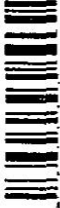


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**MASTER DEVELOPMENT
DRAINAGE REPORT
FOR
STERLING RANCH FILING NOS. 1&2
AND
FINAL DRAINAGE REPORT FOR
STERLING RANCH FILING NO. 1
EL PASO COUNTY, COLORADO**

DECEMBER 2017

Prepared for:

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

Prepared by:



CIVIL CONSULTANTS, INC.
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RECEIVED VERSION

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DSD Project # SF-16-013

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MASTER DEVELOPMENT DRAINAGE REPORT
FOR
STERLING RANCH FILING NOS. 1&2
AND
FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 1

DRAINAGE PLAN STATEMENTS

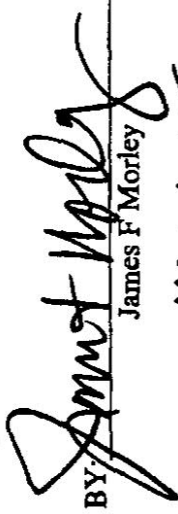
ENGINEERS STATEMENT

The attached drainage plan and report was prepared under my direction and supervision, and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County of El Paso drainage reports and said report is in conformity with the master plan of the drainage basin.


Virgil A. Sanchez, P.E. #37160
For and on Behalf of **McGREGOR CONSULTANTS, Inc**

DEVELOPER'S STATEMENT

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

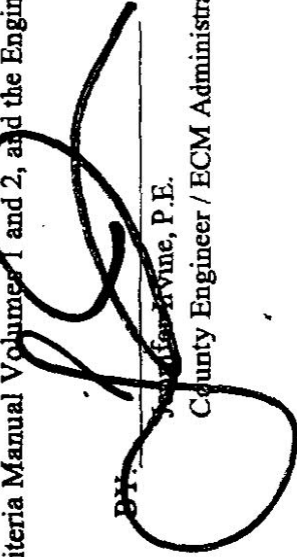
BY: 
James F. Morley

TITLE: MANAGER
DATE: 4/17/2017

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

EL PASO COUNTY'S STATEMENT

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

BY:  DATE: 30 JAN 18
County Engineer / ECM Administrator

**MASTER DEVELOPMENT DRAINAGE REPORT
FOR
STERLING RANCH FILING NOS. 1&2
AND
FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 1**

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MASTER DEVELOPMENT DRAINAGE REPORT
FOR
STERLING RANCH FILING NOS. 1&2
AND
FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 1

PURPOSE

This document is the Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual. The principal use for this Final Drainage Report and Final Plat, is only for the major roadways and tracts. The defined tracts are for the development of, landscape areas, and future single family lots. The tracts proposed for future single family development will be replated into lots, and will have a separate final drainage report. The following report is an analysis of the drainage for the entire development, single family lots, onsite and offsite drainage.

GENERAL LOCATION AND DESCRIPTION

Sterling Ranch Filing Nos. 1&2 are located in Section 33, Township 12 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The site is bound on the north and west by existing Vollmer Road. The site is bound on the north by proposed Briargate Parkway. The property is bound to the south by proposed Marksheffel Road, existing Industrial property and the City of Colorado Springs,. The site is bound on the east by Sand Creek, and the west by existing Vollmer Road. The existing Barbarick Subdivision (Existing Industrial property) lies within the middle of the site and is currently developed. Sterling Ranch lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

Sterling Ranch Filing No. 1 consists of 134.39 acres and Filing No. 2 is ~47.87 acres, presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to south at grade rates that vary between 2% and 8%.

The Sterling Ranch Filing Nos. 1&2 are currently zoned "RS-5000" for residential single family development, and "CS" for Commercial development. Improvements proposed for the site include paved, streets, trails, utilities, and storm drainage improvements, as normally constructed for a residential and commercial development. Full spectrum detention facilities are proposed to be constructed along the length of the site, off line of Sand Creek, to provide water quality treatment and detain stormwater for the development.

SOILS

Soils for this project are delineated by the map in the appendix as Blakeland Loamy Sand (8), Flakeland-Fluvaquentic Haplaquolis (9) and Columbine Gravelly Sandy Loam (19) are characterized as Hydrologic Soil Types "A". Pring Coarse Sandy Loam (71) is characterized as Hydrologic Soil Types "B". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". Vegetation is sparse, consisting of native grasses and weeds.

HYDROLOGIC CALCULATIONS

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

The historic and developed drainage conditions in this report were calculated using the Soil Conservation Service (SCS) Hydrograph procedure per the El Paso County Drainage Criteria Manual. Since the majority of the existing drainage basins in this report exceed 100 acres in size, this method was selected for an “MDDP” level of detail. However, in future phases of drainage analysis for Sterling Ranch, the Rational Method will be used to analyze smaller drainage basin areas. Normally, the Rational Method is a bit more conservative, but is better used to analyze smaller basins and smaller “local” drainage facilities. The SCS procedure will be used for regional and larger drainage facilities, such as, detention ponds, channel improvements and culverts.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

A portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0535 F, effective date March 17, 1997 and revised to reflect LOMR, 08-08-0541P, dated July 23, 2009. An annotated FIRM Panel is included in the Appendix. The only development within the floodplain will be outfall pipes and minor bank stabilization. A “No Rise Permit” will be performed with the proposed improvements to Sand Creek.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual, Volumes I & II, dated November 1991, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County’s Engineering Criteria Manual (ECM), 2008). In addition to the ECM, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates. Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method. The site is in excess of 100 acres, which according to the above referenced criteria triggers the use of the Soil Conservation Service (SCS) Method for peak runoff determination. To be conservative, the rational method is used to ensure downstream structures are of adequate size to accept anticipated peak flows, and to be consistent with future Final Drainage Reports within Sterling Ranch. However, the SCS method, Full Spectrum Detention was used to size the detention ponds for the development. The SCS method is less conservative and more accurately sizes the storm events to model the detention ponds, and Sand Creek channel conveyance.

WETLANDS

Sterling Ranch was authorized under Section 404 of the Clean Water Act to discharge dredged and fill materials into waters of the United States to conduct work associated with construction of Sterling Ranch Residential Development in accordance with Action Number SPA-2015-00428-SCO. A copy of the permit is within the Appendix of this report. For the construction of Sterling Ranch Filing No. 1, ~2950 square feet of wetlands will be displaced and mitigated. The disturbance areas are located within the general area of Pond BB, Pond 4 and Pond 8 which outfall into the Sand Creek Channel. A mitigation area is designated on the construction drawings. Coordination with the wetlands consultant and the Army Corp of Engineers will be in conformance with the wetland permit. No other construction associated with Sterling Ranch Filing No. 1 will disturb the existing wetlands. Sterling Ranch Filing No. 2 will have significant wetland disturbance. The area(s) of mitigation will be shown on the construction drawings and Final Drainage report associated with Filing No. 2. Included in this report (in the appendix) are the memo and map from Core Consultants showing intent to have wetlands delineated in the Filing No. 2 areas of wetland disturbance and mitigation.

EXISTING DRAINAGE CONDITIONS

The Sterling Ranch Filing No. 1 site consists of 182.26 acres and is situated west of the Sand Creek Watershed. This area was previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996. More recently the area was studied in the "Preliminary Drainage Report for Sterling Ranch-Phase 1", dated May 2015, by M&S Civil Consultants, Inc. (henceforth referred to as "PDR"). A "Master Development Drainage Plan For Sterling Ranch", prepared by M&S Civil Consultants, Inc., dated July 2010 and "Technical Memorandum Sand Creek Channel Study (North of Woodmen Road) Hydrologic Analysis" (TM-SCCS) prepared by M&S Civil Consultants, Inc., dated July 2016, was submitted and under review but not approved.

The Sand Creek DBPS assumed the Sterling Ranch property to have a "large lot residential" use for the majority of the site. However, the proposed master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located east of the site running north to south. This reach of drainage conveyance is not currently improved. There are a few stock ponds within the creek channel used for cattle watering. Barbed wire fences bound the entire ~1440 acres of Sterling Ranch.

Offsite flows enter Sterling Ranch from the east, west and north, described as follows;

To the west, the existing subdivisions west of Vollmer Road historically drains south to the west side of Vollmer Road. A roadside ditch carries the flow southwesterly and is conveyed under the roadway through Sterling Ranch to Sand Creek in a few locations. See the Historic Basin Descriptions section of this report.

To the east; Sand Creek conveys flows from north to south. Flows from Sand Creek will continue to be conveyed through Sterling Ranch. (DBPS SEG: 170, 187, 163)

To the north; an existing drainage swale conveys flows from the west side of Vollmer Road to Sand Creek. (DBPS SEG: 169, 186)

To the south of Sterling Ranch Filing No.2 lies developed Industrial properties, and low density single family development. The undeveloped runoff from these areas is conveyed from north to south, via historic drainage patterns, and do not impact any Sterling Ranch property.

