DRAINAGE LETTER
FOR
STERLING RANCH ROAD
CROSSING OF SAND CREEK

Prepared for:
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Job No. 1183.11

PCD Project No.

DRAINAGE LETTER FOR
STERLING RANCH ROAD CROSSING OF SAND CREEK

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:

CLASSIC CONSULTING ENGINEERS & SURVEYORS

DRAINAGE LETTER FOR
STERLING RANCH ROAD CROSSING OF SAND CREEK

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VICINITY MAP

SOILS MAP (WEB SOIL SURVEY)

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

HYDRAULIC CALCULATIONS

REFERENCE MATERIAL (JR Engineering, LLC Report Excerpts)

SECTION 404 PERMITTING (2016)

STERLING RANCH ROAD CULVERT DESIGN DOCUMENTS (KBJW)

PURPOSE

The purpose of this Drainage Letter is to support the independent CDR submittal of the proposed culvert structure for Sterling Ranch Road crossing Sand Creek within the Sterling Ranch development. However, this reach of Sand Creek including this crossing has recently been submitted for required channel improvements associated with the development of Homestead North at Sterling Ranch Filing No. 1. Please reference the following documents prepared by JR Engineering, LLC for all roadway, drainage design and channel design at this crossing:

Sterling Ranch Road & Briargate Parkway Street Plans, dated October 2021
Drainage Letter for Sterling Ranch Rd. & Briargate Pkwy. Interim Plan, dated Dec. 2021
MDDP Amendment for Sterling Ranch, dated April 2022
Final Design Report – Sand Creek Restoration, dated October 2021
Sand Creek Restoration – Public Improvement Plans, dated April 2022
Homestead North at Sterling Ranch Filing No. 1 Final Plat, dated November 2021

GENERAL DESCRIPTION

This proposed roadway crossing of Sand Creek is shown on the Sterling Ranch Sketch Plan, included in the Sterling Ranch MDDP, approved November 2018 and as mentioned above, now included within the Homestead North at Sterling Ranch Filing No. 1 Final Plat. It is located in section 33, township 12 south, range 65 west of the sixth principal meridian. The site is bounded on the north and south by the Sand Creek main channel, to the east by future Sterling Ranch East property (zoned for future urban development) and to the west by existing Sterling Ranch Road and existing residential development. The site is in the upper portion of the Sand Creek Drainage Basin. A public roadway crossing consisting of a BridgeCor Steel Arch Culvert (38’-1” span x 11’-11” high x 90 LF) with associated headwalls and wingwalls is proposed at this location.

The average soil condition reflects 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).

DRAINAGE CONDITIONS

This crossing is located in the upper portion of the Sand Creek drainage basin within the southern portion of the Sterling Ranch Sketch Plan. Sterling Ranch Road is planned as a non-residential collector roadway (80' ROW) at this location. This roadway will be final platted along with the Homestead North at Sterling Ranch Filing No. 1 Final Plat. The adjacent Sand Creek channel both upstream and downstream will be final platted with the future adjacent subdivisions.

Nearly the entire site, other than the Sand Creek corridor, is mainly covered with native grasses with few or no trees. Some minor disturbance due to adjacent roadway construction and utility installation has taken place west of the crossing. (Sterling Ranch Road) This portion of Sand Creek (Reach SC-8) was originally studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Engineering Corporation, March 1996. However, all required improvements to the Sand Creek channel within this reach are described in separate reports prepared by JR Engineering, "Final Design Report for Sand Creek Restoration", dated October 21, 2021 and "MDDP Amendment for Sterling Ranch", dated April 2022. Please reference these reports along with the "Master Development Drainage Plan for Sterling Ranch", prepared by M&S Civil Consultants, approved November 2018 for all drainage information, creek improvement requirements, associated wetland mitigation plans and permitting within jurisdictional waters.

The following references from the above previous reports represent the tributary area and flow design points for this Sand Creek crossing:

MDDP for Sterling Ranch – 2018

Pre-Developed Condition at Design Point 63 (South Boundary of Sterling Ranch Property)

Q_2 = 251.4 cfs, Q_5 = 430.7 cfs, Q_{100} = 1911.5 cfs

Developed Condition at Design Point 63 (South Boundary of Sterling Ranch Property)

Q_2 = 154.4 cfs, Q_5 = 201.0 cfs, Q_{100} = 1385.1 cfs

Developed Condition at Design Point 68 (Sterling Ranch Road crossing of Sand Creek)

Q_2 = 214.6 cfs, Q_5 = 374.5 cfs, Q_{100} = 2204.1 cfs

FEMA

FIS Flow Rate at Design Point 68 (Sterling Ranch Road crossing of Sand Creek)

Q_{100} = 2600 cfs

MDDP Amendment for Sterling Ranch – 2022

Release from Pond W3 at Design Point 68 (Sterling Ranch Road crossing of Sand Creek)

Q_{100} = 1580 cfs

As described in the MDDP Amendment – 2022, the FIS flow rate of 2600 cfs has been utilized for the channel design and the design of the existing stock pond outlet structure release and in-line detention pond W3. However, these two facilities design now reduces the peak 100-yr. release directly into the proposed culvert crossing at Sterling Ranch Road to Q_{100} = 1580 cfs. Based on this flow rate the proposed culvert calculations meet the criteria found in the DCM Vol. 1 6.4.2. which provides the 2 feet freeboard within the structure. (See Calculations in Appendix)

This proposed public roadway crossing of Sand Creek is planned along with the construction of this portion of Sterling Ranch Road, final platted with Homestead North at Sterling Ranch Filing

No. 1. The proposed crossing will consist of a single cell BridgeCor Steel Box (38'-1" span x 11'-11" rise) with concrete headwalls and wingwalls to facilitate the conveyance of the 100 yr. flow. (See Appendix) The proposed structure is made from heavy gage corrugated steel plates with 3 oz. per square foot galvanized coating (both sides) capable of providing a service life of 75 years or longer. Soils testing provide further design information related to wall thickness to account for corrosion and abrasion requirements per County standards.

SAND CREEK CHANNEL IMPROVEMENTS

This crossing structure design provides for the ultimate collector roadway crossing over Sand Creek for Sterling Ranch Road (80' ROW) while incorporating the culvert structure into the ultimate Sand Creek channel improvements. The intent is to allow for an interim grading plan for the construction of the culvert structure and associated appurtenances all within the current 404 Permit prior to the formal approval of the channel improvements and LOMR. Please reference "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021 and "Sand Creek Restoration – Public Improvement Plans", also prepared by JR Engineering, LLC, dated April 2022 for further channel drainage and improvement design details.

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. Runoff Coefficients are based on the imperviousness of the particular land use and the hydrologic soil type in accordance with Table 6-6. The average rainfall intensity, by recurrence interval found in the Intensity-Duration-Frequency (IDF) curves in Figure 6-5. (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.

This development only provides a culvert design for the public roadway crossing of Sand Creek in support of the surrounding Sterling Ranch residential development. The adjacent developments will be required to adhere to the **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Proposed urban lot impervious area (roof tops, patios, etc.) will sheet flow across landscaped yards and through 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.

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 and eventually public storm systems. These collected flows are then routed directly to multiple extended detention basins (full-spectrum facilities). Where developed flows are not able to be routed to public street, sheet flows will travel across landscaped rear yards and then through undeveloped property prior to entering Sand Creek. The Sand Creek channel corridor will be protected with various channel improvements as recommended in the Sand Creek DBPS and proposed with the "Sand Creek Restoration – Public Improvement Plans", prepared by JR Engineering, LLC, dated April 2022 in order to reduce velocities to erosive levels.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from the adjacent developments 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 Basins designed per current El Paso County drainage criteria.

4. **Consider need for Industrial and Commercial BMPs**: No industrial or commercial uses are proposed directly adjacent to this creek crossing. However, future site-specific storm water quality and erosion control plan and narrative will be submitted along with any future 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 these plans and narratives to protect receiving waters. Multiple temporary BMP's may proposed based on specific phasing of the overall development. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

FLOODPLAIN STATEMENT

This site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C 0533G with effective date 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

The Final Plat for Sterling Ranch Road was prepared by JR Engineering, LLC under separate submittal. (Homestead North at Sterling Ranch Filing No. 1) All associated Drainage and Bridge Fees are described in that report.

SUMMARY

This proposed public roadway crossing of Sand Creek is within the Sand Creek Drainage Basin and was shown conceptually in the Sand Creek DBPS and more recently in the Sterling Ranch Sketch Plan. Design and construction of this facility will be incorporated into the ultimate corridor design for this reach of Sand Creek as shown in the "Sand Creek Restoration – Public Improvement Plans", prepared by JR Engineering, LLC, dated April 2022. The construction of this proposed structure 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 City of Colorado Springs/County of El Paso Drainage Criteria Manual.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Marc A. Whorton, P.E.
Project Manager

maw/118311/Drainage Letter.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. "MDDP Amendment for Sterling Ranch", JR Engineering, LLC, dated April 2022

6. "Sand Creek Restoration – Public Improvement Plans", JR Engineering, LLC, dated April 2022

7. "Final Design Report – Sand Creek Restoration", JR Engineering, LLC, dated October 2021

APPENDIX

VICINITY MAP

VICINITY MAP

N.T.S.

N

SOILS MAP (S.C.S SURVEY)

Map Scale: 1:4,290 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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: Aug 19, 2018—May 26, 2019

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
9	Blakeland-Fluvaquentic Haplaquolls	0.1	0.1%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	29.4	35.2%
71	Pring coarse sandy loam, 3 to 8 percent slopes	54.0	64.7%
Totals for Area of Interest		**83.4**	**100.0%**

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 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: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

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)

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Vertical Datum Offset Table

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

Panel Location Map

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

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

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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A Cross section line
23 - - - - - 23 Transect line
97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4279000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0533G

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

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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

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

MAP NUMBER
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDRAULIC CALCULATIONS

HY-8 Culvert Analysis Report

Crossing Discharge Data

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

Minimum Flow: 0.00 cfs

Design Flow: 1550.00 cfs

Maximum Flow: 2600.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sterling Ranch Rd.

Headwater Elevation (ft)	Total Discharge (cfs)	Sterling Ranch Road Crossing Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7003.90	0.00	0.00	0.00	1
7006.42	260.00	260.00	0.00	1
7007.26	520.00	520.00	0.00	1
7007.92	780.00	780.00	0.00	1
7008.51	1040.00	1040.00	0.00	1
7009.04	1300.00	1300.00	0.00	1
7009.54	1550.00	1550.00	0.00	1
7010.08	1820.00	1820.00	0.00	1
7010.60	2080.00	2080.00	0.00	1
7011.12	2340.00	2340.00	0.00	1
7011.65	2600.00	2600.00	0.00	1
7019.00	5595.93	5595.93	0.00	Overtopping

Rating Curve Plot for Crossing: Sterling Ranch Rd.

Culvert Data: Sterling Ranch Road Crossing

Table 2 - Culvert Summary Table: Sterling Ranch Road Crossing

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	7003.90	0.00	3.100	0-NF	0.00	0.00	3.60	0.00	0.00	0.00
260.00 cfs	260.00 cfs	7006.42	1.87	5.623	3-M1t	1.61	1.13	6.08	2.48	1.15	4.97
520.00 cfs	520.00 cfs	7007.26	2.98	6.456	3-M1t	2.48	1.80	6.83	3.23	2.06	6.00
780.00 cfs	780.00 cfs	7007.92	3.90	7.124	3-M1t	3.19	2.35	7.38	3.78	2.90	6.68
1040.	1040.	7008.5	4.73	7.71	3-	3.83	2.85	7.8	4.21	3.68	7.24

00 cfs	00 cfs	1		0	M1t			1			
1300.00 cfs	1300.00 cfs	7009.04	5.50	8.241	3-M1t	4.42	3.30	8.17	4.57	4.45	7.80
1550.00 cfs	1550.00 cfs	7009.54	6.18	8.744	3-M1t	4.96	3.72	8.48	4.88	5.15	8.26
1820.00 cfs	1820.00 cfs	7010.08	6.87	9.282	3-M1t	5.51	4.14	8.79	5.19	5.89	8.70
2080.00 cfs	2080.00 cfs	7010.60	7.53	9.801	3-M1t	6.04	4.52	9.07	5.47	6.58	9.07
2340.00 cfs	2340.00 cfs	7011.12	8.19	10.322	3-M1t	6.60	4.89	9.33	5.73	7.26	9.42
2600.00 cfs	2600.00 cfs	7011.65	8.82	10.848	3-M1t	7.20	5.25	9.58	5.98	7.92	9.73

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 7000.80 ft,

Outlet Elevation (invert): 7000.30 ft

Culvert Length: 90.00 ft,

Culvert Slope: 0.0056

Culvert Performance Curve Plot: Sterling Ranch Road Crossing

Water Surface Profile Plot for Culvert: Sterling Ranch Road Crossing

Site Data - Sterling Ranch Road Crossing

Site Data Option: Culvert Invert Data

Inlet Station: 100.00 ft

Inlet Elevation: 7000.80 ft

Outlet Station: 190.00 ft

Outlet Elevation: 7000.30 ft

Number of Barrels: 1

Culvert Data Summary - Sterling Ranch Road Crossing

Barrel Shape: User Defined

Barrel Span: 38.00 ft

Barrel Rise: 11.90 ft

Barrel Material: Corrugated Metal Riveted or Welded

Embedment: 0.00 in

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Sterling Ranch Rd.

Table 3 - Downstream Channel Rating Curve (Crossing: Sterling Ranch Rd.)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	7003.90	0.00	0.00	0.00	0.00
260.00	7006.38	2.48	4.97	1.55	0.77
520.00	7007.13	3.23	6.00	2.01	0.81
780.00	7007.68	3.78	6.68	2.36	0.83
1040.00	7008.11	4.21	7.24	2.63	0.85
1300.00	7008.47	4.57	7.80	2.85	0.87
1550.00	7008.78	4.88	8.26	3.04	0.88
1820.00	7009.09	5.19	8.70	3.24	0.89
2080.00	7009.37	5.47	9.07	3.41	0.90
2340.00	7009.63	5.73	9.42	3.58	0.91
2600.00	7009.88	5.98	9.73	3.73	0.91

Tailwater Channel Data - Sterling Ranch Rd.

