

**FINAL DRAINAGE REPORT
FOR
ELECTRONIC STORAGE
LOT 2 MOUNTAIN STATES PIPE AND SUPPLY
7765 ELECTRONIC DRIVE
COLORADO SPRINGS, COLORADO**

PURPOSE

The purpose of this Final Drainage Report is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size drainage structures for conveyance of developed runoff, and present solutions to drainage impacts on-site and off-site resulting from this development. The site has previously been platted and has previously been studied in:

“Preliminary and Final Drainage Report for TMC Design Corporation”, dated December 2011, prepared by Stillwater Engineering

As previously discussed with staff there is no record that this report was ever approved by the County. Please provide a statement regarding this.

GENERAL DESCRIPTION

This Final Drainage Report (FDR) is an analysis of approximately 2.25 acres of undeveloped land located at 7765 Electronic Drive. This site is being developed as a mini storage facility. The site is in the southeast quarter of Section 32, Township 13 South, Range 65 West of the 6th Principal Meridian within El Paso County. The parcels are bounded to the north by Electronic Drive, to the east by Marksheffel Road, to the south by LOT 6 AKERS ACRES SUB 1, EX THAT PT CONV TO COUNTY FOR R/W BY REC #210004057, and to the west by WLY 631.22 FT OF TRACT 5 AKERS ACRES SUB NO 1. (See vicinity map, Appendix).

The site lies within the Sand Creek Basin, with storm runoff draining from the southeast corner of the site, and flowing south, then west, before entering Sand Creek.

Sand creek is east of Marksheffel

Soils for this project are delineated by the map in the appendix as Blakeland loamy sand (8), 1 to 9 percent slopes. Soils in the study area are shown as mapped by S.C.S. in the “Soils Survey of El Paso County Area” and contains soils of Hydrologic Group A.

Actually, it on both sides of Marksheffel per the basins map. Sand Creek is to the west, and East Fork of Sand Creek is to the east. In this case, the runoff flows west toward the Sand Creek main channel.

sheet flows onto the site from Basin OS-A. Basin OS-A has flows of $Q_5 = 1.9$ cfs and $Q_{100} = 3.9$ cfs.

Please identify how Design point 1 flows are conveyed to basin PR-2 as there is a concrete curb that is proposed all around basin PR-2

Basin OS-B is 1.38 acres and drains to Design Point B on the western edge of the site. Runoff sheet flows onto the site from Basin OS-B. Basin OS-B has : It's there (east end of the basin). cfs.

OS-C

Please identify this design point on the drainage plan. I could not find it on the plan

Basin OS-C is 0.01 acres and drains to Design Point C on the north edge of the site. Runoff sheet flows onto the site from Basin OS-C. Basin OS-A has flows of $Q_5 = 0.1$ cfs and $Q_{100} = 0.1$ cfs.

Please indicate the other design point/basin that is included in these combined flows. Typical for all combined flows mentioned.

Onsite Basin

Basin PR-1 is 0.37 acres and drains to Design Point 1 at the northwest edge of the paved area onsite. Basin PR-1 has flows of $Q_5 = 0.2$ cfs and $Q_{100} = 1.1$ cfs. Design Point 1 has combined flows of $Q_5 = 2.0$ cfs and $Q_{100} = 5.0$ cfs.

Basin PR-2 is 0.62 acres and drains to Design Point 2 at the southeast edge of the paved area onsite.

Basin PR-2 has flows of $Q_5 = 0.2$ cfs and $Q_{100} = 1.1$ cfs. Design Point 1 has combined flows of

Please indicate how the flows in this basin are conveyed to design point 2. Additionally there are inlets and storm pipes indicated at Design point 2 yet there is no mention of them in the narrative. Include them in your narrative.

Basin PR-3 is 0.15 acres and drains to Design Point 3 at the southwest edge of the building roof.

Basin PR-3 has flows of $Q_5 = 2.3$ cfs and $Q_{100} = 4.5$ cfs.