The central-west area of Sterling Ranch Filing No. 1; contains the Barbarick Subdivision (Industrial property). The existing flows from this subdivision generally drain from north to south. A portion of the Barbarick property is currently under construction and will provide detention and water quality ponds. The discharge will continue to be conveyed through Sterling Ranch. See "Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3 & 4, by Matrix Design Group, June 2016". (DBPS SEG: 164, 159)

The following "Proposed Drainage Characteristics" will address how developed and historic flows will be routed through Sterling Ranch to Sand Creek. If future offsite development occurs upstream of Sterling Ranch from the west or north, the propertie(s) will be required to detain to historic/ existing conditions per the County / City drainage criteria.

Refer to the Sterling Ranch Historic Drainage Map and Sterling Ranch Filing No.1&2 MDDP-Proposed Drainage Map (in the appendix) for off-site basin information. Descriptions of off-site basins are discussed below.

The following drainage basin narratives are based on information derived from field visits, USGS topographic mapping, aerial topography, field surveys and information provided by others familiar with the site. A "sheet flow" verses "concentrated ditch flow" designation was determined as best as possible from the available source topography, actual conditions may vary. Ownership was determined by the use of the El Paso County Assessor's web site as of the date of this report. A summary of peak runoff for the basins and designated design points are depicted on the Sterling Ranch Historic Drainage Map and Existing Conditions Drainage Map in the appendix.

Historic Basin Descriptions

Basin EX-1 (Q5 = 3 cfs, Q100 = 40 cfs) is a 24 acre area of land located in the southwestern portion of the site, southeast of Vollmer Road. This area of land, as well as the balance of Sterling Ranch is undeveloped and is used for pasture. Runoff from the basin generally travels as sheet flow from north to south until it reaches the northern boundary of an existing gravel pit.

Basin EX-2 (Q5 = 3 cfs, Q100 = 45 cfs) is a 31 acre area of land located in the southwest portion of the site, southeast of Vollmer Road. Runoff from the basin generally travels as sheet flow and concentrated ditch flow from north to south until it reaches the northern boundary of an existing gravel pit.

Basin EX-3 (Q5 = 49 cfs, Q100 = 341 cfs) is a 311 acre area of land located in the western portion of the site. A portion of the basin extends off-site to the northwest side of Vollmer Road, and is undeveloped (See Proposed Drainage Map, Sub-basin EX3~W-2, OS1A, OS1B, OS1C, OS1D~ Q5=21.0 cfs and Q100=154.2 cfs). A southern portion of the basin (adjacent to Vollmer Road) is currently developed as commercial/industrial ground outside of the Sterling Ranch boundary, (Barbarick Subdivision). The remaining southern portion of the ground is within Sterling Ranch. Runoff from the basin generally travels from north to south until it reaches the southern boundary of Sterling Ranch and flows into a tributary of Sand Creek (See Sand Creek Drainage Basin Planning Study, Segment 159, page 47-48, anticipated flows=950 cfs). Per the approved Preliminary/Final Drainage Report for the Barbarick Subdivision, detention ponds are proposed to detain flows discharging to the south into Sterling Ranch. At the time of this report, the detention ponds have not been constructed. (See Proposed Map for location and flows).

Basin EX-4 (Q5 = 71 cfs, Q100 = 352 cfs) is a 330 acre area of land located on the western portion of the

site, including the Sand Creek channel. A portion of this basin extends off-site to the northwest of Vollmer Road, and is currently undeveloped property. Runoff from the basin generally travels from north to south until it reaches the northern boundary of the site, being conveyed in the Sand Creek channel (See Proposed Drainage Map, Sub-Basin EX4A, EX4B, EX4C~Q5=28.2 cfs and Q100=208.4 cfs). (See SCDBPS, Segment 163, pages 49-51)

Basin EX-5 (Q5 = 14 cfs, Q100 = 209 cfs) is a 152 acre area of land located on the northwestern portion of the site, including the Sand Creek channel. A portion of this basin extends off-site to the north of the site boundary. Runoff from the basin generally travels from northwest to southeast until it reaches the Sand Creek Channel, then being conveyed through Sterling Ranch. (See SCDBPS, Segments, 170, & 187, pages 51-54).

Basin EX-6 (Q5 = 118 cfs, Q100 = 2168 cfs) is a 1,692 acre area of land located north of Sterling Ranch, tributary to the Sand Creek channel. Some of the basin developed as low density residential, or is vacant and used for pasture. Runoff from the basin generally travels from north to south until it reaches the Sand Creek Channel, then being conveyed through Sterling Ranch. (See SCDBPS, Segments, 170, & 171, pages 54-55. The anticipated SCDBPS flow at the north boundary of Sterling Ranch is Q10 = 670cfs, Q100 = 2260cfs)

Basins EX 7 – 13 exist on the east side of Sand Creek and do not affect Sterling Ranch Filing No. 1 & 2. (Per Historic Drainage Map in the Appendix)

Basins OS 20-23 and Off-Site Conveyance

The existing drainage patterns on the west side of Vollmer Road are not intended to be significantly altered by the development of Sterling Ranch. The construction of Vollmer Road will address the ditch flows along the west side and will install drainage culverts were necessary per this report. The majority of the flows from the west side of Vollmer Road are to be routed in the historical direction to the southwest along the roadway to a proposed Pond W-2. At the north end of the Barbarick subdivision, west side of Vollmer Road, a new 48" RCP is proposed to convey the flows from the full spectrum detention pond and across Sterling Ranch development to Sand Creek. The proposed 48" RCP replaces an undersized existing 24" CMP that historically conveyed a portion of the runoff from the upstream watershed, but at a different location. The purpose of this relocation is to conveniently route the flows across Sterling Ranch in a logical path to Sand Creek as in the historical condition. Runoff produced from the remaining off-site watershed located along the west edge of the development will be routed along the west side of Vollmer Road to the southwest corner of the development. At the northwest corner of Tahiti Drive and Vollmer Road a 72" RCP will be installed to collect and convey runoff under proposed Marksheffel Road before ultimately discharging into Sand Creek. Runoff reaching the development along the south boundary line of the Barbarick Subdivision will be conveyed through the proposed site by portions of the existing western tributary channel, proposed temporary swales and proposed storm sewer until it ultimately reaches Pond W-5. Additional internal collection and conveyance storm sewer systems will be constructed with future development parcels within Sterling Ranch. Runoff reaching the northern boundary of Phase I at proposed Briargate Parkway will be redirected around the site via a temporary swale to Sand Creek. BMP's will be installed to prevent erosion of the temporary swale.

The intention of the drainage design for Sterling Ranch is to not adversely affect any adjacent property within the developed flows from Sterling Ranch. As previously mentioned, on the south end of the site, the developed flows are to be re-directed and collected in local storm sewer facilities onsite to Sterling Ranch. Only very minor amount of storm water shall be conveyed from small landscaped areas, or tracts onto the adjacent lands. This amount of discharge is far less than the historic runoff onto these properties. (East side of the Barbarick Subdivision). No downstream retention ponds exist that would be sacrificed by this redirection of flow.

To the east of the proposed Sterling Ranch – Phase I, the property is not planned for development at this time. Therefore, the adjacent properties to the east and south will not see any change in the upstream historical conveyance of flows. The majority of all major flows exiting the Sterling Ranch – Phase I development will be detained and treated in onsite full spectrum detention ponds, prior to discharging into the Sand Creek channel. The option to construct larger online regional facilities to aid in the treatment and detention of runoff produced from planned and future development will continue to be re-evaluated.

Existing Utilities – High Pressure Gas Pipelines

At the southwest corner of Sterling Ranch exists three high pressure gas/petroleum pipelines. There are two 20-inch diameter and one 6-inch diameter pipelines. Special care in design and coordination with the appropriate utility agency shall be made to ensure of safety. Also, at the southwest portion of the site exists a Colorado Springs Utilities gas distribution line that serves the Barbarick Subdivision. This gas line will likely be relocated in the proposed right-of-way of the southern proposed Filing No. 2 subdivision. However, it should be noted that the gas pipelines existed pre-development. Additional utilities (including MVEA, Century link, CIG,...) are present adjacent to the Vollmer right-of-way, and will be relocated where necessary with the Vollmer Road improvements.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

The following is a description of the offsite and onsite basins, offsite bypass flows and the overall future drainage characteristics for the development of Sterling Ranch Filing No. 1. The initial development of Filing No. 1 consists only of the roadway and storm sewer infrastructure for; Marksheffel Road (4 lane urban principal arterial), Briargate Parkway (4 lane urban principal arterial) Vollmer Road (modified Urban Minor Arterial), Sterling Ranch Road (urban non-residential collector), and Dines Boulevard (urban residential collector). Calculations have been provided to show the proposed development will adequately convey flows for the adjacent tracts to be developed. The following DPs and Basins were determined using the Rational Method since this method offers a more conservative approach to sizing swales and storm drain. It should be noted that all calculations and drainage basins have been revised to reflect the new criteria updates by the El Paso County/City of Colorado Springs Drainage Criteria Manual. See appendix for minor and major street capacity rating table sheets for street sections, sump inlet capacity rating table and design peak flow sheets for at-grade inlets. Surface flow is designated as Design Points (DP) and storm sewer routing as Pipe Run (PR).

