

CITY OF ALBUQUERQUE

Planning Department
Alan Varela, Director



Mayor Timothy M. Keller

April 6, 2023

Ronald Bohannon, P.E.
Tierra West, LLC
5571 Midway Park Place NE
Albuquerque, NM 87109

**RE: Golf Course & Westside Commercial Development
Grading & Drainage Plans and Drainage Report
Engineer's Stamp Date: 03/29/23
Hydrology File: A12D008B2**

Dear Mr. Bohannon:

Based upon the information provided in your submittal received 03/29/2023, the Grading & Drainage Plans and Drainage Report are approved for Grading Permit, Work Order and for action by the Development Hearing Officer (DHO) on Preliminary/Final Plat. Please place this stamp approved Grading & Drainage Plan to the Work Order set of construction drawings.

As a reminder, if the project total area of disturbance (including the staging area and any work within the adjacent Right-of-Way) is 1 acre or more, then an Erosion and Sediment Control (ESC) Plan and Owner's certified Notice of Intent (NOI) is required to be submitted to the Stormwater Quality Engineer (Dough Hughes, PE, jhughes@cabq.gov, 924-3420) 14 days prior to any earth disturbance.

If you have any questions, please contact me at 924-3995 or rbrissette@cabq.gov.

Sincerely,

Renée C. Brissette

Renée C. Brissette, P.E. CFM
Senior Engineer, Hydrology
Planning Department



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

Project Title: Golf Course & Westside Blvd **Building Permit #** _____ **Hydrology File #** _____

DRB# _____ **EPC#** _____

Legal Description: TR D-1 Plat of TRS D-1, E-1 AMAFCA **City Address OR Parcel** 101206651048211303
Black Arroyo Channel Row Paradise Heights Unit 1

Applicant/Agent: Tierra West, LLC **Contact:** Luis Noriega

Address: 5571 Midway Park Place NE Albuquerque, NM 87109 **Phone:** (505) 858-3100

Email: LNORIEGA@TIERRAWESTLLC.COM

Applicant/Owner: Dennis & George LLC **Contact:** Dennis Carpenter

Address: 8618 Menaul Suite H Albuquerque, NM 87109 **Phone:** (505) 269-1812

Email: denniscarpenter1@aol.com

TYPE OF DEVELOPMENT: ☒ PLAT (#of lots) 4 RESIDENCE ☐ DRB SITE ☐ ADMIN SITE: ☐

RE-SUBMITTAL: ☒ YES ☐ NO

DEPARTMENT: ☐ TRANSPORTATION ☒ HYDROLOGY/DRAINAGE

Check all that apply:

TYPE OF SUBMITTAL:

- ☐ ENGINEER/ARCHITECT CERTIFICATION
- ☐ PAD CERTIFICATION
- ☐ CONCEPTUAL G&D PLAN
- ☐ GRADING PLAN
- ☒ DRAINAGE REPORT
- ☐ DRAINAGE MASTER PLAN
- ☐ FLOOD PLAN DEVELOPMENT PERMIT APP.
- ☐ ELEVATION CERTIFICATE
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ADMINISTRATIVE
- ☐ TRAFFIC CIRCULATION LAYOUT FOR DRB APPROVAL
- ☐ TRAFFIC IMPACT STUDY (TIS)
- ☐ STREET LIGHT LAYOUT
- ☐ OTHER (SPECIFY) _____
- ☐ PRE-DESIGN MEETING?

TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY
- ☐ CONCEPTUAL TCL DRB APPROVAL
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ SITE PLAN FOR SUB'D APPROVAL
- ☐ SITE PLAN FOR BLDG PERMIT APPROVAL
- ☒ FINAL PLAT APPROVAL
- ☐ SIA/RELEASE OF FINANCIAL GUARANTEE
- ☐ FOUNDATION PERMIT APPROVAL
- ☐ GRADING PERMIT APPROVAL
- ☐ SO-19 APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ GRADING PAD CERTIFICATION
- ☐ WORK ORDER APPROVAL
- ☐ CLOMR/LOMR
- ☐ FLOOD PLAN DEVELOPMENT PERMIT
- ☐ OTHER (SPECIFY) _____

DATE SUBMITTED: 03.29.2023



TIERRA WEST, LLC

March 29, 2023

Ms. Renee C. Brissette, P.E. CFM
Senior Engineer, Hydrology – Planning Department
600 2nd Street NW
Albuquerque, NM. 87102

**RE: GOLF COURSE & WESTSIDE COMMERCIAL DEVELOPMENT
GRADING & DRAINAGE RESPONSE TO COMMENT**

Dear Ms. Brissette:

Per the correspondence dated March 16; 2023, please find the following responses addressing the comments listed below:

1. The overall drafting needs some serious attention. There are existing easements with labels that are too thick in pen width. These need to be shaded back.
Response: Acknowledged, existing easements shaded back.
2. There are proposed easements which just face into the background. These needs a little bit more pen width to them.
Response: Added pen width to proposed easements.
3. It appears that the entrances for Tracts D-1-A & D-1-B are too close to Westside Blvd. Please check with Transportation Section to verify the distance requirements.
Response: Per DPM Section 7-4(B)(4) Vehicular access section the minimum distance between site access and intersection is 75 ft, driveways were shifted to meet requirements.
4. Please make all drives perpendicular to the private drives or public streets. There are several that are askew and need to be fixed.
Response: Curb cuts were updated to be more perpendicular to the street.
5. The proposed sidewalk in this area appears not to conform to construction conventions. Please verify with the Transportation section.
Response: Sidewalk at this location was updated to conform with construction conventions.
6. All the storm drain within the development is private. There are call outs for HDPE and then there are call ours for RCP. Since this is all private storm sewer, please stick with only one material type.
Response: All storm drain pipe material was updated to HDPE.
7. All stub outs should be only 5 feet beyond the proposed sidewalk and should have a plug with an inv elevation.
Response: Stub outs updated to be 5 feet beyond the proposed sidewalk with end caps and invert elevations are called out.

8. Depending on the material that is to be used, please fix the stub out connections, If RCP is to be used, then you will need manholes for the connections. If you use the HDPE, then that is not needed since they do make Tee connections. If HDPE is to be used, please ensure that the tee connections are at least 5 feet from all manholes and inlets for buildability.

Response: Since the proposed pipe material is HDPE all tee connections are either manhole connections or 5 ft from a manhole.

9. The proposed stand pipe will not function as shown. It needs to be at the bottom of the detention pond in order to work since the 1' dia holes will be drilled 360 degrees around the pipe. Also, the detail has information missing in order to build it as designed.

Response: The proposed stand pipe riser detail was updated to work under the specific site circumstances and constraints.

10. Future Conditions. Please include the future conditions for Drainage Area D3. This drainage are is missing in the calculations.

Response: Please refer drainage report for updated Future Conditions sections in Appendix A of the report.

11. The AHYMMO calculations for the detention pond were only run for the proposed conditions and not the future conditions. Please run this for the future conditions to in sure that the allowable discharge is only 19.5 cfs and please show what the size of the detention pond would be for the future conditions.

Response: Please refer drainage report for updated Future AHYMO input and output sections in Appendix A of the report.

If you have any questions or need additional information regarding this matter, please do not hesitate to contact me.

Sincerely,



Ronald R. Bohannon, P.E

JN: 2022055
RRB/ln/ca

DRAINAGE REPORT FOR

Golf Course and Westside Commercial Development SE Corner of Golf Course Rd and Westside Blvd

Prepared by:



Tierra West, LLC
5571 Midway Park Place NE
Albuquerque, New Mexico 87109

TW# 2022055

February 2022

I certify that this report was prepared under my supervision, and I am a registered Professional Engineer in the State of New Mexico in good standing.



A handwritten signature in black ink, appearing to read "Ron R. Bohannon", written over a horizontal line.

Ronald R. Bohannon
PE # 7868

City of Albuquerque
Planning Department
Development Review Services
HYDROLOGY SECTION
APPROVED

DATE: 04/06/23
BY: A handwritten signature in purple ink, appearing to read "Renee C. Briassette", written over a horizontal line.
HydroTrans # A12D008B2

THE APPROVAL OF THESE PLANS/REPORT SHALL NOT BE
CONSTRUED TO PERMIT VIOLATIONS OF ANY CITY
ORDINANCE OR STATE LAW, AND SHALL NOT PREVENT
THE CITY OF ALBUQUERQUE FROM REQUIRING
CORRECTION, OR ERROR OR DIMENSIONS IN PLANS,
SPECIFICATIONS, OR CONSTRUCTIONS. SUCH APPROVED PLANS
SHALL NOT BE CHANGED, MODIFIED OR ALTERED WITHOUT
AUTHORIZATION.