Tailwater Channel Option: Irregular Channel

Channel Slope: Irregular Channel

User Defined Channel Cross-Section

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	7020.00	0.0350
2	46.00	7006.00	0.0350
3	60.20	7003.90	0.0350
4	102.50	7008.00	0.0350
5	130.40	7016.00	0.0350
6	173.40	7020.00	0.0350

Roadway Data for Crossing: Sterling Ranch Rd.

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 7019.00 ft

Roadway Surface: Paved

Roadway Top Width: 80.00 ft

REFERENCE MATERIAL

MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT FOR STERLING RANCH

Prepared For:
SR Land, LLC
20 Boulder Crescent, 2nd Floor
Colorado Springs, CO 80903
(719) 491-3024

April 12, 2022
Project No. 25188.04

Prepared By:
JR Engineering, LLC
5475 Tech Center Drive
Colorado Springs, CO 80919
(303)-267-6240
Contact: Mike Bramlett, PE

CUHP-SWMM Comparison to HEC-HMS

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

Existing Conditions

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

Proposed Conditions

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

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

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

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

- With Sterling Ranch Phase 3 progressing to preliminary design, a 17.23 acre portion of Sub-Basin SCE-7 and a 11.06 acre portion of SCE-10 has been shifted to basin SC3-14B based on the proposed storm layout.

- As part of Sterling Ranch Phase 3, Pond 11A proved to be unnecessary as hypothesized in the MDDP. Pond 11A was proposed to be located on the east side of the development and drain to the east in directly into Sand Creek. Sub-Basin 11A now drains to Pond FSD6.

- Sub-Basin SC3-7 still drains to FSD6 based on Pond W5 sizing. JR Engineering is currently coordinating with Matrix about the future routing of the flows from the Barbarick detention pond and rain garden through Sterling Ranch Phase 3, but for the purposes of this MDDP Amendment, flows from Sub-Basin SC3-7 have been accounted for in the design of Pond W-5 in Sterling Ranch Filing 2.

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

- The previous MDDP showed a discrepancy between the map and model for Basin SC3-15A. The approved map showed the basin being routed around Pond FSD15B and outfalling undetained in Sand Creek, while the approved model showed the basin being routed through FSD15B. The pond does not appear to be sized to handle the additional flows from SC3-15A, but for continuity the Amendment SWMM model has flows from basin SC3-15A routing through Pond FSD15B.

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

The last and most crucial comparison is between the updated existing conditions model and the updated proposed conditions model. As seen in Table 1, all of the online and offline detention shows a clear reduction in flows along Sand Creek. The total volume of runoff is very similar in the undeveloped upper portion of the reach at Design Points 74, 75, and 78. As runoff accumulates downstream at Design Points 73, 71, 69, and 63 the volume of runoff drastically increases due to the increased imperviousness of the adjacent developments, but the peak flow rates remain lower than existing due to all of the full spectrum detention ponds along the reach. As seen in Table 1, Pond W-3 reduces peak flow rates downstream of it at Design Points 60A and 53A to below the pre-development rates seen in the updated existing conditions model. Flows have been reduced from 1969.2 and 2197.2 cfs, respectively, to 1889.4 and 1895.2 cfs. A table comparing the peak runoff rates and the total volume of runoff at the design points can be found in **Appendix C**.

DRAINAGE FACILITY DESIGN

General Concept

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

Specific Details

Compared to the previous preliminary design of Pond W-3, the amount of storage volume has decreased from 78.2 ac-ft. to 50.6 ac-ft. In order to avoid classification as a jurisdictional dam, the maximum ponding depth is 10 feet. The peak release rate has been increased from 1350.6 cfs to 1552.5 cfs. Despite the increase in release rate, peak flow rates along Sand Creek downstream of the pond are lower than existing. The previous MDDP model outfalls at DP 53A, which is defined as the Full Spectrum Pond at Woodmen Drive, and so does the MDDP Amendment SWMM model. The MDDP model over-detains at Pond W-3 in order to reduce flows downstream well below those in the existing conditions. With the goal being to simply reduce flows to less than predevelopment rates, this amount of detention is unnecessary, hence the reduced storage volume and the increased release rate. A complete comparison between existing and proposed conditions of design flows along Sand Creek can be seen below.

Table 1.

Design Point Comparison Summary						
Location	Design Point ID	Existing (Updated)	Proposed (MDDP)	Proposed (Amendment)	% Difference Amend vs. MDDP	% Difference Amend vs. EX
		Q100 (cfs)				
	DP-74	352.3	262.8	293.76	12%	-17%
	DP-75	970.5	950.5	887.87	-7%	-9%
	DP-78	497.7	385.3	422.09	10%	-15%
	DP-73	1672	1506.7	1497.12	-1%	-10%
Sterling Ranch N BNDY	DP-71	1734.9	1612.2	1642.96	2%	-5%
Briargate Pkwy X'ing	DP-69	1988.4	1775.7	1795.11	1%	-10%
Sterling Ranch S BNDY	DP-63	1980.7	1385.1	1554.72	12%	-22%
Marksheffel X'ing	DP-60A	1969.2	1661.8	1839.17	11%	-7%
Sand Creek and Pond 3	DP-53A	2197.7	1668.9	1843.8	10%	-16%
Near SE Prop Corner	DP-56	242.9	196.4	145.69	-26%	-40%

Conceptually, the current preliminary design for Pond W-3 is similar to what was previously shown in the MDDP. Ponding will occur adjacent to Sterling Ranch Road and pass through an outlet structure before entering the roadway culvert and continuing downstream. The Sterling Ranch Road culvert is currently proposed to be a Conspan arch, O-535 shape (by others).

The existing stock pond upstream of Sterling Ranch Road will remain in place, with flows passing through the pond and leaving through an outlet structure. The major change in how the

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

The proposed channel improvements begin just north of the Sterling Ranch southern property boundary and run north roughly two miles to the northern property boundary. The channel will include a 17 feet wide, 0.71 feet deep, meandering bankfull channel along with a 1% flood terrace along the east side that ranges from 80 feet to 120 feet wide. The straight sections of channel will be rock riffles, while the curves will be eddy pools. The new bankfull will be set lower than the existing channel to establish a new thalweg. Along the west side the bankfull channel will grade up to tie into the existing thalweg in order to preserve as many of the existing wetlands as possible. The channel has been broken up into three separate sections; Reach 1 is the portion between the southern boundary and Sterling Ranch Road, Reach 2 is the portion between Sterling Ranch Road and Briargate Parkway, and Reach 3 is the portion from Briargate Parkway to the northern boundary. A 15’ maintenance trail will run the length of the channel on both sides of it, sitting several feet above the 100 year water surface, while access points from the proposed adjacent developments will be provided.

Reach 1 of the channel is approximately 900 feet long. Upstream, it ties in directly to the downstream grading of the proposed Conspan Arch, Type O-535 (designed by others) culvert at Sterling Ranch Road. The culvert was designed to pass the full 100-year FIS flow rate of 2600 cfs while still providing 1 foot of freeboard within the culvert. In the amended MDDP hydrology, the peak 100-year release from Pond W-3 is 1580 cfs. There are 7 riffle sections, all with a slope of 0.50%, while the slope through the eddy pools is flat. There are two grouted boulder drops structures along this reach, one approximately 3 feet tall and the other approximately 4 feet tall. Due to the development on both sides of the channel, the flood terrace is at its narrowest width of 50 feet along this section. As the channel moves downstream it eventually widens to a maximum flood terrace width of approximately 240 feet, before tying into the existing channel upstream of the property boundary.

Reach 2 of the channel is approximately 5,030 feet long. Upstream, it ties in directly to the downstream grading of the proposed Conspan Arch, Type C42T (designed by others) culvert at Briargate Parkway. The culvert was designed to pass the full 100-year FIS flow rate of 2600 cfs

HY-8 Culvert Analysis Report

Crossing Discharge Data

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

Minimum Flow: 0 cfs

Design Flow: 1550 cfs

Maximum Flow: 2600 cfs

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

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 (low flow) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7000.88	0.00	0.00	0.00	0.00	0
7003.13	260.00	151.32	108.64	0.00	3
7004.37	520.00	339.63	180.32	0.00	4
7005.52	780.00	552.62	227.38	0.00	4
7006.71	1040.00	773.45	266.59	0.00	4
7008.18	1300.00	994.87	305.19	0.00	4
7009.91	1550.00	1205.48	344.57	0.00	4
7011.14	1820.00	1333.23	369.90	115.89	7
7011.40	2080.00	1359.45	375.23	344.67	5
7011.62	2340.00	1380.22	379.47	580.03	5
7011.81	2600.00	1398.22	383.17	817.61	4
7010.88	1672.34	1307.58	364.76	0.00	Overtopping

Rating Curve Plot for Crossing: SRR (separate berm)

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	7000.88	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
260.00	151.32	7003.13	1.745	1.751	3-M2t	1.225	1.017	1.177	1.738	4.944	2.537
520.00	339.63	7004.37	2.954	2.998	3-M2t	2.077	1.743	2.032	2.593	6.429	3.216
780.00	552.62	7005.52	4.097	4.143	3-M2t	2.886	2.412	2.703	3.264	7.863	3.673
1040.00	773.45	7006.71	5.326	5.184	3-M2t	3.644	3.018	3.274	3.835	9.085	4.027
1300.00	994.87	7008.18	6.800	6.142	7-M2t	4.000	3.569	3.780	4.341	10.124	4.318
1550.00	1205.48	7009.91	8.531	4.111	5-M2t	4.000	4.000	3.780	4.781	0.000	4.558
1820.00	1333.23	7011.14	9.756	4.548	5-M2t	4.000	4.000	3.780	5.218	10.124	4.786
2080.00	1359.45	7011.40	10.024	4.939	5-M2t	4.000	4.000	3.780	5.609	10.124	4.982
2340.00	1380.22	7011.62	10.241	5.306	5-M2t	4.000	4.000	3.780	5.976	10.124	5.159
2600.00	1398.22	7011.81	10.431	5.652	5-M2t	4.000	4.000	3.780	6.322	10.124	5.322

****

Straight Culvert

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

Culvert Length: 84.00 ft, Culvert Slope: 0.0013

****

Culvert Performance Curve Plot: Culvert 1

Water Surface Profile Plot for Culvert: Culvert 1

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 7001.38 ft

Outlet Station: 84.00 ft

Outlet Elevation: 7001.27 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 13.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

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

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	7000.88	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
260.00	108.64	7003.13	2.213	2.235	7-M1t	1.340	1.294	1.738	1.738	4.808	2.537
520.00	180.32	7004.37	3.494	3.860	4-FFf	1.865	1.815	2.000	2.593	6.935	3.216
780.00	227.38	7005.52	4.644	5.380	4-FFf	2.000	2.000	2.000	3.264	8.745	3.673
1040.00	266.59	7006.71	5.825	6.807	4-FFf	2.000	2.000	2.000	3.835	10.253	4.027
1300.00	305.19	7008.18	7.300	8.288	4-FFf	2.000	2.000	2.000	4.341	11.738	4.318
1550.00	344.57	7009.91	9.031	9.860	4-FFf	2.000	2.000	2.000	4.781	13.253	4.558
1820.00	369.90	7011.14	10.255	11.097	4-FFf	2.000	2.000	2.000	5.218	14.227	4.786
2080.00	375.23	7011.40	10.524	11.663	4-FFf	2.000	2.000	2.000	5.609	14.432	4.982
2340.00	379.47	7011.62	10.740	12.172	4-FFf	2.000	2.000	2.000	5.976	14.595	5.159
2600.00	383.17	7011.81	10.931	12.642	4-FFf	2.000	2.000	2.000	6.322	14.737	5.322

****

Straight Culvert

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

Culvert Length: 84.00 ft, Culvert Slope: 0.0020

****

Culvert Performance Curve Plot: Culvert 2 (low flow)

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

Site Data - Culvert 2 (low flow)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 7000.88 ft

Outlet Station: 84.00 ft

Outlet Elevation: 7000.71 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2 (low flow)

Barrel Shape: Concrete Box

Barrel Span: 13.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7000.71	0.00	0.00	0.00	0.00
260.00	7002.45	1.74	2.54	0.22	0.36
520.00	7003.30	2.59	3.22	0.32	0.38
780.00	7003.97	3.26	3.67	0.41	0.39
1040.00	7004.55	3.84	4.03	0.48	0.40
1300.00	7005.05	4.34	4.32	0.54	0.41
1550.00	7005.49	4.78	4.56	0.60	0.41
1820.00	7005.93	5.22	4.79	0.65	0.42
2080.00	7006.32	5.61	4.98	0.70	0.42
2340.00	7006.69	5.98	5.16	0.75	0.43
2600.00	7007.03	6.32	5.32	0.79	0.43

Tailwater Channel Data - SRR (separate berm)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 52.00 ft

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

Channel Slope: 0.0020

Channel Manning's n: 0.0350

Channel Invert Elevation: 7000.71 ft

Roadway Data for Crossing: SRR (separate berm)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 7010.88 ft

Roadway Surface: Paved

Roadway Top Width: 52.00 ft

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

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

POND W-3 PLAN
SCALE: 1"=50'

KEY MAP
SCALE: 1"=2000'

GRADING NOTES:

1. ALL PROPOSED CONTOURS ARE TO FINISHED GRADE.
2. EARTHEN CUT AND FILL SLOPES SHALL BE 3:1 MAXIMUM. SLOPES IN EXCESS OF 4:1 AND AREAS OTHERWISE INDICATED BY WITHIN THESE PLANS, SHALL BE COVERED WITH SOIL RETENTION BLANKET OVER 4" MIN. THICKNESS OF TOPSOIL AND SEEDED.
3. IF THE PROJECT IS CONSTRUCTED DURING THE SUMMER WHEN SEEDING IS NOT ALLOWED, APPLY 1-1/2 TONS OF CERTIFIED WEED FREE MULCH PER ACRE MECHANICALLY CRIMPED INTO THE SOIL IN COMBINATION WITH AN ORGANIC MULCH TACKIFIER.
4. PRIOR TO ANY CONSTRUCTION ACTIVITIES THE PROPOSED SILT FENCE SHOWN ON THE EROSION CONTROL SHEET SHALL BE CONSTRUCTED. THE FENCE SHALL BE REMOVED UPON THE LATER OF STABILIZATION OF THE SITE OR COMPLETION OF CONSTRUCTION.
5. TO REDUCE THE POTENTIAL FOR CLOGGING OF DEBRIS GRATES, NO STRAW MULCH SHALL BE USED WITHIN THE EURV OR WQCV OF A DETENTION BASIN. INSTEAD, EROSION CONTROL BLANKETS SHALL BE INSTALLED FOR A WIDTH OF AT LEAST 6 FEET ON EITHER SIDE OF CONCRETE LOW-FLOW CHANNELS. THE BLANKETS SHALL COMPLY WITH THE MATERIALS AND INSTALLATION REQUIREMENTS FOR EROSION CONTROL BLANKETS (STRAW COCONUT OR 100 PERCENT COCONUT). SITE-SPECIFIC CONDITIONS MAY REQUIRE ADDITIONAL BLANKET OR OTHER EROSION CONTROL MEASURES.

