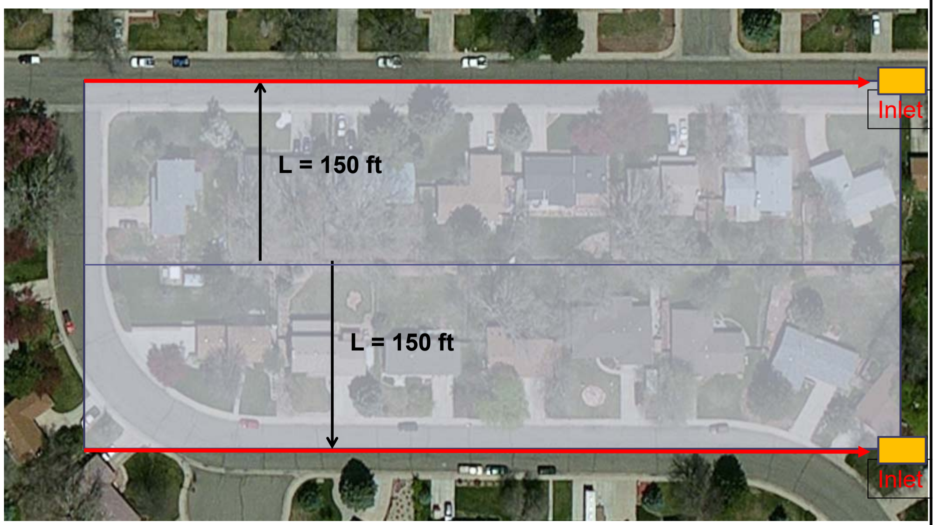
Suggested Rules of Thumb:

Undeveloped:
- **Maximum length = 100- to 500-feet**

Residential Catchments:
- **Maximum length = 100 to 300 feet**
- **back of lot to street gutter (100-175 ft)**

10

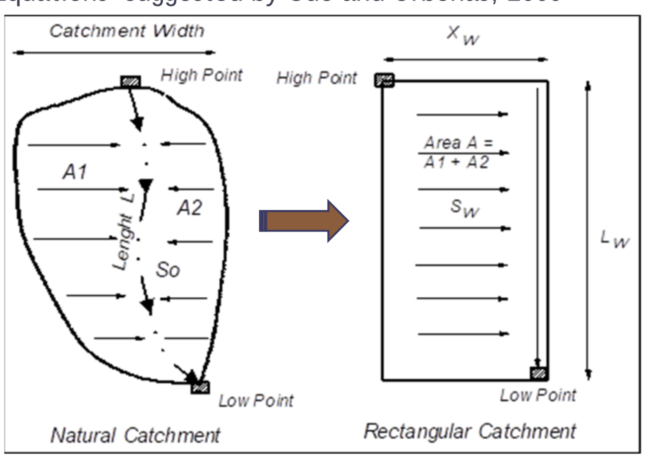
Width Parameter



11

Transforming Subcatchment Shape to a Rectangle

Equations Suggested by Guo and Urbonas, 2009



Dimensionless Variables:

$X = A/L^2$

$Y = L_w/L$

Skewness:

$Z = max(A1, A2)/A$

$0.5 \le Z \le 1.0$

$$Y = \frac{Lw}{L} = (1.5 - Z)(2.286X - 0.286X^2) \Rightarrow L_w/L = (1.5 - Z)\left\{2.286\left(A/L^2\right) - 0.286\left(A/L^2\right)^2\right\}$$

$$S_o/S_w = \left(X/Y + Y\right) \Rightarrow S_o/S_w = A/LL_w + L_w/L$$

12

Percent Impervious

Estimating/Measuring Percent Impervious:

- **If site-specific information is not available, <u>use land use classification</u>**
- **Sometimes, site-specific impervious GIS layers are available**

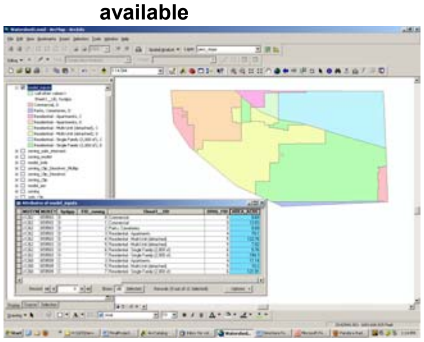


Table RO-3—Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage Imperviousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yard areas	15
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	0
Lawns, clayey soil	0

* See Figures RO-3 through RO-5 for percentage imperviousness.

Source: UDFCD Storm Drainage Criteria Manual

City of Colorado Springs DCM - Manning's n

Table 6-11. Roughness Coefficients (Manning's n) for NRCS Overland Flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, bare soil, etc.)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods [3]	
Light underbrush	0.40
Dense underbrush	0.80

Table 3-1 Impervious area as a percentage of land use.

Land Use	Percent Impervious Area
Commercial	56
Industrial	76
High density residential	51
Medium density residential	38
Low density residential	19
Institutional	34
Agricultural	2
Forest	1.9
Open Urban Land	11

As mentioned earlier, impervious areas in SWMM are hydraulically (directly) connected to the drainage system – called directly connected impervious areas (DCIA). For instance, if rooftops drain onto adjacent pervious lawn areas, they should not be treated as a hydraulically effective impervious area. Such areas are non-effective impervious areas (Doyle and Miller, 1980). On the other hand, if a driveway drains to a street and then to a stormwater inlet, the driveway would be considered hydraulically connected. Rooftops with downspouts connected directly to a sewer are clearly hydraulically connected. An example of careful measurements and statistics on imperviousness may be found in Field et al. (2000), Lee (2003), and Roy and Shuster (2007). Lee and Heaney (2003) provide detailed comparisons of imperviousness computations and their implications for modeling.

Should rooftops be treated as "pervious," the real surrounding pervious area is subject to more incoming water than rainfall alone and thus might produce runoff sooner than if rainfall alone were considered. In the possible event that this effect is important (a judgment based on infiltration parameters) it can be modeled using the overland flow re-routing option discussed earlier in Section 3.7. For example, if disconnected rooftops comprised 25 percent of the total impervious area of a subcatchment (as opposed to the total DCIA) then one could tell SWMM that this percentage of impervious area should be internally routed onto the pervious sub-area of the subcatchment.

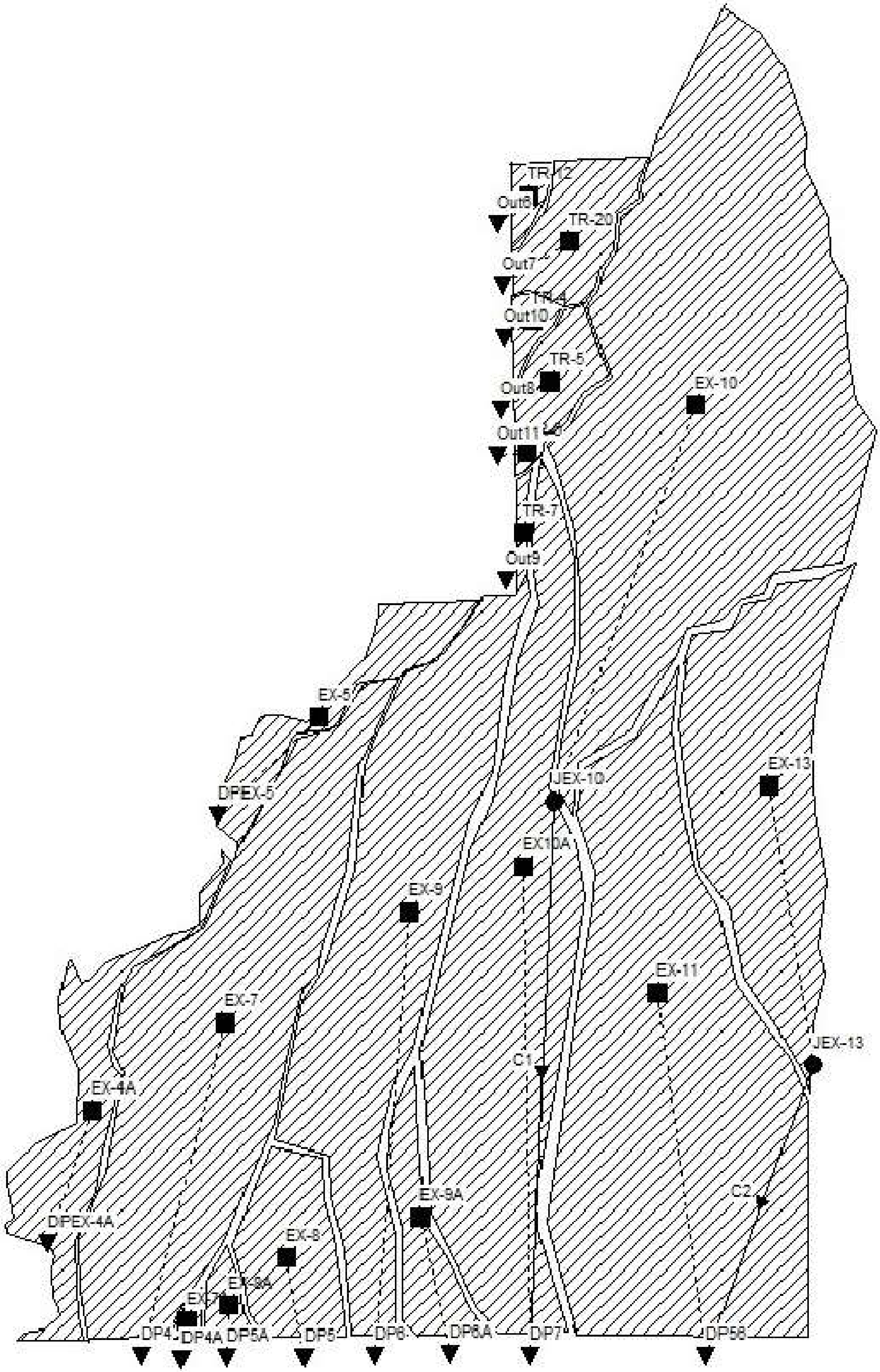
Another method of estimating the effective impervious area given measured data is to plot the runoff (in. or mm) vs. rainfall (in. or mm) for small storms. The slope of the regression line is a good estimate of the effective impervious area (Doyle and Miller, 1980).

