



---

**DRAFT**  
**MASTER DEVELOPMENT DRAINAGE REPORT**  
**FOR**  
**MEADOWLAKE RANCH**  
**(SKETCH PLAN)**

**SKP-18-004**

**AUGUST 2018**

Prepared for:  
**NES, INC.**  
619 N. CASCADE AVENUE  
COLORADO SPRINGS, CO 80907  
719-471-0073

Prepared by:  
**TERRA NOVA ENGINEERING, INC**  
**721 S. 23<sup>RD</sup> STREET**  
COLORADO SPRINGS, CO 80904  
(719) 635-6422

Job No. 1822.00

Replace this signature sheet with the correct one, see attached. Pasted on the first appendix page.

## DRAINAGE REPORT STATEMENT

### 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 Drainage Criteria Manual for the City of Colorado Springs and El Paso County. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

\_\_\_\_\_  
L Ducett, Colorado P.E. #32339

\_\_\_\_\_  
Date

### DEVELOPER'S STATEMENT:

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

Business Name: \_\_\_\_\_

\_\_\_\_\_

Title: \_\_\_\_\_

Address: 13202 JUDGE ORR RD \_\_\_\_\_

PEYTON, CO 80831

EL PASO COUNTY:

Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

\_\_\_\_\_  
For El Paso County Engineer/Director

\_\_\_\_\_  
Date

Conditions:

## **TABLE OF CONTENTS:**

PURPOSE	Page 4
GENERAL DESCRIPTION	Page 4
EXISTING DRAINAGE CONDITIONS	Page 5
DEVELOPED DRAINAGE CONDITIONS	Page 6
CHANNEL IMPROVEMENTS	Page 8
MDDP CONFORMANCE	Page 8
DETENTION FACILITIES	Page 8
HYDROLOGIC CALCULATIONS	Page 8
FLOODPLAIN STATEMENT	Page 9
DRAINAGE/BRIDGE FEES	Page 9
SUMMARY	Page 9
REFERENCES	Page 10

## **APPENDICES**

VICINITY MAP  
SOILS MAP  
F.E.M.A. MAP  
HYDROLOGIC / DETENTION CALCULATIONS  
DRAINAGE AREA MAPS

## **PURPOSE**

This document is a Master Development Drainage Plan for the Meadowlake Ranch Sketch Plan. The purpose of this report is to schematically address on-site and off-site drainage patterns as discussed and approved within the Master Development Drainage Plan (MDDP) for Meadowlake Ranch and provide general methods to handle these flows based on the Sketch Plan via on-site detention and possible channel improvements in order to limit any flows released off-site to historic levels or less. This report will remain in general compliance with the El Paso County Drainage Criteria and will be followed up with a Preliminary Drainage Report submitted in conjunction with any Preliminary Plan submittals. Thus, some County review was completed on this report but no approval was required for the Sketch Plan approval.

## **GENERAL DESCRIPTION**

The Meadowlake Ranch (Sketch Plan) site is located at the northwest corner of State Highway 24 and Judge Orr Road. The site is bounded on the north by Bandanero Drive and on the northwest by Eastonville Road. To the west are properties in the Woodmen Hills Filing No. 10 subdivision and to the northeast are properties owned by Distinctive Marine Company. Judge Orr Road and State Highway 24 form the southern and eastern borders, respectively. The El Paso County's Rock Island Trail runs between the eastern property line and State Highway 24.

The primary site influences affecting the proposed land use are the Meadow Lake Airport and the wetlands within the property. To mitigate the impact of air traffic, industrial land use is proposed for the south-central portion of the site nearest the airport. To the west of this industrial area, urban residential land use is proposed to be served by the Woodmen Hills Metropolitan District. To the south of the urban residential area, a frontage of commercial land use is proposed along Judge Orr Road to its intersection with State Highway 24. For the balance of the property, north and east of the industrial area, rural residential land use with well and septic systems is proposed and will be accessed via Bandanero Drive.

Within the proposed urban residential area the existing wetlands will form part of an open space. The wetlands are fed by a spring in the northeast portion of the property next to the old railroad right of way along Eastonville Road. The system of ponds within the wetlands, running generally north to south, was excavated by horse-drawn equipment in the early 1900s and the ponds are

connected by pipes and French drains. The wetlands are situated along the high ground between the Bennett and Haegler basins and form an independent basin within the property.

Soils for this project are delineated by the S.C.S. "El Paso County Area Soil Survey" as Columbine (gravelly sandy loam) and Stapleton (sandy loam) with Hydrologic Group designations of A and B, respectively (see Appendix). The majority of the site is covered with native grasses with a greater variety of vegetation along the natural drainage ways and in the wetland areas.

### EXISTING DRAINAGE CONDITIONS

Existing drainage from the Meadowlake Ranch (Sketch Plan) site is generally from northwest to southeast by way of existing natural drainage swales. Several features make this a unique site. First, the outfall channel from the Bennett Ranch Regional Detention Pond that regulates the developed areas to the northwest of the site runs just outside the western property line. The flows from that basin pass under Judge Orr Road at the southwest property corner via three 60" CMPs. Existing runoff from the Meadowlake Ranch site does not contribute to those outflows and runoff from the proposed conditions will be routed away from that conveyance route as well. Next, the existing wetlands on the site are not formed by the conveyance of runoff through the site, but rather by the retention of spring water within the site. As a consequence, rainfall within the limits of the wetlands or on areas draining to the wetlands does not contribute to the runoff produced by the property. And last, the Rock Island Trail running outside the eastern property line intercepts runoff from the site rather than allowing it to flow directly into the drainage ways along State Highway 24.

No portion of the Meadowlake Ranch site falls within the FEMA 100-year floodplain as designated on Map No. 08041C575 F.

Concentrated runoff enters the site at two locations along its boundary with Bandanero Drive. These basins were studied as part of the MDDP, PDR and FDR for Four Way Ranch (4 Way Ranch Filing No. 1). The basins are modeled in this study using the data from these previous studies. Basin OS-1 has a drainage area of 118.3 acres and produces runoff values of Q5= 24.4 cfs and Q100= 144.2 cfs and is conveyed under Bandanero Drive via dual 36" RCPs. Basin OS-2 has a drainage area of 13.2 acres with runoff values of Q5= 7.3 cfs and Q100= 24.3 cfs and passes under Bandanero Drive via a single 30" RCP.

Add discussion of culvert capacity for the two crossings of Bandanero Drive. Does the road overtop, Does the overtop flow get to the same place?

Please note that the drainage plan for 4 Way Ranch has recently made some changes that affect the drainages entering this site.

The runoff leaving the property is conveyed offsite at one of three locations. The first location is Design Point 1 where runoff from basin EX-1 passes through a 24" CMP under Judge Orr Road near its intersection with State Highway 24. This point drains approximately the western third of the site and encompasses range land, wetland area and the ranch house. No offsite areas contribute to this runoff. The total drainage area for EX-1 is 55.7 acres, producing runoff values of  $Q_5 = 4.0$  cfs and  $Q_{100} = 29.1$  cfs for existing conditions.

The second location is Design Point 2 where basin EX-2 passes through a 20" iron pipe under the Rock Island Trail. EX-2 encompasses a small area in the southern part of the site and includes range land and some ranch buildings. No offsite areas contribute this runoff. The total drainage area for EX-2 is 24.0 acres, producing runoff values of  $Q_5 = 2.3$  cfs and  $Q_{100} = 15.5$  cfs for existing conditions.

See note on plan, it s not clear how these flows get to the culverts and where the culverts are.

The third location is Design Point 3 where runoff from basin EX-3 passes through dual 60" CMPs under State Highway 24 at the southeast corner of the site. Design Point 3 drains the northeastern portion of the property, including runoff from the offsite conveyances at Bandanero Drive (OS-1 & OS-2). The drainage area for EX-3, made up of primarily range land, is 168.9 acres, not including the offsite contributing areas, and produces runoff values of  $Q_5 = 13.6$  cfs and  $Q_{100} = 102.1$  cfs for existing conditions. The combined drainage area for basins OS-1, OS-2 and EX-3 is 300.4 acres producing existing condition flows of  $Q_5 = 41.1$  cfs and  $Q_{100} = 247.0$  cfs.

## DEVELOPED DRAINAGE CONDITIONS

preliminary and

This MDDP is schematically addressing on-site and off-site drainage patterns for the developed conditions of this site. The individual Final Drainage Report(s) will better define developed flows within each basin to determine curb capacity/at-grade inlet requirements and specific sump inlet sizing based on flows for developed conditions.

Basin PR-1 will largely encompass the area addressed in EX-1. The proposed land uses for this area include urban residential, commercial, wetlands and open space. The total drainage area for PR-1 is 77.9 acres, producing runoff values of  $Q_5 = 114.4$  cfs and  $Q_{100} = 234.2$  cfs for developed conditions. All runoff will be conveyed to Design Point 1 located near the intersection of Judge Orr

Road and State Highway 24. Full Spectrum Detention will be provided at Design Point 1 by Pond-1 and proposed outflows will not exceed the flows for existing conditions.