Detailed Drainage Discussion

Design Points Tributary to Detention Pond 4 (Drainage Map – Sheet 4) – Filing No. 1

DP3, 2.92 acres, consists of Basin C future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of $Q_5=4.2$ cfs and $Q_{100}=10.1$ cfs has been calculated for DP3. The surface runoff is routed via overlot grading and proposed swales to a temporary sediment basin at DP3 which will be collected by a temporary 18" FES. The flows will routed east via an 18" RCP (PR5) at DP4.

DP4, 9.36 acres, consists of Basin E future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year and Basin F (Dines Boulevard) with runoff coefficients of 0.90 for the

5-year and 0.96 for the 100-year. Developed runoff of Q5=16.1 cfs and Q100=36.7 cfs has been calculated for DP4. The surface runoff is routed via overlot grading and curb and gutter to DP4 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=13.3 cfs and Q100=20.0 cfs) will combine with flows from PR5 and be routed east via a 30" RCP (PR6, Q5=16.8 cfs and Q100=29.4 cfs) to Detention Pond 4 (DP 10). Flows will outfall into a concrete lined forebay.

DP2, 5.39 acres, consists of Basin B future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=8.0 cfs and Q100=19.3 cfs has been calculated for DP2. The surface runoff is routed via overlot grading and proposed swales to a temporary sediment basin at DP2 which will be collected by a temporary 36" FES. The flows will be routed east via a 36" RCP (PR2, Q5=8.0 cfs and Q100=19.3 cfs) to DP5.

DP5, 0.80 acres, consists of Basin G future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin H (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP4. Developed runoff of Q5=4.2 cfs and Q100=19.7 cfs has been calculated for DP5. The surface runoff is routed via overlot grading and curb and gutter to DP5 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=4.2 cfs and Q100=14.7 cfs) will combine with flows from PR2 and be routed east via a 36" RCP (PR3, Q5=11.6 cfs and Q100=27.6 cfs) to DP6.

DP6, 4.68 acres, consists of Basin J and K future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin L (Dines Boulevard) and Basin I (Wheatland Drive) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=14.1 cfs and Q100=26.7cfs has been calculated for DP6. The surface runoff is routed via overlot grading and curb and gutter to DP6 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=12.1 cfs and Q100=17.2 cfs) will combine with flows from PR3 and be routed east via a 36" RCP (PR4, Q5=21.8 cfs and Q100=42.1 cfs) to Detention Pond 4 (DP 10). Flows will outfall into a concrete lined forebay.

DP9, 9.73 acres, consists of Basin R future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=12.5 cfs and Q100=30.4 cfs has been calculated for DP9. The surface runoff is routed via overlot grading and swales to a temporary sediment basin at DP9 which will be collected by a 30" FES. The flow will be routed south via a 30" RCP (PR10, Q5=12.5 cfs and Q100=30.4 cfs) to Detention Pond 4 (DP 10). Flows will outfall into a concrete lined forebay.

DP10, 1.97 acres, consists of Basin S (**Detention Pond 4**) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. The combined upstream developed runoff of Q5=50.0 cfs and Q100=102.9 cfs has been calculated for DP10. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 27.5 acres, and provide 0.46 ac-ft of water quality storage and 2.90 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention pond. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP10 will over top the emergency spillway and outfall into Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet. The peak release rate from pond 4 (PR11, Q5=2.7 cfs and Q100=36.2 cfs ~30" RCP) will combine with offsite flows from PR18 (Q5=16.2 cfs and Q100=125.9 cfs). The summed flows (PR12, Q5=18.9 cfs and Q100=162.1 cfs) will outfall, via a 54" RCP at DP11 and into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

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

Design Points Tributary to Detention Pond 8 (Drainage Map – Sheet 3) - Filing No. 1

DP18 9.74 acres, consists of Basin GG future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, Basin II (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP5. Developed runoff of Q5=14.1 cfs and Q100=41.6 cfs has been calculated for DP18. The surface runoff is routed via overlot grading and curb and gutter to DP18 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=12.1 cfs and Q100=21.1 cfs) will be routed east via a 30" RCP (PR19). These flows will combine with flows from DP19 and will be routed south via 36" RCP (PR20, Q5=25.8 cfs and Q100=42.3 cfs) to DP27 Detention Pond 8. Flows will outfall into a concrete lined forebay.

DP19 11.86 acres, consists of Basin HH future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, Basin JJ (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP6. Developed runoff of Q5=20.5 cfs and Q100=52.0 cfs has been calculated for DP19. The surface runoff is routed via overlot grading and curb and gutter to DP19 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=15.0 cfs and Q100=23.2 cfs) will be routed east via a 36" RCP (PR20). These flows will be combined flows from DP20 will be routed south via 36" RCP (PR20, Q5=25.8 cfs and Q100=42.3 cfs) to DP27 Detention Pond 8. Flows will outfall into a concrete lined forebay.

DP20 2.19 acres, consists of Basin KK future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, Basin MM (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP18. Developed runoff of Q5=5.2 cfs and Q100=27.9 cfs has been calculated for DP20. The surface runoff is routed via overlot grading and curb and gutter to DP20 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow will be routed via a 30" RCP (PR 22, Q5=5.2 cfs and Q100=17.6 cfs) will combine with flows from DP21 and be routed east via a 30" RCP (PR23, Q5=11.1 cfs and Q100=34.4 cfs) to DP27 Detention Pond 8. Flows will outfall into a concrete lined forebay.

DP21 0.43 acres, consists of Basin LL future residential backyard lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin NN (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP19. Developed runoff of Q5=6.4 cfs and Q100=30.7 cfs has been calculated for DP21. The surface runoff is routed via overlot grading and curb and gutter to DP21 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=6.4 cfs and Q100=18.4 cfs) will combine with flows from DP20 and be routed east via a 30" RCP (PR23, Q5=11.1 cfs and Q100=34.4 cfs) to DP27 Detention Pond 8. Flows will outfall into a concrete lined forebay.

DP22 0.67 acres, consists of Basin OO future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin PP (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP20. Developed runoff of Q5=1.4 cfs and Q100=13.2 cfs has been calculated for DP22. The surface runoff is routed via overlot grading and curb and gutter to DP22 which will be collected by a 10' CDOT type R sump inlet. The flow will be routed east via a 30" RCP (PR25) to PR26. In the event of clogging or total inlet failure, flows at DP22 will over top the curb and gutter and outfall into the Detention Pond 8 (DP 27).

DP23 0.59 acres, consists of Basin QQ (Dines Boulevard), mail kiosk and parking with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP21. Developed runoff of Q5=2.0 cfs and Q100=15.9 cfs has been calculated for DP23. The surface runoff is routed via curb and gutter to

DP23 which will be collected by a 10' CDOT type R sump inlet. The flow will combine with flow from PR25 and will be routed east via a 36" RCP (PR26, Q5=3.2 cfs and Q100=27.7 cfs) to Detention Pond 8 (DP 27). Flows will outfall into a concrete lined forebay. In the event of clogging or total inlet failure, flows at DP23 will over top the curb and gutter and outfall into the Detention Pond 8 (DP 27).

DP26, 1.32 acres, consists of Basin TT future residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=2.0 cfs and Q100=4.9 cfs has been calculated for DP26. The surface runoff is routed via overlot grading and swales to a temporary sediment basin at DP26 which will be collected by an 18" FES. The flow will routed south via an 18" RCP (PR28) to Detention Pond 8 (DP 27). Flows will outfall into a concrete lined forebay.

DP27, 2.17 acres, consists of Basin UU (**Detention Pond 8**) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. The combined upstream developed runoff of Q5=42.3 cfs and Q100=112.8 cfs has been calculated for DP27. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 29.0 acres, and provide 0.48 ac-ft of water quality storage and 3.00 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP27 will over top the emergency spillway and outfall into Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet. The peak release rate from pond 8 (PR29, Q5=2.9 cfs and Q100=41.7 cfs) will outfall, via a 30" RCP into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

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

Design Points Tributary to Detention Pond W-5 (Prelim. Drainage Map Sheet 1)–Filing No. 2

DP28, 33.3 acres, consists of Basin OS3 off-site Barbarick Subdivision with runoff coefficients of 0.36 for the 5-year and 0.55 for the 100-year and Basin YY future Sterling Ranch residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of Q5=25.8 cfs and Q100=60.2 cfs has been calculated for DP28. Per the "Final Drainage Report for Barbarick Subdivision Portions of Lots 1, 2 and Lots 3, 4", prepared by Matrix Design Group, dated June 6, 2016, a combined onsite flow of Q5=11.4 cfs and Q100=85.4 cfs was calculated up to the detention pond on the south boundary line of the Barbarick Subdivision. The reduction of flow, from previous reports is attributed to a reduction of Sterling Ranch Subdivision flow contributing to the OS3 basin. The release rate from the detention pond combined with Basin YY are Q5=25.8 cfs and Q100=60.2 cfs. The surface runoff shall be collected by a temporary sediment basin and 36" FES and routed south via 36" RCP (PR32) to PR34. In the event of clogging, flow will be routed via historic drainage patterns to DP33. Historic flows produced by Basin OS3 will be accounted for in the calculations for detention/water quality for Pond W5. The drainage report was prepared by Matrix Design Group, 2016 for the Barbarick Subdivision and has been attached at the end of the reference section of this report. The Final Drainage Report for Filing No. 2 will address the revisions from the previous report to the new Matrix report.