PAGE LEFT BLANK

TABLE OF CONTENTS

Contents

Purpose.....	1
Context.....	Error! Bookmark not defined.
Floodplain	3
Calculations	5
Existing Conditions	5
Proposed Conditions.....	6
Stormwater Quality Volume Management	8
Summary.....	8

Table of Figures

Figure 1 – Vicinity Map	2
Figure 2 – Site Aerial Image	3
Figure 3 – FIRM Map	4
Figure 4 – Existing Basin Map	6
Figure 5 – Developed Basin Map	7

Appendices

Drainage Basin Maps, Hydrology Tables/Calculations, and Pond-Orifice Calcs.....	APPENDIX A
Gutter Depth, Storm Drain, and Inlet Calcs.....	APPENDIX B
Pages from the Black Arroyo Channel Drainage Report.....	APPENDIX C

Map Pocket

Conceptual Grading and Drainage Plan

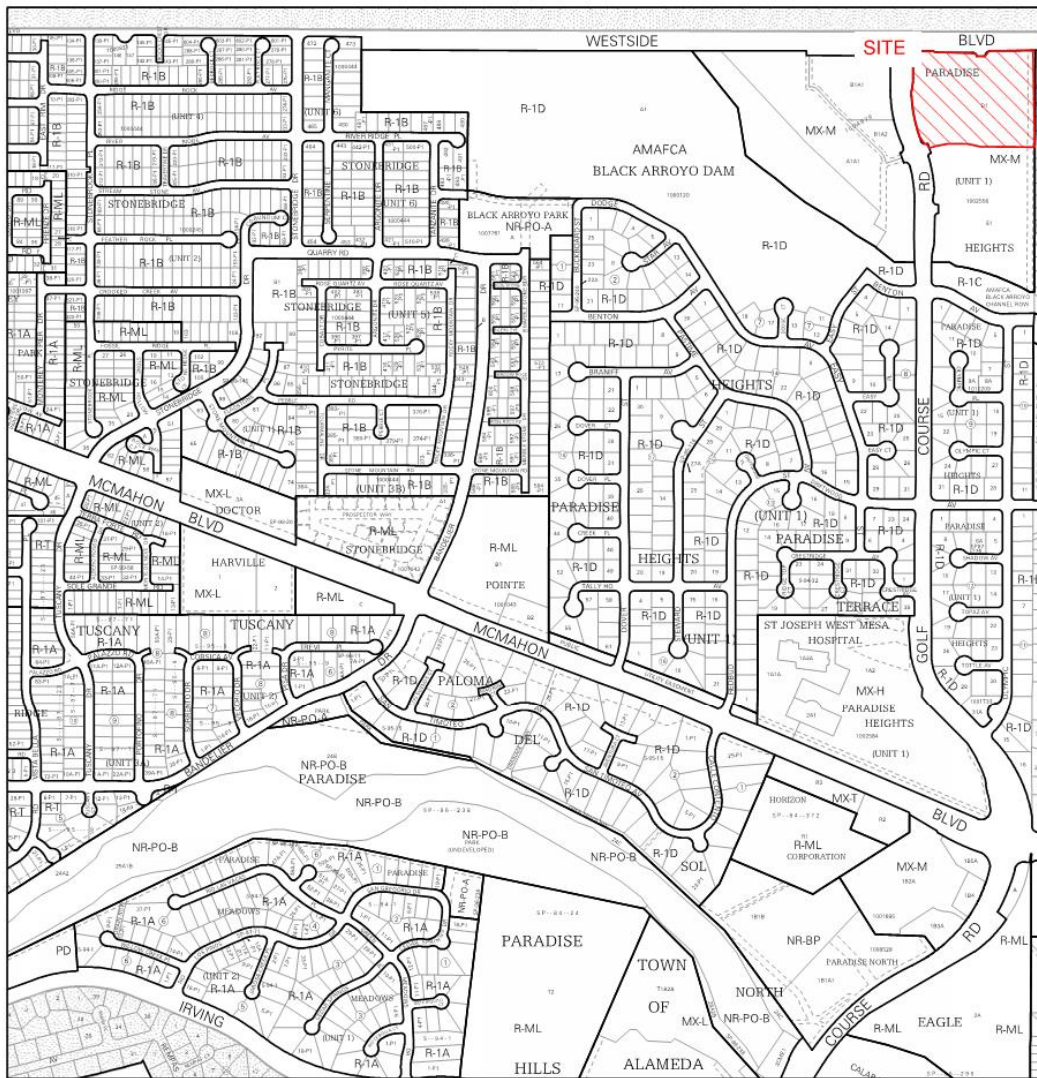
PAGE LEFT BLANK

Purpose

The purpose of this report is to outline the Drainage Plan intent and present a solution for the subdivision plat and development of the vacant Tract D-1 of Paradise Heights, Unit 1 Albuquerque, New Mexico. The project site is a 7.67-acre multi-pad commercial development project, located at 10850 Golf Course Rd, Albuquerque NM 87114 (the “project site”). The project site is in precipitation zone 1 per the city of Albuquerque Development Process Manual (DPM) Ch 6, west of the Rio Grande River. The project site is located north of the Wintergreen Apartments on Tract E-1 (Hydronum: A12D008D) and the AMAFCA Black Arroyo Channel. The project site is currently zoned MX-M and is legally described as TRACT D-1 PLAT OF TRS D-1, E-1 AMAFCA BLACK ARROYO CHANNEL ROW PARADISE HEIGHTS UNIT 1 CONT 7.6716 AC.

Context

Most of the project site has not been previously graded and remains vacant. The southern portion of the project site contains sediment ponds meant to retain the storm water discharge from the project site and protect the southern apartment development (Hydronum: A12D008D). To the north, the site is bordered by a variety of single-family homes with the City of Rio Rancho. To the south lays a new apartment complex and to the east lays single-family residential developments. West of the project site is zoned MX-M for a variety of multi-family and commercial developments. The proposed site lays within hydrology number A12D008B2. The boundary of the proposed site is located on the Zone atlas page H-13-Z as shown on **Figure 1**.



For more details about the Integrated Development Ordinance visit: <http://www.cabq.gov/planning/codes-policies-regulations/integrated-development-ordinance>

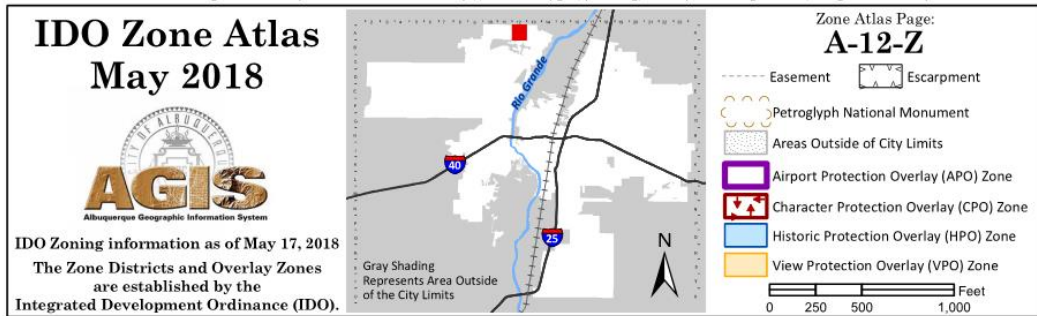


Figure 1 – Vicinity Map



Figure 2 – Site Aerial Image

Floodplain

The floodplain information is published for the site by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Bernalillo County, New Mexico and Incorporated Areas. The subject site is detailed on Community Panel Number 35001C0108G dated August 26, 2008, and is shown below.

The subject site is located within Flood Zone X, which is defined as, “Areas determined to be outside the 0.2% annual chance floodplain”. The site does not lie within a Flood Hazard Area as shown on the FEMA map requiring no further flood-proofing or other flood mitigation.