**Does the existing 24 inch culvert under Judge Orr Road have the capacity for this flow?**

**DP-1: Pond 1 – Preliminary Sizing (Full Spectrum Detention)**

Required WQCV = 1.270 ac-ft

Required EURV = 4.035 ac-ft

Required 100-Yr Detention Volume = 7.215 ac-ft

Approximate size: L= 350 ft, W= 175 ft, D=4.5 ft

Existing Flow at DP1:  $Q_5 = 4.0$  cfs,  $Q_{100} = 29.1$  cfs

Proposed Inflow at DP1:  $Q_5 = 114.4$  cfs,  $Q_{100} = 234.2$  cfs

Proposed Outflow at Pond-1:  $Q_5 = 4.0$  cfs,  $Q_{100} = 29.1$  cfs

Concrete Riser Box elevation = TBD

Max. 100 yr. WSE = TBD

Basin PR-2 encompasses the areas addressed in EX-2 and EX-3 by eliminating Design Point 2 and routing all the runoff for the proposed conditions to Design Point 3. The proposed land uses for this area include industrial, commercial, urban residential and rural residential. The drainage area for PR-2 is 206.9 acres, not including the offsite basins, and produces runoff values of  $Q_5 = 253.6$  cfs and  $Q_{100} = 553.8$  cfs for developed conditions. The combined flows for PR-2, OS-1, and OS-2 for the developed conditions are  $Q_5 = 275.5$  cfs and  $Q_{100} = 714.3$  cfs.

At Design Point 3 the water quality needs for the combined area of basins PR-2, OS-1, and OS-2 for the proposed conditions will be addressed by Pond 2. However, congruent with the previous studies, Pond 2 will only address the detention requirements for basin PR-2. The release flows for Pond-2 will be at or below the values for the existing conditions.

**DP-3: Pond 2 – Preliminary Sizing (Water Quality and Detention)**

Required WQCV = 3.491 ac-ft

Required EURV = 3.968 ac-ft

Required 100-Yr Detention Volume = 16.667 ac-ft

Approximate size: L= 550 ft, W= 275 ft, D=4.5 ft

Existing Flow at DP3:  $Q_5 = 41.1$  cfs,  $Q_{100} = 247.0$  cfs

**Does the existing culverts (Dual 60"?) under Judge Orr Road have the capacity for this flow? Please call out culverts on Proposed Drainage Plan.**

Proposed Inflow at DP3:  $Q_5 = 275.5$  cfs,  $Q_{100} = 714.3$  cfs

Proposed Outflow at Pond-2:  $Q_5 = 41.1$  cfs,  $Q_{100} = 247.0$  cfs

Concrete Riser Box elevation = TBD

Max. 100 yr. WSE = TBD

Add a section labeled " Four Step Process" that discusses the process followed for planning the development of this site. See ECM Section I.7.2.

## **CHANNEL IMPROVEMENTS**

Any required channel improvements will likely be phased based on Final Platting. Channel improvement design will also be presented with each individual Final Plat. The specific areas where the natural channels are either too shallow or incised, improvements will be provided to handle the developed flows and control velocities. Probable improvements in such areas may include but not be limited to the following: minor grade control structures, weirs, vegetation enhancements and varying channel widths. Detailed design of these natural channel corridors will be further presented in the final drainage report(s).

## **MDDP CONFORMANCE**

This proposed MDDP, from a drainage standpoint, follows the general scheme of the MDDP for Four Way Ranch, prepared by JR Engineering, Inc., dated January 2004.

## **DETENTION FACILITIES**

All on-site detention facilities have been designed to accommodate the required full spectrum Excess Urban Runoff Volume (EURV) as described by the Denver Urban Drainage and Flood Control District. These facilities are proposed to be publically owned and maintained. The on-site developed outflows from the detention facilities will be limited to existing levels. Add; by a District.

Sizing and placement of the detention facilities are based on the preliminary calculations contained in the Appendix. Additional design information related to exact size, location, and outlet structure design will be provided for each facility within the final drainage report(s) on an as platted basis.

## **HYDROLOGIC CALCULATIONS**

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, dated May 2014. The overall drainage basin design was calculated using HEC-HMS 4.2 and the SCS methodology described in the Drainage Criteria Manual. Hydrologic

Address the geotechnical studies that will be provided to ensure safety of the existing dams, and the entity that will be responsible for maintenance.



Soil Group B was used for all calculations to be consistent with the procedures used in the MDDP and PDR for Four Way Ranch and the FDR for 4 Way Ranch Filing No. 1.

## **FLOODPLAIN STATEMENT**

No portion of the Meadowlake Ranch site falls within the FEMA 100-year floodplain as designated on Map No. 08041C575 F.

## **DRAINAGE & BRIDGE FEES**

Ranch

This site lies within the Haegler Drainage Basin. These fees will be calculated at time of Final Platting using the impervious acreage method approved by El Paso County.

Also, please determine if Bennett Ranch DBPS covers a portion of this development area?

## **SUMMARY**

This proposed development remains consistent with the previously approved MDDP. All detention facilities will be designed to release at or below existing rates. The proposed development will not adversely impact surrounding developments.

PREPARED BY:

**Terra Nova Engineering, Inc.**

L Ducett, P.E.

President

1822.00/DRAINAGE/MDDP Report Items/182200mddp.doc

Provide the necessary information needed to show compliance with this DBPS, Provide the current fee, Provide the DBPS Plan Sheets that cover this development area. Were there improvements proposed in the DBPS for this area? Call them out.

## **REFERENCES**

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated May 2014.
2. Master Development Drainage Plan and Preliminary Drainage Report for Four Way Ranch, January 2004.
3. Final Drainage Report for 4 Way Ranch Phase 1 – Filing No. 1, January 2005.
4. Haegler Ranch Basin, Drainage Basin Planning Study, May 2009.

## Drainage Reports

### Design 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.

---

[Name, P.E. # \_\_\_\_\_ ]Date

### Owner/Developer's Statement: **APPENDICES**

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

---

[Name, Title]Date  
[Business Name]  
[Address]

### El Paso County:

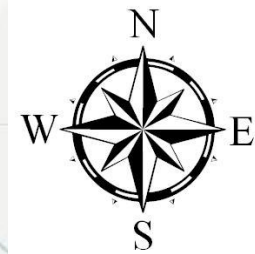
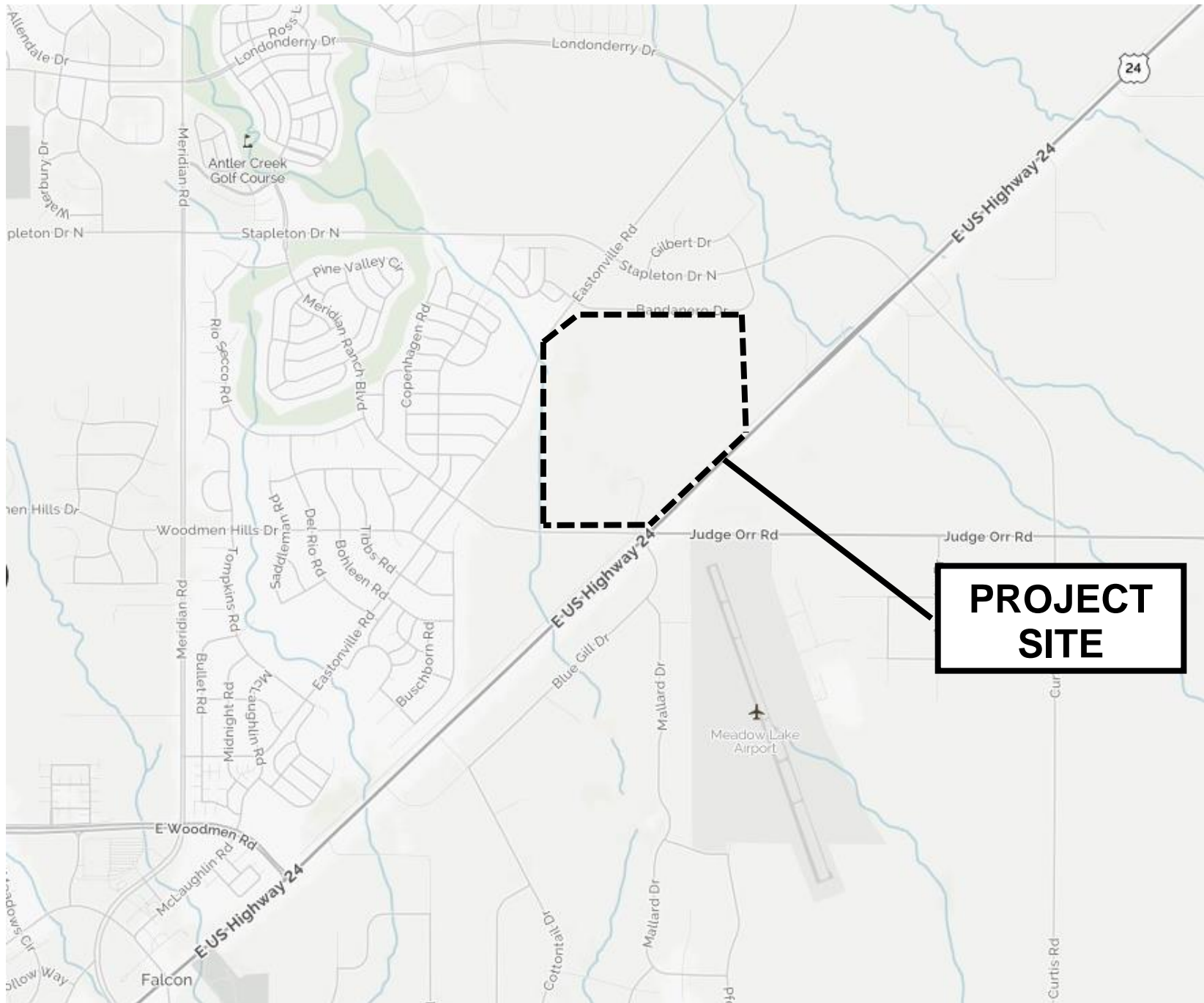
Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