POND WARNING SIGN
SCALE: N.T.S.

MAINTENANCE & ACCESS ROAD
ABOVE EURV TYPICAL SECTION
SCALE: N.T.S.

NOTE:
ROAD SLOPE DIRECTION VARIES
REFER TO PLAN

MAINTENANCE & ACCESS ROAD
BELOW EURV TYPICAL SECTION
SCALE: N.T.S.

50 25 0 50
ORIGINAL SCALE: 1" = 50'

811 Know what's below. Call before you dig.

ENGINEER'S STATEMENT
PREPARED UNDER MY DIRECT SUPERVISION
MIKE A. BRAMLE
COLORADO P.E. 3
FOR AND ON BEHALF OF JR ENGINEERING, LLC

PRELIMINARY NOT FOR CONSTRUCTION

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
SR LAND, LLC
20 BOULDER CRESCENT
2ND FLOOR
COLORADO SPRINGS, CO 80903
JAMES F. MORLEY
(719) 419-3024

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

No.	REVISION	BY	DATE

H-SCALE	1"=50'
V-SCALE	N/A
DATE	4/11/22
DESIGNED BY	DV
DRAWN BY	SCH
CHECKED BY	

SAND CREEK RESTORATION

POND PLANS

SHEET 33 OF 81

JOB NO. 25188.04

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POND W-3 OVERFLOW WEIR

SCALE: 1"=20'

KEY MAP

SCALE: 1"=2000'

SECTION B–B

SCALE: N.T.S.

BERM DETAIL

SCALE: N.T.S.

20 10 0 20 40

HORIZONTAL
ORIGINAL SCALE: 1" = 20'
VERTICAL
ORIGINAL SCALE: 1" = 5'

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No.	REVISION	BY	DATE

H–SCALE	1"=20'
V–SCALE	1"=5'
DATE	04/11/22
DESIGNED BY	DV
DRAWN BY	SCH
CHECKED BY	

SAND CREEK RESTORATION

POND PLANS

SHEET 34 OF 81

JOB NO. 25188.04

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CROSS SECTION A-A
STA 1+00.00 TO 9+55.00

POND W-3
CROSS SECTION A-A
HORIZONTAL SCALE: 1"=50'

KEY MAP
SCALE: 1"=2000'

LOW FLOW CHANNEL 1
STA 9+00.00 TO 19+00.00

POND W-3 LOW FLOW CHANNEL
HORIZONTAL SCALE: 1"=100'

50 25 0 50 100
HORIZONTAL
ORIGINAL SCALE: 1" = 50'
VERTICAL
ORIGINAL SCALE: 1" = 5'

Know what's below.
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ENGINEER'S STATEMENT
PREPARED UNDER MY DIRECT SUPERVISION

PRELIMINARY
NOT FOR
CONSTRUCTION

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No.	REVISION	BY	DATE

H-SCALE	1"=50'
V-SCALE	1"=5'
DATE	04/11/22
DESIGNED BY	DV
DRAWN BY	SCH
CHECKED BY	

SAND CREEK RESTORATION

POND PLANS

SHEET 35 OF 81

JOB NO. 25188.04

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SECTION 404 PERMITTING (2016)

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
200 SOUTH SANTA FE AVENUE, SUITE 301
PUEBLO, COLORADO 81003-4270

SIGNED

REPLY TO
ATTENTION OF

February 29, 2016

Regulatory Division

SUBJECT: Action No. SPA-2015-00428-SCO, Sterling Ranch Residential Development Project, El Paso County, Colorado

Jim Morley
SR Land, LLC
20 Boulder Crescent Suite 201
Colorado Springs, CO 80903

Mr. Morley:

You are hereby authorized under Section 404 of the Clean Water Act to discharge dredged and fill material into waters of the United States to conduct work in associated with construction of the Sterling Ranch Residential Development in accordance with Action Number SPA-2015-00428-SCO. A copy of the permit is enclosed.

To use this permit, you must ensure that the work is conducted in accordance with the terms and conditions of the permit. You must submit revised drawings to us for approval prior to construction should any changes be found necessary in either the location or plans for the work. Approval of revised plans may be granted if they are found not contrary to the public interest.

This permit is not an approval of the project design features, nor does it imply that the construction is adequate for its intended purpose. This permit does not authorize any injury to property or invasion of rights or any infringement of Federal, state or local laws or regulations. You must possess the authority, including property rights, to undertake the proposed work.

Enclosed is a compliance certification form. Upon completion of the project, please sign and date the form and return it to this office.

If you have any questions concerning our regulatory program, please contact me at 719-543-6915 or by e-mail at van.a.truan@usace.army.mil. At your convenience,

please complete a Customer Service Survey at
http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Van Truan
Chief, Southern Colorado
Regulatory Branch

Enclosure(s)

Certification of Compliance
with Department of the Army Permit

Action Number: SPA-2015-00428-SCO

Name of Permittee: SR Land, LLC

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

Van Truan
Albuquerque District, U.S. Army Corps of Engineers
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

Please enclose photographs showing the completed project (if available).

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Date Work Started _____

Date Work Completed _____

_____ _____
Date Signature of Permittee

DEPARTMENT OF THE ARMY PERMIT

Permittee Jim Morley

Permit No. SPA-2015-00428-SCO

Issuing Office Albuquerque District, U.S. Army Corps of Engineers

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: The Sterling Ranch Residential Development Project includes installation of attendant utilities, channel improvements to the main stem of Sand Creek, three off-line stormwater detention ponds, development of two permanent residential access roads and associated culverts, and development of residential units. Permanent impacts to waters of the US will result from construction of the residential access roads and associated culverts, and construction of residential units in the unnamed western tributary to Sand Creek. Total cumulative permanent impacts from the discharge of fill material into waters/wetlands of the US from the proposed project will total 4.21 acres and 5,048 linear feet within the main channel of Sand Creek and its western tributary. The project will be constructed in accordance with the attached drawings, entitled, "Sterling Ranch Wetland Impact Location Map, Sterling Ranch Sketch Plan figure number 8, and Sterling Ranch Channel Improvements & Mitigation Plan sheets 1 through 3 dated October 13, 2015, in Sand Creek, El Paso County, Colorado, Application by Jim Morley, Application No. SPA-2015-00428-SCO".

Project Location: The project is located on 1,443.7 acres northeast of the intersection of Black Forest Road and Woodmen Road in unincorporated El Paso County, Colorado. The property is on the United States Geological Survey (USGS) Falcon Quadrangle on portions of Sections 27, 28, 32, 33, and 34 in Township 12 South, Range 65 West and the northwest portion of Section 4, Township 13 South, Range 65 West. The approximate coordinates of the project center are 39.964483 latitude and -104.664944 longitude (WGS 84 datum).

Permit Conditions: In accordance with the attached Colorado Department of Public Health and Environment Section 401 Water Quality Certification pages 1 through 6 of 6, dated February 4, 2016.

General Conditions:

1. The time limit for completing the work authorized ends on March 1, 2021. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity,

although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. The permittee shall implement and abide by the compensatory mitigation plan titled Conceptual Mitigation Plan for Sterling Ranch Residential Development, prepared by CORE Consultants, Inc. on October 29, 2015 except where changes are necessary to comply with special conditions listed below. The permittee shall implement the mitigation plan concurrently with the construction of the project and complete the initial construction and plantings associated with the mitigation work prior to EITHER the initiation of operation OR completion of construction of the project. Completion of all elements of this mitigation plan is a requirement of this permit.

2. The permittee shall submit annual compensatory mitigation site monitoring reports to the Corps Albuquerque District Office by December 31st of each year, beginning in 2016, for a minimum of 3 years or until the Corps has determined that the mitigation performance standards and success criteria have been met. The monitoring reports shall be prepared in accordance with Corps Regulatory Guidance Letter 08-03 (Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources) and current Corps Albuquerque District Mitigation Monitoring Guidelines available at http://www.spa.usace.army.mil/Missions/RegulatoryProgramandPermits/Mitigation.aspx. The mitigation monitoring reports shall at a minimum include the following:

a. Comparison of pre-construction site conditions to an as-built survey as submitted in accordance with Special Condition 4.

b. A map showing the wetland AND/OR Ordinary High Water Mark (OHWM) delineation, and aerial photos marked to show the wetland AND/OR OHWM boundary.

c. Photographs (minimum 5) from fixed photographic monitoring points with a location reference map and indicating camera orientation.

d. All data collected to document whether the mitigation site is achieving performance standards described in the mitigation plan and a narrative discussion of progress made toward meeting performance standards.

e. Fish and wildlife observations at the mitigation site.

f. Summary statement regarding the perceived success of the mitigation project and any potential problem areas. Suggestions and a timetable for corrections should be included if it is anticipated that project goals may not be met.

g. Date(s) of field inspection(s).

3. In order to assist the Corps in scheduling compliance inspections, the permittee shall notify the Corps Albuquerque District Office, in writing, at least 7 calendar days in advance of the initiation of mitigation construction AND no later than 15 calendar days following completion of construction activities.

4. Within 60 days after completion of construction of the mitigation project, the permittee shall submit as-built drawings and a description of the work conducted to the Corps Albuquerque District Office. The drawings shall include the following:

a. The Department of the Army Action Number.

b. A plan view drawing of the location of the authorized work footprint (as shown in permit drawings) with an overlay of the work as constructed in the same scale. The drawing should show all "earth disturbance," wetland impacts, structures, and the boundaries of any on-site and/or off-site mitigation or avoidance areas. The drawings shall contain, at a minimum, 1-foot OR greater topographic contours of the entire site.

c. Ground photographs of the completed work. The camera positions and view-angles of the ground photographs shall be identified on a map, aerial photograph, or project drawing.

d. A description of all deviations between the work as authorized by the permit and the work as constructed. Clearly indicate on the as-built drawings the location of any deviations.

5. Your responsibility to complete the required compensatory mitigation as set forth in Special Condition No. 1 will not be considered fulfilled until you have demonstrated mitigation success and have received written verification from the U.S. Army Corps of Engineers.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this

permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE)

2/23/2016
(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

(FOR THE DISTRICT ENGINEER)

29 Feb 2016
(DATE)

Patrick J. Dagon
Lieutenant Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFERREE)

(DATE)

CORE CONSULTANTS

CIVIL ENGINEERING
DEVELOPMENT CONSULTING
LAND SURVEYING

303.703.4444
1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

Sterling Ranch

Wetland Impact Location Map

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001

LAND USE LEGEND:

44 AC. RESIDENTIAL: 0.2 DU/AC,	9 D.U.
33 AC. RESIDENTIAL: 0.4 DU/AC,	13 D.U.
35 AC. RESIDENTIAL: 1 DU/AC,	35 D.U.
163 AC. RESIDENTIAL: 2 DU/AC,	326 D.U.
475 AC. RESIDENTIAL: 3-5 DU/AC,	1,900 D.U.
101 AC. RESIDENTIAL: 5-8 DU/AC,	608 D.U.
257 AC. RESIDENTIAL: 5-8 DU/AC ACTIVE ADULT,	1,542 D.U.
32 AC. RESIDENTIAL: 8-12 DU/AC,	320 D.U.
41 AC. RESIDENTIAL: 12-20 DU/AC,	656 D.U.
58 AC. COMMERCIAL	
57 AC. ELEMENTARY / K-8 SCHOOL	
18 AC. NEIGHBORHOOD PARK	
30 AC. COMMUNITY PARK	
57 AC. OPEN SPACE / PARK / GREENWAY	
43 AC. OPEN SPACE / BUFFER	
2 AC. UTILITY PARCEL	
TOTAL: 1444 AC.	TOTAL: 5,407 D.U.

SYMBOL LEGEND:

- ROAD
- FULL MOVEMENT ACCESS POINT
- 100-YEAR FLOODPLAIN
- TRAIL
- BUFFER / OS TRAIL CORRIDOR / EASEMENT
- NEIGHBORHOOD PARK
- XXXX ACCESS SPACING (FEET)

VICINITY MAP:

OWNER & DEVELOPER INFO:

MORLEY-BENTLEY INVESTMENTS, LLC.
20 BOULDER CRESCENT ST.
COLORADO SPRINGS, CO 80903
TEL: (719) 471-1742

NOTES:

1. MTCP, CPP, AND PROPOSED CLASSIFICATION AND ROW DATA IS FOUND ON PAGE 18 OF THE SKETCH PLAN REPORT.
2. NO SCHOOL SITES ARE SHOWN IN THE ACTIVE ADULT COMMUNITY DUE TO THE NATURE OF THE USE. IF THIS USE CHANGES, OR SCHOOL-AGE CHILDREN OCCUPY THESE UNITS, SCHOOL DEDICATION WILL BE MADE.