Table 3-5 Estimates of Manning's roughness coefficient for overland flow

Source	Ground Cover	n	Range
Crawford and Linsley (1966)[a]	Smooth asphalt	0.01	
	Asphalt of concrete paving	0.014	
	Packed clay	0.03	
	Light turf	0.20	
	Dense turf	0.35	
	Dense shrubbery and forest litter	0.4	
Engman (1986)[b]	Concrete or asphalt	0.011	0.010-0.013
	Bare sand	0.010	0.01-0.016
	Graveled surface	0.02	0.012-0.03
	Bare clay-loam (eroded)	0.02	0.012-0.033
	Range (natural)	0.13	0.01-0.32
	Bluegrass sod	0.45	0.39-0.63
	Short grass prairie	0.15	0.10-0.20
	Bermuda grass	0.41	0.30-0.48
Yen (2001)[c]	Smooth asphalt pavement	0.012	0.010-0.015
	Smooth impervious surface	0.013	0.011-0.015
	Tar and sand pavement	0.014	0.012-0.016
	Concrete pavement	0.017	0.014-0.020
	Rough impervious surface	0.019	0.015-0.023
	Smooth bare packed soil	0.021	0.017-0.025
	Moderate bare packed soil	0.030	0.025-0.035
	Rough bare packed soil	0.038	0.032-0.045
	Gravel soil	0.032	0.025-0.045
	Mowed poor grass	0.038	0.030-0.045
	Average grass, closely clipped sod	0.050	0.040-0.060
	Pasture	0.055	0.040-0.070
	Timberland	0.090	0.060-0.120
	Dense grass	0.090	0.060-0.120
	Shrubs and bushes	0.120	0.080-0.180
	Business land use	0.022	0.014-0.035
	Semi-business land use	0.035	0.022-0.050
	Industrial land use	0.035	0.020-0.050
	Dense residential land use	0.040	0.025-0.060
	Suburban residential land use	0.055	0.030-0.080
	Parks and lawns	0.075	0.040-0.120

[a]Obtained by calibration of Stanford Watershed Model.
[b]Computed by Engman (1986) by kinematic wave and storage analysis of measured rainfall-runoff data.
[c]Computed on basis of kinematic wave analysis.

EXISTING CONDITIONS SWMM MODEL MAP



STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP4	46	105
DP4A	1	5
DP5	5	23
DP5A	2	9
DP6	59	122
DP6A	7	19
DP7	110	249
DP56	60	160
DPEX-4A	19	50
DPEX-5	12	32

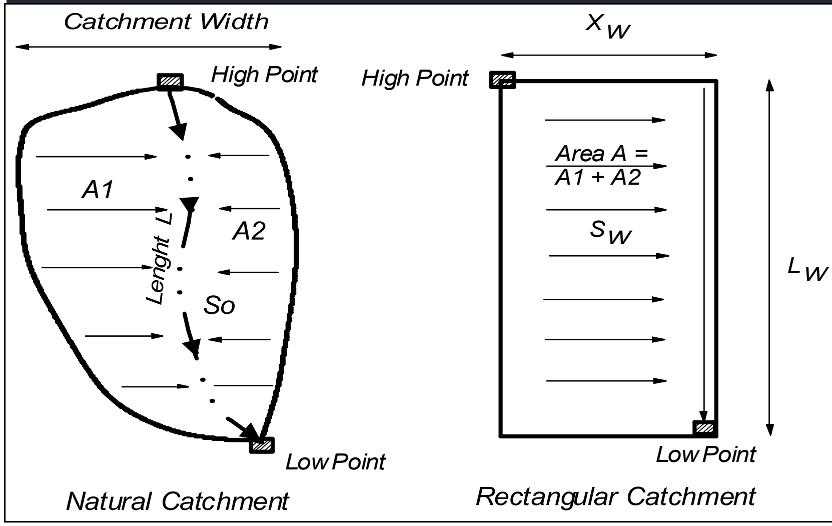
STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	*SWMM Width (Lw) (ft.)	*SWMM Slope (Sw) (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	3365	3.41%	105	222
EX10A	153.5	5%	1857	4.05%	46	103
EX-11	214.3	4%	3255	3.01%	54	129
EX-13	94.8	6%	1877	3.97%	36	85
EX-4A	44.2	8%	3355	1.09%	19	50
EX-5	26.2	8%	1959	1.65%	12	32
EX-7	152.8	5%	2234	3.13%	46	105
EX-7A	2.4	2%	416	2.70%	1	5
EX-8	32.2	2%	1679	1.47%	5	23
EX-8A	6.6	2%	698	1.80%	2	9
EX-9	139.3	8%	1837	3.19%	59	122
EX-9A	21.8	5%	786	3.01%	7	19
TR-12	4.7	5%	544	4.13%	2	9
TR-20	23.2	7%	1388	3.21%	10	32
TR-4	4.4	5%	645	2.76%	2	9
TR-5	13.7	5%	990	2.70%	5	17
TR-6	1.5	5%	519	1.55%	1	4
TR-7	2.6	5%	233	5.84%	1	5

* Reference SWMM Catchment Shape Parameter Finder for calculations

CATCHMENT SHAPE PARAMETER FINDER

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

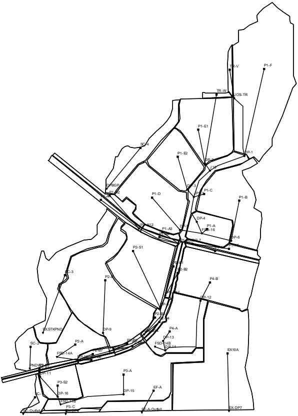
$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	$X=A/L^2$	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
EX-7	152.80	82.00	70.80	6,430	7160.0	6997.0	0.54	0.16	0.35	2,234	2,980	2.53	0.81	3.13
EX-9	139.30	65.00	74.30	7,190	7190.0	7026.0	0.53	0.12	0.26	1,837	3,302	2.28	0.71	3.19
EX10A	153.50	75.00	78.50	8,030	7,236	7,015	0.51	0.10	0.23	1,857	3,600	2.75	0.68	4.05
EX10	265.90	120.00	145.90	7,280	7,380	7,148	0.55	0.22	0.46	3,365	3,442	3.19	0.94	3.41
EX-11	214.30	100.00	114.30	6,140	7,192	7,008	0.53	0.25	0.53	3,255	2,867	3.00	1.00	3.01
EX-13	94.80	47.00	47.80	4,900	7,232	7,070	0.50	0.17	0.38	1,877	2,200	3.31	0.83	3.97
TR-4	4.40	2.20	2.20	640	7,270	7,244	0.50	0.47	1.01	645	297	4.06	1.47	2.76
TR-5	13.70	7.50	6.20	1,250	7,273	7,230	0.55	0.38	0.79	990	603	3.44	1.27	2.70
TR-6	1.50	0.75	0.75	250	7,238	7,228	0.50	1.05	2.08	519	126	4.00	2.58	1.55
TR-7	2.60	1.30	1.30	1,100	7,234	7,192	0.50	0.09	0.21	233	487	3.82	0.65	5.84
TR-12	4.70	2.50	2.20	800	7,300	7,262	0.53	0.32	0.68	544	377	4.75	1.15	4.13
TR-20	23.20	12.00	11.20	1,550	7,314	7,246	0.52	0.42	0.90	1,388	728	4.39	1.37	3.21
EX-4A	44.20	22.10	22.10	750	7,044	7,001	0.50	3.42	4.47	3,355	574	5.73	5.24	1.09
EX-5	26.20	13.10	13.10	1,200	7,186	7,144	0.50	0.79	1.63	1,959	583	3.50	2.12	1.65
EX-7A	2.40	1.20	1.20	550	7,039	7,021	0.50	0.35	0.76	416	251	3.27	1.21	2.70
EX-8A	6.60	3.30	3.30	900	7,045	7,025	0.50	0.35	0.78	698	412	2.22	1.23	1.80
EX-8A	32.20	17.00	15.20	1,750	7,062	7,025	0.53	0.46	0.96	1,679	835	2.11	1.44	1.47
EX-9A	21.80	11.80	10.00	2,600	7,082	7,022	0.54	0.14	0.30	786	1,208	2.31	0.77	3.01