---

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

### Conditions:

## **VICINITY MAP**

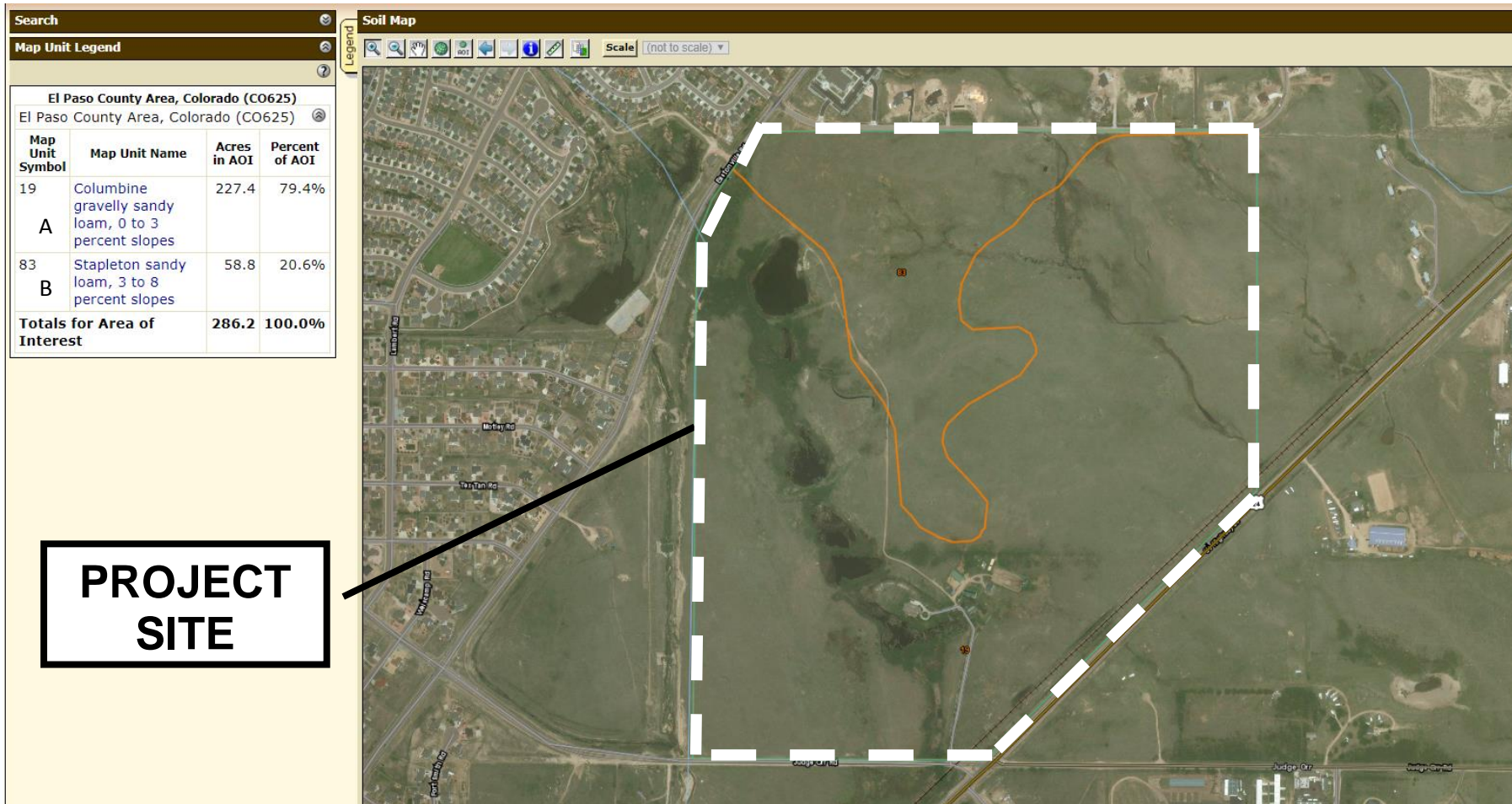


**Not to Scale**

1822.00 Meadowlake Ranch

## VICINITY MAP

## **SOILS MAP**



1822.00 Meadowlake Ranch

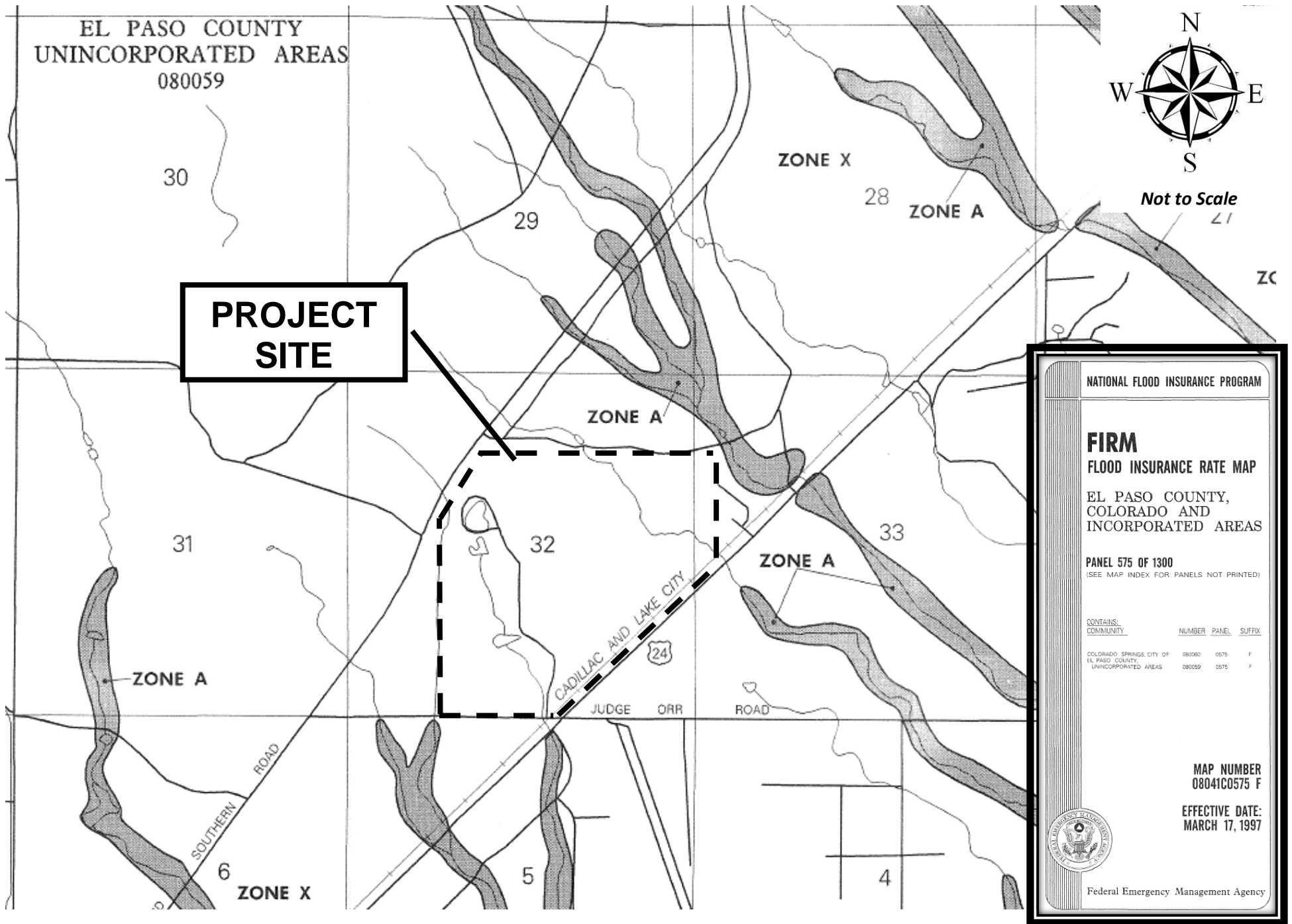
## SOILS MAP



Not to Scale

**F.E.M.A MAP**





1822.00 Meadowlake Ranch

**FIRM MAP**

## **HYDROLOGIC/DETENTION CALCULATIONS**

# DRAINAGE CALCULATIONS SUMMARY TABLE 1

## Meadowlake Ranch

### Rainfall/Runoff - SCS METHOD

#### Basin Parameters and Results - Existing Conditions

Basin Name	Area		CN	% Imp.	T <sub>c</sub>		T <sub>lag</sub>		Q5	Q100
	acres	sq mi	weighted values		hr	min	hr	min	cfs	cfs
EX-1	55.7	0.087	61	0	1.06	64	0.64	38	4.0	29.1
EX-2	24.0	0.038	62	0	0.88	53	0.53	32	2.3	15.5
EX-3	168.9	0.264	61	0	0.86	52	0.52	31	13.6	102.1
OS-1	118.3	0.185	62	2	0.35	21	0.21	13	24.4	144.2
OS-2	13.2	0.021	65	12	0.32	19	0.19	11	7.3	24.3

#### Basin Parameters and Results - Proposed Conditions

Basin Name	Area		CN	% Imp.	T <sub>c</sub>		T <sub>lag</sub>		Q5	Q100
	acres	sq mi	weighted values		hr	min	hr	min	cfs	cfs
PR-1	77.9	0.122	77	44	0.42	25	0.25	15	114.4	234.2
PR-2	206.9	0.323	74	36	0.46	28	0.27	16	253.6	553.8
OS-1	118.3	0.185	62	2	0.35	21	0.21	13	24.4	144.2
OS-2	13.2	0.021	65	12	0.32	19	0.19	11	7.3	24.3

## DRAINAGE CALCULATIONS SUMMARY TABLE 2

### Meadowlake Ranch

#### Reach Routing Paramters - MUSKINGUM-CUNGE METHOD

Reach Name	length	Slope	Manning s n	Bottom Width	Side Slopes	Description
	ft	ft/ft		ft	Z:1	
Thru EX-3	2850	0.0168	0.025	0	30	existing grassy swale
Thru PR-2	2155	0.016	0.025	10	4	proposed trapezoidal channel