DP29, 12.58 acres, consists of Basin XX future residential lots and streets with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin JP-1 future school site with runoff coefficients of 0.39 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=17.3 cfs and Q100=41.7 cfs has been calculated for DP29. The surface runoff will be routed via overlot grading and curb and gutter to a temporary sediment basin at DP29 which will be collected by a 36" FES. The flow will be routed west via

a 36" RCP (PR33) and will combine with flow from PR32. The combined flows in PR34 (Q5=41.4 cfs and Q100=97.8 cfs) will be routed south and west via a 48" RCP to PR35.

DP30, 2.46 acres, consists of Basin III future open space area with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin JP-7A (Sterling Ranch Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=6.5 cfs and Q100=13.0 cfs has been calculated for DP30. The surface runoff is routed via overlot grading and curb and gutter to DP30 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=6.5 cfs and Q100=11.1 cfs) will be routed south via a 24" RCP (PR34A) and will combine with flows from PR34 and PR34B. The combined flows (Q5=53.1 cfs and Q100=117.8 cfs) will be routed west via a 48" RCP (PR35) to PR39.

DP31, 4.64 acres, consists of Basin JJJ future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin JP-7A (Sterling Ranch Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=8.4 cfs and Q100=19.8 cfs has been calculated for DP31. The surface runoff is routed via overlot grading and curb and gutter to DP31 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=8.2 cfs and Q100=14.2 cfs) will be routed south via a 24" RCP (PR34B) and will combine with flows from PR34 and PR34A. The combined flows (PR35, Q5=53.1 cfs and Q100=117.8 cfs) will be routed west via a 48" RCP to PR39.

DP32, 17.0 acres, consists of Basin OS2 off-site Barbarick Subdivision with runoff coefficients of 0.49 for the 5-year and 0.62 for the 100-year. Developed runoff of Q5=30.4 cfs and Q100=80.8 cfs has been calculated for DP32 Per the "Final Drainage Report for Barbarick Subdivision Portions of Lots 1, 2 and Lots 3, 4", prepared by Matrix Design Group, dated June 6, 2016, a combined onsite flow of Q5=3.13 cfs and Q100=11.6 cfs was calculated up to the sand filter pond on the south boundary line of the Barbarick Subdivision. The release rate from the sand filter pond combined with Lots 1 and 2 west of the sand filter pond are Q5=30.4 cfs and Q100=80.8 cfs The surface runoff shall be collected by a temporary sediment basin and 42" FES. In the event of clogging, flow will be routed via historic drainage patterns to DP33. The flow will be routed south via 42" RCP (PR36) to PR38. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of Q5=30.4 cfs and Q100=80.8 cfs. Historic flows produced by Basin OS2 will be accounted for in the calculations for detention/water quality for Pond W5. The Final Drainage Report for Filing No. 2, will address the revisions from the previous report to the new Matrix report.

DP33, 9.68 acres, consists of Basin AAA future residential lots and streets with runoff coefficients of 0.49 for the 5-year and 0.65 for the 100-year. Developed runoff of Q5=17.3 cfs and Q100=38.5 cfs has been calculated for DP33. The surface runoff will be routed via overlot grading and curb and gutter to a temporary sediment basin at DP33 which will be collected by a 30" FES. The flow will be routed west via a 30" RCP (PR37) and will combine with flows from PR36. The combined flows (PR38, Q5=45.9 cfs and Q100=115.2 cfs) will be routed south via a 48" RCP to PR39. The combined flows of PR35 and PR38 (PR39, Q5=98.5 cfs and Q100=232.0 cfs) will be routed south via a 66" RCP to PR57.

DP40, 13.89 acres, consists of Basin CCC future residential lots and streets with runoff coefficients of 0.49 for the 5-year and 0.62 for the 100-year. Developed runoff of Q5=25.5 cfs and Q100=54.2cfs has been calculated for DP40. The surface runoff is routed via overlot grading and curb and gutter to a temporary sediment basin at DP40 which will be collected by a 36" FES. The flow will be routed west via a 36" RCP (PR46) and will combine with flow from PR47. The combined flows in PR48 (Q5=26.0 cfs and Q100=61.7 cfs) will be routed south via a 42" RCP to PR52.

DP44, 4.24 acres, consists of Basin HHH undisturbed gas line easements and minimal rear residential lots with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. Developed runoff of Q5=1.2 cfs and Q100=9.1 cfs has been calculated for DP44. The surface runoff is routed via historic drainage patterns and overlot grading to a temporary sediment basin at DP44 which will be collected by an 18" FES. The

flow will be routed west via an 18" RCP (PR47) and will combine with flows from PR46A. The combined flows in PR48 (Q5=25.8 cfs and Q100=60.7 cfs) will be routed south via a 36" RCP to PR52.

DP43A, 19.14 acres, consists of Basin FFF future residential lots and streets with runoff coefficients of 0.49 for the 5-year and 0.62 for the 100-year. Developed runoff of Q5=35.0 cfs and Q100=74.3 cfs has been calculated for DP43A. The surface runoff is routed via overlot grading to a temporary sediment basin at DP43A which will be collected by a 42" FES. The flow will be routed south via a 42" RCP (PR50) and will combine with flow from PR48. The combined flows PR50A (Q5=60.2 cfs and Q100=134.3 cfs) will be routed south via a 54" RCP to PR52.

DP45, 2.7 acres total, consists of Basin JP-7C (Sterling Ranch Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year, Basin FFF1 future residential backyard lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin GGG future residential lots and streets with runoff coefficients of 0.49 for the 5-year and 0.62 for the 100-year and flowby from DP30. Developed runoff of Q5=4.8 cfs and Q100=12.4 cfs has been calculated for DP45. The surface runoff is routed via curb and gutter to DP45 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=4.8 cfs and Q100=10.77 cfs) will be routed south via an 18" RCP (PR51) to PR52. The combined flows PR52 (Q5=65.4 cfs and Q100=146.0 cfs) will be routed south via a 54" RCP to PR56.

DP46, 0.61 acres, consists of Basin JP-7D (Sterling Ranch Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP-31. Developed runoff of Q5=2.4 cfs and Q100=9.7 cfs has been calculated for DP46. The surface runoff is routed via curb and gutter to DP46 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=2.4 cfs and Q100=9.1 cfs) will be routed south via an 18" RCP (PR53) to PR56. The combined flows PR56 (Q5=67.5 cfs and Q100=154.2 cfs) will be routed south via a 54" RCP to PR56A.

DP51, 1.76 acres, consists of Basin RP-7B (Marksheffel Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=5.8 cfs and Q100=10.5 cfs has been calculated for DP51. The surface runoff is routed via curb and gutter to DP51 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=5.8 cfs and Q100=9.7 cfs) will be routed east via an 18" RCP (PR54) to PR55. Surface flow-by (Q5=0.0 cfs and Q100=0.9 cfs) from the inlet will be released at the end of the curb section and will be routed via overlot grading as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek. Erosion control has been provided per the offsite grading plan.

DP52, 1.93 acres, consists of Basin RP-7A (Marksheffel Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP45 and DP46. Developed runoff of Q5=6.4 cfs and Q100=13.6 cfs has been calculated for DP52. The surface runoff is routed via curb and gutter to DP52 which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=6.4 cfs and Q100=11.4 cfs) will combine with flows from PR54 (PR55, Q5=12.2 cfs and Q100=21.2 cfs) and be routed east via a 30" RCP to PR56A. The combined flows from PR55 and PR56 (PR56A, Q5=79.7 cfs and Q100=175.3 cfs) will be routed south via a 54" RCP to PR56B. The flows in PR56B (Q5=79.7 cfs and Q100=175.3 cfs) will be routed east via a 2-42" RCP and combine with flows from PR39 to PR57. The combined flows in PR57 (Q5=168.6 cfs and Q100=386.2 cfs) will be routed south via a 78" RCP to PR58. Surface flow-by (Q5=0.0 cfs and Q100=2.2 cfs) from the inlet will be released at the end of the curb section and will be routed via overlot grading as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek. Erosion control has been provided per the offsite grading plan.