DEVELOPED CONDITIONS SWMM MODEL MAP



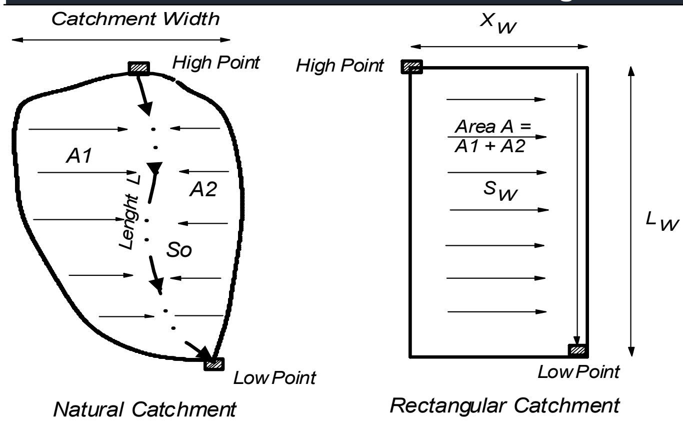
SWMM 5.1

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	*SWMM Width (Lw) (ft.)	*SWMM Slope (Sw) (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	1064	1.57%	7	20
EX10A	60.4	5%	2452	1.79%	18	50
P1-A	12.7	8%	1276	1.29%	6	19
P1-A1	5.0	45%	258	1.66%	11	21
P1-A2	6.4	45%	258	0.77%	12	23
P1-A3	1.8	50%	196	1.17%	5	9
P1-A4	2.0	50%	208	1.12%	5	10
P1-A5	5.7	45%	417	1.38%	13	25
P1-A6	2.8	50%	205	1.75%	7	14
P1-B	35.5	38%	873	1.36%	55	108
P1-C	8.9	50%	581	3.69%	23	46
P1-D	31.4	38%	1033	1.27%	53	102
P1-E1	30.4	35%	1148	1.56%	50	97
P1-E2	21.8	40%	1048	1.23%	41	80
P1-F	76.7	30%	2322	2.18%	111	215
P2-A	22.2	10%	2080	2.20%	13	41
P2-B	57.8	38%	1215	1.64%	88	173
P2-B1	2.5	50%	201	3.37%	7	13
P2-B10	1.7	50%	187	3.43%	5	10
P2-B2	1.9	50%	148	3.54%	5	10
P2-B3	2.8	45%	245	2.15%	7	13
P2-B4	1.6	50%	138	2.49%	4	8
P2-B5	1.9	45%	230	1.86%	5	9
P2-B6	1.1	50%	141	2.28%	3	6
P2-B7	2.5	45%	272	1.78%	6	12
P2-B8	1.2	50%	141	2.34%	3	7
P2-B9	2.0	50%	226	3.27%	5	11
P2-S1	35.6	40%	1756	1.44%	68	133
P3-A	52.6	40%	1290	1.37%	85	166
P3-C	1.7	11%	446	1.31%	1	5
P3-S2	11.9	40%	1103	1.27%	25	50
P4-A	25.8	35%	920	1.21%	41	80
P4-B	37.3	35%	1773	1.34%	63	123
SC-1	3.6	8%	306	2.20%	2	6
SC-2	10.8	8%	1211	2.44%	6	20
SC-3	27.2	8%	616	2.68%	12	26
SC-4	16.4	8%	1918	1.48%	8	27
TR-V	2.1	19%	162	4.13%	2	6
TR-W	1.4	38%	90	1.30%	3	5

* Reference SWMM Catchment Shape Parameter Finder for calculations

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$Y = \frac{L}{L_W};\qquad X = \frac{A}{L^2}$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	$X=A/L^2$	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
EF-A	8.20	4.10	4.10	260	7050.0	7028.0	0.50	5.28	4.09	1,064	336	8.46	5.38	1.57
P3-C	1.70	0.50	1.20	260	7027.0	7019.0	0.71	1.10	1.72	446	166	3.08	2.35	1.31
P1-A	12.70	7.00	5.70	850	7,124	7,102	0.55	0.77	1.50	1,276	433	2.59	2.01	1.29
P1-B	35.50	10.00	25.50	3,100	7,160	7,124	0.72	0.16	0.28	873	1,770	1.16	0.85	1.36
P1-C	8.90	4.50	4.40	1,700	7,158	7,122	0.51	0.13	0.30	510	761	2.12	0.75	2.83
P1-D	31.40	14.00	17.40	2,800	7,136	7,106	0.55	0.17	0.37	1,033	1,324	1.07	0.84	1.27
P1-E1	30.40	16.00	14.40	2,500	7,188	7,152	0.53	0.21	0.46	1,148	1,154	1.44	0.92	1.56
P1-E2	21.80	11.00	10.80	2,000	7,158	7,134	0.50	0.24	0.52	1,048	906	1.20	0.98	1.23
P1-F	76.70	35.00	41.70	3,000	7,240	7,158	0.54	0.37	0.77	2,322	1,439	2.73	1.25	2.18
TR-W	1.40	0.70	0.70	90	7,192	7,182	0.50	7.53	1.00	90	678	11.11	8.53	1.30
TR-V	2.10	1.50	0.60	1,000	7,220	7,190	0.71	0.09	0.16	162	563	3.00	0.73	4.13
P1-A1	5.00	3.10	1.90	2,400	7,134	7,112	0.62	0.04	0.08	182	1,199	0.92	0.58	1.59
P1-A2	6.40	3.20	3.20	2,400	7,134	7,110	0.50	0.05	0.11	264	1,056	1.00	0.55	1.82
P1-A3	1.80	0.70	1.10	800	7,110	7,103	0.61	0.12	0.25	196	400	0.88	0.74	1.17
P1-A4	2.00	1.30	0.70	800	7,112	7,105	0.65	0.14	0.26	208	419	0.88	0.78	1.12
P1-A5	5.70	3.00	2.70	1,300	7,114	7,100	0.53	0.15	0.32	417	595	1.08	0.78	1.38
P1-A6	2.80	1.30	1.50	1,300	7,114	7,100	0.54	0.07	0.16	205	595	1.08	0.62	1.75
P2-A	22.20	11.00	11.20	900	7,056	7,000	0.50	1.19	2.31	2,080	465	6.22	2.83	2.20
P2-B	57.80	18.50	39.30	3,800	7,106	7,052	0.68	0.17	0.32	1,215	2,072	1.42	0.87	1.64
P2-S1	35.60	18.00	17.60	1,900	7,110	7,072	0.51	0.43	0.92	1,756	883	2.00	1.39	1.44
P2-B1	2.50	1.50	1.00	1,100	7,102	7,077	0.60	0.09	0.18	201	541	2.27	0.67	3.37
P2-B2	1.90	1.20	0.70	1,100	7,102	7,077	0.63	0.07	0.13	148	559	2.27	0.64	3.54
P2-B3	2.80	1.70	1.10	1,000	7,077	7,061	0.61	0.12	0.25	245	498	1.60	0.74	2.15
P2-B4	1.60	1.00	0.60	1,000	7,077	7,061	0.63	0.07	0.14	138	504	1.60	0.64	2.49
P2-B5	1.90	1.20	0.70	700	7,061	7,050	0.63	0.17	0.33	230	360	1.57	0.84	1.86
P2-B6	1.10	0.65	0.45	700	7,061	7,050	0.59	0.10	0.20	141	341	1.57	0.69	2.28
P2-B7	2.50	1.60	0.90	770	7,050	7,038	0.64	0.18	0.35	272	401	1.56	0.87	1.78
P2-B8	1.20	0.70	0.50	770	7,050	7,038	0.58	0.09	0.18	141	372	1.56	0.67	2.34
P2-B9	2.00	1.00	1.00	870	7,038	7,018	0.50	0.12	0.26	226	386	2.30	0.70	3.27
P2-B10	1.70	0.90	0.80	870	7,038	7,018	0.53	0.10	0.21	187	397	2.30	0.67	3.43
P3-A	52.60	40.00	12.60	2,900	7,050	7,008	0.76	0.27	0.44	1,290	1,776	1.45	1.06	1.37
P3-S2	11.90	6.00	5.90	1,000	7,036	7,016	0.50	0.52	1.10	1,103	470	2.00	1.57	1.27
P4-A	25.80	20.00	5.80	1,950	7,078	7,052	0.78	0.30	0.47	920	1,222	1.33	1.10	1.21
P4-B	37.30	25.00	12.30	1,600	7,116	7,080	0.67	0.63	1.11	1,773	916	2.25	1.68	1.34
SC-1	3.60	1.80	1.80	150	7014.0	6996.0	0.50	6.97	2.04	306	512	12.00	5.46	2.20
SC-2	10.80	5.00	5.80	770	7040.0	7001.0	0.54	0.79	1.57	1,211	388	5.06	2.08	2.44
SC-3	27.20	14.00	13.20	4,300	7,100	7,032	0.51	0.06	0.14	616	1,925	1.58	0.59	2.68
SC-4	16.40	8.20	8.20	420	7,136	7,102	0.50	4.05	4.57	1,918	372	8.10	5.45	1.48

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	112	219
DP-2	53	103
DP-3	41	80
DP-4	218	379
DP-5	53	102
DP-6	55	108
DP-7	20	39
DP-8	119	235
DP-9	88	173
DP-10	223	441
DP-11	10	21
DP-12	63	123
DP-13	41	80
DP-14	97	189
DP-15	85	166
DP-16	34	69

PROPOSED PONDS
EFFECTIVE IMPERVIOUS AREA CALCULATIONS

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	15%
P1-B	35.5	7,500	55%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	12,500	35%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	**220.9**		**46%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-11B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P2-B9	2.0	N/A	70%
P2-B10	1.7	N/A	70%
P3-S2	11.9	School	65%
P3-A	52.6	7,000	57%
TOTAL	**68.2**		**59%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14A Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A1	5.0	N/A	70%
P1-A2	6.4	N/A	70%
P1-A3	1.8	N/A	70%
P1-A4	2.0	N/A	70%
P1-A5	5.7	N/A	70%
P1-A6	2.8	N/A	70%
P2-S1	35.6	School	65%
P2-A	22.2	Park	7%
P2-B	57.8	7,000	57%
P2-B1	2.5	N/A	70%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	70%
P2-B4	1.6	N/A	70%
P2-B5	1.9	N/A	70%
P2-B6	1.1	N/A	70%
P2-B7	2.5	N/A	70%
P2-B8	1.2	N/A	70%
TOTAL	**154.8**		**55%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P4-A	37.3	6,500	60%
P4-B	25.8	6,500	60%
TOTAL	**63.1**		**60%**