#### Reach Routing Results - Existing Conditions

Design Point	Area	Q5	Q100	Notes
	sq mi	cfs	cfs	
1	0.087	4.0	29.1	No routing - Basin EX-1 only
2	0.038	2.3	15.5	No routing - Basin EX-2 only
3	0.470	41.1	247.0	Basins OS-1, OS-2 & EX-3

#### Reach Routing Results - Proposed Conditions

Design Point	Area	Q5	Q100	Notes
	sq mi	cfs	cfs	
1	0.122	114.4	234.2	No routing - Basin PR-1 only
2	--	--	--	Area included in PR-2
3	0.526	275.5	714.3	Basins OS-1, OS-2 & PR-2

SCS METHOD - CN & Percent Impervious  
Meadowlake Ranch

			WEIGHTED	UNDEVELOPED		COMMERCIAL		RANCH or INDUSTRIAL		URBAN RES.		RURAL RES.		NOTES
BASIN	TOTAL		CN	AREA	CN	AREA	CN	AREA	CN	AREA	CN	AREA	CN	
	(Acres)	(sq mi)		(Acres)		(Acres)		(Acres)		(Acres)		(Acres)		
EX-1	55.7	0.087	61	55.7	61									
EX-2	24.0	0.038	62	23.0	61			1.0	74					Ranch
EX-3	168.9	0.264	61	168.9	61									
PR-1	77.9	0.122	77			19.4	92			58.5	72			
PR-2	206.9	0.323	74			7.1	92	62.7	88	42.2	72	94.9	65	Industrial
OS-1*	118.3	0.185	62	99.0	61							19.3	65	
OS-2*	13.2	0.021	65									13.2	65.00	

			WEIGHTED	UNDEVELOPED		COMMERCIAL		RANCH or INDUSTRIAL		URBAN RES.		RURAL RES.		NOTES
BASIN	TOTAL		% Imp	AREA	% Imp	AREA	% Imp	AREA	% Imp	AREA	% Imp	AREA	% Imp	
	(Acres)	(sq mi)		(Acres)		(Acres)		(Acres)		(Acres)		(Acres)		
EX-1	55.7	0.087	0	55.7	0									
EX-2	24.0	0.038	0	24.0	0									
EX-3	168.9	0.264	0	168.9	0									
PR-1	77.9	0.122	44			19.4	85			58.5	30			
PR-2	206.9	0.323	36			7.1	85	62.7	72	42.2	30	94.9	12	Industrial
OS-1*	118.3	0.185	2	99.0	0							19.3	12	
OS-2*	13.2	0.021	12									13.2	12	

\* Basin areas and CNs are from the MDDP Four Way Ranch and the FDR for 4 Way Ranch Filing No. 1

# SCS METHOD - Time of Concentration

## Meadowlake Ranch

**BASIN:** EX-1

$T_c$		$T_{lag}$	
(hr)	(min)	(hr)	(min)
1.06	64	0.64	38

OVERLAND FLOW					
n	P <sub>2</sub>	Length	Height	Slope	T <sub>i</sub>
	(in)	(ft)	(ft)	(ft/ft)	(hr)
n from Table 6-11: dense grasses					
0.24	1.19	300	7.0	0.023	0.88

SHALLOW CONC. FLOW			
Length	Slope	Velocity	T <sub>t</sub>
(ft)	(%)	(fps)	(hr)
Velocity from Fig. 6.25: Grassed Waterway			
970	1.9%	2.7	0.10

CONCENTRATED FLOW		
Length	Velocity	T <sub>t</sub>
(ft)	(fps)	(hr)
Velocity from Mannings Equation		
1260	4.6	0.08

Mannings Equation			
Open Channel			
z:1 (side slopes, ft)	50	Mannings Equation	
w (bottom width, ft)	0	Pipe Flowing 1/2 Full	
d (depth, ft)	1	d (diameter, in)	
n (roughness coef.)	0.025	n (mannings)	
s (channel slope, ft/ft)	0.015	s (pipe slope, ft/ft)	
Area (sqft)	50.00	Area (sqft)	0.00
Wetted Perimeter (ft)	100.02	Wetted Perimeter (ft)	0.00
Velocity (fps)	4.6	Velocity (fps)	#DIV/0!

# SCS METHOD - Time of Concentration

## Meadowlake Ranch

**BASIN:** EX-2

$T_c$		$T_{lag}$	
(hr)	(min)	(hr)	(min)
0.88	53	0.53	32

OVERLAND FLOW					
n	P <sub>2</sub>	Length	Height	Slope	T <sub>i</sub>
	(in)	(ft)	(ft)	(ft/ft)	(hr)
n from Table 6-11: dense grasses					
0.24	1.19	300	9.0	0.030	0.80

SHALLOW CONC. FLOW			
Length	Slope	Velocity	T <sub>t</sub>
(ft)	(%)	(fps)	(hr)
Velocity from Fig. 6.25: Grassed Waterway			
520	3.3%	2.8	0.05

CONCENTRATED FLOW		
Length	Velocity	T <sub>t</sub>
(ft)	(fps)	(hr)
Velocity from Mannings Equation		
610	5.9	0.03

Mannings Equation			
Open Channel			
z:1 (side slopes, ft)	50	Mannings Equation	
w (bottom width, ft)	0	Pipe Flowing 1/2 Full	
d (depth, ft)	1	d (diameter, in)	
n (roughness coef.)	0.025	n (mannings)	
s (channel slope, ft/ft)	0.025	s (pipe slope, ft/ft)	
Area (sqft)	50.00	Area (sqft)	0.00
Wetted Perimeter (ft)	100.02	Wetted Perimeter (ft)	0.00
Velocity (fps)	5.9	Velocity (fps)	#DIV/0!

# SCS METHOD - Time of Concentration

## Meadowlake Ranch

**BASIN:** EX-3

$T_c$		$T_{lag}$	
(hr)	(min)	(hr)	(min)
0.86	52	0.52	31

OVERLAND FLOW					
n	P <sub>2</sub>	Length	Height	Slope	T <sub>i</sub>
	(in)	(ft)	(ft)	(ft/ft)	(hr)
n from Table 6-11: dense grasses					
0.24	1.19	300	20.0	0.067	0.58

SHALLOW CONC. FLOW			
Length	Slope	Velocity	T <sub>t</sub>
(ft)	(%)	(fps)	(hr)
Velocity from Fig. 6.25: Grassed Waterway			
1720	2.6%	2.4	0.20

CONCENTRATED FLOW		
Length	Velocity	T <sub>t</sub>
(ft)	(fps)	(hr)
Velocity from Mannings Equation		
1260	4.3	0.08

Mannings Equation			
Open Channel		Mannings Equation	
z:1 (side slopes, ft)	30	Pipe Flowing 1/2 Full	
w (bottom width, ft)	0	d (diameter, in)	
d (depth, ft)	1	n (mannings)	
n (roughness coef.)	0.025	s (pipe slope, ft/ft)	
s (channel slope, ft/ft)	0.013	Area (sqft)	0.00
Area (sqft)	30.00	Wetted Perimeter (ft)	0.00
Wetted Perimeter (ft)	60.03	Velocity (fps)	#DIV/0!
Velocity (fps)	4.3		



# SCS METHOD - Time of Concentration

## Meadowlake Ranch

**BASIN:** PR-1

$T_c$		$T_{lag}$	
(hr)	(min)	(hr)	(min)
0.42	25	0.25	15

OVERLAND FLOW					
n	P <sub>2</sub>	Length	Height	Slope	T <sub>i</sub>
	(in)	(ft)	(ft)	(ft/ft)	(hr)
n from Table 6-11: short prairie grass					
0.15	1.19	100	2.0	0.020	0.27

SHALLOW CONC. FLOW			
Length	Slope	Velocity	T <sub>t</sub>
(ft)	(%)	(fps)	(hr)
Velocity from Fig. 6.25: Paved Area			
500	2.0%	2.8	0.05

CONCENTRATED FLOW		
Length	Velocity	T <sub>t</sub>
(ft)	(fps)	(hr)
Velocity from Mannings Equation		
4100	11.0	0.10

Mannings Equation			
Open Channel		Mannings Equation	
z:1 (side slopes, ft)		Pipe Flowing 1/2 Full	
w (bottom width, ft)		d (diameter, in)	36
d (depth, ft)		n (mannings)	0.013
n (roughness coef.)	0.025	s (pipe slope, ft/ft)	0.014
s (channel slope, ft/ft)		Area (sqft)	3.53
Area (sqft)	0.00	Wetted Perimeter (ft)	4.71
Wetted Perimeter (ft)	0.00	Velocity (fps)	11.2
Velocity (fps)	#DIV/0!		

# SCS METHOD - Time of Concentration

## Meadowlake Ranch

**BASIN:** PR-2

$T_c$		$T_{lag}$	
(hr)	(min)	(hr)	(min)
0.46	27	0.27	16

OVERLAND FLOW					
n	P <sub>2</sub>	Length	Height	Slope	T <sub>i</sub>
	(in)	(ft)	(ft)	(ft/ft)	(hr)
n from Table 6-11: short prairie grass					
0.15	1.19	100	4.0	0.040	0.20

SHALLOW CONC. FLOW			
Length	Slope	Velocity	T <sub>t</sub>
(ft)	(%)	(fps)	(hr)
Velocity from Fig. 6.25: Grassed Waterway			
1425	2.8%	2.5	0.16

CONCENTRATED FLOW		
Length	Velocity	T <sub>t</sub>
(ft)	(fps)	(hr)
Velocity from Mannings Equation		
2155	6.3	0.10

Mannings Equation			
Open Channel			
z:1 (side slopes, ft)	4	Mannings Equation	
w (bottom width, ft)	10	Pipe Flowing 1/2 Full	
d (depth, ft)	1	d (diameter, in)	
n (roughness coef.)	0.025	n (mannings)	
s (channel slope, ft/ft)	0.016	s (pipe slope, ft/ft)	
Area (sqft)	14.00	Area (sqft)	0.00
Wetted Perimeter (ft)	18.25	Wetted Perimeter (ft)	0.00
Velocity (fps)	6.3	Velocity (fps)	#DIV/0!