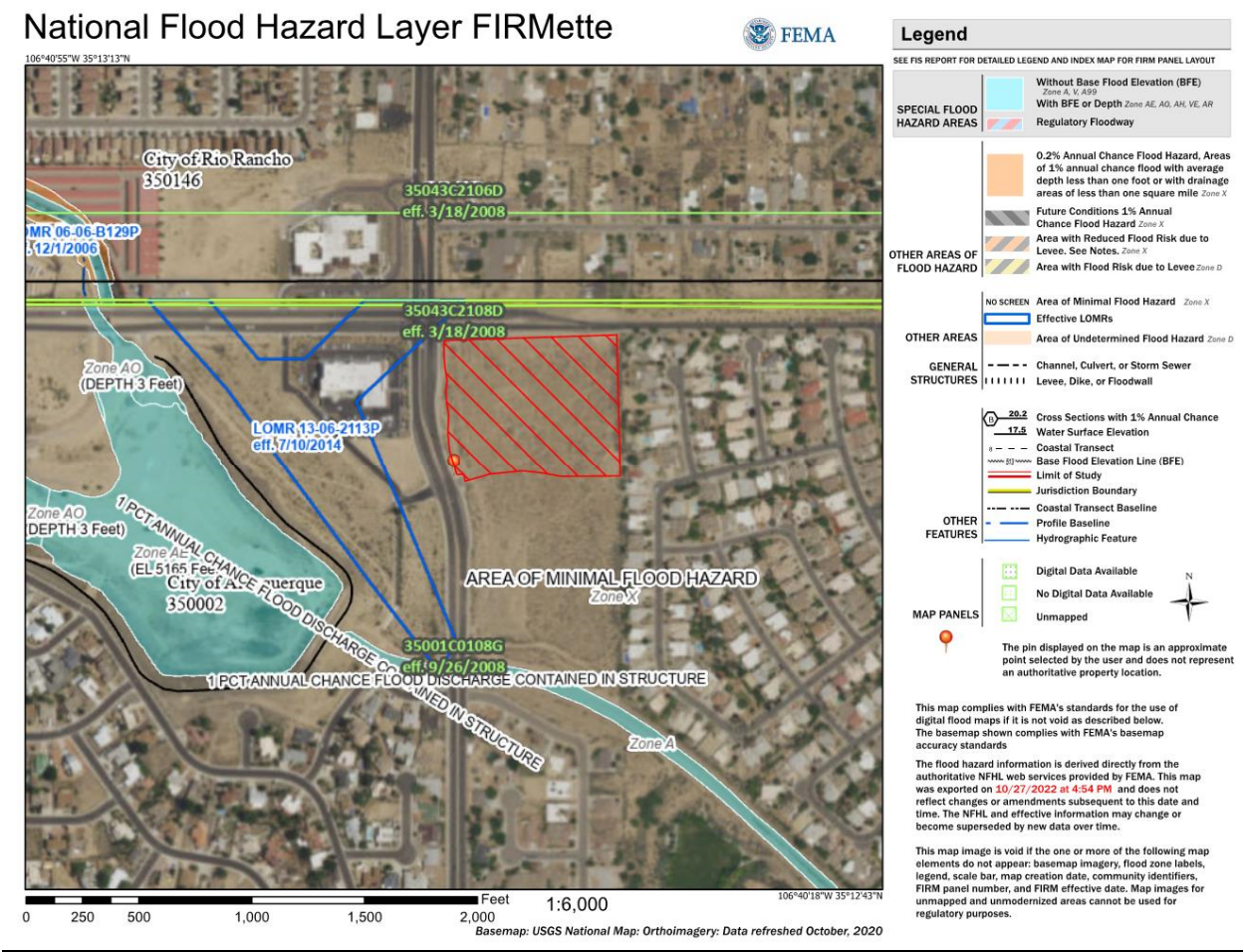


Figure 3 – FIRM Map

Calculations

The hydrology calculation follows the guidance of the DPM's Chapter 6 Part 6-2(C). Point precipitation frequency estimates were obtained from the NOAA Atlas 14, Precipitation – Frequency Atlas of the United States, Vol 1 Version 5 Semiarid Southwest, see appendix A for precipitation frequency data and study location. The principal design storm is the 100-year, 6-hour event. The appropriate land treatments A through D, as defined in the DPM Chapter 6 Section 2.A.2, will be applied to the various pervious and impervious areas for the proposed site.

AHYMO-S4 is the computer program used to determine the existing and proposed development flows for the principle 100-year, 6-hour storm event. Using the ROUTE RESERVOIR command, the AHYMO program was used to model the detention pond system and was used to determine the outflow discharge.

The proposed commercial site is located west of the Rio Grande River and according to Article 6-12 of the DPM new development site are required to retain the 0.42-inch storm runoff. Therefore, the required storm water quality volume to be captured and infiltrated is the product of the impervious area multiplied by 0.42 inches.

Existing Conditions

The subdivision is located within the Black Arroyo Detention Dam Basin Area L11 as shown in Appendix C of the report. Currently the subdivision lies in an undeveloped condition with vegetation typical of the west mesa. The southern portion of Tract D-1 contained sediments ponding and an access road with roundabout (Hydronum: A12D008D). The subdivision slopes consistently from the north to the south with the flows predominately overland with a moderately defined drainage course along the east side of Golf Course Rd and along the east side of the subdivision adjacent to the residential dwellings. The sheet flow is directed to the sediment ponds currently being constructed under (Hydronum: A12D008D) and is completely retained on site for the 100 yr. – 10 day. storm event. The subdivision is allocated mainly as treatment A with no offsite flows entering the subdivision parcels of Tract D-1 and E-1. Offsite flows are contained in the surrounding roadway and directed to curb inlets along Golf Course Rd. before discharging to the Black Arroyo Channel at the overpass. Flows from the access road and roundabout are managed by the apartment site (Hydronum: A12D008D). The site is divided into 2 drainage basins as shown in Figure 4.

A 24-inch storm drainpipe is being extended up to the project site with the construction of the apartment site to the south (Hydronum: A12D008D). The overall site is characterized as free discharge per the City of Albuquerque online mapping system and the Black Arroyo Detention Dam Hydrology Report but due to capacity constraints in the 24-inch pipe the project site is allowed to discharge at an allowable flow of 19.5 CFS per (Hydronum: A12D008D). The allowable flow rate can be increased with a developer funded plan to increase the size of the 24-inch storm drainpipe. AMAFCA approval is also required with the increase in flow.

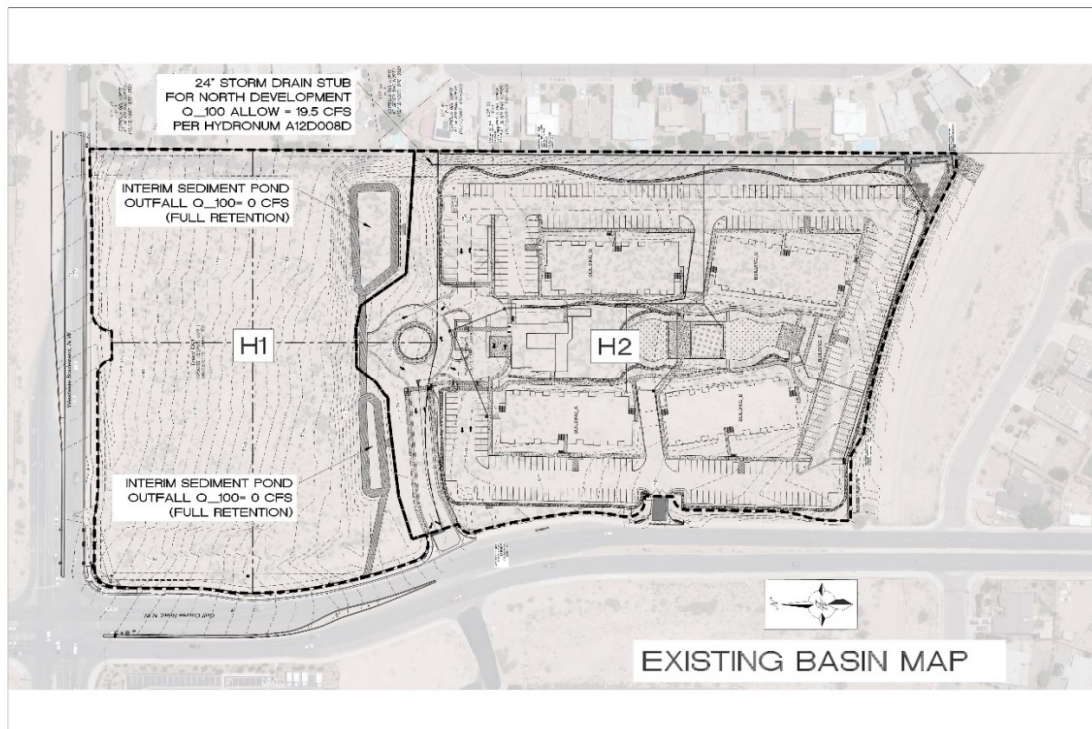


Figure 4 – Existing Basin Map

Proposed Conditions

The developed project site has been analyzed to determine the peak flow, storm water volume and drainage pipe system requirements. The project site was divided into three basins one of the basins (Basin D2) being the center access road as depicted on **Figure 5** below. Basins D1 and D3 represent the east and west portions of the project site currently undeveloped. Storm water runoff from basin D1 will be routed into the existing sediment pond on the southwest corner of the overall property constructed under (Hydronum: A12D008D). the volume of the sediment pond is 0.349 acre-ft and the required storage for basin D-1 is 0.270 acre-ft (1-year,

10-day volume). Basins D2 and D3 will be routed to a new detention pond on the southeast corner of the site via storm drain pipe and surface flow respectfully. As shown in the AHYMO calculations in Appendix A of the report the proposed detention pond reduces the peak flow from 10.78 CFS to 6.89 CFS and per the Wintergreen Apartment drainage report (Hydronum: A12D008D) the overall site is allowed to discharge at a rate of 19.5 CFS.