Please clarify where DP3 flows are conveyed to.

Basin PR-4 is 0.32 acres and drains to Design Point 4 at the outlet of the onsite detention basin.

Basin PR-4 has flows of $Q_5 = 0.2$ cfs and $Q_{100} = 1.2$ cfs. Design Point 4 has combined flows of $Q_5 = 7.8$ cfs and $Q_{100} = 17.4$ cfs.

PR-5?

Basin PR-5 is 0.34 acres and drains to Design Point 5 at the southeast corner of the site. This basin is undeveloped/landscaping area. Basin PR-1 has flows of $Q_5 = 0.1$ cfs and $Q_{100} = 1.0$ cfs. Design Point 5 has combined flows of $Q_5 = 5.6$ cfs and $Q_{100} = 12.2$ cfs.

Basin PR-6 is 0.03 acres and drains to Design Point 6 at the northeast corner of the site. This basin

The flow leaving the site shall be at or below historic. This flow is larger than what is indicated on existing drainage map (5.6/8.5 cfs for 5/100 yr) flow. Revise your design accordingly so that the your flows are at or below historic.

The existing flows have been recalculated since the County isn't allowing the use of the existing report.

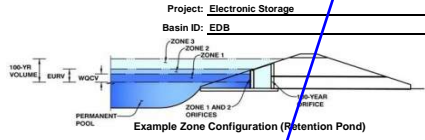
75% is a sizing estimate with a factor of safety. The calculated value is 61.02%, so I rounded up to 62%. 1.08 imp acres / 1.77 total acres or basins PR-2 and PR-3 / basins PR-1 through PR-4.

Please provide a calculation for how you determined the sites imperviousness

Please use the latest UD-Detention worksheet.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	1.74 acres
Watershed Length =	340 ft
Watershed Slope =	0.060 ft/ft
Watershed Imperviousness =	75.00% percent
Percentage Hydrologic Soil Group A =	98.0% percent
Percentage Hydrologic Soil Group B =	2.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Desired WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building
Water Quality Capture Volume (WQCV) =	0.043 acre-feet
Excess Urban Runoff Volume (EURV) =	0.168 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.117 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.152 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.184 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.219 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.255 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	0.298 acre-feet
500-yr Runoff Volume (P1 = 3 in.) =	0.377 acre-feet
Approximate 2-yr Detention Volume =	0.110 acre-feet
Approximate 5-yr Detention Volume =	0.144 acre-feet
Approximate 10-yr Detention Volume =	0.172 acre-feet
Approximate 25-yr Detention Volume =	0.205 acre-feet
Approximate 50-yr Detention Volume =	0.224 acre-feet
Approximate 100-yr Detention Volume =	0.243 acre-feet