## SCS METHOD - Time of Concentration

**BASIN:** OS-1\*

$T_c$		$T_{lag}$	
<i>(hr)</i>	<i>(min)</i>	<i>(hr)</i>	<i>(min)</i>
0.35	21	0.21	13

\* values for  $T_c$  and  $T_{lag}$  are from the MDDP for Four Way Ranch

## SCS METHOD - Time of Concentration

### Meadowlake Ranch

**BASIN:** OS-2      derived from FDR for 4 Way Ranch Filing No. 1

$T_c$		$T_{lag}$	
(hr)	(min)	(hr)	(min)
0.32	19	0.19	12

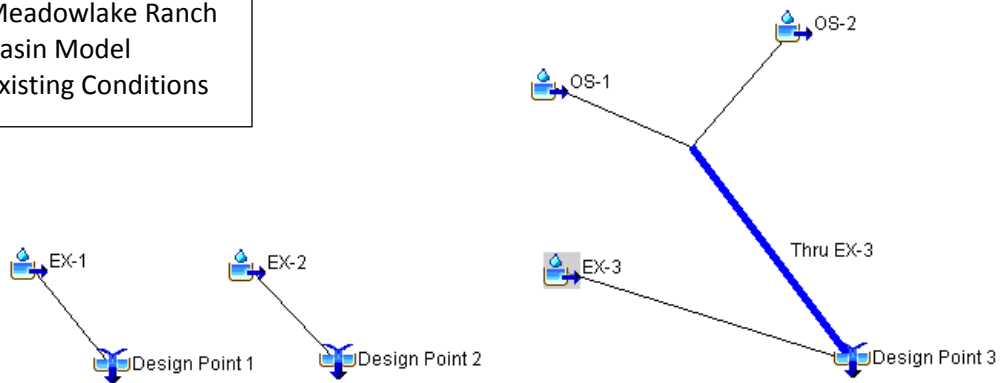
OVERLAND FLOW					
n	P <sub>2</sub>	Length	Height	Slope	T <sub>i</sub>
	(in)	(ft)	(ft)	(ft/ft)	(hr)
n from Table 6-11: short prairie grass					
0.15	1.19	130	8.0	0.062	0.21

SHALLOW CONC. FLOW			
Length	Slope	Velocity	T <sub>t</sub>
(ft)	(%)	(fps)	(hr)
Velocity from Fig. 6.25: Paved Area			
470	2.6%	2.4	0.05

CONCENTRATED FLOW		
Length	Velocity	T <sub>t</sub>
(ft)	(fps)	(hr)
Velocity from Mannings Equation		
900	4.5	0.06

Mannings Equation			
Open Channel			
z:1 (side slopes, ft)	4	Mannings Equation	
w (bottom width, ft)	0	Pipe Flowing 1/2 Full	
d (depth, ft)	1	d (diameter, in)	
n (roughness coef.)	0.025	n (mannings)	
s (channel slope, ft/ft)	0.015	s (pipe slope, ft/ft)	
Area (sqft)	4.00	Area (sqft)	0.00
Wetted Perimeter (ft)	8.25	Wetted Perimeter (ft)	0.00
Velocity (fps)	4.5	Velocity (fps)	#DIV/0!

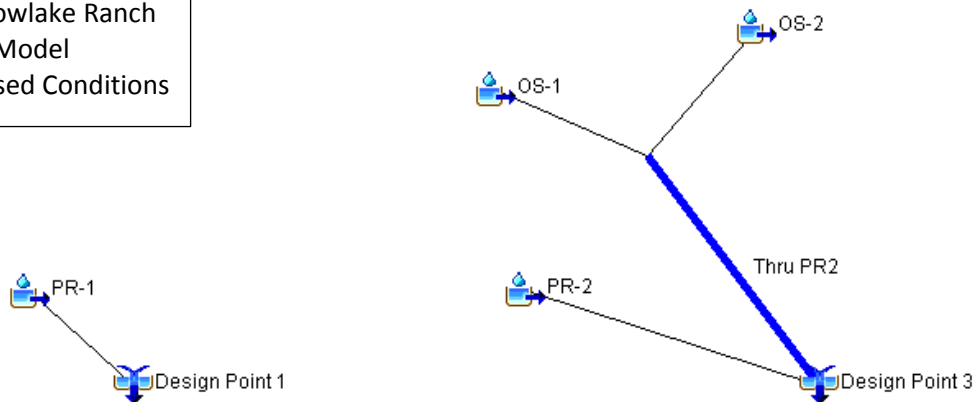
Meadowlake Ranch  
Basin Model  
Existing Conditions



Global Summary Results for Run "Existing 5yr"				
Project: 1822.00 Meadowlake Ranch Simulation Run: Existing 5yr				
Start of Run: 01Jul2018, 12:00		Basin Model: Meadowlake Ranch Existing		
End of Run: 03Jul2018, 12:00		Meteorologic Model: El Paso Cnty 5		
Compute Time: 23Jul2018, 10:50:08		Control Specifications: Control 1		
Show Elements: All Elements		Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> AC-FT		Sorting: Alphabetic
Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.087	4.0	02Jul2018, 00:46	0.26
Design Point 2	0.038	2.3	02Jul2018, 00:36	0.29
Design Point 3	0.470	41.1	02Jul2018, 00:20	0.31
EX-1	0.087	4.0	02Jul2018, 00:46	0.26
EX-2	0.038	2.3	02Jul2018, 00:36	0.29
EX-3	0.264	13.6	02Jul2018, 00:36	0.26
OS-1	0.185	24.4	02Jul2018, 00:10	0.33
OS-2	0.021	7.3	02Jul2018, 00:06	0.65
Thru EX-3	0.206	31.0	02Jul2018, 00:20	0.37

Global Summary Results for Run "Existing 100yr"				
Project: 1822.00 Meadowlake Ranch Simulation Run: Existing 100yr				
Start of Run: 01Jul2018, 12:00		Basin Model: Meadowlake Ranch Existing		
End of Run: 03Jul2018, 12:00		Meteorologic Model: El Paso Cnty 100		
Compute Time: 23Jul2018, 10:52:14		Control Specifications: Control 1		
Show Elements: All Elements		Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> AC-FT		Sorting: Alphabetic
Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.087	29.1	02Jul2018, 00:36	1.14
Design Point 2	0.038	15.5	02Jul2018, 00:28	1.20
Design Point 3	0.470	247.0	02Jul2018, 00:16	1.22
EX-1	0.087	29.1	02Jul2018, 00:36	1.14
EX-2	0.038	15.5	02Jul2018, 00:28	1.20
EX-3	0.264	102.1	02Jul2018, 00:28	1.14
OS-1	0.185	144.2	02Jul2018, 00:08	1.27
OS-2	0.021	24.3	02Jul2018, 00:06	1.78
Thru EX-3	0.206	167.3	02Jul2018, 00:14	1.32

Meadowlake Ranch  
Basin Model  
Proposed Conditions



Global Summary Results for Run "Proposed 5yr"

Project: 1822.00 Meadowlake Ranch Simulation Run: Proposed 5yr

Start of Run: 01Jul2018, 12:00 Basin Model: Meadowlake Ranch Developed  
 End of Run: 03Jul2018, 12:00 Meteorologic Model: El Paso Cnty 5  
 Compute Time: 23Jul2018, 10:57:44 Control Specifications: Control 1

Show Elements: All Elements Volume Units: ☒ IN ☐ AC-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.122	114.4	02Jul2018, 00:08	1.67
Design Point 3	0.526	275.5	02Jul2018, 00:08	1.02
OS-1	0.185	24.4	02Jul2018, 00:10	0.33
OS-2	0.021	7.3	02Jul2018, 00:06	0.65
PR-1	0.122	114.4	02Jul2018, 00:08	1.67
PR-2	0.320	253.6	02Jul2018, 00:08	1.44
Thru PR2	0.206	31.1	02Jul2018, 00:14	0.37

Global Summary Results for Run "Proposed 100yr"

Project: 1822.00 Meadowlake Ranch Simulation Run: Proposed 100yr

Start of Run: 01Jul2018, 12:00 Basin Model: Meadowlake Ranch Developed  
 End of Run: 03Jul2018, 12:00 Meteorologic Model: El Paso Cnty 100  
 Compute Time: 23Jul2018, 10:57:51 Control Specifications: Control 1

Show Elements: All Elements Volume Units: ☒ IN ☐ AC-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.122	234.2	02Jul2018, 00:08	3.31
Design Point 3	0.526	714.3	02Jul2018, 00:08	2.32
OS-1	0.185	144.2	02Jul2018, 00:08	1.27
OS-2	0.021	24.3	02Jul2018, 00:06	1.78
PR-1	0.122	234.2	02Jul2018, 00:08	3.31
PR-2	0.320	553.8	02Jul2018, 00:08	2.97
Thru PR2	0.206	167.2	02Jul2018, 00:10	1.32

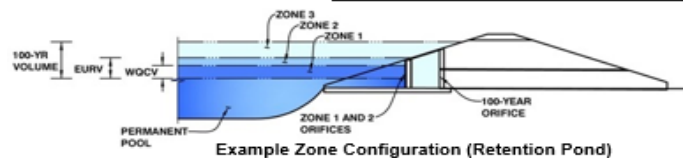
## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

[Clear Workbook](#)