Future Conditions

At fully developed conditions the developed peak flow is expected to be roughly 27.25 CFS with an average 85% impervious surface. Per the drainage report prepared for the apartment site on Tract E-1 south of the project site (Hydronum: A12D008D) the allowable discharge is to be 19.5 CFS. As mentioned above the flow rate can be increased with a developer funded plan to increase the size of the 24-inch storm drainpipe along Tract E-1 to the south and requires AMAFCA approval for the increase in flow or each new development shall be allowed to discharge at a rate of 2.67 CFS per acre. Each development shall contain a flow rate control structure such as a detention pond and shall discharge into an underground storm drainpipe system under an easement to be granted by the subdivision plat. Stormwater from Basin D2 (the center road) will discharge into the proposed detention pond on the southeast corner of the site in order to retain the storm water quality volume. After the detention ponds the storm water will then be routed to the 24" storm drain system along Tract E-1 where the stormwater will discharge into the Black Arroyo Channel to the south.

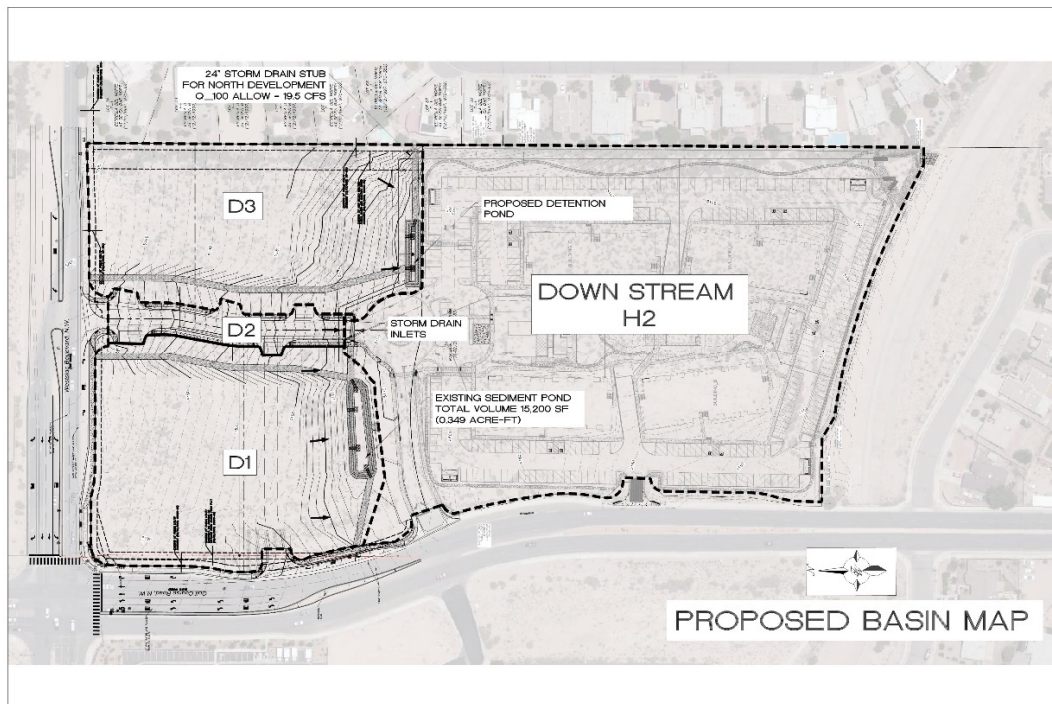


Figure 5 – Developed Basin Map

Stormwater Quality Volume Management

As this site is a new development, the water quality volume is calculated based on the 0.42-inch storm. The methodology used in the EPA Report, Estimating Predevelopment Hydrology in the Middle Rio Grande Watershed, New Mexico, TetraTech, April 2014, EPA Publication Number 832-R-14-007, yields a runoff value of 0.42 inches for the 90th percentile storm. Therefore, to calculate the Stormwater Quality Volume the impervious area is multiplied by 0.42 inches. The formula used is $SWQV = I * 43,560 * 0.42 * (1/12)$ where I is the impervious area in acres. The impervious areas and SWQV ponding required for Tract D-1 is detailed on the design calculations in Appendix A of the report.