STORMWATER QUALITY CALCULATIONS

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Marc A. Whorton, P.E.**
Company:	**Classic Consulting**
Date:	**October 3, 2022**
Project:	**Sterling Ranch East Preliminary Plan No. 1**
Location:	**FSD-16**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 46.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.460

C) Contributing Watershed Area — Area = 220.900 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ◯ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) — V_{DESIGN}= ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$= 3.516 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 0 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 100 %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

Revise for this PUDSP area

J) Excess Urban Runoff Volume (EURV) Design Volume
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

$EURV_{DESIGN}$ = 10.823 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$= ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.105 ac-ft

B) Actual Forebay Volume — V_F = 0.105 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 30.0 in

D) Forebay Discharge
- i) Undetained 100-year Peak Discharge — Q_{100} = 499.00 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 9.98 cfs

E) Forebay Discharge Design

Choose One
- ◯ Berm With Pipe
- ◉ Wall with Rect. Notch
- ◯ Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 15.1 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Marc A. Whorton, P.E.**
Company:	**Classic Consulting**
Date:	**October 3, 2022**
Project:	**Sterling Ranch East Preliminary Plan No. 1**
Location:	**FSD-16**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0060 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 132 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 3.19 inches

E) Total Outlet Area — A_{ot} = 56.00 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 6 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 460 cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 66.0 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 1,592 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio =

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 2243 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 5.5 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 94 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 23.9 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: October 3, 2022
Project: Sterling Ranch East Preliminary Plan No. 1
Location: FSD-16

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	Concrete overflow wall with associated buried rip-rap per DCM
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

WATER QUALITY TREATMENT PLAN MAP

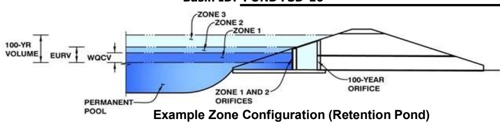
DETENTION POND CALCULATIONS

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)

Type A soils need to be used as this is for pre-development conditions

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	220.90	acres
Watershed Length =	5,000	ft
Watershed Length to Centroid =	2,500	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	46.00%	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) =	3.600	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	10.791	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	10.435	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	15.167	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	19.361	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	25.144	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	29.760	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	35.676	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	54.235	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	8.071	acre-feet		
Approximate 5-yr Detention Volume =	11.142	acre-feet		
Approximate 10-yr Detention Volume =	14.960	acre-feet		
Approximate 25-yr Detention Volume =	16.493	acre-feet		
Approximate 50-yr Detention Volume =	17.267	acre-feet		
Approximate 100-yr Detention Volume =	19.464	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	3.600	acre-feet
Zone 2 Volume (EURV - Zone 1) =	7.191	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	8.673	acre-feet
Total Detention Basin Volume =	19.464	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
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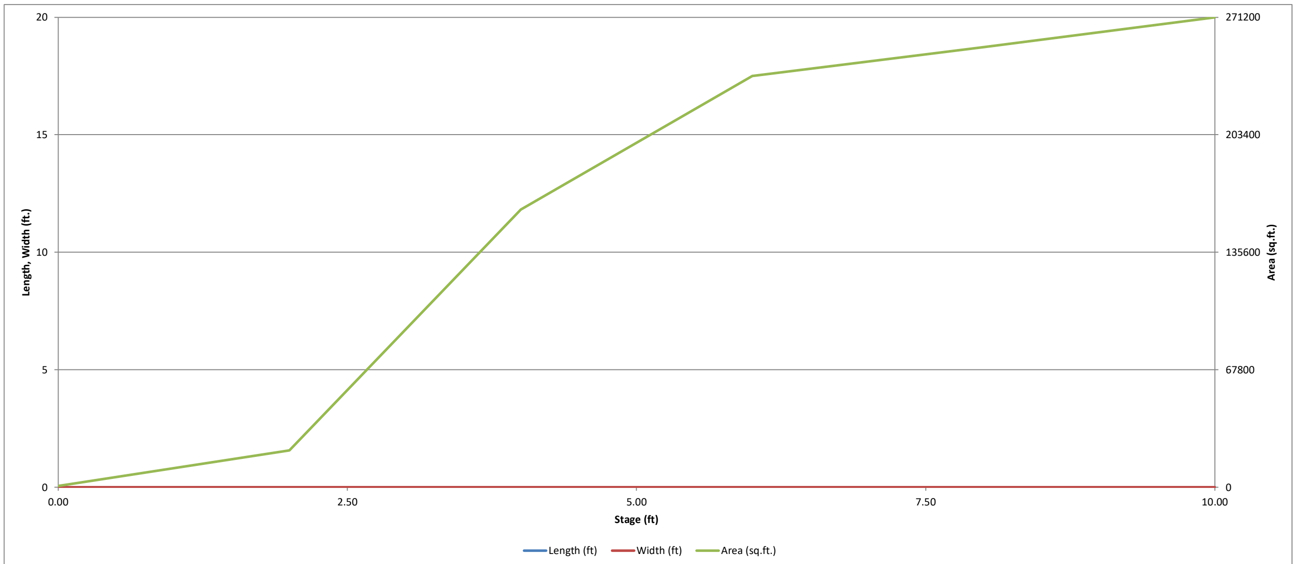
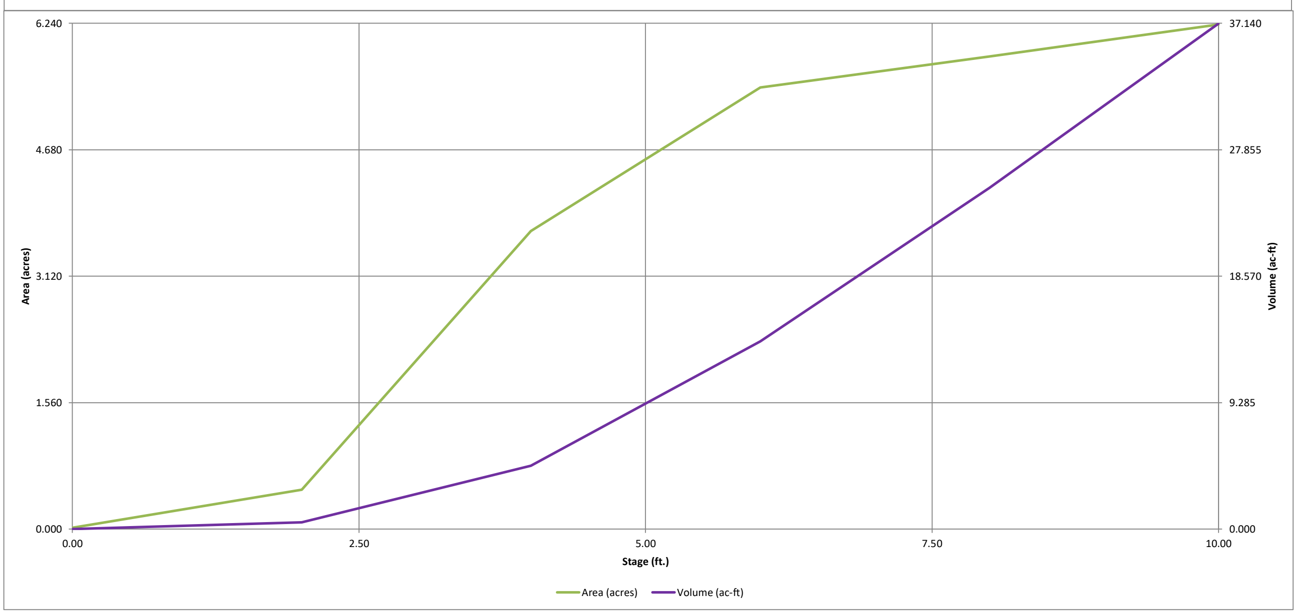
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



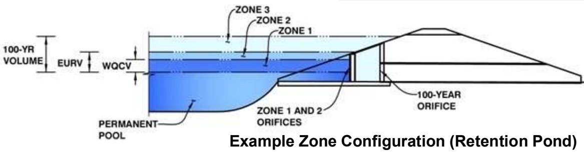


DETENTION BASIN OUTLET STRUCTURE DESIGN

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)	3.69	3.600	Orifice Plate
Zone 2 (EURV)	5.43	7.191	Orifice Plate
Zone 3 (100-year)	7.03	8.673	Weir&Pipe (Restrict)
Total (all zones)		19.464	

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

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

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 =	5.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	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)	8.00	16.00	16.00	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) — Calculated Parameters for Vertical Orifice

	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				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe) — Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.50	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 =	6.29	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	%				

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

	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 =	12.57	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	2.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	48.00		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=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.00	feet
Spillway Crest Length =	165.00	feet	Stage at Top of Freeboard =	10.00	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