**Project: 1822.00 Meadowlake Ranch**

**Basin ID:** Pond-1



### Required Volume Calculation

Extended Detention Basin (EDB)		EDB		
Watershed Area =	77.90	acres		
Watershed Length =	4,700	ft		
Watershed Slope =	0.014	ft/ft		
Watershed Imperviousness =	46.00%	percent		
Percentage Hydrologic Soil Group A =	100.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired W/QCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (W/QCV) =	1.270	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	4.036	acre-feet		
2-yr Runoff Volume (P1 = 1.03 in.) =	2.377	acre-feet		1.03 inches
5-yr Runoff Volume (P1 = 1.32 in.) =	3.184	acre-feet		1.32 inches
10-yr Runoff Volume (P1 = 1.59 in.) =	4.064	acre-feet		1.59 inches
25-yr Runoff Volume (P1 = 2.01 in.) =	5.651	acre-feet		2.01 inches
50-yr Runoff Volume (P1 = 2.38 in.) =	7.535	acre-feet		2.38 inches
100-yr Runoff Volume (P1 = 2.77 in.) =	9.801	acre-feet		2.77 inches
500-yr Runoff Volume (P1 = 3.85 in.) =	16.027	acre-feet		3.85 inches
Approximate 2-yr Detention Volume =	2.239	acre-feet		
Approximate 5-yr Detention Volume =	3.002	acre-feet		
Approximate 10-yr Detention Volume =	3.798	acre-feet		
Approximate 25-yr Detention Volume =	5.166	acre-feet		
Approximate 50-yr Detention Volume =	6.097	acre-feet		
Approximate 100-yr Detention Volume =	7.215	acre-feet		

### Stage-Storage Calculation

Zone 1 Volume (WQGV)	1.270	acre-feet
Zone 2 Volume (EURV - Zone 1)	2.767	acre-feet
Zone 3 Volume (100-year - Zoner 1&2)	3.179	acre-feet
Total Detention Basin Volume =	7.215	acre-feet
Initial Surcharge Volume (ISV) =	user	user

[illegible]

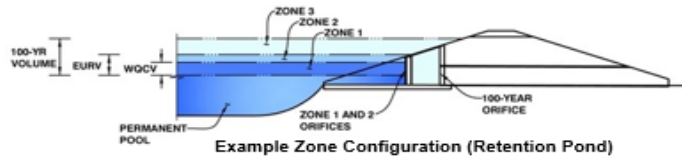
### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Clear Workbook

**Project: 1822.00 Meadolake Ranch**

**Basin ID: Pond-2 Detention for Basin PR-2**



### Required Volume Calculation

Extended Detention Basin (EDB)		EDB		
Watershed Area =	206.90	acres		
Watershed Length =	3,620	ft		
Watershed Slope =	0.027	ft/ft		
Watershed Imperviousness =	36.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	2.914	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	7.756	acre-feet		
2-yr Runoff Volume (P1 = 1.03 in.) =	5.240	acre-feet		1.03 inches
5-yr Runoff Volume (P1 = 1.32 in.) =	7.472	acre-feet		1.32 inches
10-yr Runoff Volume (P1 = 1.59 in.) =	11.238	acre-feet		1.59 inches
25-yr Runoff Volume (P1 = 2.01 in.) =	19.413	acre-feet		2.01 inches
50-yr Runoff Volume (P1 = 2.38 in.) =	25.330	acre-feet		2.38 inches
100-yr Runoff Volume (P1 = 2.77 in.) =	32.988	acre-feet		2.77 inches
500-yr Runoff Volume (P1 = 3.85 in.) =	51.745	acre-feet		3.85 inches
Approximate 2-yr Detention Volume =	4.895	acre-feet		
Approximate 5-yr Detention Volume =	7.013	acre-feet		
Approximate 10-yr Detention Volume =	10.165	acre-feet		
Approximate 25-yr Detention Volume =	12.728	acre-feet		
Approximate 50-yr Detention Volume =	14.080	acre-feet		
Approximate 100-yr Detention Volume =	16.963	acre-feet		

### Stage-Storage Calculation

Zone 1 Volume (WQCV)	2.914	acre-feet
Zone 2 Volume (EURV - Zone 1)	4.842	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2)	9.207	acre-feet
<b>Total Detention Basin Volume =</b>	<b>16.963</b>	<b>acre-feet</b>
Initial Surcharge Volume (ISV) =		ac

[illegible]



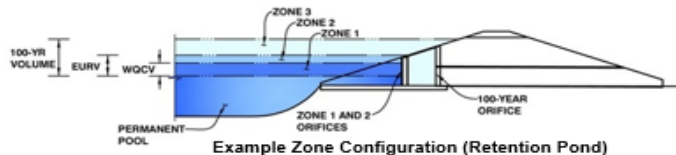
### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

[Clear Workbook](#)

Project: 1822.00 Meadowlake Ranch

**Basin ID: Pond-2 VQ for Offsite Basins (OS-1 and OS-2) and Detention for Basin PR-2**



### Required Volume Calculation

Extended Detention Basin (EDB)		EDB															
Watershed Area =	338.70	acres															
Watershed Length =	7,685	ft															
Watershed Slope =	0.018	ft/ft															
Watershed Imperviousness =	22.00%	percent															
Percentage Hydrologic Soil Group A =	0.0%	percent															
Percentage Hydrologic Soil Group B =	100.0%	percent															
Percentage Hydrologic Soil Groups C/D =	0.0%	percent															
Desired W/QCV Drain Time =	40.0	hours															
Location for 1-hr Rainfall Depths =	<div> <div>User Input</div> <div></div> </div>																
Water Quality Capture Volume (W/QCV) =	3.491	acre-feet	<div>Optional User Override</div> <div>1-hr Precipitation</div> <table> <tr><td>1.03</td><td>inches</td></tr> <tr><td>1.32</td><td>inches</td></tr> <tr><td>1.59</td><td>inches</td></tr> <tr><td>2.01</td><td>inches</td></tr> <tr><td>2.38</td><td>inches</td></tr> <tr><td>2.77</td><td>inches</td></tr> <tr><td>3.85</td><td>inches</td></tr> </table>	1.03	inches	1.32	inches	1.59	inches	2.01	inches	2.38	inches	2.77	inches	3.85	inches
1.03	inches																
1.32	inches																
1.59	inches																
2.01	inches																
2.38	inches																
2.77	inches																
3.85	inches																
Excess Urban Runoff Volume (EURV) =	7.460	acre-feet															
2-yr Runoff Volume (P1 = 1.03 in.) =	4.799	acre-feet															
5-yr Runoff Volume (P1 = 1.32 in.) =	7.123	acre-feet															
10-yr Runoff Volume (P1 = 1.59 in.) =	12.289	acre-feet															
25-yr Runoff Volume (P1 = 2.01 in.) =	25.775	acre-feet															
50-yr Runoff Volume (P1 = 2.38 in.) =	35.372	acre-feet															
100-yr Runoff Volume (P1 = 2.77 in.) =	47.961	acre-feet															
500-yr Runoff Volume (P1 = 3.85 in.) =	78.135	acre-feet															
Approximate 2-yr Detention Volume =	4.473	acre-feet															
Approximate 5-yr Detention Volume =	6.679	acre-feet															
Approximate 10-yr Detention Volume =	10.855	acre-feet															
Approximate 25-yr Detention Volume =	14.622	acre-feet															
Approximate 50-yr Detention Volume =	16.254	acre-feet															
Approximate 100-yr Detention Volume =	20.586	acre-feet															

### Stage-Storage Calculation

Zone 1 Volume (WQCV)	3.491	acre-feet
Zone 2 Volume (EURV - Zone 1)	3.968	acre-feet
Zone 3 Volume (User Defined - Zones 1&2)	9.207	acre-feet
<b>Total Detention Basin Volume =</b>	<b>16.667</b>	<b>acre-feet</b>
Initial Surgeback Volume (ISV) =		

[illegible]

## **DRAINAGE AREA MAPS**



DESIGN POINT SUMMARY

DESIGN POINT	BASIN TRIBUTARY	FLOW	
		5 YR (cfs)	100 YR (cfs)
1	EX-1	4.0	29.1
2	EX-2	2.3	15.5
3	OS-1, OS-2 & EX-3	41.1	247.2

Bennett Ranch DBPS ?

Haegler Ranch DBPS ?

It appears there is some Bandanero Drive and Distinctive Marine offsite drainage that may enter this site. Please clarify.

Bennett Ranch Regional Detention Basin Outfall

Call out dual 60 inch CMP's as discussed on page 6.

Show culverts and add discussion of the HWY 24, roadside ditch.

Show downstream flowpath.