DP38, 25.89 acres, consists of Basin OOO future residential lots and streets with runoff coefficients of 0.45 for the 5-year and 0.59 for the 100-year. Developed runoff of Q5=37.2 cfs and Q100=81.9 cfs has

been calculated for DP38. The surface runoff is routed via overlot grading and curb and gutter to a temporary sediment basin at DP38 which will be collected by a 42" FES. The flow will be routed south via a 42" RCP (PR44) and will combine with flows from PR57 and PR57A. The combined flows in PR58 (Q5=209.5 cfs and Q100=483.5 cfs) will be routed south via an 84" RCP to Detention Pond W-5 (DP57). Flows will outfall into a concrete lined forebay.

DP56, 8.17 acres total, consists of Basin RRR future commercial site with runoff coefficients of 0.81 for the 5-year and 0.88 for the 100-year, Basin PPP1 future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin QQQ undisturbed gas line easements with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. Developed runoff of Q5=5.7 cfs and Q100=20.5 cfs has been calculated for DP56. The surface runoff is routed via historic drainage patterns and overlot grading to DP56 which will be collected by a 24" FES. The flow will be routed south via a 24" RCP (PR57A) and will combine with flows from PR57 and PR44. The combined flows in PR58 (Q5=209.5 cfs and Q100=483.5 cfs) will be routed south via an 84" RCP to Detention Pond W-5 (DP57). Flows will outfall into a concrete lined forebay.

DP57, 7.95 acres, consists of Basin UUU (**Detention Pond W-5**) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. Contributing surface runoff to detention pond W-5 include Basin PPP2 0.75 acres, future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin TTT 1.38 acres, future open space with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin OS4 5.13 acres, existing residential lots with runoff coefficients of 0.20 for the 5-year and 0.44 for the 100-year. The combined upstream developed runoff of Q5=217.9 cfs and Q100=520.3 cfs has been calculated for DP57. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 175.6 acres, and provide 2.90 ac-ft of water quality storage and 17.16 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention pond. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP57 will over top the emergency spillway and outfall into Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet. The peak release rate from pond W-5 (PR71, Q5=3.1 cfs and Q100=149.7 cfs) will outfall, via a 48" RCP into Sand Creek. The summed flows at DP68 (PR71&PR67, Q5=42.2 cfs and Q100=472.2 cfs) will routed via an 84" RCP (PR74) south and outfall into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS. Pond design will be finalized in Sterling Ranch Filing No. 2 Final Drainage Report.

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

Design Points Tributary to Sand Creek Filing No. 1

DP66, 186 acres, consists of Basin EX-4B (existing offsite basin) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year. Existing runoff of Q5=26.4 cfs and Q100=193.7 cfs has been calculated for DP66. The offsite flows have been routed via a temporary 8' wide diversion swale to Sand Creek. Historic flows north of Briargate Parkway will be routed in a swale as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek DP67. The vegetated grass swale will facilitate sedimentation and filtering while limiting erosion.

DP58, 5.98 acres, consists of Basin EX4A (Briargate Parkway, Vollmer Road, offsite swale and **Detention Pond BB**) with runoff coefficients of 0.25 for the 5-year and 0.47 for the 100-year. The interim construction of Briargate Parkway will begin at Vollmer Road and end at the east curb return of Wheatland Drive. The combined upstream developed runoff of $Q5=4.7$ cfs and $Q100=15.0$ cfs has been calculated for DP58. The proposed temporary Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approximately 5.98 acres, and provide 0.04 ac-ft of water quality storage and 0.48 ac-ft of 100-year storage. The outlet structure and pipe have been designed to release the required rates per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention pond. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP58 will over top the emergency spillway, with erosion control measures, and outfall into Sand Creek. The peak release rate from pond BB (PR70, $Q5=0.5$ cfs and $Q100=4.9$ cfs ~18" CMP) will combine with offsite flows from DP66. The summed flows (DP67, $Q5=28.2$ cfs and $Q100=208.4$ cfs) will outfall, via an 8' wide diversion swale into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

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

DP67, 201.38 acres, consists of Sub-basins EX4A, EX4B and EX4C. Runoff of $Q5=28.2$ cfs and $Q100=208.4$ cfs has been calculated for DP67. The existing flows from EX4 are discussed in the historic conditions of this report. Developed flows and historic flows north of Briargate Parkway will be routed in a swale as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek DP67. The vegetated grass swale will facilitate sedimentation and filtering while limiting erosion. The swale has capacity to carry flows and is within the required velocities for the North American Green SC250 fabric specified (See swale calculations and specification sheet for fabric in appendix). Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

DP15, 14.14 acres, consists of Basin WP-3 a future commercial parcel with runoff coefficients of 0.81 for the 5-year and 0.88 for the 100-year. Developed runoff of $Q5=42.1$ cfs and $Q100=76.8$ cfs has been calculated for DP15. In the undeveloped condition, runoff of $Q5=3.8$ cfs and $Q100=27.8$ cfs are routed via historic drainage patterns and proposed swales to DP15. The surface runoff will be collected by a 5'x3' modified CDOT type D inlet. The flows will routed south and east via a 42" RCP (PR15) and outfall into a swale as shown on "Sterling Ranch-Phase 1 Onsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015. Flows will outfall into Sand Creek. A riprap apron will be constructed to dissipate energy and prevent local scour at the outlet. The storm sewer has been designed to carry the developed flow rate. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of $Q5=3.8$ cfs and $Q100=27.8$ cfs. (See swale and riprap calculations and specification sheet for fabric in appendix).

DP62, 3.01 acres, consists of Sub-Basin OS1A (2.7 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1A (0.31 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Calculated runoff of $Q5=1.6$ cfs and $Q100=6.9$ cfs has been calculated for DP62. The flow will be routed south via an existing 12" CMP (PR72) under an access road. The surface runoff shall be routed via historic drainage patterns and an existing road side swale to DP63.

DP63, 9.35 acres, consists of Sub-Basin OS1B (9.09 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1B (0.26 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flows from DP7. Calculated runoff of Q5=4.8 cfs and Q100=26.1 cfs has been calculated for DP63. The flow will be captured by a 2.9'x5.7' CDOT type D inlet and be routed, under Vollmer Road, south via a 24" RCP (PR77). Minimal grading, within DP63, will be provided within the Vollmer Road ROW. In the event of clogging, runoff will overtop the sump condition and the surface runoff shall be routed via historic drainage patterns and an existing road side swale to DP64.

DP64, 5.85 acres, consists of Sub-Basin OS1C (5.64 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1C (0.21 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Calculated runoff of Q5=2.2 cfs and Q100=12.3 cfs has been calculated for DP64. The flow will be captured by a 2.9'x2.9' CDOT type C inlet and will be routed, under Vollmer Road, via an 18" RCP (PR78). These flows will be combined with flows from PR77 and be routed south via a 30" RCP, PR79 (Q5=7.0 cfs and Q100=38.2 cfs). These flows will combine with flows from PR80 and will be routed south to a manhole via a 30" RCP, PR81 (Q5=7.6 cfs and Q100=46.8 cfs). Minimal grading, at DP64, will be provided within the Vollmer Road ROW. In the event of clogging, runoff will overtop the sump condition and the surface runoff shall be routed via historic drainage patterns and an existing road side swale to DP65.

DP65, 94.43 acres, consists of Sub-Basin OS1D (94.3 ac) existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and Basin V1D (0.13 ac) existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Calculated runoff of Q5=16.5 cfs and Q100=119.9 cfs has been calculated for DP65. The flow will be routed south via historic drainage patterns and an existing road side swale to DP59.

DP59, 10.32 acres, consists of Basin W-2 (10.0 ac), existing low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year, Basin V2 (0.32 ac), existing west half of Vollmer Road with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and DP65. Calculated runoff of Q5=18.9 cfs and Q100=133.7 cfs has been calculated for DP59. The flow will be captured by a 4.0'x14.0' modified CDOT type D inlet and will be routed, under Vollmer Road, via a 54" RCP (PR18A) to a manhole. These flows will combine with flows from PR81 and be routed east, within the Homestead Sterling Ranch Filing No. 1 subdivision, via a 54" RCP, PR18 (Q5=23.8 cfs and Q100=164.1 cfs). These flows will combine with flows from PR11 (Q5=2.7 cfs and Q100=36.2 cfs, release rate Pond 4) and be routed south via a 60" RCP, PR12 (Q5=26.5 cfs and Q100=200.3 cfs). These flows will outfall into a low tailwater riprap basin and into Sand Creek. Minimal grading, at DP59, will be provided within the Vollmer Road ROW. In the event of clogging, runoff will overtop the sump condition and the surface runoff shall be routed via historic drainage patterns and an existing road side swale south along Vollmer Road. The majority of improvements to Vollmer Road will drain to the east and be captured by FSD Pond W-9. No developed flows will be introduced to the westside of Vollmer Road.