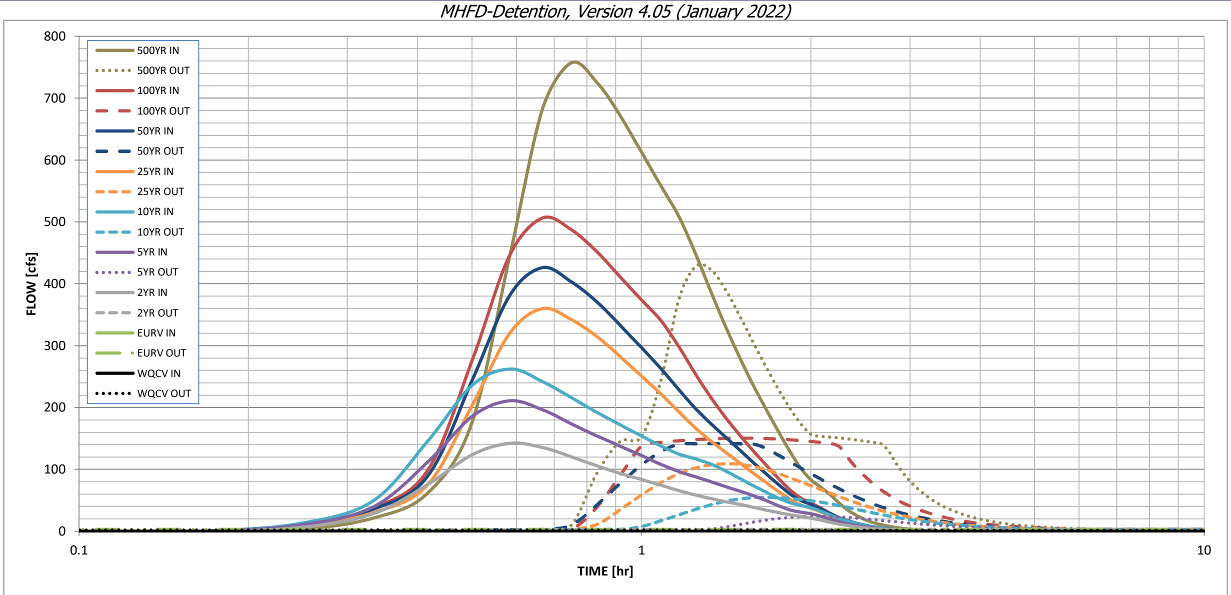
Routed Hydrograph Results

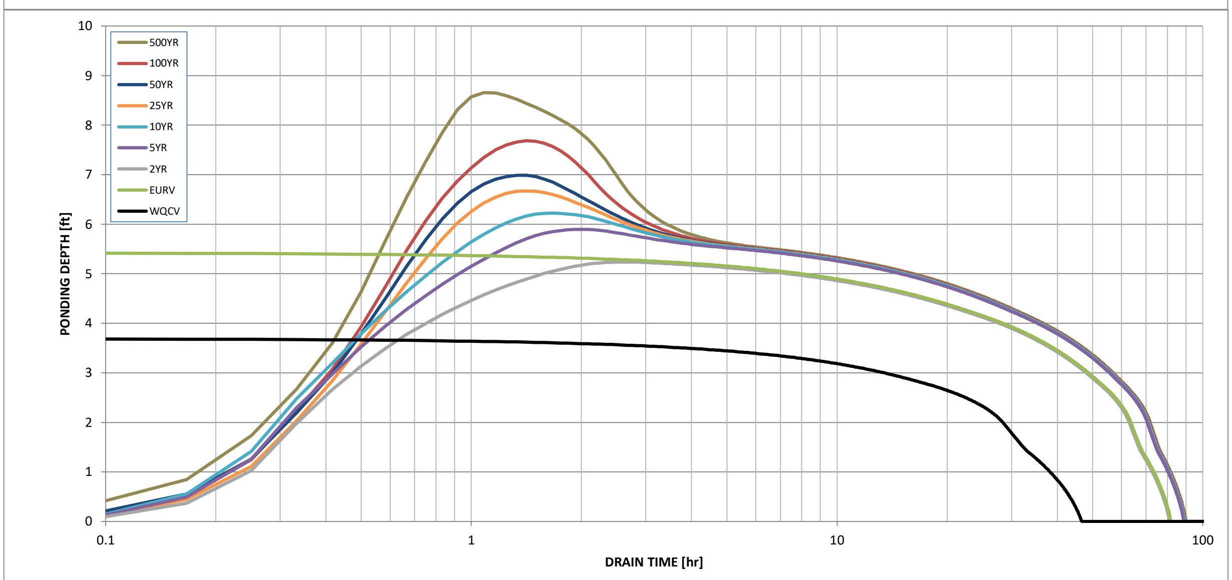
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

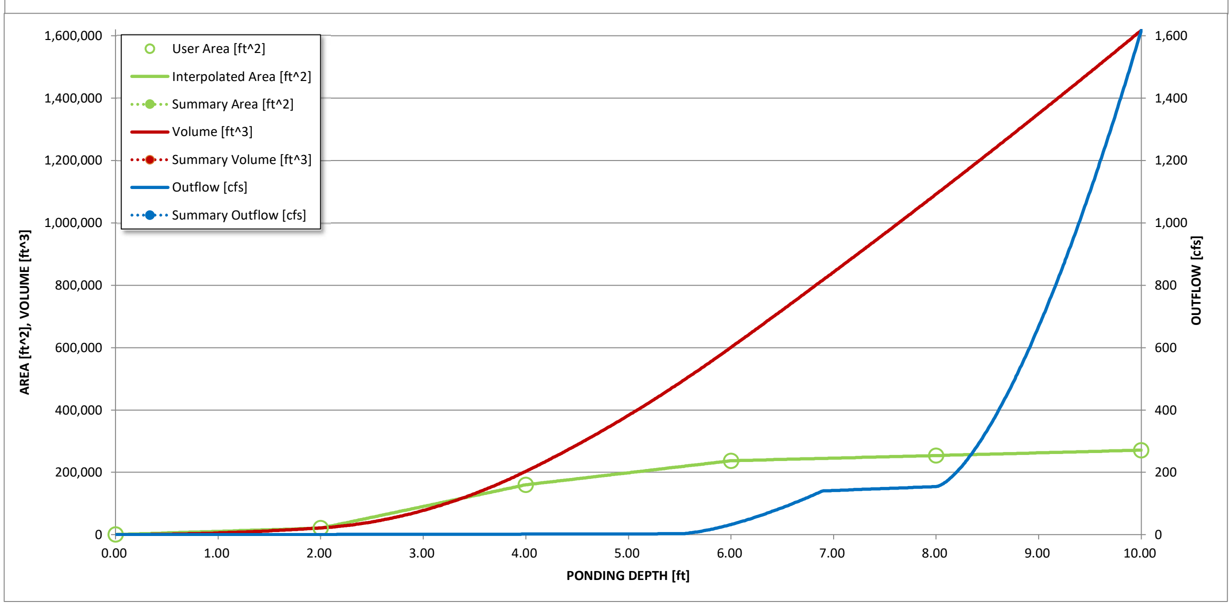
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	3.600	10.791	10.435	15.167	19.361	25.144	29.760	35.676	54.235
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	10.435	15.167	19.361	25.144	29.760	35.676	54.235
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	20.3	57.3	88.3	160.1	201.2	256.4	417.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.40	0.72	0.91	1.16	1.89
Peak Inflow Q (cfs) =	N/A	N/A	142.2	210.8	262.0	359.9	425.9	506.3	757.2
Peak Outflow Q (cfs) =	1.8	3.2	3.0	24.2	55.0	109.2	141.8	150.5	428.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.7	0.6	1.0
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	0.3	0.7	1.3	1.7	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) =	40	67	66	71	70	68	66	64	58
Time to Drain 99% of Inflow Volume (hours) =	**43**	75	74	80	78	76	75	74	71
Maximum Ponding Depth (ft) =	3.69	5.43	5.24	5.90	6.23	6.67	6.99	7.68	8.66
Area at Maximum Ponding Depth (acres) =	3.18	4.94	4.77	5.35	5.49	5.58	5.63	5.77	5.96
Maximum Volume Stored (acre-ft) =	3.604	10.831	9.860	13.199	14.995	17.485	19.223	23.214	28.901

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.

Time Interval
5.00 min

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	0.75	0.07	3.70
0:15:00	0.00	0.00	6.52	10.70	13.29	8.94	11.78	10.99	21.38
0:20:00	0.00	0.00	28.52	39.39	49.17	30.09	35.87	37.45	61.67
0:25:00	0.00	0.00	75.51	111.48	145.19	74.96	88.78	98.15	175.91
0:30:00	0.00	0.00	123.75	185.57	235.95	203.31	243.44	275.71	444.83
0:35:00	0.00	0.00	142.21	210.78	262.01	319.95	381.31	446.27	682.04
0:40:00	0.00	0.00	135.59	196.43	241.98	359.95	425.95	506.30	757.18
0:45:00	0.00	0.00	120.49	173.78	216.22	342.10	403.21	487.43	725.70
0:50:00	0.00	0.00	105.77	154.34	192.45	314.78	370.73	451.74	671.81
0:55:00	0.00	0.00	93.62	137.73	172.10	282.37	332.95	411.07	612.57
1:00:00	0.00	0.00	83.58	122.38	153.98	250.92	296.58	373.81	557.78
1:05:00	0.00	0.00	74.48	108.09	137.72	221.69	262.63	340.50	508.24
1:10:00	0.00	0.00	65.70	96.51	124.80	192.64	228.62	297.86	446.88
1:15:00	0.00	0.00	58.34	87.82	116.74	166.14	197.80	252.96	384.11
1:20:00	0.00	0.00	52.59	79.84	108.24	145.01	172.88	214.64	327.97
1:25:00	0.00	0.00	47.70	71.91	96.90	126.72	150.93	182.28	278.38
1:30:00	0.00	0.00	43.17	64.48	84.72	109.56	130.15	154.06	234.65
1:35:00	0.00	0.00	38.75	57.44	73.38	93.41	110.58	129.39	196.57
1:40:00	0.00	0.00	34.36	49.61	62.97	78.41	92.46	106.71	161.77
1:45:00	0.00	0.00	30.28	41.61	53.74	64.66	75.90	86.00	130.10
1:50:00	0.00	0.00	26.98	34.88	46.47	52.35	61.14	67.81	102.95
1:55:00	0.00	0.00	24.06	30.90	41.91	42.86	49.98	54.10	83.44
2:00:00	0.00	0.00	21.40	28.34	38.13	37.38	43.54	45.78	71.36
2:05:00	0.00	0.00	18.08	24.43	32.57	31.32	36.42	37.48	58.75
2:10:00	0.00	0.00	14.61	19.63	26.17	24.61	28.57	28.74	45.19
2:15:00	0.00	0.00	11.53	15.36	20.53	18.83	21.82	21.39	33.71
2:20:00	0.00	0.00	9.12	12.10	16.09	14.58	16.84	15.95	25.15
2:25:00	0.00	0.00	7.16	9.48	12.48	11.20	12.89	11.83	18.66
2:30:00	0.00	0.00	5.60	7.36	9.57	8.59	9.84	8.90	14.02
2:35:00	0.00	0.00	4.37	5.62	7.23	6.54	7.46	6.79	10.61
2:40:00	0.00	0.00	3.38	4.25	5.44	4.94	5.61	5.17	8.05
2:45:00	0.00	0.00	2.59	3.20	4.15	3.76	4.27	3.99	6.21
2:50:00	0.00	0.00	1.95	2.40	3.16	2.88	3.26	3.07	4.76
2:55:00	0.00	0.00	1.40	1.73	2.30	2.13	2.41	2.26	3.50
3:00:00	0.00	0.00	0.95	1.19	1.58	1.50	1.69	1.58	2.43
3:05:00	0.00	0.00	0.58	0.77	1.00	0.98	1.10	1.02	1.56
3:10:00	0.00	0.00	0.31	0.45	0.56	0.57	0.63	0.59	0.88
3:15:00	0.00	0.00	0.13	0.21	0.25	0.27	0.29	0.27	0.39
3:20:00	0.00	0.00	0.04	0.06	0.07	0.08	0.08	0.07	0.10
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]