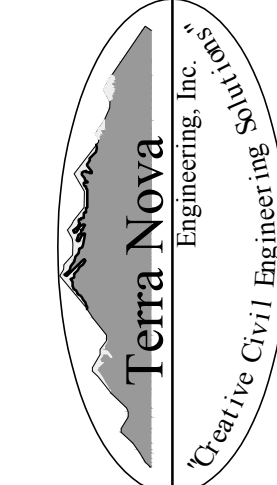
LEGEND

- BASIN DESIGNATION AREA IN BASIN (AC)
- DESIGN POINT
- BASIN BOUNDARY
- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- FEMA MAPPED EXISTING FLOODPLAIN
- ROAD AND DITCH FLOW DIRECTION
- SURFACE FLOW DIRECTION

EXISTING CONDITIONS

BASIN	MI^2	Q5 CFS	Q100 CFS
EX-1	0.087	4.0	29.1
EX-2	0.038	2.3	15.5
EX-3	0.264	13.6	102.1
OS-1	0.185	24.4	144.2
OS-2	0.021	7.3	24.3

PREPARED FOR:  
DAN FERGUSON  
ATTN: DAN FERGUSON  
13202 JUDGE ORR ROAD  
PEYTON CO 80831-8401



721 S. 23RD STREET  
COLORADO SPRINGS, CO 80904  
OFFICE: 719-635-6422  
FAX: 719-635-6426  
www.terra-nova.com

MEADOWLAKE MDDP

EXISTING DRAINAGE PLAN

DESIGNED BY DWD  
DRAWN BY DWD  
CHECKED BY LD  
H-SCALE AS SHOWN  
V-SCALE N/A  
JOB NO. 1822.00  
DATE ISSUED 7/24/18  
SHEET NO. 1 OF 2



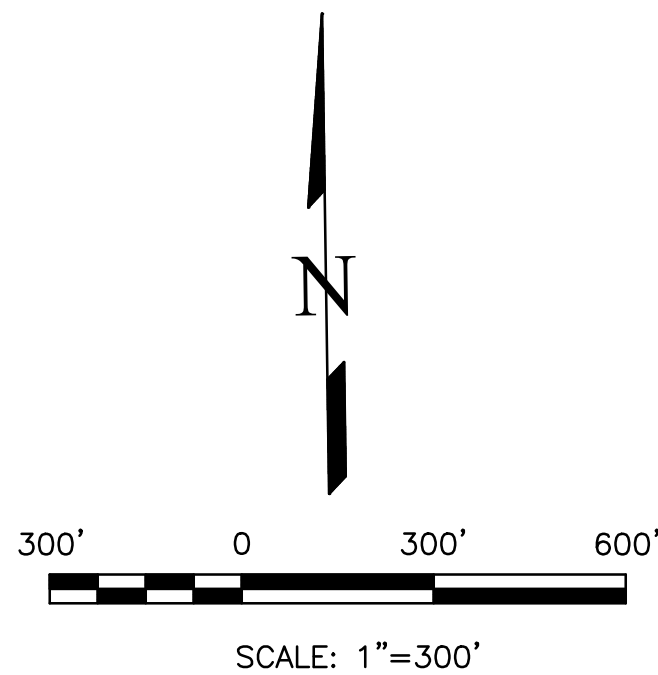
DESIGN POINT SUMMARY

DESIGN POINT	BASIN TRIBUTARY	FLOW	
		5 YR (cfs)	100 YR (cfs)
1	PR-1	114.4	234.2
2	---	---	---
3	OS-1, OS-2 & PR-3	275.5	714.7

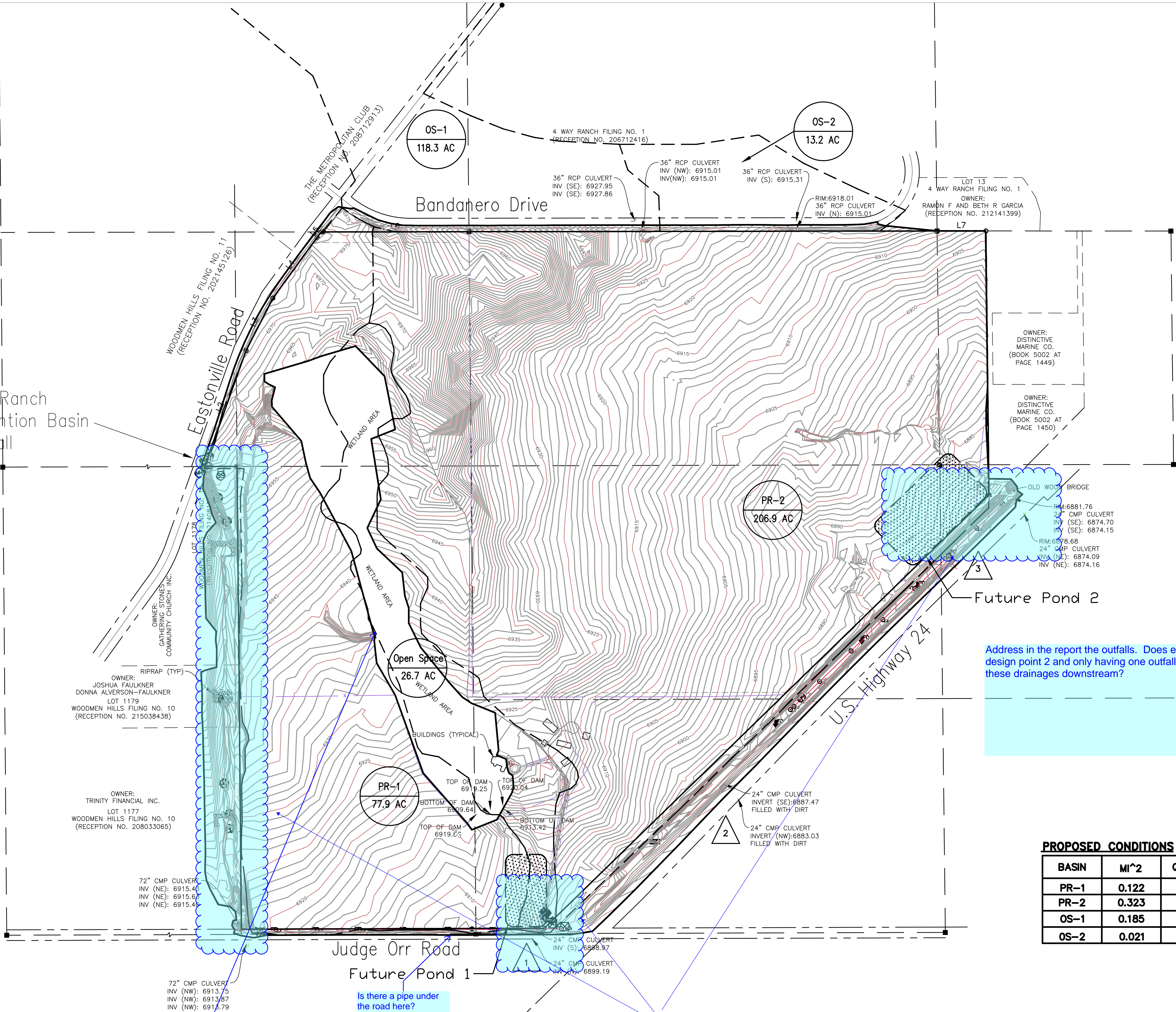
LEGEND

- BASIN DESIGNATION  
 AREA IN BASIN (AC)  
 DESIGN POINT  
--- BASIN BOUNDARY  
--- EXISTING 2' CONTOUR  
--- EXISTING 10' CONTOUR  
■ ■ ■ FEMA MAPPED EXISTING FLOODPLAIN  
→ ROAD AND DITCH FLOW DIRECTION

Provide a clear property line  
linetype



Bennett Ranch  
Regional Detention Basin  
Outfall



Address in the report the outfalls. Does eliminating the outfall at  
design point 2 and only having one outfall (design point 3) impact  
these drainages downstream?

PROPOSED CONDITIONS

BASIN	MI^2	Q5 CFS	Q100 CFS
PR-1	0.122	114.4	234.2
PR-2	0.323	253.6	553.8
OS-1	0.185	24.4	144.2
OS-2	0.021	7.3	24.3

If this Wetland area does  
not need to be accounted  
for in the final drainage  
calculations then provide  
an exhibit that shows how  
this volume is contained.

Is there a pipe under  
the road here?

Provide exhibits that demonstrate how the 100 year storm can be routed to these areas, how the roadside ditches  
can be captured and routed to these areas, and show the existing culverts. The current scale of these drawings is  
such that you cannot see the contours and elevations.

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE  
DRAWINGS ARE APPROVED  
BY THE APPROPRIATE  
REVIEWING AGENCIES,  
TERRA NOVA ENGINEERING,  
INC. SHALL BE USED  
ONLY FOR THE  
PURPOSES DESIGNATED BY  
WRITTEN AUTHORIZATION.

PREPARED FOR:  
DAN FERGUSON  
ATTN: DAN FERGUSON  
13202 JUDGE ORR ROAD  
PEYTON CO 80831-8401

Terra Nova  
Engineering, Inc.  
Creative Civil Engineering

721 S. 25RD STREET  
COLORADO SPRINGS, CO 80904  
OFFICE: 719-635-6422  
FAX: 719-635-6426  
www.tnec.com

MEADOWLAKE MDDP


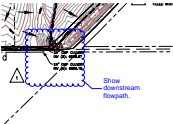
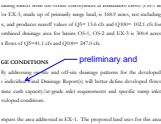
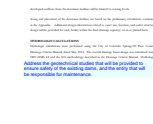
PROPOSED DRAINAGE PLAN

DESIGNED BY DWD  
DRAWN BY DWD  
CHECKED BY LD  
H-SCALE AS SHOWN  
V-SCALE N/A  
JOB NO. 1822.00  
DATE ISSUED 7/24/18  
SHEET NO. 2 OF 2

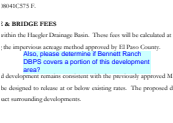





# Markup Summary

dsdrice (4)

	<p><b>Subject:</b> Text Box <b>Page Label:</b> [1] PR-DR <b>Author:</b> dsdrice <b>Date:</b> 10/24/2018 2:57:45 PM <b>Color:</b> ■</p>	Provide a clear property line linetype
	<p><b>Subject:</b> Cloud+ <b>Page Label:</b> [1] EX-DR <b>Author:</b> dsdrice <b>Date:</b> 10/24/2018 2:59:40 PM <b>Color:</b> ■</p>	Show downstream flowpath.
	<p><b>Subject:</b> Callout <b>Page Label:</b> 6 <b>Author:</b> dsdrice <b>Date:</b> 10/24/2018 3:04:34 PM <b>Color:</b> ■</p>	preliminary and
	<p><b>Subject:</b> Text Box <b>Page Label:</b> 8 <b>Author:</b> dsdrice <b>Date:</b> 10/24/2018 3:07:24 PM <b>Color:</b> ■</p>	Address the geotechnical studies that will be provided to ensure safety of the existing dams, and the entity that will be responsible for maintenance.