Sterling Ranch SKETCH PLAN

MORLEY-BENTLEY INVESTMENTS, LLC.

FIGURE NO. 8 OF 30

DATE: 05/15/2008

0 100 200
Feet

Potential Riparian Enhancement
Potential Wetland Mitigation Area
Existing Wetland
Pond
Dry Wash
Existing Isolated Wetland
NHD Watercourse
100-year Floodplain
500-year Floodplain
Proposed Road
Proposed Trail
Proposed Lot Lines
Proposed Contour
Index Contour
Intermediate Contour
Parcel Boundary

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LAND SURVEYING
303.703.4444
1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

Sterling Ranch

Channel Improvements & Mitigation Plan
Sheet 1

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001

0 100 200
Feet

Potential Riparian Enhancement
Potential Wetland Mitigation Area
Existing Wetland
Pond
Dry Wash
Existing Isolated Wetland
NHD Watercourse
100-year Floodplain
500-year Floodplain
Proposed Road
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1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

Sterling Ranch

Channel Improvements & Mitigation Plan
Sheet 2

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001

0 100 200
Feet

Potential Riparian Enhancement
Potential Wetland Mitigation Area
Existing Wetland
Pond
Dry Wash
Existing Isolated Wetland
NHD Watercourse
100-year Floodplain
500-year Floodplain
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1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

Sterling Ranch

Channel Improvements & Mitigation Plan
Sheet 2

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001

0 100 200
Feet

Potential Riparian Enhancement
Potential Wetland Mitigation Area
Existing Wetland
Pond
Dry Wash
Existing Isolated Wetland
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Littleton, CO 80120

Sterling Ranch
Channel Improvements & Mitigation Plan
Sheet 3
El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001

PUBLIC NOTICE

US Army Corps of Engineers®
Albuquerque District
Project

Permit Application No.:	SPA-2015-00428-SCO
Project Name:	Sterling Ranch Residential Development Project
Applicant:	SR Land, LLC
Waterway:	Sand Creek
Public Notice Date:	December 9, 2015
Comment Due Date:	January 9, 2016
USACE Contact Phone:	(719) 543-8102

Reply To:

Southern Colorado Regulatory Office
US Army Corps of Engineers, Albuquerque District
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270

PERMIT APPLICATION UNDER SECTION 404 OF THE CLEAN WATER ACT (33 USC 1344)

Summary of Proposed Project: We are requesting public comment on the following project before the above comment due date. The application is for a permit to place dredged/fill material into waters of the US associated with the construction of a residential development in Sand Creek and one tributary located near Falcon, El Paso County, Colorado. Details of the proposed project are provided below.

Name of Applicant: SR Land, LLC, 20 Boulder Crescent, Suite 201, Colorado Springs, CO 80903.

Location: The project is located on 1,443.7 acres northeast of the intersection of Black Forest Road and Woodmen Road in unincorporated El Paso County, Colorado. The property is on the United States Geological Survey (USGS) Falcon Quadrangle on portions of Sections 27, 28, 32, 33, and 34 in Township 12 South, Range 65 West and the northwest portion of Section 4, Township 13 South, Range 65 West. The approximate coordinates of the project center are 39.964483 latitude and -104.664944 longitude (WGS 84 datum).

Description of Work: The Sterling Ranch Residential Development Project includes installation of attendant utilities, channel improvements to the main stem of Sand Creek, three off-line stormwater detention ponds, development of two permanent residential access roads and associated culverts, and development of residential units. Permanent impacts to waters of the US will result from construction of the residential access roads and associated culverts, and construction of residential units in the unnamed western

NEWS RELEASE

tributary to Sand Creek. Total cumulative permanent impacts to waters of the US from the proposed project will total 4.21 acres and 5,048 linear feet within the main channel of Sand Creek and its western tributary.

Purpose and Need: The project purpose is twofold: (1) the development of a medium sized single-family residential development and associated facilities and infrastructure on multiple parcels of land which will be incorporated in the City of Colorado Springs; and (2) creek channel improvements for hydrology and stormwater capability through control of flood water conveyance, establishing improved grade control, and facilitating improved water quality.

Likewise, the project need is twofold: (1) to satisfy market demand for additional housing in the City of Colorado Springs, El Paso County, based on recent County and City economic development reports; and (2) to address a County-wide high-priority stormwater management project while simultaneously managing an increase in stormwater runoff to Sand Creek via channel improvements.

Mitigation: Mitigation for impacts to wetlands and waters of the US on the Sterling Ranch project site is proposed within the Middle Fountain Creek watershed and includes creation of 4.21 acres of emergent wetlands located within and adjacent to the main channel of Sand Creek, with improvements throughout to allow for construction and reestablishment of wetlands.

Plans and Data: Drawings showing the location of the work site and other data are enclosed with this notice. If additional information is desired, it may be obtained from the applicant, or from:

Christopher M. Grosso
U.S. Army Corps of Engineers
Southern Colorado Regulatory Office
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270
(719) 543-8102
Fax No. (719) 543-9475
E-mail: Christopher.M.Grosso@usace.army.mil

Statement of Findings: The Corps consulted district files and records, the latest version of the National Register of Historic Places (NRHP), and state records of NRHP-eligible and potentially eligible historic properties to determine if there are any historic properties that may be affected by the proposed undertaking. Based on this initial information, the Corps has made a preliminary determination that the proposed project will not affect any historic properties that meet the criteria for inclusion in the NRHP.

The Corps has reviewed the U.S. Fish and Wildlife Service's latest published version of Federally-listed endangered and threatened species located in El Paso County, Colorado to determine if any listed species or their critical habitat may occur in the proposed project area. The Corps has made a preliminary determination that the

proposed project will not affect any Federally-listed endangered or threatened species or their critical habitat that are protected by the Endangered Species Act.

The applicant is required to obtain water quality certification, under Section 401 of the Clean Water Act, from the Colorado Department of Public Health and Environment. Section 401 requires that any applicant for an individual Section 404 permit provide proof of water quality certification to the Corps of Engineers prior to permit issuance.

In accordance with environmental procedures and documentation required by the National Environmental Policy Act of 1969, an environmental assessment will be prepared for this project. Upon completion, the assessment may be seen at the U.S. Army Corps of Engineers, Albuquerque District Office, at the address given above.

Comments: Any comments concerning this project should be received by the District Engineer no later than January 9, 2016. Comments received after the end of the Public Notice comment period will not be considered. However, more time may be given if a request, with a valid reason, is received prior to the suspense date. The Corps of Engineers is soliciting comments from the public; federal, state, and local agencies and officials; Indian tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed below. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

The decision whether to issue a permit will be based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The evaluation of the impact of this activity will include application of the guidelines promulgated by the Administrator, EPA, under authority of Section 404(b) of the Clean Water Act. All factors relevant to the proposal and the cumulative effects will be considered; among these are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people.

If the District Engineer determines that the project complies with the 404(b) (1) guidelines, he will grant the permit unless issuance would be contrary to the public interest.

Any person may request a public hearing. The request must be submitted, in writing, to the District Engineer within 21 days of the date of this notice and must clearly set forth the reasons for holding a public hearing.

Patrick J. Dagon
Lieutenant Colonel, U.S. Army
District Commander

Enclosures:
Sheet 1 of 2 – Wetland Location Map
Sheet 2 of 2 – Wetland Impact Location Map

COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

February 4, 2016

RECEIVED
FEB 07 2016
By

SR Land, LLC
Attn: Jim Morley
20 Boulder Crescent, Ste. 201
Colorado Springs, CO 80903

Re: **Section 401 Water Quality Certification**
Colorado 401 Certification No.: 4378
US Corps of Engineers 404 Permit No.: SPA-2015-00428-SCO
Description: Construction of a residential development
Location: Latitude: 38.962389, Longitude -104.675084 in El Paso County, Colorado
Watercourse: Sand Creek and tributaries, Arkansas River Basin, Segment COARFO04 of Fountain Creek Sub-basin
Designation: Use Protected

Dear Mr. Morley:

The Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (Division) has completed its review of the subject Clean Water Act (CWA) Section 404 Permit Application, and our preliminary determination with the issuance of the State of Colorado 401 Certification Public Notice (5 CCR 1002-82.5(B)). This segment is designated "Use Protected" thus no antidegradation review is required (5 CCR 1002-31.8(2)).

This letter shall serve as official notification that the Division is issuing "Regular Certification" in accordance with 5 CCR 1002-82.5(A)(2).

The 401 Certification issued by the Division pursuant to 5 CCR 1002-82.3(C) shall apply to both the construction and operation of the project for which a federal license or permit is required, and shall apply to the water quality impacts associated with the project. This certification does not constitute a relinquishment of the Division's authority as defined in the Colorado Water Quality Control Act, nor does it fulfill or waive any other local, state, or federal regulations.

If you have any questions or need additional information, please contact me at (303) 692-3586.

Sincerely,

John C. Hranac
Water Quality Assessor
Environmental Data Unit
Water Quality Control Division

Attachment

cc: US Army Corps of Engineers, Southern Colorado Regulatory Office
Applicant's Agent, Mr. Chris Haas - CORE Consultants, Inc.
File

Certification Requirements:

(A) The following requirements shall apply to all certifications:

(1) Authorized representatives from the Division shall be permitted to enter upon the site where the construction activity or operation of the project is taking place for purposes of inspection of compliance with BMPs and certification conditions.

(2) In the event of any changes in control or ownership of facilities where the construction activity or operation of the project is taking place, the successor shall be notified in writing by his predecessor of the existence of the BMPs and certification conditions. A copy of such notification shall be provided to the Division.

(3) If the permittee discovers that certification conditions are not being implemented as designed, or if there is an exceedance of water quality standards despite compliance with the certification conditions and there is reason to believe that the exceedance is caused, in whole or in part, by the project, the permittee shall verbally notify the Division of such failure or exceedance within two (2) working days of becoming aware of the same. Within ten (10) working days of such notification, the permittee shall provide to the Division, in writing, the following:

(a) In the case of the failure to comply with the certification conditions, a description of (i) the nature of such failure, (ii) any reasons for such failure, (iii) the period of non-compliance, and (iv) the measures to be taken to correct such failure to comply; and

(b) In the case of the exceedance of a water quality standard, (i) an explanation, to the extent known after reasonable investigation, of the relationship between the project and the exceedance, (ii) the identity of any other known contributions to the exceedance, and (iii) a proposal to modify the certification conditions so as to remedy the contribution of the project to the exceedance.

(4) Any anticipated change in discharge location and/or quantities associated with the project which may result in water quality impacts not considered in the original certification must be reported to the Division by submission of a written notice by the permittee prior to the change. If the change is determined to be significant, the permittee will be notified within ten days, and the change will be acknowledged and approved or disapproved.

(5) Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions herein is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with limitations and prohibitions herein. The Division shall be notified immediately in writing of each such diversion or bypass.

(6) At least fifteen days prior to commencement of a project in a watercourse, which the Division has certified, or conditionally certified, the permittee shall notify the following:

(a) Applicable local health departments;

(b) Owners or operators of municipal and domestic water treatment intakes which are located within twenty miles downstream from the site of the project; and

(c) Owners or operators of other intakes or diversions which are located within five miles downstream from the site of the project.

The permittee shall maintain a list of the persons and entities notified, including the date and form of notification.

(7) Immediately upon discovery of any spill or other discharge to waters of the state not authorized by the applicable license or permit, the permittee shall notify the following;

(a) Applicable local health departments;

(b) Owners or operators of municipal and domestic water treatment intakes which are located within twenty miles downstream from the site of the project; and

(c) Owners or operators of other intakes or diversions which are located within five miles downstream from the site of the project.

The permittee shall maintain a list of the persons and entities notified, including the date and form of notification.

(8) Construction operations within watercourses and water bodies shall be restricted to only those project areas specified in the federal license or permit.

(9) No construction equipment shall be operated below the existing water surface unless specifically authorized by the 401 certification issued by the Division.

(10) Work should be carried out diligently and completed as soon as practicable. To the maximum extent practicable, discharges of dredged or fill material shall be restricted to those periods when impacts to designated uses are minimal.

(11) The project shall incorporate provisions for operation, maintenance, and replacement of BMPs to assure compliance with the conditions identified in this section, and any other conditions placed in the permit or certification. All such provisions shall be identified and compiled in an operation and maintenance plan which will be retained by the project owner and available for inspection within a reasonable timeframe upon request by any authorized representative of the Division.

(12) The use of chemicals during construction and operation shall be in accordance with the manufacturers' specifications. There shall be no excess application and introduction of chemicals into state waters.

(13) All solids, sludges, dredged or stockpiled materials and all fuels, lubricants, or other toxic materials shall be controlled in a manner so as to prevent such materials from entering state waters.

(14) All seed, mulching material and straw used in the project shall be state-certified weed-free.

(15) Discharges of dredged or fill material in excess of that necessary to complete the project are not permitted.

(16) Discharges to state waters not identified in the license or permit and not certified in accordance therewith are not allowed, subject to the terms of any 401 certification.

(17) Except as otherwise provided pursuant to subsection 82.7(C), no discharge shall be allowed which causes non-attainment of a narrative water quality standard identified in the Basic Standards and Methodologies for Surface Waters, Regulation #31 (5 CCR 1002-31), including, but not limited to discharges of substances in amounts, concentrations or combinations which:

(a) Can settle to form bottom deposits detrimental to beneficial uses; or

(b) Form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or

(c) Produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species, or to the water; or

(d) Are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or

(e) Produce a predominance of undesirable aquatic life; or

(f) Cause a film on the surface or produce a deposit on shorelines.