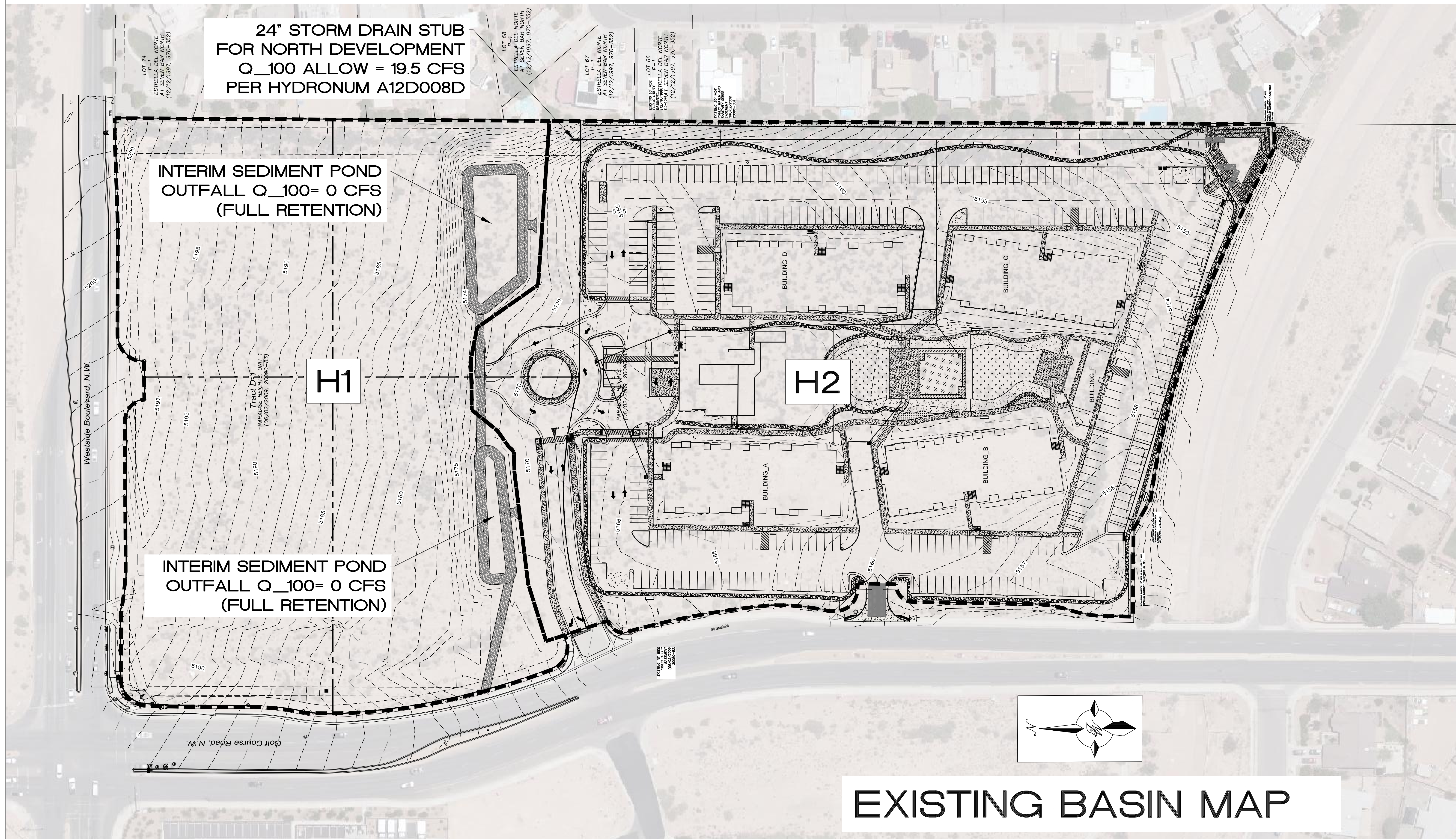
Summary

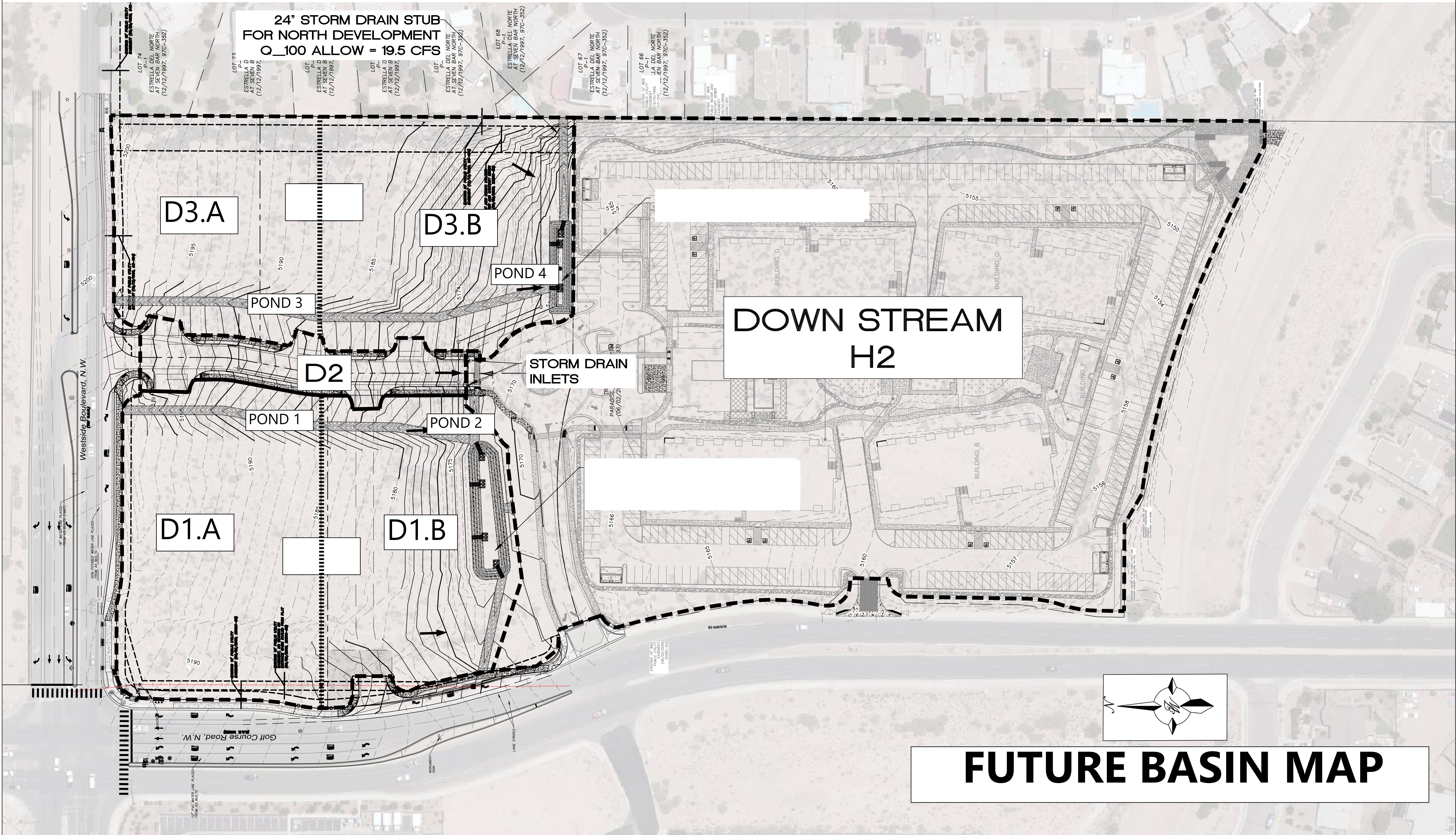
This report outlines the Drainage Management Plan for the Golf Course and Westside Commercial Subdivision and presents the on-site best management practices, storm water quality ponding, and drainage improvements needed to safely convey the future developed flows for Tract D-1. The required storm water quality volume ponding for Tract D-1 is achieved with a suitable sized pond located within each future lot. Developed stormwater runoff from the

center road shall be collected through combination of curb inlets and discharged to the storm water quality pond at the southeast corner of the project site, before passing directly into the Black Arroyo Channel.

APPENDIX A

EXISTING/PROPOSED HYDROLOGY TABLE, POND DISCHARGE-
ORIFICE CALCULATIONS AND DRAINAGE BASIN MAPS





FUTURE BASIN MAP

Existing Conditions

Existing Conditions															
Basin Descriptions													100-Year, 6-Hr (AHYMO-S4)		
Basin ID	Tract	Area (sf)	Area (acres)	Area (sq miles)	Treatment A		Treatment B		Treatment C		Treatment D		Time To Peak (Hours)	Volume (ac-ft)	Flow cfs
					%	(acres)	%	(acres)	%	(acres)	%	(acres)			
H1	D-1	297,705	6.83	0.01068	90%	6.151	0%	0.000	10%	0.683	0%	0.000	1.560	0.363	11.14
H2	E-1	418,883	9.62	0.01503	0%	0.000	7%	0.673	18%	1.731	75%	7.212	1.550	1.414	35.87
Total		716,588	16.45	0.02570		6.151		0.673		0.000		7.212		1.777	47.01

Proposed Conditions

Proposed Conditions															
Basin Descriptions													100-Year, 6-Hr (AHYMO-S4)		
Basin ID	Tract	Area (sf)	Area (acres)	Area (sq miles)	Treatment A		Treatment B		Treatment C		Treatment D		Time To Peak (Hours)	Volume (ac-ft)	Flow cfs
					%	(acres)	%	(acres)	%	(acres)	%	(acres)			
D1	D-1	148,725	3.41	0.00533	0%	0.000	0%	0.000	100%	3.414	0%	0.000	1.500	0.284	9.91
D2	E-1	21,971	0.50	0.00079	0%	0.000	0%	0.000	10%	0.050	90%	0.454	1.500	0.081	2.03
D3	E-1	131,200	3.01	0.00471	0%	0.000	0%	0.000	100%	3.012	0%	0.000	1.500	0.251	8.76
H2	E-1	409,960	9.41	0.01471	0%	0.000	0%	0.000	20%	1.882	80%	7.529	1.500	1.399	35.45
Total		711,856	16.34	0.02553	0.000		0.000		8.359		7.983			2.015	56.150

SWQV Pond Volume Calculation				
BASIN ID	AREA D (AC)	AREA D (SF)	SWQV (CF) REQUIRED	SWQV (CF) PROVIDED
D1	-	-	-	-
D2	0.45	19,773.90	692.09	-
D3	-	-	-	2,831.00
Total	0.45	19,773.90	692.09	2,831.00

Retention Volume Calculation															
Basin Descriptions													10-Year, 10-day (DPM Ch 6)		
Basin ID	Tract	Area (sf)	Area (acres)	Area (sq miles)	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E (in)	Volume (ac-ft)	Flow cfs
					%	(acres)	%	(acres)	%	(acres)	%	(acres)			
D1	E-1	148,725	3.41	0.00533	0%	0.000	0%	0.000	100%	3.414	0%	0.000	0.950	0.270	9.80
Total		148,725	3.41	0.00533		0.000		0.000		3.414		0.000		0.270	9.799

Sediment Pond Volume Calculation	
Area at Mid Depth	3,800 Sq. Ft.
Depth of Pond	4 Ft.
Total Volume	15,200 Cubic Ft. (0.349 Acre-ft)
Required Volume	11,761 Cubic Ft. (0.270 Acre-ft)

Proposed Conditions Detention Pond Storage-Discharge Calculations

POND VOLUME CALCULATIONS			
ELEVATION (ft)	AREA (sf)	VOLUME (cf)	CUMULATIVE VOLUME (cf)
65	443	0	0
66	820	631.5	632
67	1229	1024.5	1656
67.833	1592	1174.947	2831
68	1670	272.377	3103
69	2141	1905.5	5009
70	2638	2389.5	7398