Steve Kuehster (44)

	<p><b>Subject:</b> text box <b>Page Label:</b> 9 <b>Author:</b> Steve Kuehster <b>Date:</b> 10/15/2018 1:15:23 PM <b>Color:</b> ■</p>	Also, please determine if Bennett Ranch DBPS covers a portion of this development area?
	<p><b>Subject:</b> arrow &amp; box <b>Page Label:</b> 5 <b>Author:</b> Steve Kuehster <b>Date:</b> 10/15/2018 10:18:35 AM <b>Color:</b> ■</p>	Provide an exhibit that demonstrates how these two flows are isolated and also shows the 100 year storm water surface elevations for the outfalls land contributing areas.
	<p><b>Subject:</b> arrow &amp; box <b>Page Label:</b> 5 <b>Author:</b> Steve Kuehster <b>Date:</b> 10/15/2018 10:18:59 AM <b>Color:</b> ■</p>	This will need to be demonstrated for the design storm.
	<p><b>Subject:</b> text box <b>Page Label:</b> 5 <b>Author:</b> Steve Kuehster <b>Date:</b> 10/15/2018 10:28:42 AM <b>Color:</b> ■</p>	Add discussion of culvert capacity for the two crossings of Bandanero Drive. Does the road overtop, Does the overtop flow get to the same place?

Call out dual 60 inch  
CMP's as discussed on  
page 6.

**Subject:** text box  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 10:42:02 AM  
**Color:** ■

Call out dual 60 inch CMP's as discussed on page 6.

30" ?

**Subject:** text box  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 10:44:15 AM  
**Color:** ■

30" ?

Show culverts and add  
discussion of the HWY 24,  
roadside ditch.

**Subject:** text box  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 10:50:04 AM  
**Color:** ■

Show culverts and add discussion of the HWY 24, roadside ditch.

See note on plan, it's not clear how these flows get to the culverts and where the culverts are.

**Subject:** text box  
**Page Label:** 6  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 10:51:23 AM  
**Color:** ■

See note on plan, it's not clear how these flows get to the culverts and where the culverts are.

Does the existing 24 inch culvert under Judge Orr Road have the capacity for this flow?

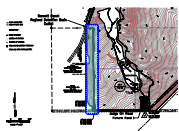
**Subject:** text box  
**Page Label:** 7  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:06:56 AM  
**Color:** ■

Does the existing 24 inch culvert under Judge Orr Road have the capacity for this flow?

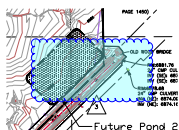
Does the existing culverts (Dual 60") under Judge Orr Road have the capacity for this flow? Please call out culverts on Proposed Drainage Plan.

**Subject:** text box  
**Page Label:** 7  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:10:55 AM  
**Color:** ■

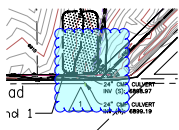
Does the existing culverts (Dual 60") under Judge Orr Road have the capacity for this flow? Please call out culverts on Proposed Drainage Plan.



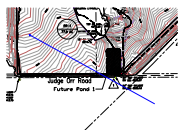
**Subject:** Engineer  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:15:34 AM  
**Color:** ■



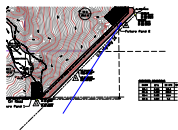
**Subject:** Engineer  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:15:57 AM  
**Color:** ■



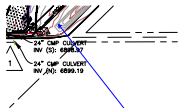
**Subject:** Engineer  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:16:14 AM  
**Color:** ■



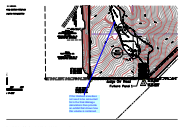
**Subject:** Arrow  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:16:56 AM  
**Color:** ■



**Subject:** Arrow  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:17:21 AM  
**Color:** ■



**Subject:** Arrow  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:17:34 AM  
**Color:** ■



**Subject:** arrow & box  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:28:45 AM  
**Color:** ■

If this Wetland area does not need to be accounted for in the final drainage calculations then provide an exhibit that shows how this volume is contained.



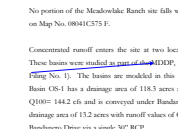
**Subject:** text box  
**Page Label:** 8  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:42:22 AM  
**Color:** ■

Add a section labeled " Four Step Process" that discusses the process followed for planning the development of this site. See ECM Section I.7.2.

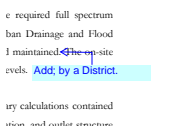


**Subject:** text box  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:43:42 AM  
**Color:** ■

Provide exhibits that demonstrate how the 100 year storm can be routed to these areas, how the roadside ditches can be captured and routed to these areas, and show the existing culverts. The current scale of these drawings is such that you cannot see the contours and elevations.



**Subject:** Arrow  
**Page Label:** 5  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:52:44 AM  
**Color:** ■



**Subject:** arrow & box  
**Page Label:** 8  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 11:56:48 AM  
**Color:** ■

Add; by a District.



**Subject:** Highlight  
**Page Label:** 9  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:40:58 PM  
**Color:** ■

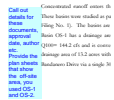


**Subject:** Highlight  
**Page Label:** 9  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:41:03 PM  
**Color:**



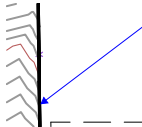
**Subject:** text box  
**Page Label:** 9  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:46:17 PM  
**Color:**

Provide the necessary information needed to show compliance with this DBPS, Provide the current fee, Provide the DBPS Plan Sheets that cover this development area.  
Were there improvements proposed in the DBPS for this area? Call them out.



**Subject:** text box  
**Page Label:** 5  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:48:46 PM  
**Color:**

Call out details for these documents, approval date, author etc.  
Provide the plan sheets that show the off-site area, you used OS-1 and OS-2.



**Subject:** Arrow  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:49:25 PM  
**Color:**



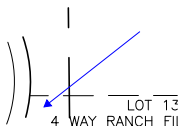
**Subject:** Pen  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:50:25 PM  
**Color:**



**Subject:** Highlight  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:50:33 PM  
**Color:**



**Subject:** Highlight  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:50:37 PM  
**Color:**

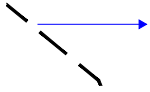


**Subject:** Arrow  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:50:48 PM  
**Color:**

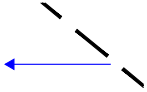


**Subject:** Highlight  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:50:54 PM  
**Color:**





**Subject:** Arrow  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:55:24 PM  
**Color:** ■



**Subject:** Arrow  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 12:55:35 PM  
**Color:** ■

HEADWATER RAN  
(SKETCH PLAN)  
SKP-18-004  
AUGUST 2018

**Subject:** text box  
**Page Label:** 1  
**Author:** Steve Kuehster  
**Date:** 10/15/2018 9:34:42 AM  
**Color:** ■

SKP-18-004



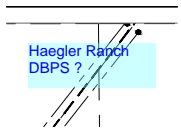
**Subject:** text box  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:17:35 AM  
**Color:** ■

Address in the report the outfalls. Does eliminating the outfall at design point 2 and only having one outfall (design point 3) impact these drainages downstream?

Bennett Ranch  
DBPS ?

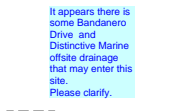
**Subject:** text box  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:20:02 AM  
**Color:** ■

Bennett Ranch DBPS ?



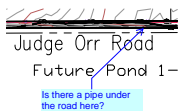
**Subject:** text box  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:20:31 AM  
**Color:** ■

Haegler Ranch DBPS ?



**Subject:** text box  
**Page Label:** [1] EX-DR  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:24:03 AM  
**Color:** ■

It appears there is some Bandanero Drive and Distinctive Marine offsite drainage that may enter this site.  
Please clarify.




**Subject:** arrow & box  
**Page Label:** [1] PR-DR  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:25:08 AM  
**Color:** ■

Is there a pipe under the road here?

**Subject:** Snapshot  
**Page Label:** 1  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:26:58 AM  
**Color:** ■



**Subject:** text box  
**Page Label:** 1  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:27:48 AM  
**Color:** 

## Drainage Reports

### Design 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.

\_\_\_\_\_  
[Name, P.E. # \_\_\_\_\_] Date

### Owner/Developer's Statement:

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

\_\_\_\_\_  
[Name, Title] Date  
[Business Name]  
[Address]

### 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.

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

### Conditions:

Replace this signature sheet with the correct one, see attached. Pasted on the first appendix page.


I, the undersigned, being a duly licensed Professional Engineer in the State of Texas, do hereby certify that the foregoing is a true and correct copy of the original as the same was presented to me for filing with the City of Colorado Springs and El Paso County for my signature and seal, and that I am not aware of any other person or entity having a right to the same.

**Subject:** text box  
**Page Label:** 2  
**Author:** Steve Kuehster  
**Date:** 10/16/2018 8:30:00 AM  
**Color:** 


Replace this signature sheet with the correct one, see attached.  
Pasted on the first appendix page.


Replace this signature sheet with the correct one, see attached. Pasted on the first appendix page.

I, the undersigned, being a duly licensed Professional Engineer in the State of Texas, do hereby certify that the foregoing is a true and correct copy of the original as the same was presented to me for filing with the City of Colorado Springs and El Paso County for my signature and seal, and that I am not aware of any other person or entity having a right to the same.

**Subject:** text box  
**Page Label:** 6  
**Author:** Steve Kuehster  
**Date:** 10/22/2018 12:01:32 PM  
**Color:** 

Please note that the drainage plan for 4 Way Ranch has recently made some changes that affect the drainages entering this site.

FEES  Ranch  
gler Drainage Basin. The  
re acreage method review

**Subject:** arrow & box  
**Page Label:** 9  
**Author:** Steve Kuehster  
**Date:** 10/22/2018 7:56:25 AM  
**Color:** 

Ranch