DP17, 2.04 acres, consists of Basin RP-2B (Vollmer Road) with runoff coefficients of 0.63 for the 5-year and 0.76 for the 100-year. Developed runoff of Q5=4.9 cfs and Q100=9.9 cfs has been calculated for DP17. Surface runoff will be routed via curb and gutter to a 7.5' concrete lined CDOT Type 5 embankment protector to a 12' wide swale. A riprap apron will be provided to dissipate energy and prevent local scour. Flows in the swale will be routed to Detention Pond W-9 at DP61.

DP16, 1.28 acres, consists of Basin RP-2C (Vollmer Road) with runoff coefficients of 0.74 for the 5-year and 0.84 for the 100-year. Developed runoff of Q5=4.3 cfs and Q100=8.2 cfs has been calculated for DP16. Surface runoff will sheet flow off the shoulder and flow to Detention Pond W-9 at DP61.

DP61, 2.75 acres, consists of Basin M future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year and Basin M2 FSD Sand Filter Pond W-9 and landscape area with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and DP16 and DP17. The combined upstream developed runoff of Q5=8.9 cfs and Q100=21.2 cfs has been calculated for DP61. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 5.87 acres, and provide 0.092 ac-ft of water quality storage and 0.638 ac-ft of 100-year storage. The outlet structure, 18" filter layer(minimum), underdrain and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.07 workbook. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention pond. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP61 will over top the emergency spillway and outfall into a proposed swale which will route flows to an existing Vollmer Road side swale. The peak release rate from pond W-9 (PR80, Q5=0.6 cfs and Q100=8.8 cfs) will be routed via a 18" RCP to PR81 (Q5=7.6 cfs and Q100=46.8 cfs). These flows will be combine with flows from PR18A and be routed east, within the Homestead Sterling Ranch Filing No. 1 subdivision, via a 54" RCP, PR18 (Q5=23.8 cfs and Q100=164.1 cfs). These flows will combine with flows from PR11 (Q5=2.7 cfs and Q100=36.2 cfs, release rate Pond 4) and be routed south via a 60" RCP, PR12 (Q5=26.5 cfs and Q100=200.3 cfs). These flows will outfall into a low tailwater riprap basin and into Sand Creek.

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

DP69, 15.73 acres, consists of Sub-Basin OS20A partially developed low density residential with runoff coefficients of 0.10 for the 5-year and 0.36 for the 100-year. Calculated runoff of Q5=4.5 cfs and Q100=27.4 cfs has been calculated for DP69. The surface runoff is be routed via historic drainage patterns and an existing road side swale south along Vollmer Road to an existing 24" CMP in Glider Loop. DP69 calculations are for reference only. No developed flows will be introduced to the westside of Vollmer Road.

Design Points Tributary to Sand Creek Filing No. 2

DP47A, 3.12 acres, consists of Basin RP-3B (Vollmer Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=11.1 cfs and Q100=24.4 cfs has been calculated for DP47A. In the interim the surface runoff is routed to a road side swale to DP47A which will be collected by a 2.91' x 5.67' CDOT Type D inlet. In the interim a riprap apron will be constructed to dissipate energy and prevent local scour at the outlet.

In the future, upon full build out of Vollmer Road, the surface runoff will be routed via curb and gutter to DP47A which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (PR68, Q5=10.0 cfs and Q100=15.8 cfs) will be routed north via a 30" RCP to DP60.

DP48A, 4.12 acres, consists of Basin RP-3A (Vollmer Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=13.5 cfs and Q100=26.6 cfs has been calculated for DP48A. In the interim the surface runoff will be routed to a roadside swale and ultimately to DP60.

In the future, upon full build out of Vollmer Road, the surface runoff will be routed via curb and gutter to DP48A which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=11.4 cfs and Q100=16.5 cfs) will combine with flows from PR68 and be routed north via a 30" RCP (PR69). The cumulative flows in PR69 (Q5=21.2 cfs and Q100=31.9 cfs) will outfall into a proposed road side swale

and be routed to DP60. Upon full build out a riprap apron will be constructed to dissipate energy and prevent local scour at the outlet.

DP60, 308 acres, consists of Basin OS20 (off-site basin) partially developed low density residential with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and flow from PR69. Calculated runoff of Q5=59.7 cfs and Q100=316.2 cfs has been calculated for DP60. Capacity and function of the existing 3.5'x5.5' HECMP will be addressed in the Final Drainage report for Sterling Ranch Filing No. 2. An existing roadside swale will provide adequate drainage, assuming the swale has been maintained. Flows in the swale will be routed to DP 49 (Pond W-4).

DP47, 2.05 acres, consists of Basin RP-4B (Vollmer Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP47A (in the future condition). Developed runoff of Q5=7.7 cfs and Q100=20.4 cfs has been calculated for DP47. The surface runoff is routed via curb and gutter to DP47 which will be collected by a 14' CDOT type R sump inlet. The flow will be routed north via a 24" RCP (PR61) to PR62.

DP48, 1.94 acres, consists of Basin RP-4A (Vollmer Road) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from DP48A (in the future condition). Developed runoff of Q5=8.2 cfs and Q100=21.0 cfs has been calculated for DP48. The surface runoff is routed via curb and gutter to DP48 which will be collected by a 14' CDOT type R sump inlet. The flow will combine with flows from PR61 and be routed north to via a 36" RCP to PR62. The cumulative flows in PR62 (Q5=15.8 cfs and Q100=41.0 cfs) will outfall to DP 49 (Pond W-4).

DP49 consists of Basin OS21 33.0 acres, (**Conceptual Detention Pond W-4**) with runoff coefficients of 0.11 for the 5-year and 0.37 for the 100-year, flow from DP60 and PR62. The combined upstream developed runoff of Q5=72.9 cfs and Q100=368.4 cfs has been calculated for DP49. The proposed interim Detention Pond functions to provide full spectrum detention and water quality for runoff calculated offsite. The pond is designed to treat approx 352.2 acres, and provide 1.73 ac-ft of water quality storage and 6.63 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-JD-Detention v3.05 workbook. The ultimate design and build out of detention pond W-4 shall be discussed in the Sterling Ranch Filing No. 2 Final Drainage Report. The detention pond will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention pond. A private maintenance agreement document shall accompany the submittal. In the event of clogging or total inlet failure, flows at DP49 will over top the emergency spillway and outfall into the existing roadside swale parallel to Vollmer Road. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet. The peak release rate from pond W-4 (PR63, Q5=20.8 cfs and Q100=289.2 cfs) will be routed south, via a 66" RCP to PR65. The combined flows of PR63 and PR64 (PR65, Q5=32.0 cfs and Q100=309.7 cfs) will be routed via a 72" RCP south to PR67. Cumulative flows from PR67 and PR71 will be routed via an 84" RCP (PR74, Q5=42.2 cfs and Q100=472.2 cfs) and will eventually outfall into Sand Creek. Future pipe sizing and future Detention Pond calculations will be addressed in the Filing No. 2 Final Drainage Report. See Sand Creek Channel Study-Future Hydrologic Conditions Map in the appendix. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS. The Conceptual Detention Pond W-4 is subject to El Paso County approval for the site shown.

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

DP50, 8.56 acres, consists of Basin JP-11 a future commercial parcel with runoff coefficients of 0.81 for the 5-year and 0.88 for the 100-year. Developed runoff of Q5=29.4 cfs and Q100=53.7 cfs has been

calculated for DP50. In the undeveloped condition, runoff of Q5=2.0 cfs and Q100=15.0 cfs are routed via historic drainage patterns and proposed swales to DP50. The surface runoff will be collected by a 36" FES. The flows will be routed south via a 36" RCP (PR64) to PR65. The accumulated flow in PR65 (Q5=32.0 cfs and Q100=309.7 cfs) will be routed south to PR67. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of Q5=2.0 cfs and Q100=15.0 cfs.

DP53, 5.37 acres, consists of Basin JP-12 a future commercial parcel with runoff coefficients of 0.81 for the 5-year and 0.88 for the 100-year. Developed runoff of Q5=19.8 cfs and Q100=36.1 cfs has been calculated for DP53. In the undeveloped condition, runoff of Q5=1.4 cfs and Q100=10.0 cfs are routed via historic drainage patterns and proposed swales to DP53. The surface runoff will be collected by a 30" FES. The flows will be routed south via a 30" RCP (PR66) to PR67. The accumulated flow in PR67 (Q5=39.1 cfs and Q100=322.5 cfs) will be routed via a 72" RCP south to Sand Creek. Upon future development of this basin, full spectrum detention shall be required and will release to historic release rates of Q5=1.4 cfs and Q100=10.0 cfs. The summed flows at DP68 (PR74, Q5=42.2 cfs and Q100=472.2 cfs) will outfall into Sand Creek. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS. A riprap apron will be constructed to dissipate energy and prevent local scour at the outlet.