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).

DRAINAGE MAPS

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

CLASSIC CONSULTING
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(719)785-0799 (Fax)

FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

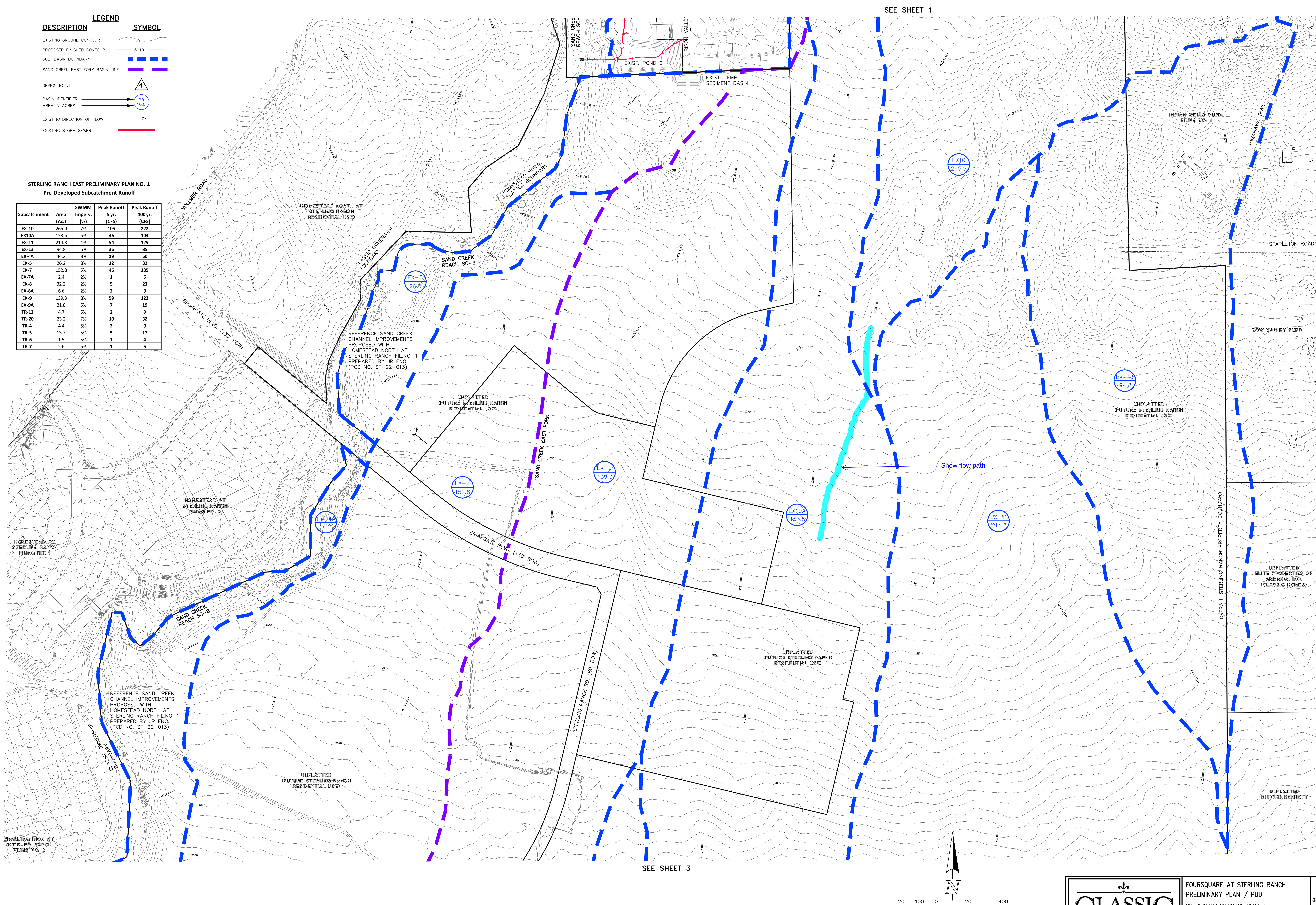
DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 1 OF 7
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.20

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	

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5



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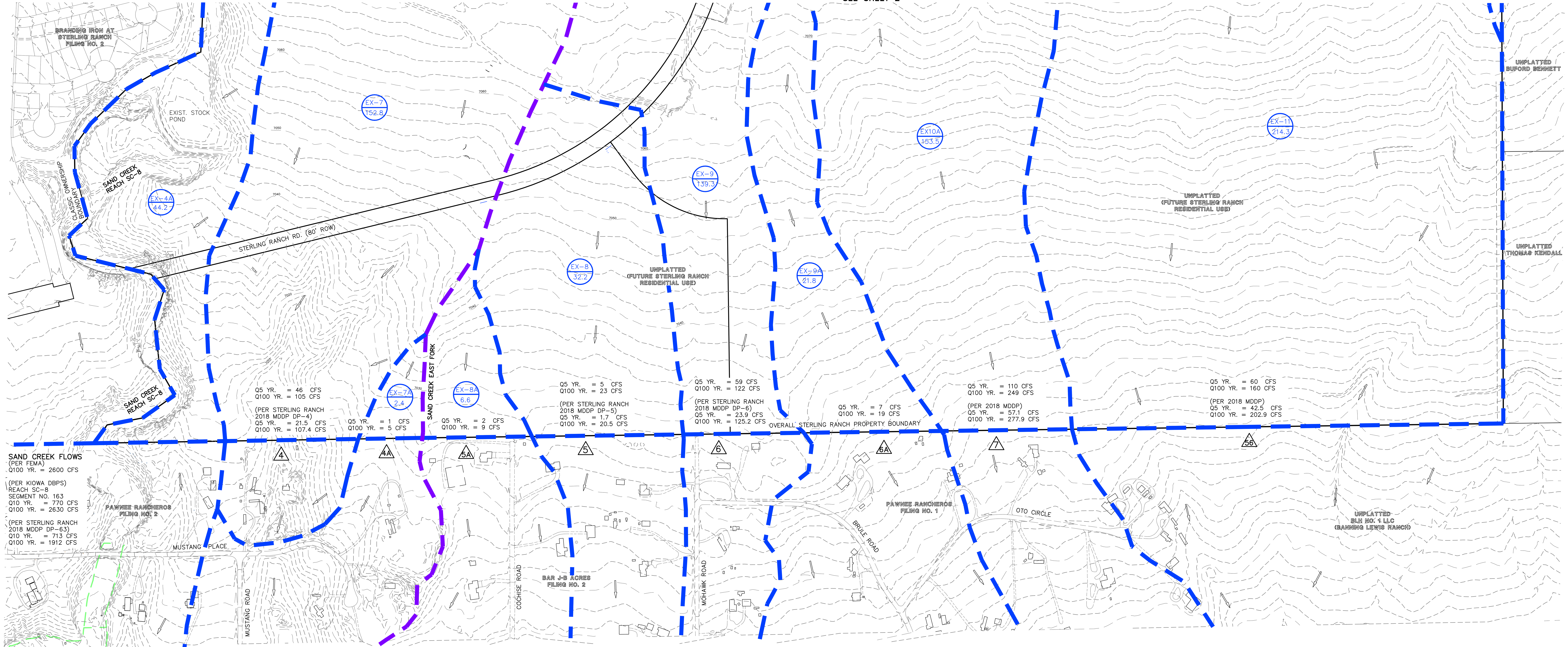
FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY MAW	SCALE	DATE 4-1-22	
DRAWN BY MAW	(H) 1"= 200'	SHEET 2 OF 7	
CHECKED BY	(V) 1"= N/A	JOB NO. 1183.20	

SEE SHEET 2



STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP4	46	105
DP4A	1	5
DP5	5	23
DP5A	2	9
DP6	59	122
DP6A	7	19
DP7	110	249
DP56	60	160
DPEX-4A	19	50
DPEX-5	12	32

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'

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FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