(B) Best Management Practices:

(1) Best management practices are required for all projects for which Division certification is issued except for section 402 permits. Project applicants must select BMPs to be employed in their project. A listing and description of best management practices is located in Appendix I of Regulation No. 82: 401 Certification Regulation 5 CCR 1002-82.

(2) All requests for certifications which require BMPs shall include a map of project location, a site plan, and a listing of the selected BMPs chosen for the project. At a minimum, each project must provide for the following:

(a) Permanent erosion and sediment control measures that shall be installed at the earliest practicable time consistent with good construction practices and that shall be maintained and replaced as necessary throughout the life of the project.

(b) Temporary erosion and sediment control measures that shall be coordinated with permanent measures to assure economical, effective, and continuous control throughout the construction phase and during the operation of the project.

STERLING RANCH ROAD CULVERT DESIGN DOCUMENTS

(KBJW)

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

BRIDGECOR STEEL BOX
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

GENERAL NOTES:

1. THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE GALVANIZED STEEL DEEP CORRUGATED ARCH STRUCTURE (BRIDGECOR®) AS DETAILED IN THE PLANS. ANY INSTALLATION INFORMATION PROVIDED HEREIN SHALL BE REVIEWED AND APPROVED BY THE ENGINEER. CHANGES AND DISCREPANCIES MUST BE FORWARDED TO THE MANUFACTURER TO BE INCORPORATED IN A REVISED DRAWING SET.
2. THE ENGINEER SHALL VERIFY THAT THE PROPOSED STRUCTURE IS APPROPRIATE FOR THE SITE CONDITIONS AND THE DESIGN PARAMETERS ARE CONSISTENT WITH THE PROJECT REQUIREMENTS. ALL ASPECTS OF THE STRUCTURE DESIGN AND SITE LAYOUT NOT EXPLICITLY INCLUDED IN THESE DRAWINGS SHALL BE PROVIDED OR COORDINATED BY THE ENGINEER. THIS MAY INCLUDE BUT IS NOT LIMITED TO: FOUNDATIONS, BACKFILL, END TREATMENTS, HYDRAULIC ANALYSIS AND SCOUR ANALYSIS AS REQUIRED.
3. CONTECH PRODUCT DRAWINGS MAY NOT BE USED, REPRODUCED, COPIED, OR ISSUED TO A THIRD PARTY WITHOUT THE PRIOR WRITTEN PERMISSION OF CONTECH ENGINEERED SOLUTIONS.
4. ALL DIMENSIONS ARE TO THE INSIDE CREST OF THE CORRUGATION PROFILE UNLESS NOTED OTHERWISE AND ARE SUBJECT TO MANUFACTURING TOLERANCES.
5. THE STRUCTURE GEOMETRY, DESIGN, AND MATERIALS AS SHOWN IN THESE DRAWINGS ONLY APPLY FOR BRIDGECOR®, DESIGNED AND FABRICATED BY CONTECH ENGINEERED SOLUTIONS (CONTECH). ALTERNATIVE SYSTEMS SHALL BE FULLY DESIGNED AND APPROVED PRIOR TO BIDDING, WITH SEALED DRAWINGS AND CALCULATIONS PROVIDED TO DEMONSTRATE COMPLIANCE WITH THE SAME GEOMETRY, DESIGN, AND MATERIAL REQUIREMENTS AS SHOWN HEREIN.
6. CIRCUMFERENTIAL PLATE LENGTHS ARE IN TERMS OF S = 16 INCHES.
7. FOR WATER CONVEYANCE APPLICATIONS THE STRUCTURE MUST MEET HYDRAULIC REQUIREMENTS OF THE SITE AS DETERMINED BY THE ENGINEER. SHEET PILING, INLET AND OUTLET APRONS, CUTOFF WALLS, RIP RAP, AND/OR OTHER MEASURES SHALL BE INSTALLED AS NECESSARY TO PREVENT LOSS OF ENGINEERED BACKFILL AND/OR FOUNDATION SOILS DUE TO SCOUR. THE EXTENT, SIZE, AND LOCATION OF SCOUR PROTECTION SHALL BE DETERMINED BY THE ENGINEER.
8. PERIMETER DRAINAGE, SURFACE DRAINAGE, AND GRADING AROUND THE STRUCTURE SHALL BE DESIGNED, SPECIFIED, SUPPLIED, AND INSTALLED BY OTHERS.

DESIGN PARAMETERS

1. DESIGN BY CONTECH ENGINEERED SOLUTIONS IS BASED ON THE FOLLOWING DESIGN CRITERIA:
   - VEHICLE LIVE LOAD: HL-93
   - MINIMUM COVER: 2.0'
   - MAXIMUM COVER: 5.0'
   - DESIGN UNIT WEIGHT OF ENGINEERED BACKFILL = 120 LBS/FT³.
2. ENGINEERED BACKFILL MATERIAL SHALL COMPLY WITH THE ENGINEERED BACKFILL MATERIAL REQUIREMENTS SHOWN IN THESE DRAWINGS.
3. DESIGN COVER AND LATERAL EXTENT OF ENGINEERED BACKFILL ZONE SHALL BE AS SHOWN IN THESE DRAWINGS AND REQUIRED BY THE DESIGN STANDARDS REFERENCED IN THESE NOTES.
4. REFERENCE AASHTO LRFD SECTION 12.6.1 FOR SEISMIC DESIGN CONSIDERATIONS.
5. STRUCTURE DESIGN BASED ON SITE SOIL INFORMATION PROVIDED IN CONTRACT DOCUMENTS. IF UNEXPECTED SITE SOIL CONDITIONS ARE ENCOUNTERED, CONTECH MUST BE NOTIFIED TO DETERMINE IF DESIGN CHANGES ARE NEEDED.
6. TEMPORARY CONSTRUCTION VEHICLE LOADING HEAVIER THAN THE DESIGN VEHICLE LIVE LOAD SHALL NOT BE PERMITTED TO CROSS OVER THE STRUCTURE WITHOUT THE APPROVAL OF CONTECH. IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY CONTECH OF THE SIZE, TYPE AND WEIGHT OF ANY CONSTRUCTION VEHICLES INTENDED TO CROSS OVER THE STRUCTURE.

PLATE MAKE UP: 1 @ 14 S, 1 @ 13 S, 1 @ 10 S

NOTES:

1) MEASUREMENTS ARE TO THE INSIDE CRESTS OF THE CORRUGATIONS.
2) DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
3) CIRCUMFERENTIAL PLATE LENGTHS ARE IN TERMS OF S = 16 INCHES.

BRIDGECOR STEEL BOX
INSIDE END AREA = 355 fl²
TOTAL S = 37

STRUCTURE CROSS-SECTION

COLORADO LICENSED
DARRELL J. SANDERS
55263
PROFESSIONAL ENGINEER
4/18/22

FOR APPROVAL

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MARK	DATE	REVISION DESCRIPTION	BY

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

BridgeCor

CONTECH
CONTRACT
DRAWING

BRIDGECOR STEEL BOX
38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No.	SEQ. No.	DATE
705931	010	4/6/2022
DESIGNED: XXX		DRAWN: SCC
CHECKED: EDE		APPROVED: XXX
SHEET NO.: 1 OF 7		

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1. **DESIGN AND MANUFACTURING STANDARDS**

1.1 ALL STANDARDS REFER TO THE CURRENT ASTM/AASHTO EDITION UNLESS OTHERWISE NOTED

1.2 AASHTO M111 - STANDARD SPECIFICATION FOR ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS

1.3 AASHTO M232 - STANDARD SPECIFICATION FOR ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE

1.4 AASHTO M 167 - STANDARD SPECIFICATION FOR CORRUGATED STEEL STRUCTURAL PLATE, ZINC COATED, FOR FIELD-BOLTED PIPE, PIPE-ARCHES AND ARCHES

1.5 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS - SECTION 12

1.6 AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS - SECTION 26

1.7 ASTM A761 - STANDARD SPECIFICATION FOR CORRUGATED STEEL STRUCTURAL PLATE, ZINC COATED, FOR FIELD-BOLTED PIPE, PIPE-ARCHES AND ARCHES

1.8 ASTM A796 - STANDARD PRACTICE FOR STRUCTURAL DESIGN OF CORRUGATED STEEL PIPE, PIPE-ARCHES, AND ARCHES FOR STORM AND SANITARY SEWERS AND OTHER BURIED APPLICATIONS

1.9 ASTM A807 - STANDARD PRACTICE FOR INSTALLING CORRUGATED STEEL STRUCTURAL PLATE PIPE FOR SEWERS AND OTHER APPLICATIONS

1.10 ASTM A449 - STANDARD SPECIFICATION FOR HEX CAP SCREWS, BOLTS AND STUDS, HEAT TREATED, 120/105/90 KSI MINIMUM TENSILE STRENGTH, GENERAL USE

1.11 ASTM A123 - STANDARD SPECIFICATION FOR ZINC (HOT DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS

1.12 ASTM A153 - STANDARD SPECIFICATION FOR ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE

2. **DEFINITIONS**

2.1 ENGINEER - IN THESE NOTES THE WORD "ENGINEER" SHALL MEAN THE ENGINEER OF RECORD OR OWNER'S DESIGNATED ENGINEERING REPRESENTATIVE.

2.2 MANUFACTURER - IN THESE NOTES THE WORD "MANUFACTURER" SHALL MEAN THE MANUFACTURER OF THE DEEP CORRUGATED ARCH PLATES, CONTECH ENGINEERED SOLUTIONS @ PHONE 800/338-1122.

2.3 CONTRACTOR - IN THESE NOTES THE WORD "CONTRACTOR" SHALL MEAN THE FIRM OR CORPORATION UNDERTAKING THE EXECUTION OF ANY INSTALLATION WORK UNDER THE TERMS OF THESE SPECIFICATIONS.

3. **BRIDGECOR® STRUCTURE ASSEMBLY**

3.1 ASSEMBLY OF THE BRIDGECOR® STRUCTURE SHALL BE IN ACCORDANCE WITH SECTION 26 OF AASHTO LRFD CONSTRUCTION SPECIFICATIONS (LATEST EDITION, WITH INTERIMS) AND ANY SUPPLEMENTAL RECOMMENDATIONS PROVIDED BY THE MANUFACTURER.

3.2 ALL PLATES SHALL BE UNLOADED AND HANDLED WITH REASONABLE CARE. PLATES SHALL NOT BE ROLLED OR DRAGGED OVER GRAVEL ROCK AND SHALL BE PREVENTED FROM STRIKING ROCK OR OTHER HARD OBJECTS DURING PLACEMENT IN TRENCH OR ON BEDDING.

GALVANIZED COATINGS THAT HAVE BEEN COMPROMISED SHALL BE RESTORED WITH A MINIMUM OF TWO COATS OF COLD GALVANIZING COMPOUND (SPRAY OR PAINT) IN ACCORDANCE WITH ASTM A761, SECTION 7 OR OTHER MEASURES AS DESCRIBED IN ASTM A780.

3.3 FOR STRUCTURES SET ON FOOTINGS, PLATE ASSEMBLY CAN BEGIN AFTER PLACEMENT OF STRUCTURE FOOTINGS HAS BEEN APPROVED BY THE ENGINEER. VERIFICATION OF PROPER SPACING, ALIGNMENT, AND ORIENTATION OF THE FOUNDATIONS IS STRONGLY RECOMMENDED PRIOR TO BEGINNING PLATE ASSEMBLY. ANY MODIFICATIONS TO THE FOUNDATIONS SHALL BE MADE PRIOR TO BEGINNING PLATE ASSEMBLY.

BEDDING PREPARATION FOR ROUND AND ELLIPTICAL SHAPES SHOULD BE APPROVED BY THE ENGINEER PRIOR TO ASSEMBLY. THE BED SHOULD BE CONSTRUCTED TO UNIFORM LINE AND GRADE. IT SHOULD BE FREE OF ROCK FORMATIONS, PROTRUDING STONES, FROZEN LUMPS, ROOTS AND OTHER FOREIGN MATTER.

3.4 THE SPAN AND RISE OF THE STRUCTURE SHOULD BE CHECKED FREQUENTLY DURING THE EARLY STAGES OF ASSEMBLY TO VERIFY THAT ASSEMBLY TOLERANCES ARE BEING ACHIEVED AND TO ALLOW FOR ADJUSTMENTS TO PROCEDURES, IF NECESSARY, BEFORE ASSEMBLY IS COMPLETE.

3.5 CUT PLATES FOR SKEWED OR BEVELED ENDS SHOULD BE ATTACHED AFTER THE MAIN BARREL OF A STRUCTURE HAS BEEN ASSEMBLED. WHEN CAST-IN-PLACE CONCRETE COLLARS OR HEADWALLS ARE TO BE CONSTRUCTED, THE CONTRACTOR MUST ALLOW FOR FORMWORK TO BE ERECTED ON THE END OF THE STRUCTURE. FORMING AGAINST A SKEWED CORRUGATION PROFILE IS COMPLEX AND SHOULD BE ACCOUNTED FOR BY THE FORMING CONTRACTOR WHEN PLANNING PROCEDURES AND METHODS FOR FORMWORK CONSTRUCTION. IN SOME CASES, FIELD TRIMMING OF THE STRUCTURE MAY BE NECESSARY. SPECIAL BRACING AND/OR SCAFFOLDING (DESIGN BY OTHERS) IS REQUIRED TO SUPPORT SKEWED ENDS UNTIL ADEQUATE COMPRESSIVE STRENGTH IS ACHIEVED AS REQUIRED BY THE COLLAR/HEADWALL DESIGNER.

3.6 NUTS SHALL BE PLACED WITH THE ROUNDED FACE IN CONTACT WITH THE PLATES UNLESS NOTED OTHERWISE. NUTS CAN BE ON EITHER THE INSIDE OR OUTSIDE OF THE STRUCTURE TO FACILITATE ASSEMBLY.

3.7 RECOMMENDED TORQUE RANGE ON THE BOLTS IS 150 TO 300 FT-LBS FOR 3/4" DIAMETER BOLTS AND 200-350 FT-LBS FOR 7/8" DIAMETER BOLTS.