INV

POND STORAGE FUNCTION				
ACTUAL ELEV.	H (FT)	VOLUME (CF)	Q (CFS)	VOLUME (AC-FT)
65	0.00	0	0.00	0.0000
66	0.00	632	0.00	0.0145
67	0.00	1656	0.00	0.0380
67.833	0.00	2831	0.00	0.0650
68	0.17	3103	2.41	0.0712
69	1.17	5009	6.38	0.1150
70	2.17	7398	8.70	0.1698

INV

Pond Orifice Equation	
Q =	$CA(2gh)^{(1/2)}$
C =	0.6
DIA (Ft)	1.25
A (SF) =	1.2272
H (Ft) =	Head
Q (CFS)=	Flow

Future Conditions

Future Conditions																
Basin Descriptions														100-Year, 6-Hr (AHYMO-S4)		
Basin ID	Tract	Area (sf)	Area (acres)	Area (sq miles)	Treatment A		Treatment B		Treatment C		Treatment D		Time To Peak (Hours)	Volume (ac-ft)	Flow cfs	
					%	(acres)	%	(acres)	%	(acres)	%	(acres)				
D1.A		66,979	1.54	0.00240	0%	0.000	0%	0.000	15%	0.231	85%	1.307	1.500	0.241	6.04	
D1.B		81,746	1.88	0.00293	0%	0.000	0%	0.000	15%	0.281	85%	1.595	1.500	0.294	7.37	
D2		21,971	0.50	0.00079	0%	0.000	0%	0.000	10%	0.050	90%	0.454	1.500	0.081	2.03	
D3.A		62,070	1.42	0.00223	0%	0.000	0%	0.000	15%	0.214	85%	1.211	1.500	0.224	5.61	
D3.B		69,130	1.59	0.00248	0%	0.000	0%	0.000	15%	0.238	85%	1.349	1.500	0.249	6.24	
Total		301,896	6.93	0.01083		0.000		0.000		1.014		5.916		1.089	27.290	

SWQV Pond Volume Calculation				
BASIN ID	AREA D (AC)	AREA D (SF)	SWQV (CF) REQUIRED	SWQV (CF) PROVIDED
D1.A	1.31	56,932.15	1,992.63	2,421.00
D1.B	1.60	69,484.10	2,431.94	2,587.00
D2	0.45	19,773.90	692.09	
D3.A	1.21	52,759.50	1,846.58	2,173.00
D3.B	1.35	58,760.50	2,056.62	2,831.00
Total	5.92	257,710.15	9,019.86	10,012.00



NOAA Atlas 14, Volume 1, Version 5
Location name: Albuquerque, New Mexico, USA*
Latitude: 35.2168°, Longitude: -106.6758°
Elevation: 5184.48 ft**

* source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

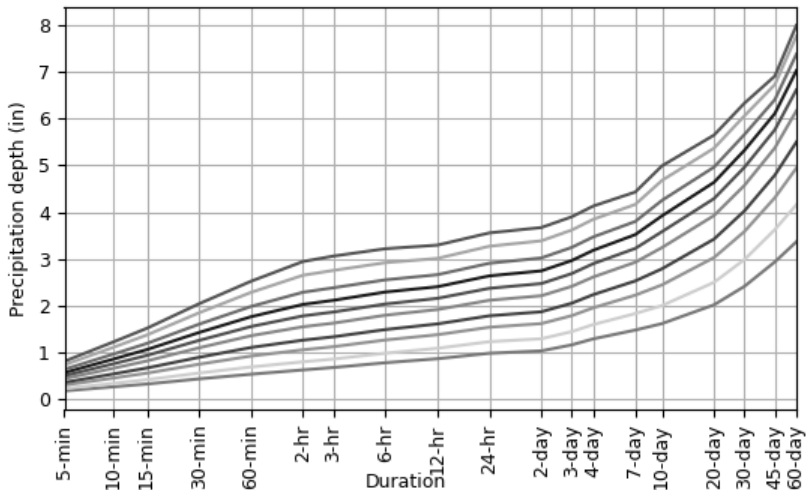
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.167 (0.143-0.196)	0.217 (0.184-0.253)	0.291 (0.248-0.342)	0.349 (0.296-0.409)	0.429 (0.363-0.502)	0.492 (0.414-0.575)	0.559 (0.467-0.652)	0.629 (0.522-0.734)	0.725 (0.595-0.846)	0.801 (0.653-0.934)
10-min	0.255 (0.218-0.298)	0.329 (0.281-0.386)	0.443 (0.377-0.520)	0.532 (0.451-0.622)	0.653 (0.552-0.764)	0.749 (0.631-0.875)	0.850 (0.710-0.993)	0.957 (0.794-1.12)	1.10 (0.905-1.29)	1.22 (0.993-1.42)
15-min	0.315 (0.270-0.370)	0.408 (0.348-0.478)	0.548 (0.467-0.644)	0.659 (0.560-0.771)	0.810 (0.684-0.947)	0.928 (0.782-1.08)	1.05 (0.880-1.23)	1.19 (0.984-1.38)	1.37 (1.12-1.60)	1.51 (1.23-1.76)
30-min	0.425 (0.363-0.498)	0.550 (0.469-0.644)	0.739 (0.629-0.868)	0.887 (0.753-1.04)	1.09 (0.921-1.28)	1.25 (1.05-1.46)	1.42 (1.18-1.66)	1.60 (1.32-1.86)	1.84 (1.51-2.15)	2.04 (1.66-2.37)
60-min	0.525 (0.450-0.616)	0.680 (0.580-0.797)	0.914 (0.779-1.07)	1.10 (0.932-1.28)	1.35 (1.14-1.58)	1.55 (1.30-1.81)	1.76 (1.47-2.05)	1.98 (1.64-2.31)	2.28 (1.87-2.66)	2.52 (2.05-2.94)
2-hr	0.617 (0.523-0.740)	0.791 (0.668-0.949)	1.05 (0.884-1.26)	1.26 (1.06-1.49)	1.54 (1.29-1.83)	1.78 (1.47-2.10)	2.02 (1.66-2.39)	2.28 (1.86-2.69)	2.65 (2.14-3.12)	2.94 (2.35-3.48)
3-hr	0.669 (0.572-0.797)	0.850 (0.726-1.01)	1.12 (0.953-1.32)	1.33 (1.13-1.57)	1.62 (1.37-1.92)	1.86 (1.56-2.19)	2.11 (1.76-2.49)	2.38 (1.97-2.80)	2.75 (2.25-3.24)	3.06 (2.48-3.61)
6-hr	0.771 (0.665-0.910)	0.975 (0.843-1.15)	1.26 (1.09-1.48)	1.48 (1.28-1.74)	1.79 (1.53-2.10)	2.03 (1.73-2.37)	2.29 (1.93-2.67)	2.55 (2.14-2.97)	2.92 (2.42-3.40)	3.22 (2.65-3.76)
12-hr	0.857 (0.749-0.986)	1.08 (0.945-1.24)	1.37 (1.20-1.58)	1.60 (1.39-1.84)	1.91 (1.65-2.19)	2.15 (1.85-2.46)	2.40 (2.06-2.75)	2.66 (2.26-3.04)	3.01 (2.54-3.45)	3.29 (2.75-3.78)
24-hr	0.974 (0.859-1.12)	1.22 (1.08-1.40)	1.53 (1.35-1.75)	1.78 (1.56-2.02)	2.11 (1.85-2.40)	2.37 (2.06-2.69)	2.63 (2.29-2.99)	2.90 (2.51-3.29)	3.27 (2.80-3.70)	3.55 (3.03-4.03)
2-day	1.02 (0.908-1.16)	1.28 (1.14-1.45)	1.61 (1.43-1.82)	1.86 (1.65-2.10)	2.21 (1.94-2.48)	2.47 (2.17-2.78)	2.74 (2.40-3.08)	3.02 (2.62-3.39)	3.38 (2.93-3.81)	3.67 (3.16-4.14)
3-day	1.15 (1.04-1.28)	1.44 (1.30-1.59)	1.78 (1.61-1.97)	2.05 (1.85-2.26)	2.41 (2.17-2.66)	2.68 (2.41-2.96)	2.96 (2.65-3.27)	3.24 (2.89-3.58)	3.62 (3.21-4.00)	3.90 (3.44-4.32)
4-day	1.28 (1.18-1.40)	1.59 (1.46-1.74)	1.95 (1.79-2.12)	2.23 (2.05-2.43)	2.61 (2.39-2.84)	2.90 (2.65-3.15)	3.18 (2.90-3.46)	3.47 (3.15-3.77)	3.85 (3.48-4.19)	4.13 (3.73-4.50)
7-day	1.47 (1.35-1.60)	1.82 (1.68-1.98)	2.22 (2.04-2.40)	2.52 (2.32-2.73)	2.92 (2.69-3.16)	3.22 (2.96-3.47)	3.52 (3.22-3.79)	3.80 (3.48-4.10)	4.16 (3.80-4.50)	4.43 (4.03-4.79)
10-day	1.61 (1.48-1.75)	2.00 (1.84-2.16)	2.44 (2.25-2.64)	2.78 (2.57-3.01)	3.24 (2.99-3.50)	3.58 (3.29-3.86)	3.92 (3.60-4.22)	4.25 (3.89-4.58)	4.68 (4.27-5.05)	4.99 (4.55-5.40)
20-day	2.01 (1.85-2.18)	2.49 (2.30-2.71)	3.02 (2.79-3.27)	3.42 (3.16-3.70)	3.93 (3.62-4.24)	4.29 (3.95-4.62)	4.64 (4.26-4.99)	4.96 (4.56-5.35)	5.37 (4.92-5.78)	5.65 (5.18-6.09)
30-day	2.41 (2.22-2.60)	2.98 (2.75-3.22)	3.58 (3.31-3.86)	4.02 (3.71-4.32)	4.57 (4.22-4.90)	4.96 (4.57-5.32)	5.32 (4.90-5.70)	5.66 (5.20-6.06)	6.06 (5.57-6.50)	6.33 (5.81-6.79)
45-day	2.93 (2.71-3.16)	3.62 (3.36-3.90)	4.31 (3.99-4.63)	4.79 (4.44-5.15)	5.37 (4.98-5.77)	5.76 (5.35-6.18)	6.11 (5.67-6.54)	6.41 (5.95-6.86)	6.73 (6.27-7.19)	6.92 (6.45-7.38)
60-day	3.36 (3.12-3.63)	4.16 (3.85-4.48)	4.94 (4.59-5.32)	5.50 (5.11-5.91)	6.17 (5.73-6.63)	6.62 (6.16-7.10)	7.03 (6.54-7.54)	7.38 (6.88-7.92)	7.77 (7.25-8.34)	8.00 (7.49-8.58)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