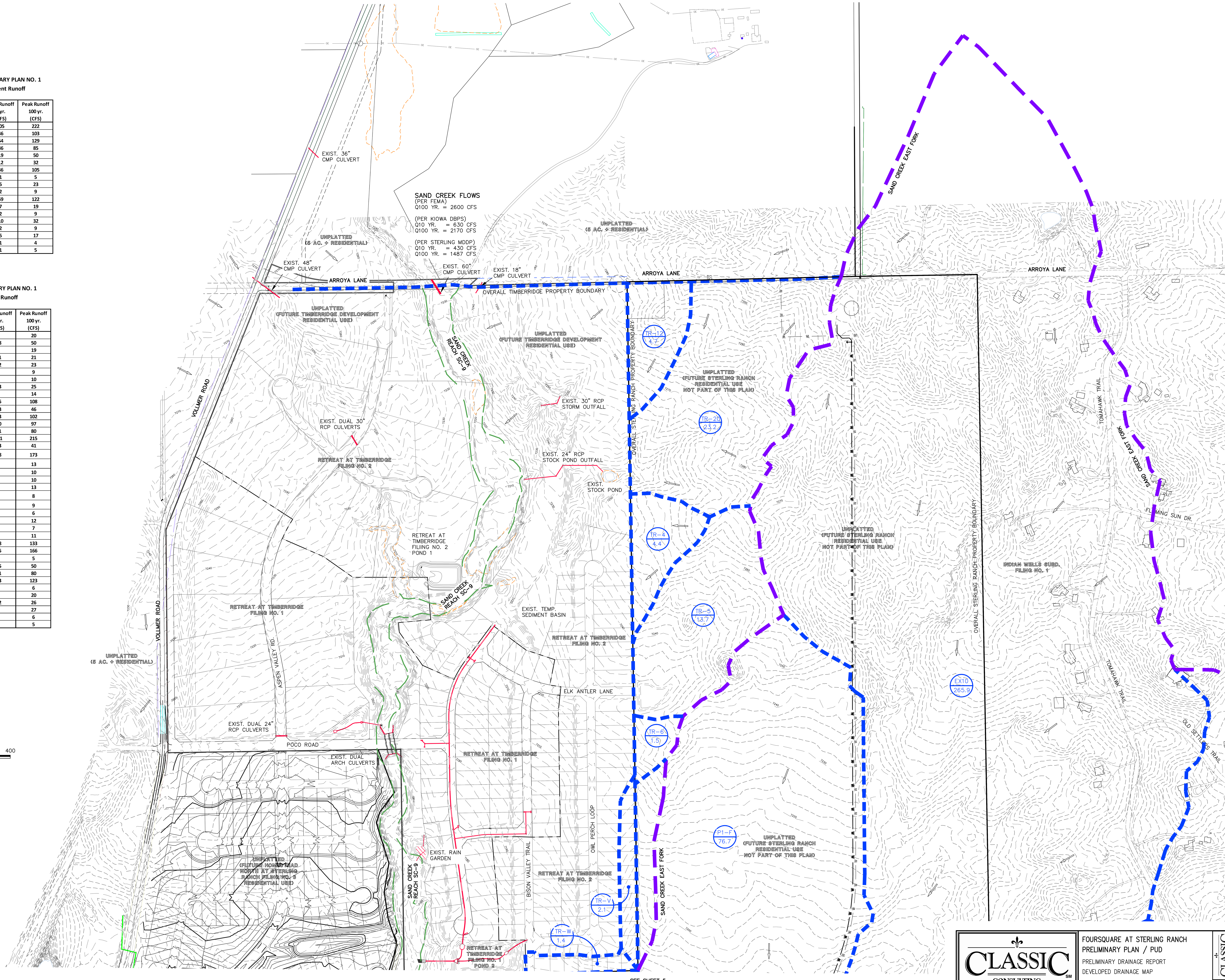
DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 3 OF 7
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.20

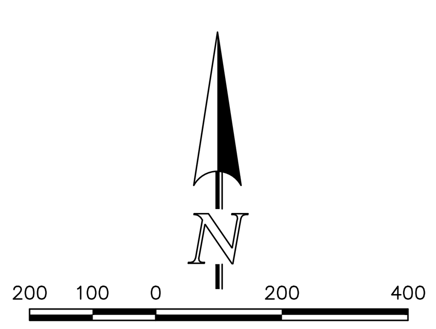
STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A	60.4	5%	18	50
P1-A	12.7	8%	6	19
P1-A1	5.0	45%	11	21
P1-A2	6.4	45%	12	23
P1-A3	1.8	50%	5	9
P1-A4	2.0	50%	5	10
P1-A5	5.7	45%	13	25
P1-A6	2.8	50%	7	14
P1-B	35.5	38%	55	108
P1-C	8.9	50%	23	46
P1-D	31.4	38%	53	102
P1-E1	30.4	35%	50	97
P1-E2	21.8	40%	41	80
P1-F	76.7	30%	111	215
P2-A	22.2	10%	13	41
P2-B	57.8	38%	88	173
P2-B1	2.5	50%	7	13
P2-B10	1.7	50%	5	10
P2-B2	1.9	50%	5	10
P2-B3	2.8	45%	7	13
P2-B4	1.6	50%	4	8
P2-B5	1.9	45%	5	9
P2-B6	1.1	50%	3	6
P2-B7	2.5	45%	6	12
P2-B8	1.2	50%	3	7
P2-B9	2.0	50%	5	11
P2-S1	35.6	40%	68	133
P3-A	52.6	40%	85	166
P3-C	1.7	11%	1	5
P3-S2	11.9	40%	25	50
P4-A	25.8	35%	41	80
P4-B	37.3	35%	63	123
SC-1	3.6	8%	2	6
SC-2	10.8	8%	6	20
SC-3	27.2	8%	12	26
SC-4	16.4	8%	8	27
TR-V	2.1	19%	2	6
TR-W	1.4	38%	3	5





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	

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FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 4 OF 7
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.20

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	B8 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	

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A	60.4	5%	18	50
P1-A	12.7	8%	6	19
P1-A1	5.0	45%	11	21
P1-A2	6.4	45%	12	23
P1-A3	1.8	50%	5	9
P1-A4	2.0	50%	5	10
P1-A5	5.7	45%	13	25
P1-A6	2.8	50%	7	14
P1-B	35.5	38%	55	108
P1-C	8.9	50%	23	46
P1-D	31.4	38%	53	102
P1-E1	30.4	35%	50	97
P1-E2	21.8	40%	41	80
P1-F	76.7	30%	111	215
P2-A	22.2	10%	13	41
P2-B	57.8	38%	88	173
P2-B1	2.5	50%	7	13
P2-B10	1.7	50%	5	10
P2-B2	1.9	50%	5	10
P2-B3	2.8	45%	7	13
P2-B4	1.6	50%	4	8
P2-B5	1.9	45%	5	9
P2-B6	1.1	50%	3	6
P2-B7	2.5	45%	6	12
P2-B8	1.2	50%	3	7
P2-B9	2.0	50%	5	11
P2-S1	35.6	40%	68	133
P3-A	52.6	40%	85	166
P3-C	1.7	11%	1	5
P3-S2	11.9	40%	25	50
P4-A	25.8	35%	41	80
P4-B	37.3	35%	63	123
SC-1	3.6	8%	2	6
SC-2	10.8	8%	6	20
SC-3	27.2	8%	12	26
SC-4	16.4	8%	8	27
TR-V	2.1	19%	2	6
TR-W	1.4	38%	3	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14A Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A1	5.0	N/A	70%
P1-A2	6.4	N/A	70%
P1-A3	1.8	N/A	70%
P1-A4	2.0	N/A	70%
P1-A5	5.7	N/A	70%
P1-A6	2.8	N/A	70%
P2-S1	35.6	School	65%
P2-A	22.2	Park	7%
P2-B	57.8	7,000	57%
P2-B1	2.5	N/A	70%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	70%
P2-B4	1.6	N/A	70%
P2-B5	1.9	N/A	70%
P2-B6	1.1	N/A	70%
P2-B7	2.5	N/A	70%
P2-B8	1.2	N/A	70%
TOTAL	154.8		55%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	112	219
DP-2	53	103
DP-3	41	80
DP-4	218	379
DP-5	53	102
DP-6	55	108
DP-7	20	39
DP-8	119	235
DP-9	88	173
DP-10	223	441
DP-11	10	21
DP-12	63	123
DP-13	41	80
DP-14	97	189
DP-15	85	166
DP-16	34	69

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	15%
P1-B	35.5	7,500	55%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	12,500	35%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	220.9		46%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P4-A	37.3	6,500	60%
P4-B	25.8	6,500	60%
TOTAL	63.1		60%