Optional User Override
1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.00	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.043	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.125	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.075	acre-feet
Total Detention Basin Volume =	0.243	acre-feet
Initial Surcharge Volume (ISV) =	user	ft ³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H _{total}) =	user	ft
Depth of Trickle Channel (H _{TC}) =	user	ft
Slope of Trickle Channel (S _{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S _{main}) =	user	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	user	
Initial Surcharge Area (A _{sur}) =	user	ft ²
Surcharge Volume Length (L _{sur}) =	user	ft
Surcharge Volume Width (W _{sur}) =	user	ft
Depth of Basin Floor (H _{f,100yr}) =	user	ft
Length of Basin Floor (L _{f,100yr}) =	user	ft
Width of Basin Floor (W _{f,100yr}) =	user	ft
Area of Basin Floor (A _{f,100yr}) =	user	ft ²
Volume of Basin Floor (V _{f,100yr}) =	user	ft ³
Depth of Main Basin (H _{main}) =	user	ft
Length of Main Basin (L _{main}) =	user	ft
Width of Main Basin (W _{main}) =	user	ft
Area of Main Basin (A _{main}) =	user	ft ²
Volume of Main Basin (V _{main}) =	user	ft ³
Calculated Total Basin Volume (V _{total}) =	user	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acres)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00				1,219	1,219	0.028		
	0.25				1,375	1,375	0.032	310	0.007
	0.50				1,530	1,530	0.035	672	0.015
	0.75				1,686	1,686	0.039	1,072	0.025
	1.00				1,841	1,841	0.042	1,512	0.035
Top of WQCV	1.25				1,997	1,997	0.046	1,990	0.046
	1.50				2,152	2,152	0.049	2,507	0.058
	1.75				2,308	2,308	0.053	3,063	0.070
	2.00				2,463	2,463	0.057	3,657	0.084
	2.25				2,617	2,617	0.061	4,294	0.099
	2.50				2,771	2,771	0.066	5,019	0.115
	2.75				2,925	2,925	0.071	5,767	0.132
	3.00				3,079	3,079	0.076	6,588	0.151
Top of EURV	3.25				3,232	3,232	0.081	7,422	0.170
	3.50				3,385	3,385	0.086	8,328	0.191
	3.75				3,538	3,538	0.091	9,288	0.213
	4.00				3,691	3,691	0.095	10,300	0.236
Top of 100 YR	4.25				3,844	3,844	0.102	11,372	0.261
	4.50				3,997	3,997	0.108	12,511	0.287
	4.75				4,150	4,150	0.114	13,717	0.315
	5.00				4,303	4,303	0.120	14,990	0.344
	5.25				4,456	4,456	0.126	16,330	0.375
	5.50				4,609	4,609	0.132	17,737	0.407
	5.75				4,762	4,762	0.138	19,210	0.441
	6.00				4,915	4,915	0.145	20,751	0.476
	6.25				5,068	5,068	0.151	22,358	0.513
	6.50				5,221	5,221	0.157	24,033	0.552
	6.75				5,374	5,374	0.163	25,774	0.592
	7.00				5,527	5,527	0.169	27,582	0.633
	7.25				5,680	5,680	0.175	29,457	0.676
	7.50				5,833	5,833	0.181	31,399	0.721
	7.75				5,986	5,986	0.188	33,408	0.767
Top of Berm	8.00				6,139	6,139	0.204	35,540	0.816