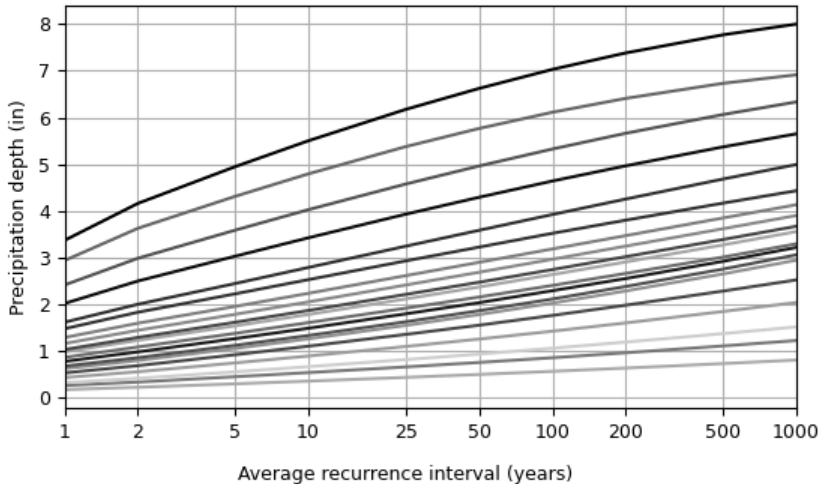
[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 35.2168°, Longitude: -106.6758°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Thu Oct 27 21:09:43 2022

[Back to Top](#)

Maps & aerials

Small scale terrain



Large scale terrain

AHYMO-S4 INPUT


```

*****
*                                GOLF COURSE AND WESTSIDE (COMERCIAL)                                *
*****
*                                100-YEAR 6-HR STORM (UNDER EXISTING CONDITIONS)                        *
*****
*Zone 1                                                                *
*NOAA ATLAS 14, VOLUME 1, VERSION 5                                    *
*LATITUDE: 35.2168°                                                    *
*LONGITUDE: -106.6758°                                                 *
*ELEVATION: 5184.48 FT                                                *
*****
START                                TIME=0.0

*
RAINFALL                            TYPE=1 RAIN QUARTER=0.0 IN
                                    RAIN ONE=1.76 IN RAIN SIX=2.29 IN
                                    RAIN DAY=2.63 IN DT=0.01 HR

*
* H1
*
COMPUTE NM HYD                      ID=1 HYD NO=H1 AREA=0.01068 SQ MI
                                    PER A=90.00 PER B=0.00 PER C=10.00 PER D=0.00
                                    TP= 0.15 HR MASS RAINFALL=-1

PRINT HYD                           ID=1 CODE=1

*
* H2
*
COMPUTE NM HYD                      ID=1 HYD NO=H2 AREA=0.01503 SQ MI
                                    PER A=0.00 PER B=7.00 PER C=18.00 PER D=75.00
                                    TP= 0.15 HR MASS RAINFALL=-1

PRINT HYD                           ID=1 CODE=1

*****
*                                100-YEAR 6-HR STORM (UNDER PROPOSED CONDITIONS)                        *
*****
*****
START                                TIME=0.0
*
*
RAINFALL                            TYPE=1 RAIN QUARTER=0.0 IN
                                    RAIN ONE=1.76 IN RAIN SIX=2.29 IN
                                    RAIN DAY=2.63 IN DT=0.15 HR

*
* D1
*
COMPUTE NM HYD                      ID=1 HYD NO=D1 AREA=0.00533 SQ MI
                                    PER A=0.00 PER B=0.00 PER C=100.00 PER D=0.00
                                    TP=0.15 HR MASS RAINFALL=-1

PRINT HYD                           ID=1 CODE=1
*

```

* D2

*

COMPUTE NM HYD ID=2 HYD NO=D2 AREA=0.00079 SQ MI
PER A=0.00 PER B=0.00 PER C=10.00 PER D=90.00
TP=0.15 HR MASS RAINFALL=-1

PRINT HYD ID=2 CODE=1

*

* D3

*

COMPUTE NM HYD ID=3 HYD NO=D3 AREA=0.00471 SQ MI
PER A=0.00 PER B=0.00 PER C=100.00 PER D=0.00
TP=0.15 HR MASS RAINFALL=-1

PRINT HYD ID=3 CODE=1

*

* H2

*

COMPUTE NM HYD ID=14 HYD NO=H2 AREA=0.01433 SQ MI
PER A=0.00 PER B=0.00 PER C=20.00 PER D=80.00
TP=0.15 HR MASS RAINFALL=-1

PRINT HYD ID=14 CODE=1

*

* ADD BASINS D2, D3

*

ADD HYD ID =5 HYD = 100.1 ID I = 2 ID II = 3

PRINT HYD ID=5 CODE=1

*

* ROUTE BASINS TO POND 4 *

ROUTE RESERVOIR	ID=6 HYD NO=POND.4 INFLOW	ID=5 CODE=1
	OUTFLOW(CFS)	STORAGE(AC-FT) ELEVATION(FT)
	0.0000	0.0000 65.00
	0.0100	0.0650 67.83
	2.4100	0.0712 68.00
	6.3800	0.1150 69.00
	8.7000	0.1698 70.00

*

PRINT HYD ID=6 CODE=1

*

FINISH

AHYMO-S4 OUTPUT

RUN DATE (MON/DAY/YR)

INPUT FILE = S\Z_Drive\2022\2022055 Golf Course & Westside Blvd\Drainage\2022055-Hymo.txt USER NO.=

AHYMO_Temp_User:20122010

[illegible]