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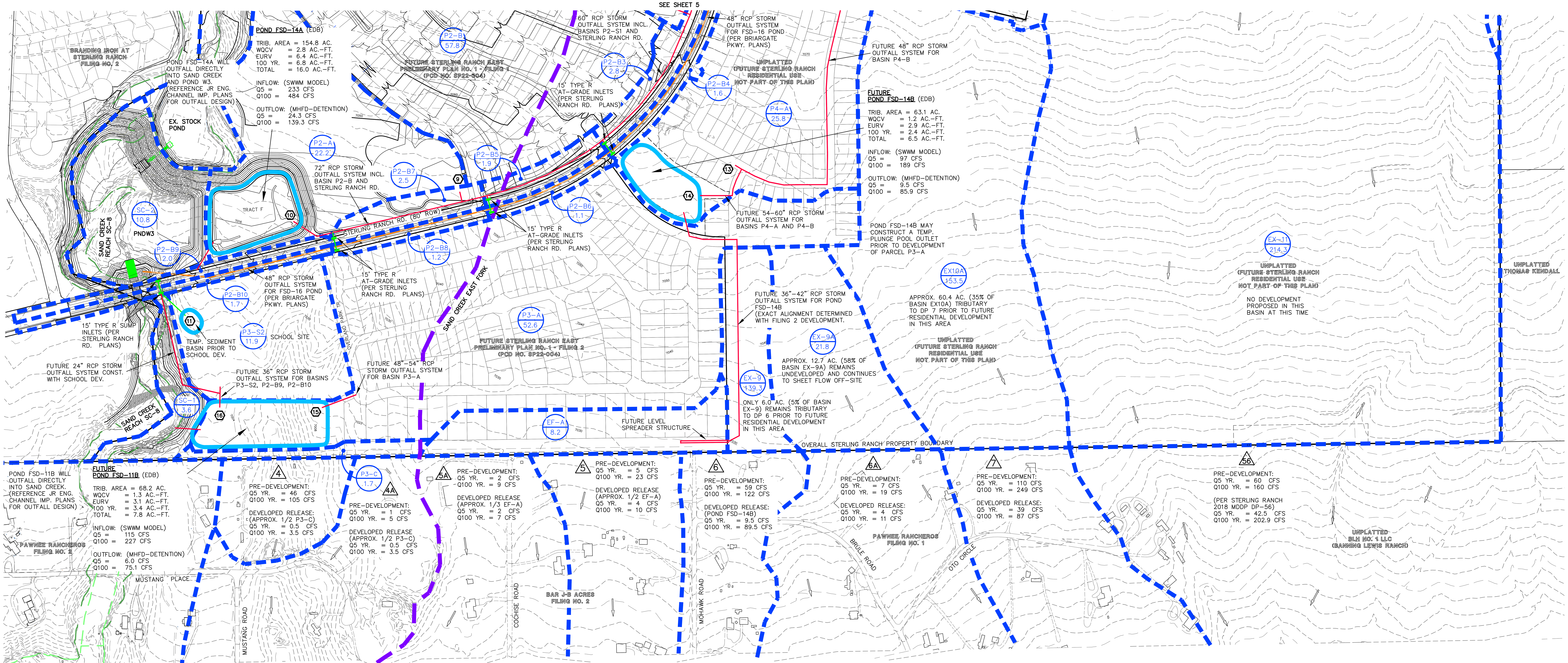
FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY MAW	SCALE	DATE 4-1-22	
DRAWN BY MAW	(H) 1"= 200'	SHEET 5 OF 7	
CHECKED BY	(V) 1"= N/A	JOB NO. 1183.20	

SEE SHEET 5



See SP-22-004 PDR/MDDP comments

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14A Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A1	5.0	N/A	70%
P1-A2	6.4	N/A	70%
P1-A3	1.8	N/A	70%
P1-A4	2.0	N/A	70%
P1-A5	5.7	N/A	70%
P1-A6	2.8	N/A	70%
P2-S1	35.6	School	65%
P2-A	22.2	Park	7%
P2-B	57.8	7,000	57%
P2-B1	2.5	N/A	70%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	70%
P2-B4	1.6	N/A	70%
P2-B5	1.9	N/A	70%
P2-B6	1.1	N/A	70%
P2-B7	2.5	N/A	70%
P2-B8	1.2	N/A	70%
TOTAL	154.8		55%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P4-A	37.3	6,500	60%
P4-B	25.8	6,500	60%
TOTAL	63.1		60%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-11B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P2-B9	2.0	N/A	70%
P2-B10	1.7	N/A	70%
P3-S2	11.9	School	65%
P3-A	52.6	7,000	57%
TOTAL	68.2		59%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A	60.4	5%	18	50
P1-A	12.7	8%	6	19
P1-A1	5.0	45%	11	21
P1-A2	6.4	45%	12	23
P1-A3	1.8	50%	5	9
P1-A4	2.0	50%	5	10
P1-A5	5.7	45%	13	25
P1-A6	2.8	50%	7	14
P1-B	35.5	38%	55	108
P1-C	8.9	50%	23	46
P1-D	31.4	38%	53	102
P1-E1	30.4	35%	50	97
P1-E2	21.8	40%	41	80
P1-F	76.7	30%	111	215
P2-A	22.2	10%	13	41
P2-B	57.8	38%	88	173
P2-B1	2.5	50%	7	13
P2-B10	1.7	50%	5	10
P2-B2	1.9	50%	5	10
P2-B3	2.8	45%	7	13
P2-B4	1.6	50%	4	8
P2-B5	1.9	45%	5	9
P2-B6	1.1	50%	3	6
P2-B7	2.5	45%	6	12
P2-B8	1.2	50%	3	7
P2-B9	2.0	50%	5	11
P2-S1	35.6	40%	68	133
P3-A	52.6	40%	85	166
P3-C	1.7	11%	1	5
P3-S2	11.9	40%	25	50
P4-A	25.8	35%	41	80
P4-B	37.3	35%	63	123
SC-1	3.6	8%	2	6
SC-2	10.8	8%	6	20
SC-3	27.2	8%	12	26
SC-4	16.4	8%	8	27
TR-V	2.1	19%	2	6
TR-W	1.4	38%	3	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	112	219
DP-2	53	103
DP-3	41	80
DP-4	218	379
DP-5	53	102
DP-6	55	108
DP-7	20	39
DP-8	119	235
DP-9	88	173
DP-10	223	441
DP-11	10	21
DP-12	63	123
DP-13	41	80
DP-14	97	189
DP-15	85	166
DP-16	34	69

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP4	46	105
DP4A	1	5
DP5	5	23
DP5A	2	9
DP6	59	122
DP6A	7	19
DP7	110	249
DP56	60	160
DPEX-4A	19	50
DPEX-5	12	32

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

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	88 / 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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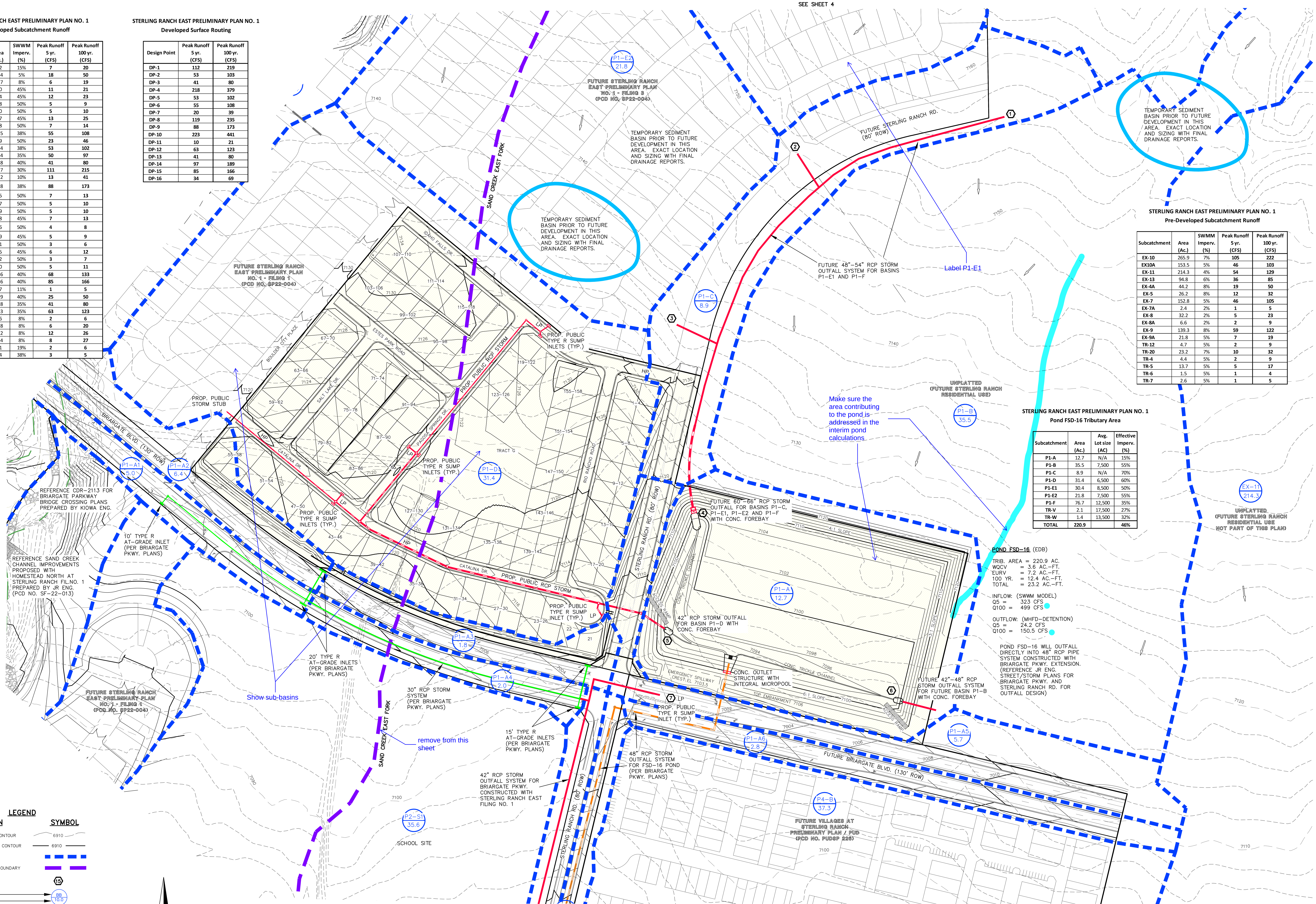
FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 6 OF 7
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.20

SEE SHEET 4



STERLING RANCH EAST PRELIMINARY PLAN NO. 1
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STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
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DP-16	34	69

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
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TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	15%
P1-B	35.5	7,500	55%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	12,500	35%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	**220.9**		**46%**

SEE SHEET 6

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FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 9-30-22
DRAWN BY	MAW	(H) 1"= 100'	SHEET 7 OF 7
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.20