DP54, 1.21 acres, consists of Basin RP-7D (Marksheffel Road) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and DP51 flowby. Undeveloped runoff of Q5=0.4 cfs and Q100=3.5 cfs has been calculated for DP54. Undeveloped flows will be routed to a temporary sediment basin via overlot grading as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek. Erosion control will be provided.

DP55, 1.28 acres, consists of Basin RP-7C (Marksheffel Road) with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and DP51 flowby. Undeveloped runoff of Q5=0.4 cfs and Q100=4.9 cfs has been calculated for DP55. Undeveloped flows will be routed to a temporary sediment basin via overlot grading as shown on the "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015, which will route flows to Sand Creek. Erosion control will be provided.

Basin SSS, 1.21 acres, consists of the backyards of future residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of Q5=1.1 cfs and Q100=3.8 cfs has been calculated for this basin. Developed flows will be sheet flow into Sand Creek. Erosion control will be provided.

There will be bank stabilization improvements to the Sand Creek Drainage Channel with the development of the STERLING RANCH FILING NOS. 1&2 site (Roadways and tracts) to maintain the integrity of roadways and ponds. However, channel improvements for Sand Creek (checks, drops, etc...) will be installed in accordance with the Subdivision Improvement Agreement.

DETENTION PONDS

Detention Pond 4, has combined upstream developed runoff of Q5=50.0 cfs and Q100=102.9 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 27.5 acres, and provide 0.46 ac-ft of water quality storage and 2.90 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-JD-Detention v3.05 workbook.

Detention Pond 8, has combined upstream developed runoff of Q5=42.3 cfs and Q100=112.8 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff

calculated onsite. The pond is designed to treat approximately 29.0 acres, and provide 0.48 ac-ft of water quality storage and 3.00 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook.

Detention Pond W-5, has combined upstream developed runoff of $Q_5=233.2$ cfs and $Q_{100}=518.2$ cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 175.6 acres, and provide 2.90 ac-ft of water quality storage and 17.16 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. Design and calculations will be addressed in the Filing No. 2 Final Drainage Report. See Sand Creek Channel Study-Future Hydrologic Conditions Map in the appendix. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS.

Detention Pond B-B, has combined upstream developed runoff of $Q_5=4.7$ cfs and $Q_{100}=15.0$ cfs. The proposed temporary Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approximately 5.98 acres, and provide 0.04 ac-ft of water quality storage and 0.48 ac-ft of 100-year storage. The outlet structure and pipe have been designed to release the required rates per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook.

Detention Pond W-9, has combined upstream developed runoff of $Q_5=8.9$ cfs and $Q_{100}=21.2$ cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated offsite. The pond is designed to treat approx 5.87 acres, and provide 0.092 ac-ft of water quality storage and 0.638 ac-ft of 100-year storage. The outlet structure, 18" filter layer(minimum), underdrain and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.07 workbook.

Conceptual Detention Pond W-4, has combined upstream developed runoff of $Q_5=72.9$ cfs and $Q_{100}=368.4$ cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated offsite. The pond is designed to treat approx 352.2 acres, and provide 1.73 ac-ft of water quality storage and 6.63 ac-ft of 100-year storage. The forebay, trickle channel micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.05 workbook. Design and calculations will be addressed in the Filing No. 2 Final Drainage Report. See Sand Creek Channel Study-Future Hydrologic Conditions Map in the appendix. Impacts from the outfall into Sand Creek will be addressed in the revised TM-SCCS. The Conceptual Detention Pond W-4 is subject to El Paso County approval for the site shown.

The detention ponds will be private and shall be maintained by the Sterling Ranch Metropolitan District. Access shall be granted to the owner and El Paso County for access and maintenance of the private detention ponds. A private maintenance agreement documents shall accompany the submittal. In the event of clogging or total inlet failure, flows will over top the emergency spillway and outfall into Sand Creek. A rip rap apron will be constructed to dissipate energy and prevent local scour at the outlet.

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

EROSION CONTROL

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. EPC approved "Early Grading Plan for Sterling Ranch Phase I Onsite Grading &

Erosion Control”, November 18, 2015. And “Early Grading Plan for Sterling Ranch Phase I Offsite Grading & Erosion Control”, December 3, 2015. Grading and Erosion control operations are currently underway (August 2016). Grading and Erosion Control will cease with the final development of the site in the next 12-36 months.

CHANNEL IMPROVEMENTS

Per the Sand Creek DBPS, Sand Creek and connected tributaries in the area of the site will require improvements. The east tributary reaches within the site boundary (DBPS SEG: 169, 186, 164, 159) will not require improvements because they will no longer be present, as development in the areas will eliminate them, and replace them with, a storm sewer system to discharge into Sand Creek. Sand Creek itself will continue to be routed through the development. Per the DBPS, selective rip rap linings, grade control check structures, and drop structure improvements are required to stabilize the channel to prevent further degradation, scour and meandering. Full Spectrum Detention will also be used on its benefits to the integrity of the Sand Creek Channel. A separate document with detailed alternative sections, HEC-RAS analyses, etc. will be submitted with for the applicable and adjoining areas of development, in accordance with SIA requirements.

Downstream channel improvements are proposed to be similar to what was anticipated in the SCDBPS. Check structures and rip-rap lining in some locations shall be installed to handle the volume of flows from the full spectrum detention ponds. In the final design stage of the applicable and adjoining development, the channels will be analyzed to verify the amount of improvements necessary.

The approved Subdivision Improvements Agreement for Sterling Ranch Filing No. 1 address the timing and funding for channel improvements.

Channel Improvements and Wetland Mitigation

Areas with the existing floodplain or the low flow zone of the drainageways where riparian or wetland vegetation exists shall be preserved in its existing cross section. Areas disturbed by the construction of drops, grade controls, culverts or channel bank linings shall be revegetated with native species. Coordination with a wetland consultant will take place for mitigation of the disturbed wetlands. Included in this report (in the appendix) are the memo and map from Core Consultants showing intent to have wetlands delineated in the Filing No. 2 areas of wetland disturbance.

CONSTRUCTION COST OPINION – FILING NO. 1

Drainage Facilities:

Item	Description	Quantity	Unit Cost	Cost
1	18" RCP	198	\$40 /LF	\$7,920.00
2	24" RCP	609	\$50 /LF	\$30,450.00
3	30" RCP	1957	\$65 /LF	\$127,205.00
4	36" RCP	584	\$75 /LF	\$43,800.00
5	42" RCP	385	\$85 /LF	\$32,725.00
6	54" RCP	1180	\$200 /LF	\$236,000.00
7	60" RCP	254	\$250 /LF	\$63,500.00
8	18" CMP	55	\$30 /LF	\$1,650.00
9	18" FES	1	\$245 /LF	\$245.00
10	30" FES	4	\$475 /EA	\$1,900.00
11	36" FES	2	\$775 /EA	\$1,550.00
12	42" FES	1	\$895 /EA	\$895.00
13	18" CMP	1	\$150 /EA	\$150.00
14	60" End Treatment Headwall/Wing walls	1	\$15000 /EA	\$15,000.00
15	15' CDOT Type R At-Grade	7	\$6000 /EA	\$42,000.00
16	10' CDOT Type R Sump Inlet	2	\$4700 /EA	\$9,400.00
17	6.83'x6.33' MH	1	\$6500 /EA	\$6,500.00
18	7.83'x6.33" MH	2	\$6750 /EA	\$13,500.00
19	8.0'x8.0' MH	4	\$7000 /EA	\$28,000.00
20	8.0'x8.3' MH	1	\$8000 /EA	\$8,000.00
21	Type II MH	6	\$6000 /EA	\$36,000.00
22	Type III MH	1	\$6000 /EA	\$6,000.00
23	*Detention Pond 4	1	\$40000 /EA	\$40,000.00
24	*Detention Pond 8	1	\$40000 /EA	\$40,000.00
25	*Detention Pond W-9	1	\$30000 /EA	\$30,000.00
26	* Detention Pond BB	1	\$25000 /EA	\$25,000.00
27	Fabr. 36" Riser w/Trash rack	1	\$5000 /EA	\$5,000.00
28	CDOT Type C Area Inlet	1	\$5000 /EA	\$5,000.00
29	CDOT Type D Area Inlet	2	\$6000 /EA	\$12,000.00
30	Mod CDOT Type D Area Inlet	1	\$6000 /EA	\$6,000.00
31	Mod CDOT Outlet Structure	3	\$15000 /EA	\$45,000.00
	Total			\$920,390.00

CONSTRUCTION COST OPINION – FILING NO. 2

Drainage Facilities:

Item	Description	Quantity	Unit Cost	Cost
1	18"RCP	229	\$40 /LF	\$ 9,160.00
2	24" RCP	146	\$50 /LF	\$ 7,300.00
3	30" RCP	121	\$65 /LF	\$ 7,865.00
4	36" RCP	1243	\$75 /LF	\$ 93,225.00