3.8 INSIDE SPAN AND RISE OF THE ASSEMBLED STRUCTURE AFTER BOLTING SHALL BE WITHIN 2% (OR 5 INCHES, WHICHEVER IS LESS) OF THE PLAN DIMENSIONS. THE TOLERANCE ON STRUCTURE LENGTH IS ± 1/2" PER 10 FT OF STRUCTURE LENGTH

4. **ENGINEERED BACKFILL ENVELOPE**

4.1 ENGINEERED BACKFILL MATERIAL SHALL BE PLACED WITHIN THE ENGINEERED BACKFILL ENVELOPE TO THE MINIMUM WIDTH AND WITHIN THE COVER LIMITS SHOWN ON THESE DRAWINGS. THE ENGINEERED BACKFILL ENVELOPE SHALL NOT BE ALTERED WITHOUT WRITTEN APPROVAL FROM CONTECH.

4.2 IN-SITU SOILS BELOW AND ADJACENT TO THE ENGINEERED BACKFILL ENVELOPE SHALL PROVIDE A FIRM SURFACE AGAINST WHICH TO COMPACT THE ENGINEERED BACKFILL MATERIAL. THE GEOTECHNICAL ENGINEER SHALL EVALUATE THE IN-SITU SOILS AND DETERMINE THE TYPE AND DEGREE OF ANY SOIL IMPROVEMENTS REQUIRED. THESE MAY INCLUDE BENCHING OR SLOPING OF THE SIDE SOILS. BACKFILL PLACEMENT MAY NOT BEGIN UNTIL THE GEOTECHNICAL ENGINEER HAS APPROVED THE IN-SITU SOILS AND ANY REQUIRED IMPROVEMENTS.

4.3 A DRAINED CONDITION WAS ASSUMED FOR THE ENGINEERED BACKFILL ENVELOPE. DESIGN AND SUPPLY OF A SUBSURFACE DRAINAGE SYSTEM (IF NEEDED) SHALL BE PROVIDED BY OTHERS.

4.4 IF REQUIRED BY THE GEOTECHNICAL ENGINEER, A GEOTEXTILE OR GRADED SOIL FILTER MAY BE USED BETWEEN THE ENGINEERED BACKFILL AND IN-SITU SOIL TO PREVENT MIGRATION OF FINES AND POSSIBLE INTERNAL EROSION OF THE SOIL.

5. **ENGINEERED BACKFILL MATERIAL REQUIREMENTS**

5.1 THE DESIGN OF BRIDGECOR® STRUCTURES RELIES ON COMPACTED SOIL PROPERTIES PROVIDED BY THE ENGINEERED BACKFILL MATERIALS. THE CORRECT SELECTION AND PLACEMENT OF COMPACTED ENGINEERED BACKFILL MATERIAL IS CRITICAL TO THE PERFORMANCE OF BRIDGECOR® STRUCTURES.

5.2 THE ENGINEERED BACKFILL MATERIAL SHALL NOT BE ADVERSELY AFFECTED BY WETTING, DRYING, SATURATION, FREEZE/THAW, VIBRATIONS, OR FLOWING WATER.

5.3 BACKFILL MATERIALS SHALL CONFORM TO PROPERTIES REFERENCED IN THE PROJECT SPECIFICATIONS OR THE PROPERTIES DESCRIBED HEREIN, WHICHEVER IS MORE STRINGENT.

5.4 BACKFILL MATERIAL SHOULD CONSIST OF A WELL-GRADED, ANGULAR GRANULAR SOIL WITH A MAXIMUM PARTICLE SIZE OF 3 INCHES. OPEN GRADED OR GAP GRADED MATERIALS ARE NOT PREFERRED. THE BACKFILL MATERIAL SHOULD BE FREE OF FROZEN LUMPS, FOREIGN MATERIAL OR ORGANIC DECOMPOSABLE MATERIALS. FINE BEACH SANDS, WINDBLOWN SANDS, AND STREAM DEPOSITED SANDS ALL OF WHICH EXHIBIT FINE, ROUNDED PARTICLES AND TYPICALLY ARE CLASSIFIED BY AASHTO M 145 AS A-3 MATERIALS ARE NOT ALLOWED. WHEN USING A-2 MATERIALS, MOISTURE CONTENT MUST BE BETWEEN -3% AND +2% OPTIMUM AS DEFINED BY AASHTO T 180

5.5 GRAIN SIZE DISTRIBUTION (GRADATION) OF THE ENGINEERED BACKFILL MATERIAL SHALL SATISFY: Cu GREATER THAN OR EQUAL TO 3 AND Cc BETWEEN 0.7 AND 3, WHERE Cu = COEFFICIENT OF UNIFORMITY = D60/D10 AND Cc = COEFFICIENT OF CURVATURE = $(D30)^2/(D60XD10)$. DXX IS THE PARTICLE SIZE CORRESPONDING TO XX% FINER ON THE CUMULATIVE PARTICLE SIZE DISTRIBUTION CURVE (ASTM D2487).

Cu REQUIREMENTS ARE WAIVED FOR CRUSHER RUN SCREENED AGGREGATES. Cc REQUIREMENTS ARE WAIVED FOR BACKFILL MATERIAL CONTAINING MORE THAN 60% GRAVEL (> #4 SIEVE).

5.6 ABRASION LOSS SHALL NOT EXCEED 45% AS DETERMINED BY THE LOS ANGELES ABRASION TEST (ASTM C131).

5.7 HUMIC (DECAYING) ORGANIC MATTER SHALL NOT EXCEED 1.0% (DRY WEIGHT BASIS).

5.8 ELECTROCHEMICAL REQUIREMENTS FOR SOIL AND WATER IN CONTACT WITH BOTH THE INSIDE AND OUTSIDE OF THE BRIDGECOR® STRUCTURE ARE AS FOLLOWS, PER THE NCSPA DESIGN MANUAL:

- PH = 6 TO 10
- RESISTIVITY = 2,000 to 10,000 OHM-CM
- WATER HARDNESS > 50 PPM $CaCO_3$

5.9 IF THE ELECTROCHEMICAL PROPERTIES OF THE BACKFILL OR WATER FALL OUTSIDE OF THE RECOMMENDED RANGE, A SECONDARY PROTECTION SYSTEM MAY BE NEEDED TO ACHIEVE THE DESIGN SERVICE LIFE. SECONDARY PROTECTION SYSTEMS (IF REQUIRED) SHALL BE DESIGNED AND PROVIDED BY OTHERS.

5.10 THE SELECTION AND EVALUATION OF PROPOSED ENGINEERED BACKFILL MATERIAL IS THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL PROVIDE CONTECH WITH DOCUMENTATION FROM A QUALIFIED GEOTECHNICAL ENGINEER THAT THE PROPOSED ENGINEERED BACKFILL MATERIAL MEETS OR EXCEEDS THE REQUIREMENTS.

6. **ENGINEERED BACKFILL PLACEMENT PROCEDURE**

6.1 A CONTECH REPRESENTATIVE WILL CONDUCT A PRECONSTRUCTION CONFERENCE PRIOR TO COMMENCEMENT OF WORK TO REVIEW AND DISCUSS THE RECOMMENDED PROCEDURES FOR BACKFILLING, AND STRUCTURE SHAPE MEASUREMENTS. ANY CONTRACTOR WITH RESPONSIBILITY FOR BACKFILLING OR CONSTRUCTION OF END TREATMENTS MUST BE REPRESENTED AT THIS MEETING. IT IS RECOMMENDED THAT THE ENGINEER AND ANY THIRD PARTY INVOLVED IN COMPACTION TESTING OR OTHER QUALITY CONTROL MEASURES ALSO ATTEND.

6.2 ANY IMPROVEMENT OF THE SUBGRADE AND EMBANKMENT SOILS REQUIRED BY THE GEOTECHNICAL ENGINEER SHALL BE COMPLETED AND APPROVED PRIOR TO BEGINNING PLACEMENT OF ENGINEERED BACKFILL MATERIAL.

6.3 THE ENGINEERED BACKFILL MATERIAL SHALL BE PLACED UNIFORMLY ON BOTH SIDES OF THE STRUCTURE IN LAYERS OF 8 INCHES OR LESS (BEFORE COMPACTION).

6.4 BACKFILL SHALL BE COMPACTED TO THE MINIMUM DENSITY INDICATED IN THESE DRAWINGS. DEPENDING ON THE COMPACTION EQUIPMENT AND ENGINEERED BACKFILL MATERIAL USED, IT MAY BE NECESSARY TO DECREASE THE LIFT THICKNESS AND/OR MOISTURE CONDITION THE LOOSE SOIL TO ACHIEVE THE SPECIFIED MINIMUM LEVEL OF COMPACTION.

6.5 IF THE ENGINEERED BACKFILL MATERIAL DOES NOT PRODUCE A PROCTOR CURVE AND/OR IS NOT CONDUCIVE TO TRADITIONAL FIELD-TESTING METHODS, QUALITATIVE METHODS OF EVALUATING COMPACTION MAY BE USED. SUCH METHODS SHALL BE EVALUATED AND APPROVED BY THE GEOTECHNICAL ENGINEER AND A COPY OF THE METHOD BE PROVIDED TO THE DESIGNER.

6.6 THE DIFFERENCE IN BACKFILL LEVELS ON THE TWO SIDES OF THE STRUCTURE AT ANY TRANSVERSE SECTION SHALL NOT EXCEED 24 INCHES WITHOUT PRIOR APPROVAL FROM CONTECH.

6.7 CONSTRUCTION EQUIPMENT USED WITHIN 5 FEET LATERALLY OF THE WIDEST PART OF THE STRUCTURE, UP TO THE MINIMUM DESIGN COVER HEIGHT ABOVE THE STRUCTURE, SHALL HAVE A STATIC MASS OF 10 TONS OR LESS. IT MAY BE POSSIBLE TO USE HEAVIER EQUIPMENT IF IT CAN BE DEMONSTRATED THAT THE STRUCTURE SHAPE IS NOT ADVERSELY AFFECTED. ENGINEERED BACKFILL MATERIAL PLACED WITHIN 1 FOOT LATERALLY OF THE WIDEST PART OF THE STRUCTURE SHALL BE COMPACTED USING HAND OPERATED EQUIPMENT UNTIL THE MINIMUM COVER HEIGHT IS REACHED. OVER-COMPACTION OF ENGINEERED BACKFILL IN THIS ZONE SHOULD BE AVOIDED, AS THIS CAN CONTRIBUTE TO EXCESSIVE DEFLECTION OF SOME STRUCTURES. AREAS CLOSEST TO THE STRUCTURE SHALL BE COMPACTED RUNNING PARALLEL TO THE LENGTH OF THE STRUCTURE.

6.8 ONCE THE BACKFILL ELEVATION REACHES APPROXIMATELY ¾ OF THE STRUCTURE RISE (DEPENDING ON THE SHAPE OF THE STRUCTURE AND RELATIVE MOVEMENT DURING THE BACKFILL PROCESS), PLACE AND COMPACT ENGINEERED BACKFILL MATERIAL IN RADIAL LIFTS OVER THE TOP OF THE STRUCTURE USING EQUIPMENT AS DESCRIBED ABOVE. THE FIRST RADIAL LIFT SHOULD BE THICKER AND PROVIDE A MINIMUM 12 INCHES OF COVER BETWEEN THE STRUCTURE AND COMPACTION EQUIPMENT. EQUIPMENT SHOULD RUN PERPENDICULAR TO THE LONGITUDINAL AXIS OF THE STRUCTURE. NO EQUIPMENT SHALL BE ALLOWED OVER THE STRUCTURE THAT WOULD EXCEED THE DESIGN LOAD AT THE MINIMUM DESIGN HEIGHT OF COVER. NO CONSTRUCTION EQUIPMENT SHALL BE ALLOWED TO PARK ON TOP OF A PARTIALLY BACKFILLED STRUCTURE.

6.9 AT NO TIME SHALL THE ENGINEERED BACKFILL MATERIAL BE DUMPED OR PUSHED AGAINST THE STRUCTURE WALL(S) SO AS TO CHANGE THE SHAPE OR ALIGNMENT OF THE STRUCTURE. MATERIAL SHALL NOT BE DUMPED ON TOP OF THE STRUCTURE AT ANY TIME. TRUCKS MAY UNLOAD IN ROUGH LAYERS NO CLOSER THAN 5 FEET FROM THE WIDEST PART OF THE STRUCTURE.

6.10 THE STRUCTURE SHALL BE CHECKED PERIODICALLY DURING BACKFILLING TO ENSURE THE SHAPE OF THE STRUCTURE MEETS DESIGN REQUIREMENTS AND IS CONSISTENT WITH THE ASSEMBLY TOLERANCES AS STATED IN THESE NOTES. IF DEFLECTION OF THE STRUCTURE IS GREATER THAN EXPECTED, BACKFILLING SHALL BE HALTED AND BACKFILL PLACEMENT AND COMPACTION PROCEDURES MODIFIED TO CORRECT THE STRUCTURE SHAPE. IT MAY BE NECESSARY TO REMOVE SOME OF THE BACKFILL TO CORRECT EXCESSIVE DEFLECTION. AFTER COMPLETION OF BACKFILL PLACEMENT, THE FINAL SHAPE OF THE STRUCTURE SHALL BE WITHIN 2% (OR 5 INCHES, WHICHEVER IS LESS) OF THE PLAN DIMENSIONS.

7. **CONSTRUCTION OBSERVATIONS AND TESTING**

7.1 OBSERVATION AND TESTING SHALL BE PERFORMED DURING CONSTRUCTION TO VERIFY COMPLIANCE WITH THESE DRAWINGS , APPLICABLE PROJECT DOCUMENTS, AND STANDARDS REFERENCED IN THESE NOTES.