ELECTRONIC STORAGE SITE DEVELOPMENT PLAN PROPOSED DRAINAGE MAP MARCH 2020

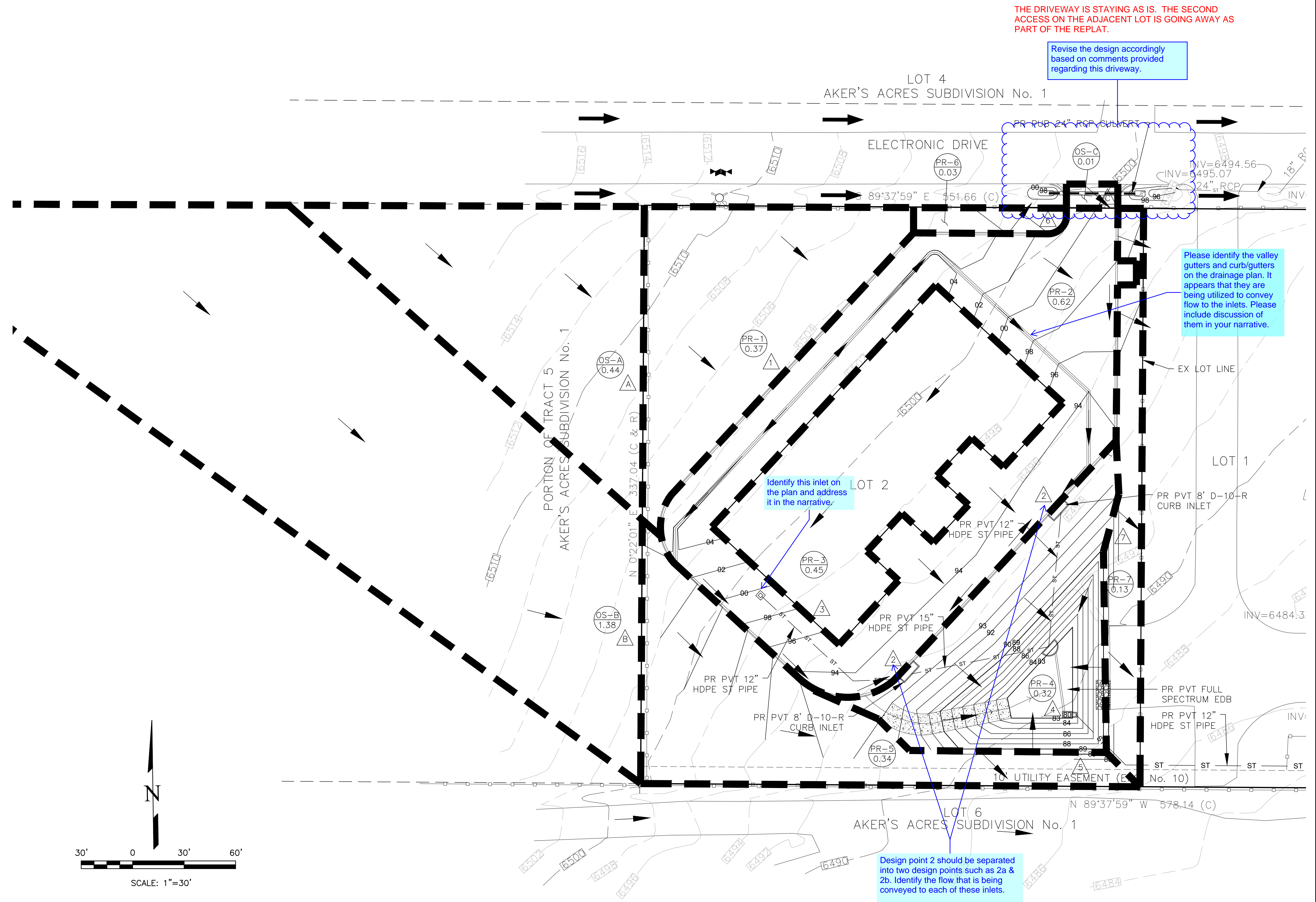
NOTE TO REVIEWER: THE POND OUTLET STORM PIPE WILL NEED A DRAINAGE EASEMENT ONCE IT LEAVES THE LOT. THIS WILL BE ADDED FOLLOWING THE FIRST REVIEW.

BASIN SUMMARY				
DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
A	OS-A	0.44	1.9	3.9
B	OS-B	1.38	5.5	11.2
C	OS-C	0.01	0.1	0.1
1	PR-1	0.37	0.2	1.1
2	PR-2	0.62	3.2	6.5
3	PR-3	0.45	2.3	4.5
4	PR-4	0.32	0.2	1.2
5	PR-5	0.34	0.1	1.0
6	PR-6	0.03	0.0	0.1
7	PR-7	0.13	0.1	0.6

DESIGN POINT SUMMARY				
DESIGN POINT	CONTRIBUTING BASINS	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
A	OS-A	0.44	1.9	3.9
B	OS-B	1.38	5.5	11.2
C	OS-C	0.01	0.1	0.1
1	OS-A, PR-1	0.81	2.0	5.0
2	OS-A, OS-C, PR-1, PR-2	1.44	5.3	11.6
3	PR-3	0.45	2.3	4.5
4	OS-A, OS-C, PR-1, PR-2, PR-3, PR-4	2.21	7.8	17.4
5	OS-B, PR-5	1.72	5.6	12.2
6	PR-6	0.03	0.0	0.1
7	PR-7	0.13	0.1	0.6