5	42" RCP	1649	\$85 /LF	\$	140,165.00
6	48" RCP	1008	\$150 /LF	\$	151,200.00
7	54" RCP	553	\$200 /LF	\$	110,600.00
8	66" RCP	1882	\$300 /LF	\$	564,600.00
9	72" RCP	2591	\$350 /LF	\$	906,850.00
10	78" RCP	238	\$400 /LF	\$	95,200.00
11	84" RCP	305	\$450 /LF	\$	137,250.00
12	18" FES	1	\$245 /EA	\$	245.00
13	24" FES	1	\$335 /EA	\$	335.00
14	30" FES	1	\$475 /EA	\$	475.00
15	36" FES	6	\$775 /EA	\$	4,650.00
16	42" FES	2	\$895 /EA	\$	1,790.00
17	84" Headwall	1	\$10000 /EA	\$	10,000.00
18	15' CDOT Type R At-Grade	8	\$6000 /EA	\$	48,000.00
19	14' CDOT Type R Sump Inlet	2	\$6000 /EA	\$	12,000.00
20	5.0'x6.5' MH	3	\$6500 /EA	\$	19,500.00
21	7.0'x9.5' MH	6	\$7000 /EA	\$	42,000.00
22	9.0'x9.0' MH	3	\$8300 /EA	\$	24,900.00
23	6.0'x10.0' MH	3	\$7000 /EA	\$	21,000.00
24	9.0'x10.0' MH	5	\$9000 /EA	\$	45,000.00
26	*Detention Pond W-5	1	\$200000 /EA	\$	200,000.00
27	*Detention Pond W-4	1	\$200000 /EA	\$	200,000.00
28	Mod CDOT Outlet Structure	3	\$15000 /EA	\$	45,000.00
	Total			\$	2,898,310.00

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

DRAINAGE & BRIDGE FEES – FILING NO. 1

This site is within the Sand Creek Drainage Basin. The 2017 Drainage and Bridge Fees per El Paso County for the STERLING RANCH FILING NO. 1 site is as follows: (see next sheet for itemized statement)

	Total Area	134.379 Acres
FILING NO. 1 FEES:		
Drainage Fees: (See attached Spreadsheet)	\$	232,075.77 ✓
Bridge Fees: (See attached Spreadsheet)	\$	70,301.83 ✓

FILING NO. 2 FEES:

Drainage Fees:	\$	TBD
Bridge Fees:	\$	TBD

STERLING RANCH TOTAL:

Sand Creek Channel Improvements (DBPS Estimate – 2017 dollars) \$7,961,288.00

STERLING RANCH FILING NO. 1 - TRACTS AND RIGHT-OF-WAY - DRAINAGE & BRIDGE FEES

TRACT	SIZE/ACRE	USE	MAINTENANCE	OWNERSHIP	% Impervious	DRAINAGE FEE	FEE	BRIDGE FEE	FEE
A	0.112	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 35.21	\$ 4,762	\$ 10.67
B	0.987	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY/TIER IV TRAIL	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 310.31	\$ 4,762	\$ 94.00
C	14.816	FUTURE COMMERCIAL PAD SITES/TIER IV TRAIL	SR LAND, LLC	SR LAND, LLC	N/A				
D	14.785	OPEN SPACE/FLOODPLAIN/TIER 1 TRAIL	SRMD #1/EPC	SRMD #1/EPC	5.0%	\$ 15,720	\$ 11,621.01	\$ 4,762	\$ 3,520.31
E	29.658	FUTURE SINGLE FAMILY LOTS	SR LAND, LLC	SR LAND, LLC	N/A				
F	3.987	OPEN SPACE/DRAINAGE POND/FLOODPLAIN/PUB. IMPROVEMENTS/PUB. UTILITY/TIER 1 TRAIL	SRMD #1	SRMD #1	50.0%	\$ 15,720	\$ 31,337.82	\$ 4,762	\$ 9,493.05
G	19.607	FUTURE SINGLE FAMILY LOTS	SR LAND, LLC	SR LAND, LLC	N/A				
H	0.329	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	35.0%	\$ 15,720	\$ 1,810.16	\$ 4,762	\$ 548.34
I	0.063	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 19.81	\$ 4,762	\$ 6.00
J	1.727	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 542.97	\$ 4,762	\$ 164.48
K	18.887	FUTURE SINGLE FAMILY LOTS	SR LAND, LLC	SR LAND, LLC	N/A				
L	2.734	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY/TRAIL	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 859.57	\$ 4,762	\$ 260.39
M	0.168	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY/TRAIL	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 52.82	\$ 4,762	\$ 16.00
N	0.075	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 23.58	\$ 4,762	\$ 7.14
O	0.153	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 48.10	\$ 4,762	\$ 14.57
P	0.057	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 17.92	\$ 4,762	\$ 5.43
Q	0.051	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 16.03	\$ 4,762	\$ 4.86
R	0.064	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 20.12	\$ 4,762	\$ 6.10
S	0.064	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 20.12	\$ 4,762	\$ 6.10
T	0.057	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 17.92	\$ 4,762	\$ 5.43
U	0.031	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 9.75	\$ 4,762	\$ 2.95
V	0.052	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 16.35	\$ 4,762	\$ 4.95
W	0.064	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 20.12	\$ 4,762	\$ 6.10
X	0.064	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 20.12	\$ 4,762	\$ 6.10
Y	0.051	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 16.03	\$ 4,762	\$ 4.86
Z	0.027	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 8.49	\$ 4,762	\$ 2.57
AA	0.181	LANDSCAPE/PUB. IMPROVEMENTS/PUB. UTILITY	SRMD #1	SRMD #1	2.0%	\$ 15,720	\$ 56.91	\$ 4,762	\$ 17.24
BB	10.545	FUTURE SINGLE FAMILY LOTS	SR LAND, LLC	SR LAND, LLC	N/A				
CC	2.727	OPEN SPACE/DRAINAGE POND/PARK/PUB. IMPROVEMENTS/PUB. UTILITY/ SRMD #1	SRMD #1	SRMD #1	5.0%	\$ 15,720	\$ 2,143.42	\$ 4,762	\$ 649.30
R.O.W.	12.256	ROAD RIGHTS OF WAY	EPC	EPC	95.0%	\$ 15,720	\$ 183,031.10	\$ 4,762	\$ 55,444.92
	134.379	TOTAL AREA			TOTAL FEES		\$ 232,075.77	\$ 70,301.83	

**Sand Creek Bridge Improvements (DBPS Estimate – 2017 dollars)
DRAINAGE & BRIDGE FEES - FILING NO. 1 - CONTINUED**

\$1,839,552.00

An Intergovernmental Agreement for the Establishment of The Sterling Ranch Storm-Water Escrow Fund and the Subdivision Improvements Agreement Sterling Ranch Filing No. 1, address the timing of drainage improvement and fees. The above cost estimate is for informational purposes only. Final drainage improvement costs will be determined post construction. A Final Drainage Report for Sterling Ranch Filing No. 2 will be provided at a later date, and will determine the appropriate fees.

SUMMARY

Development of this site will not adversely affect the surrounding development per this final drainage report with no negative impact of the neighboring developments. The proposed drainage facilities will adequately convey, detain and route runoff from the tributary and onsite flows to the Sand Creek Drainage channel. Full Spectrum Detention and Water Quality Ponds will be used to discharge developed flows into Sand Creek per the Urban Drainage criteria flow rates, which are at or less than the historic flow. Care will be taken during construction to accommodate overland flow routes onsite and temporary drainage conditions. The development of the STERLING RANCH FILING NOS. 1 & 2 project(s) shall not adversely affect adjacent or downstream property.

REFERENCES

- 1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
- 2.) "Urban Storm Drainage Criteria Manuals, Volumes 1-3"
- 3.) NRSC Web Soil Survey Map for El Paso County. <http://websoilsurvey.nrcs.usda.gov>
- 4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date March 17, 1997.
- 5.) "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996
- 6.) "Preliminary Drainage Report for Sterling Ranch-Phase 1", dated May 2015, by M&S Civil Consultants, Inc.
- 7.) "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 8.) "Sterling Ranch-Phase 1 Onsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 9.) "Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3 & 4, by Matrix Design Group, dated June 2016.
- 10.) "Preliminary and Final Drainage Report, Barbarick Subdivision, A Replat of Lot "D", McClintock Subdivision", El Paso County, Revised August 15, 2007, prepared by Oliver E. Watts, Consulting Engineer, Inc.
- 11.) "Master Development Drainage Plan for Sterling Ranch", prepared by M&S Civil Consultants, Inc., dated July 2010 (Draft not approved)
- 12.) "Technical Memorandum Sand Creek Channel Study (North of Woodmen Road) Hydrologic Analysis" (TM-SCCS) prepared by M&S Civil Consultants, Inc., dated July 2016

APPENDIX