7.2 THE CONTRACTOR IS RESPONSIBLE FOR QUALITY CONTROL PROCEDURES, VERIFICATION MEASUREMENTS, ADEQUATE SUPERVISION, PROGRESS TESTING, EVALUATION OF PROPOSED ENGINEERED BACKFILL MATERIALS, AND/OR OTHER MEASURES AS NEEDED TO ENSURE THAT THE COMPLETED PROJECT COMPLIES WITH THESE DRAWINGS AND NOTES.

7.3 THE PROJECT OWNER (OR THEIR DESIGNATED REPRESENTATIVE) IS RESPONSIBLE FOR PROJECT OVERSIGHT AND FINAL ACCEPTANCE OF THE CONSTRUCTED STRUCTURE. THE OWNER MAY ACCEPT THE CONTRACTOR'S QUALITY CONTROL PROGRAM OR ADOPT AN INDEPENDENT QUALITY ASSURANCE PROGRAM TO VERIFY COMPLIANCE.

7.4 OBSERVATIONS AND TESTING PRIOR TO STRUCTURE ASSEMBLY & BACKFILL SHALL INCLUDE BUT NOT BE LIMITED TO:

- EVALUATION OF FOUNDATION SOILS BELOW FOOTINGS AND THE ENGINEERED BACKFILL ENVELOPE
- VERIFICATION OF PROPER ALIGNMENT, DIMENSIONS, AND PLACEMENT OF FOUNDATIONS
- VERIFICATION OF PROPER SHAPING, PLACEMENT, AND PREPARATION OF BEDDING SOILS (STRUCTURES WITH INVERTS)
- VERIFICATION OF PROPER PREPARATION OF EMBANKMENT SOILS ADJACENT TO THE ENGINEERED BACKFILL ENVELOPE
- EVALUATION AND APPROVAL OF ENGINEERED BACKFILL MATERIALS
- VERIFICATION OF PROPER PLACEMENT OF GEOTEXTILES (WHEN REQUIRED)

7.5 OBSERVATIONS AND TESTING DURING ASSEMBLY & BACKFILLING SHALL INCLUDE BUT NOT BE LIMITED TO:

- STRUCTURE ALIGNMENT
- PLATE TIGHTNESS OBSERVATIONS
- BOLT TORQUE MEASUREMENTS
- INITIAL STRUCTURE SHAPE MEASUREMENTS (PRIOR TO STARTING BACKFILLING)
- PERIODIC STRUCTURE SHAPE MEASUREMENTS (DURING BACKFILLING)
- ENGINEERED BACKFILL MATERIAL SAMPLING AND TESTING
- OBSERVATIONS OF PROPER FILL PLACEMENT AND COMPACTION PROCEDURES.

7.6 CONTECH MAY REQUIRE ADDITIONAL OBSERVATIONS AND/OR TESTING WHICH MAY INCLUDE, BUT NOT BE LIMITED TO, FULL TIME SHAPE MONITORING, ADDITIONAL SOIL TESTING, AND SITE EVALUATIONS DEPENDING ON THE STRUCTURE GEOMETRY, DESIGN, AND/OR OTHER PROJECT SPECIFIC FACTORS.

COLORADO LICENSED
DARRELL J. SANDERS
55263
PROFESSIONAL ENGINEER
4/12/22

FOR APPROVAL

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CONTECH
CONTRACT
DRAWING

BRIDGECOR STEEL BOX
38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No.: 705931	SEQ. No.: 010	DATE: 4/6/2022
DESIGNED: XXX		DRAWN: SCC
CHECKED: EDE		APPROVED: XXX
SHEET NO.: 2 OF 7		

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NORTH

N

BRIDGE PLAN

COLORADO LICENSED
DARRELL J. SANDERS
55263
PROFESSIONAL ENGINEER

4/18/22

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BRIDGECOR STEEL BOX
38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No.	SEQ. No.:	DATE:
705931	010	4/6/2022
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NOTES:

1. ALL COMPONENTS MUST BE ASSEMBLED AS SHOWN. PAY CLOSE ATTENTION TO MARK NUMBERS ON THE COMPONENTS.
2. MANUFACTURING FACILITY: MANSFIELD, TX.
3. REFERENCE FINAL SHEET FOR PLATE LAP DETAIL.

DETAIL A

SCALE: N.T.S.

LEGEND

⌀ 2 PLATE LAP SEAMS

△ 3-PLATE SEAM

PLATE LAYOUT DRAWING
BRIDGECOR STEEL BOX (OUTSIDE VIEW)
38'-1" SPAN x 11'-11" RISE

BRIDGECOR PLATE DETAILS (30" LONG PLATES)						
PLATE WIDTH "S"	GAGE	PLATE QTY.	MK #	OVERALL WIDTH (INCHES)	NUMBER OF CIRCUMFERENTIAL BOLT HOLES AT 16" CENTERS	PLATE WEIGHT WITHOUT FASTENERS
10	7	36	2 ; 5	169	11	381
13	7	36	3 ; 4	217	14	512
14	7	36	1 ; 6	233	15	549

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4/18/22

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38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No.: 705931	SEQ. No.: 010	DATE: 4/6/2022
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NOTES:

1. REFERENCE PLATE LAYOUT DIAGRAM FOR MOVEMENT CONTROL HOOK LOCATIONS.

MOVEMENT CONTROL HOOK DETAIL

MOVEMENT CONTROL HOOK PLACEMENT DETAIL

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BRIDGECOR STEEL BOX
38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No.:	SEQ. No.:	DATE:
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SECTION

SELECT GRANULAR STRUCTURAL BACKFILL LIMITS.

INITIAL LIFTS OVER THE CROWN OF STRUCTURE AS INDICATED BY SHADED AREA TO BE COMPACTED TO REQUIRED DENSITY WITH HAND OPERATED EQUIPMENT OR WITH LIGHTWEIGHT TRACTOR (D-4 OR LIGHTER) EQUIPMENT.

NOTES:

1. MINIMUM SELECT GRANULAR STRUCTURAL BACKFILL WIDTH IS BASED ON AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12 AND/OR THE RESULTS OF THE PROJECT SPECIFIC FINITE ELEMENT ANALYSIS.
2. ALL SELECT GRANULAR STRUCTURAL BACKFILL TO BE PLACED IN A BALANCED FASHION IN THIN LIFTS (8" LOOSE TYPICALLY) AND COMPACTED TO 90 PERCENT DENSITY PER AASHTO T-180.
3. MONITORING OF THE STEEL BOX STRUCTURE IS REQUIRED DURING THE BACKFILLING PROCESS. THE METHOD, FREQUENCY AND DURATION SHALL BE DETERMINED BASED ON THE SIZE AND SHAPE OF THE STRUCTURE.
4. PREVENT DISTORTION OF SHAPE AS NECESSARY BY VARYING COMPACTION METHODS AND EQUIPMENT.
5. PLACE SELECT GRANULAR STRUCTURAL BACKFILL IN RADIAL LIFTS AT APPROXIMATELY 75% OF THE RISE OF THE STEEL BOX STRUCTURE.
6. BECAUSE OF THE FLEXING AND VIBRATION OF THE CROWN PLATES, THE FULL COMPACTION DENSITY LEVELS OFTEN CAN NOT BE ACHIEVED N THE FIRST SEVERAL INCHES OF FILL OVER THE CROWN.

BASED ON A PROJECT SPECIFIC ANALYSIS GAGE TO BE 7, BACKFILL MATERIAL TO BE A-1, COMPACTED TO 90 % PER AASHTO T-180.

IF OTHER BACKFILL MATERIALS ARE TO BE EVALUATED, CONTACT YOUR LOCAL CONTECH REPRESENTATIVE.

ADDITIONAL SELECT GRANULAR STRUCTURAL BACKFILL NOTES:

SATISFACTORY BACKFILL MATERIAL, PROPER PLACEMENT, AND COMPACTION ARE KEY FACTORS IN OBTAINING MAXIMUM STRENGTH AND STABILITY.

THE BACKFILL MATERIAL SHOULD BE FREE OF ROCKS, FROZEN LUMPS, AND FOREIGN MATERIAL THAT COULD CAUSE HARD SPOTS OR DECOMPOSE TO CREATE VOIDS. BACKFILL MATERIAL SHOULD BE WELL GRADED GRANULAR MATERIAL THAT MEETS THE REQUIREMENTS OF THE PROJECT SPECIFIC ANALYSIS NOTED BELOW. REFERENCE THE STRUCTURAL PLATE BACKFILL GROUP CLASSIFICATION TABLE ON THIS SHEET. RECYCLED CONCRETE/SLAG ARE NOT RECOMMENDED FOR STRUCTURAL BACKFILL MATERIAL.
BACKFILL MUST BE PLACED SYMMETRICALLY ON EACH SIDE OF THE STRUCTURE IN 8" LOOSE LIFTS. EACH LIFT IS TO BE COMPACTED TO THE SPECIFIED DENSITY.

A HIGH PERCENTAGE OF SILT OR FINE SAND IN THE NATIVE SOILS SUGGESTS THE NEED FOR A WELL GRADED GRANULAR BACKFILL MATERIAL TO PREVENT SOIL MIGRATION. IF THE PROPOSED BACKFILL IS NOT A WELL GRADED GRANULAR MATERIAL, A NON-WOVEN GEOTEXTILE FILTER FABRIC SHALL BE PLACED BETWEEN THE SELECT BACKFILL AND THE IN SITU MATERIAL.

DURING BACKFILL, ONLY LIGHTWEIGHT TRACKED VEHICLES (D-4 OR LIGHTER) SHOULD BE NEAR THE STRUCTURE AS FILL PROGRESSES ABOVE THE CROWN AND TO THE FINISHED GRADE. THE ENGINEER AND CONTRACTOR ARE CAUTIONED THAT THE MINIMUM COVER MAY NEED TO BE INCREASED TO HANDLE TEMPORARY CONSTRUCTION VEHICLE LOADS (HEAVIER THAN D-4).

STRUCTURAL PLATE BACKFILL GROUP CLASSIFICATION, REFERENCE AASHTO M-145		
GROUP CLASSIFICATION	A-1-a	A-1-b
Sieve Analysis Percent Passing		
No. 10 (2.000 mm)	50 max.	----
No. 40 (0.425 mm)	30 max.	50 max.
No. 200 (0.075 mm)	15 max.	25 max.
Atterberg Limits for Fraction Passing No. 40 (0.425 mm)		
Liquid Limits	----	----
Plasticity Index	6 max.	6 max.
Usual Materials	Stone Fragment, Gravel and Sand	

*Modified from AASHTO M-145

Fine beach sands, windblown sands, stream deposited sands, etc., exhibiting fine, rounded particles and typically classified by AASHTO M-145 as A-3 Materials should not be used.

If 95% Compaction per AASHTO T-180 is specified, the backfill material shall be a A-1-a.

Reference the most current version of ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), for comparable soil groups.

COLORADO LICENSED
DARRELL J. SANDERS
55263
PROFESSIONAL ENGINEER
4/18/22

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BRIDGECOR STEEL BOX
38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No: 705931	SEQ No: 010	DATE 4/6/2022
DESIGNED: XXX	DRAWN SCC	
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BRIDGECOR CORRUGATION PROFILE

PLATE LAP DETAIL

ANCHOR BOLT BOLTING DETAIL

TYPICAL BOLTING DETAIL

PLATE LAPPING DETAIL (LOOKING DOWNSTREAM)

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DARRELL J. SANDERS
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4/18/22

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38'-1" SPAN X 11'-11" RISE
STERLING RANCH ROAD- CO SPRINGS
COLORADO SPRINGS, CO

PROJECT No:	SEQ. No.:	DATE:
705931	010	4/6/2022
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CONTECH ENGINEERED SOLUTIONS, LLC
Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado

INDEX

1. TITLE SHEET / INDEX
2. PLAN, ELEVATIONS & FOOTING DETAIL
3. UPSTREAM HEADWALL DETAILS
4. DOWNSTREAM HEADWALL DETAILS
5. WINGWALL SECTION & TYPICAL DETAILS
6. SPECIFICATIONS

COLORADO LICENSED
MITCHELL T. HARDING
PE-45339
PROFESSIONAL ENGINEER

KLOINTZ BRYANT JOHNSON WILLIAMS
Formerly CBC Engineers

TITLE SHEET / INDEX

Drawn By: DJH	Date: 4/18/22	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado
Approved By:	Date:	
Scale: GRAPHIC	Project No.: KBJW-24879	Rev.: - / Sheet: 1 OF 6

PLAN VIEW

GRAPHIC SCALE

20' 10' 0 20' 40'

TYPICAL STEEL BOX FOOTING SECTION

GRAPHIC SCALE

2' 1' 0 2' 4'

UPSTREAM END ELEVATION VIEW

GRAPHIC SCALE

10' 5' 0 10' 20'

DOWNSTREAM END ELEVATION VIEW

GRAPHIC SCALE

10' 5' 0 10' 20'

NOTES:

1.) CONCRETE SHALL BE f'c = 4,000 psi.
2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

COLORADO LICENSED
MICHAEL T. HARDING
PE-45839
PROFESSIONAL ENGINEER

KOONTZ BRYANT JOHNSON WILLIAMS
Formerly CBC Engineers

PLAN, ELEVATIONS & FOOTING DETAIL

Drawn By	Date	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado
DJH	4/18/22	
Approved By	Date	

Scale	Project No.	Rev.	Sheet
GRAPHIC	KBJW-24879	-	2 OF 6

PLAN VIEW

ELEVATION VIEW

UPSTREAM HEADWALL DETAILS

GRAPHIC SCALE

3' 1.5' 0 3' 6'

SIDE VIEW

SECTION 'A-A'

GRAPHIC SCALE

2' 1' 0 2' 4'

NOTE:
RIGHT SIDE OF HEADWALL IS DEPICTED IN THIS VIEW.
LEFT SIDE OF HEADWALL IS SYMMETRICAL TO THIS DESIGN.