LEGEND

- P-7
12.22 BASIN DESIGNATION
- D DESIGN POINT
- BASIN BOUNDARY
- EXISTING 1' CONTOUR
- EXISTING 10' CONTOUR
- GROUND SURFACE FLOW DIRECTION
- ROAD AND DITCH FLOW DIRECTION
- CHAIN-LINK FENCE



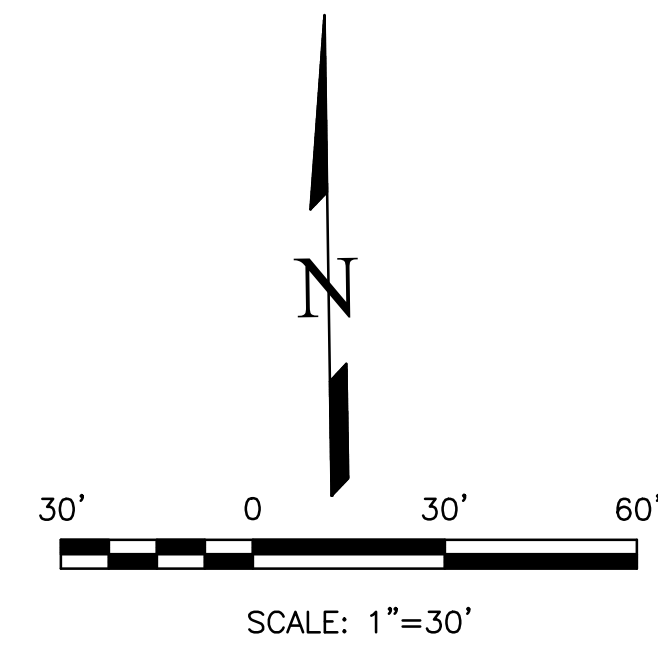
THE DRIVEWAY IS STAYING AS IS. THE SECOND ACCESS ON THE ADJACENT LOT IS GOING AWAY AS PART OF THE REPLAT.

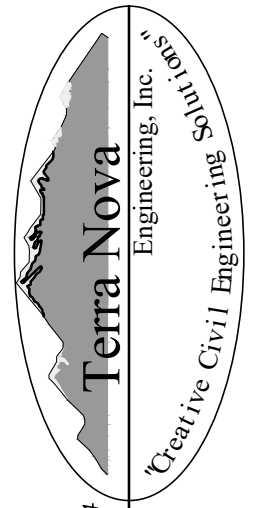
Revise the design accordingly based on comments provided regarding this driveway.

Please identify the valley gutters and curb/gutters on the drainage plan. It appears that they are being utilized to convey flow to the inlets. Please include discussion of them in your narrative.

Identify this inlet on the plan and address it in the narrative.

Design point 2 should be separated into two design points such as 2a & 2b. Identify the flow that is being conveyed to each of these inlets.



REVISIONS NO. _____ DATE _____ DESCRIPTION _____	UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE REVIEWING AGENCIES, THE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PROJECT AND FOR THE MOST PART, BY WRITTEN AUTHORIZATION.
PREPARED FOR: D. STEFANO-BUILDING &... ATTN: DAVID STEFANO 520 W 21ST ST, G-2 #710 NORFOLK, CA 94551 757.333.3144	 Terra Nova Engineering, Inc. Civil/Environmental Engineers
721 S. ZARO STREET COLORADO SPRINGS, CO 80904 OFFICE: 719-635-6422 FAX: 719-635-6426 www.tninc.com	ELECTRONIC STORAGE PROPOSED DRAINAGE MAP PROPOSED DRAINAGE MAP
DESIGNED BY DLF DRAWN BY DLF CHECKED BY LD	H-SCALE AS SHOWN V-SCALE N/A
JOB NO. 1971.00 DATE ISSUED 03/23/20 SHEET NO. 2 OF 3	DATE ISSUED 03/23/20 SHEET NO. 2 OF 3

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