SECTION 'B-B'

GRAPHIC SCALE

2' 1' 0 2' 4'

NOTES:
1.) CONCRETE SHALL BE f'c = 4,000 psi.
2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

KOONTZ BRYANT JOHNSON WILLIAMS
Formerly CBC Engineers

UPSTREAM HEADWALL DETAILS

Drawn By	Date	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado		
DJH	4/18/22			
Approved By	Date			
Scale		Project No.	Rev.	Sheet
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COLORADO LICENSED MICHAEL T. HARDING PE-45839 PROFESSIONAL ENGINEER

PLAN VIEW

ELEVATION VIEW

DOWNSTREAM HEADWALL DETAILS

GRAPHIC SCALE

3' 1.5' 0 3' 6'

SIDE VIEW

SECTION 'C-C'

GRAPHIC SCALE

2' 1' 0 2' 4'

NOTE:
RIGHT SIDE OF HEADWALL IS DEPICTED IN THIS VIEW.
LEFT SIDE OF HEADWALL IS SYMMETRICAL TO THIS DESIGN.

SECTION 'D-D'

GRAPHIC SCALE

2' 1' 0 2' 4'

NOTES:
1.) CONCRETE SHALL BE f'c = 4,000 psi.
2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

KOONTZ BRYANT JOHNSON WILLIAMS
Formerly CBC Engineers

DOWNSTREAM HEADWALL DETAILS

Drawn By: DJH	Date: 4/18/22	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado
Approved By	Date	

Scale	Project No.	Rev.	Sheet
GRAPHIC	KBJW-24879	-	4 OF 6

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TYPICAL WINGWALL SECTION VIEW

GRAPHIC SCALE

2' 1' 0 2' 4'

WEEP HOLE DETAIL

NOT TO SCALE

EXPANSION JOINT DETAIL

NOT TO SCALE

NOTES FOR EXPANSION JOINT:
A FILTER CLOTH THREE FEET IN WIDTH AND DOUBLE THICKNESS SHALL BE APPLIED TO ALL TRANSVERSE JOINTS IN THE FOOTING AND WALLS. THE MATERIAL SHALL BE CENTERED ON THE JOINT AND THE EDGES SEALED WITH A MASTIC OR WITH TWO SIDED TAPE. THE FILTER CLOTH SHALL BE A GEOTEXTILE MEETING THE APPROVAL OF THE ENGINEER.

KEYED CONSTRUCTION JOINT DETAIL

NOT TO SCALE

CONTROL JOINT TYPICAL DETAIL

(@ 22'-0" MAX.)

NO SCALE

NOTES:
1.) CONCRETE SHALL BE f'c = 4,000 psi.
2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

COLORADO LICENSED MITCHELL T. HARGRAVE PE-45339 PROFESSIONAL ENGINEER

KOONTZ BRYANT JOHNSON WILLIAMS
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WINGWALL SECTION & TYPICAL DETAILS

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I – GENERAL

1.0 STANDARDS AND DEFINITIONS

1.1 STANDARDS - All standards refer to latest edition unless otherwise noted.

1.1.1 ASTM D-698-70 (Method C) "Standard Test Methods for Moisture. Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.5 kg.) Rammer and 12-inch (305-mm) Drop".

1.1.2 ASTM D-2922 "Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear methods (Shallow Depth)".

1.1.3 ASTM D-1556 "Standard Test Method for Density of Soil in place by the Sand-Cone Method".

1.1.4 ASTM D-1557 "Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort."

1.1.5 All construction and materials shall be in accordance with the latest AASHTO LRFD Bridge Design Specifications.

1.2 DEFINITIONS

1.2.1 Owner - In these specifications the word "Owner" shall mean El Paso County, Colorado

1.2.2 Engineer - In these specifications the word "Engineer" shall mean the Owner designated engineer.

1.2.3 Design Engineer - In these specifications the words "Design Engineer" shall mean KBJW, Inc.

1.2.4 Contractor - In these specifications the word "Contractor" shall mean the firm or corporation undertaking the execution of any work under the terms of these specifications.

1.2.5 Approved - In these specifications the word "approved" shall refer to the approval of the Engineer or his designated representative.

1.2.6 As Directed - In these specifications the words "as directed" shall refer to the directions to the Contractor from the Owner or his designated representative.

2.0 GENERAL CONDITIONS

2.1 The Contractor shall furnish all labor, material and equipment and perform all work and services except those set out and furnished by the Owner, necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction, grading, footing construction, endwall construction as shown on the plans and as described therein.

This work shall consist of all mobilization clearing and grading, grubbing, stripping, removal of existing material unless otherwise stated, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the lines, grades, slopes, and specifications.

This work is to be accomplished under the observation of the Owner or his designated representative.

2.2 Prior to bidding the work, the Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the owner can investigate the condition.

2.3 The construction shall be performed under the direction of an experienced engineer who is familiar with the design plan.

I – BRIDGECOR FOOTINGS

1.0 EXCAVATION FOR FOOTINGS

1.1 Footing excavation shall consist of the removal of all material, of whatever nature, necessary for the construction of foundations.

1.2 It shall be the responsibility of the Contractor to identify and relocate all existing utilities which conflict with the proposed footing locations shown on the plan. The Contractor must call the appropriate utility company at least 48 hours before any excavation to request exact field location of utilities, and coordinate removal and installation of all utilities with the respective utility company.

1.3 The side of all excavations shall be cut to prevent sliding or caving of the material above the footings.

1.4 Excavated material shall be disposed in accordance with the plan established by the Engineer.

1.5 The footings are designed for a factored bearing resistance of 8,700 psf (Ultimate Bearing Resistance of 14,500 psf) based on a 0.60 resistance factor in accordance with the updated recommendations by Entech Engineering, Inc for a minimum permanent footing embedment depth of 5 feet. A friction factor of 0.34 has also been utilized based on an ultimate friction coefficient of 0.40 and the recommended sliding resistance factor of 0.85. These shall be verified in the field before construction. The evaluation and design of any required foundation improvement to achieve the recommended factored bearing resistance and friction factor, and to protect against frost and scour and settlement, is the responsibility of others than KBJW. All recommendations in the project geotechnical report shall be followed during construction.

1.6 Care must be exercised to ensure that heavy equipment is not operated adjacent to the footings. Heavy equipment shall not be allowed any closer than 5 feet to the footings.

2.0 CONCRETE FOOTING DIMENSIONS

2.1 The footings shall be reinforced in accordance with the construction drawings.

III – HEADWALLS AND WINGWALLS

1.0 The headwalls and wingwalls shall consist of reinforced concrete conforming to Chapter IV of these specifications, and AASHTO LRFD Bridge Design Specifications having a minimum compression strength of 4,000 psi.

2.0 Reinforcing steel shall conform to ASTM A-615, Grade 60, having minimum yield strength of 60,000 psi.

3.0 The headwalls shall be anchored to the BridgeCor box in the manner shown on the plans and shall be formed and poured in accordance with the plan dimensions.

4.0 Round weep holes spaced not over 5 feet on center shall be placed in the walls above finished grade as shown on the construction drawings. A granular envelope, consisting of #57 stone (clean ¾" aggregate) or equivalent, shall be placed behind each weep hole for a distance of approximately 1 foot from all edges of the weep hole. A free-draining geotextile screen shall be placed between the weep hole and the stone to prevent erosion of the stone.

5.0 The select backfill behind the headwalls must be a well-graded, angular, durable granular material conforming to the select backfill specifications for the BridgeCor arch placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. The material must be placed in strict conformance with the project specifications, the manufacturer's requirements, and industry standards. The select backfill behind the wingwalls must be a well-graded, angular, durable granular material placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. These values to be field verified.

6.0 All Federal, State, and Local regulations shall be strictly adhered to relative to excavation side-slope geometry and any required excavation shoring.

IV – CONCRETE FOR FOOTINGS AND ENDWALLS

1.0 CODES AND STANDARDS

1.1 Reinforced concrete shall conform to the requirements of Colorado DOT Standards and Section V of the AASHTO LRFD Bridge Design Specifications having a minimum compressive strength of 4,000 psi.

2.0 STANDARDS FOR MATERIALS

2.1 Portland Cement - Conforming to ASTM Specification C-150, Type I or II.

2.2 Water - The water shall be drinkable, clean free from injurious amounts of oils, acids, alkalis, organic materials, or deleterious substances.

2.3 Aggregates - Fine and coarse aggregates shall conform to current ASTM Specification C-33 "Specification for Concrete Aggregates" except that local aggregates which have been shown by tests and by actual service to produce satisfactory qualities may be used when approved by the Engineer.

2.4 Submittals - Test data and/or certifications to the Owner shall be furnished upon request.

3.0 PROPORTIONING OF CONCRETE

3.1 COMPOSITION

3.1.1 The concrete shall be composed of cement, fine aggregate, coarse aggregate and water.

3.1.2 The concrete shall be homogeneous, readily placeable and uniformly workable and shall be proportioned in accordance with ACI-211.1.

3.1.3 Proportions shall be established on the basis of field experience with the materials to be employed. The amount of water used shall not exceed the maximum 0.45 water/cement ratio, and shall be reduced as necessary to produce concrete of the specified consistency at the time of placement.

3.1.4 An air-entraining admixture, conforming to the requirements of ASTM C260, shall be used in all concrete furnished under this contract. The quantity of admixture shall be such as to produce an air content in the freshly mixed concrete of 6 percent plus or minus 1 percent as determined in accordance with ASTM C231 or C173.

3.2 Qualities Required - As indicated in the table below:

TABLE IV-1
QUALITIES REQUIRED

ITEM	QUALITY REQUIRED
AASHTO Class	A
Type of Cement	I or II
Compressive Strength f'c @ 28 days	4,000 psi
Slump, inches	2 - 4 in.

3.3 Maximum Size of Coarse Aggregates - Maximum size of coarse aggregates shall not be larger than 19 mm (3/4 inches).

3.4 Rate of Hardening of Concrete - Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions:

Under 40°F Ambient Temperature – All work to be in accordance with the recommendations of ACI-306R "Cold Weather Concreting."

4.0 MIXING AND PLACING

4.1 Equipment - Ready Mix Concrete shall be used and shall conform to the "Specifications for Ready-Mix Concrete," ASTM C-94. Approval is required prior to using job mixed concrete.

4.2 Preparation - All work shall be in accordance with ACI-304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete." All construction debris and extraneous matter shall be removed from within the forms. Concrete shall be placed on clean surfaces, free from water. Concrete that has to be dropped four (4) feet or more shall be placed through a tremie.

4.3 All concrete shall be consolidated by internal mechanical vibration immediately after placement. Vibrators shall be of a size appropriate for the work, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute.

5.0 FORM WORK

5.1 Forms shall be of wood, steel or other approved material and shall be set and held true to the dimensions, lines and grades of the structure prior to and during the placement of concrete.

5.2 Forms shall not be removed until the concrete has sufficient strength to prevent concrete damage and/or drainage.

6.0 CURING

6.1 Fresh concrete shall be protected from rains, flowing water and mechanical injury for a period of seven (7) days. Loads shall not be placed on the concrete until it has reached its design strength.

7.0 REINFORCING STEEL

7.1 MATERIAL

7.1.1 All reinforcing bars shall be deformed bars (ASTM-A615) Grade 60.

7.2 BENDING AND SPLICING

7.2.1 Bar reinforcement shall be cut and bent to the shapes shown on the plans. Fabrication tolerances shall be in accordance with ACI 315. All bars shall be bent cold, unless otherwise permitted.

7.2.2 All reinforcement shall be furnished in the full lengths indicated on the plans unless otherwise permitted. Except for splices shown on the plans and splices for No. 5 or smaller bars, splicing of bars will not be permitted without written approval. Splices shall be staggered as far as possible.

7.2.3 In lapped splices, the bars shall be placed and wired in such a manner as to maintain the minimum distance to the surface of the concrete shown on the plans.

7.2.4 Substitution of different size bars will be permitted only when authorized by the engineer. The substituted bars shall have an area equivalent to the design area, or larger.

7.3 PLACING AND FASTENING

7.3.1 Steel reinforcement shall be accurately placed as shown on the plans and firmly held in position during the placing and setting of concrete. Bars shall be tied at all intersections around the perimeter of each mat and at not less than 2-foot centers or at every intersection, whichever is greater, elsewhere. Welding of cross bars (tack welding) will not be permitted for assembly of reinforcement.

7.3.2 Reinforcing steel shall be supported in its proper position by use of mortar blocks, wire bar supports, supplementary bars or other approved devices. Such devices shall be of such height and placed at sufficiently frequent intervals so as to maintain the distance between the reinforcing and the formed surface or the top surface within 1/4 inch of that indicated on the plans.

V - FILTER FABRIC (GEOTEXTILE SCREEN)

1.0 Filter fabric shall be placed at all locations shown on the construction drawings, and as necessary between all dissimilar materials to prevent soil migration and to maintain a soil-tight system.

2.0 Filter fabric cloth shall conform to Contech specification for C60-NW or equivalent and shall meet the following ASTM tests:

2.1 ASTM D4751 - Apparent opening size equal to #70 U.S. Standard Sieve Size.

2.2 ASTM D4632 (Grab Tensile Test) - Minimum Strength = 160 pounds.

2.3 ASTM D4632 (Grab Elongation) - 30-70%.

2.4 ASTM D4533 (Trapezoidal Tear) - Minimum Strength = 60 pounds.

2.5 ASTM D4355 (Stabilized for Heat and Ultra-Violet Degradation) - 70% strength retained.

3.0 The minimum fabric coefficient of permeability (ASTM D4491) shall be 0.24 cm/sec.

4.0 The fabric shall be non-woven with a minimum thickness (ASTM D5199) of 60 mils.

5.0 Fabric shall not be placed over sharp or angular rocks that could tear or puncture it.

6.0 Care should be exercised to prevent any puncturing or rupture of the filter fabric. Should such rupture occur, the damaged area should be covered with a patch of filter fabric using an overlap minimum of one (1) foot.

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SPECIFICATIONS

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