FUTURE

AHYMO-S4 INPUT

```

*****
*                                GOLF COURSE AND WESTSIDE (COMERCIAL)                                *
*****
*                                100-YEAR 6-HR STORM (UNDER FUTURE CONDITIONS)                        *
*****
*Zone 1                                                                    *
*NOAA ATLAS 14, VOLUME 1, VERSION 5                                        *
*LATITUDE: 35.2168°                                                       *
*LONGITUDE: -106.6758°                                                    *
*ELEVATION: 5184.48 FT                                                    *
*****
START                                TIME=0.0
*
*
RAINFALL                            TYPE=1 RAIN QUARTER=0.0 IN
                                    RAIN ONE=1.76 IN RAIN SIX=2.29 IN
                                    RAIN DAY=2.63 IN DT=0.15 HR
*
* D1.A
*
COMPUTE NM HYD                      ID=1 HYD NO=D1.A AREA=0.00240 SQ MI
                                    PER A=0.00 PER B=0.00 PER C=15.00 PER D=85.00
                                    TP=0.15 HR MASS RAINFALL=-1
PRINT HYD                          ID=1 CODE=1
*
* D1.B
*
COMPUTE NM HYD                      ID=2 HYD NO=D1.B AREA=0.00293 SQ MI
                                    PER A=0.00 PER B=0.00 PER C=15.00 PER D=85.00
                                    TP=0.15 HR MASS RAINFALL=-1
PRINT HYD                          ID=2 CODE=1
*
* D2
*
COMPUTE NM HYD                      ID=3 HYD NO=D2 AREA=0.00079 SQ MI
                                    PER A=0.00 PER B=0.00 PER C=10.00 PER D=90.00
                                    TP=0.15 HR MASS RAINFALL=-1
PRINT HYD                          ID=3 CODE=1
*
* D3.A
*
COMPUTE NM HYD                      ID=4 HYD NO=D3.A AREA=0.00223 SQ MI
                                    PER A=0.00 PER B=0.00 PER C=15.00 PER D=85.00
                                    TP=0.15 HR MASS RAINFALL=-1
PRINT HYD                          ID=4 CODE=1
*
* D3.B
*
COMPUTE NM HYD                      ID=5 HYD NO=D3.B AREA=0.00248 SQ MI
                                    PER A=0.00 PER B=0.00 PER C=15.00 PER D=85.00
                                    TP=0.15 HR MASS RAINFALL=-1
PRINT HYD                          ID=5 CODE=1
*

```


* ADD BASINS D2, D3.B

*

ADD HYD ID=6 HYD = 100.1 ID I = 3 ID II = 5

PRINT HYD ID=6 CODE=1

*

* ROUTE BASINS TO POND 1 *

ROUTE RESERVOIR	ID=7	HYD NO=POND.1	INFLOW ID=1	CODE=1
	OUTFLOW(CFS)	STORAGE(AC-FT)	ELEVATION(FT)	
	0.0000	0.0000	80.00	
	0.0100	0.0556	82.75	
	2.9500	0.0677	83.00	
	6.6100	0.1301	84.00	

PRINT HYD ID=7 CODE=1

*

* ROUTE BASINS TO POND 2 *

ROUTE RESERVOIR	ID=8	HYD NO=POND.2	INFLOW ID=2	CODE=1
	OUTFLOW(CFS)	STORAGE(AC-FT)	ELEVATION(FT)	
	0.0000	0.0000	70.00	
	0.0100	0.0594	72.75	
	2.9500	0.0697	73.00	
	6.6100	0.1210	74.00	

PRINT HYD ID=8 CODE=1

*

* ROUTE BASINS TO POND 3 *

ROUTE RESERVOIR	ID=9	HYD NO=POND.3	INFLOW ID=4	CODE=1
	OUTFLOW(CFS)	STORAGE(AC-FT)	ELEVATION(FT)	
	0.0000	0.0000	82.00	
	0.0100	0.0499	84.50	
	2.6700	0.0741	85.00	
	4.6300	0.1393	86.00	

PRINT HYD ID=9 CODE=1

*

* ROUTE BASINS TO POND 4 *

ROUTE RESERVOIR	ID=10	HYD NO=POND.4	INFLOW ID=6	CODE=1
	OUTFLOW(CFS)	STORAGE(AC-FT)	ELEVATION(FT)	
	0.0000	0.0000	65.00	
	0.0100	0.0650	67.83	
	2.4100	0.0712	68.00	
	6.3800	0.1150	69.00	
	8.7000	0.1698	70.00	

*

PRINT HYD ID=10 CODE=1

*

* ADD BASINS

*

ADD HYD	ID =11	HYD = 100.2	ID I = 7	ID II = 8
ADD HYD	ID =12	HYD = 100.3	ID I =11	ID II = 9
ADD HYD	ID =13	HYD = 100.4	ID I =12	ID II = 10

FUTURE

AHYMO-S4 OUTPUT

AHYMO PROGRAM SUMMARY TABLE (AHYMO-S4)

- Ver. S4.01a, Rel: 01a

RUN DATE

(MON/DAY/YR) =03/29/2023

INPUT FILE = ve\2022\2022055 Golf Course & westside Blvd\Drainage\2022055-Hymo-Future.txt USER NO.=
AHYMO_Temp_User:20122010

PAGE = 1		FROM	TO		PEAK	RUNOFF		TIME TO	CFS
COMMAND	HYDROGRAPH	ID	ID	AREA	DISCHARGE	VOLUME	RUNOFF	PEAK	PER
NOTATION	IDENTIFICATION	NO.	NO.	(SQ MI)	(CFS)	(AC-FT)	(INCHES)	(HOURS)	ACRE
START									
TIME= 0.00									
RAINFALL TYPE= 1 NOAA 14									
RAIN6= 2.290									
COMPUTE NM HYD	D1.A	-	1	0.00240	6.04	0.241	1.88222	1.500	3.931
PER IMP= 85.00									
COMPUTE NM HYD	D1.B	-	2	0.00293	7.37	0.294	1.88222	1.500	3.931
PER IMP= 85.00									
COMPUTE NM HYD	D2	-	3	0.00079	2.03	0.081	1.93412	1.500	4.008
PER IMP= 90.00									
COMPUTE NM HYD	D3.A	-	4	0.00223	5.61	0.224	1.88222	1.500	3.931
PER IMP= 85.00									
COMPUTE NM HYD	D3.B	-	5	0.00248	6.24	0.249	1.88222	1.500	3.931
PER IMP= 85.00									
ADD HYD	100.10	3& 5	6	0.00327	8.27	0.330	1.89457	1.500	3.949
ROUTE RESERVOIR	POND.1	1	7	0.00240	4.10	0.241	1.88199	1.650	2.668
AC-FT= 0.087									
ROUTE RESERVOIR	POND.2	2	8	0.00293	5.21	0.294	1.88204	1.650	2.781
AC-FT= 0.101									
ROUTE RESERVOIR	POND.3	4	9	0.00223	3.21	0.224	1.88203	1.650	2.249
AC-FT= 0.092									
ROUTE RESERVOIR	POND.4	6	10	0.00327	6.01	0.330	1.89437	1.650	2.869
AC-FT= 0.111									
ADD HYD	100.20	7& 8	11	0.00533	9.31	0.524	1.84164	1.650	2.730
ADD HYD	100.30	11& 9	12	0.00756	12.52	0.742	1.84118	1.650	2.588
ADD HYD	100.40	12&10	13	0.01083	18.53	1.066	1.84604	1.650	2.673

APPENDIX B

GUTTER DEPTH CALCULATION,
STORM DRAIN AND INLET SCHEMEMATIC MAP

Private Road Gutter Calculations

Project Description		
Friction Method	Manning Formula	
Solve For	Normal Depth	
Input Data		
Channel Slope	0.065 ft/ft	
Discharge	2.03 cfs	

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.67
0+00	0.67
0+01	0.00
0+03	0.13
0+16	0.38
0+29	0.13
0+31	0.00
0+31	0.67
0+31	0.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.67)	(0+31, 0.67)	0.017

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.1 in
Roughness Coefficient	0.017
Elevation	0.17 ft
Elevation Range	0.0 to 0.7 ft
Flow Area	0.6 ft²
Wetted Perimeter	9.4 ft
Hydraulic Radius	0.7 in
Top Width	9.07 ft
Normal Depth	2.1 in
Critical Depth	2.8 in
Critical Slope	0.010 ft/ft
Velocity	3.49 ft/s
Velocity Head	0.19 ft

Private Road Gutter Calculations

Results	
Specific Energy	0.36 ft
Froude Number	2.434
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.1 in
Critical Depth	2.8 in
Channel Slope	0.065 ft/ft
Critical Slope	0.010 ft/ft

Private Road Gutter Calculation CS

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.065 ft/ft
Normal Depth	2.1 in
Discharge	2.03 cfs

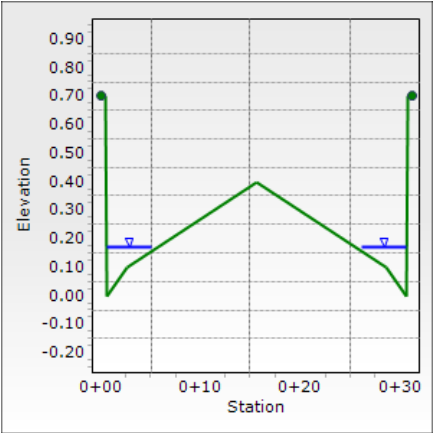
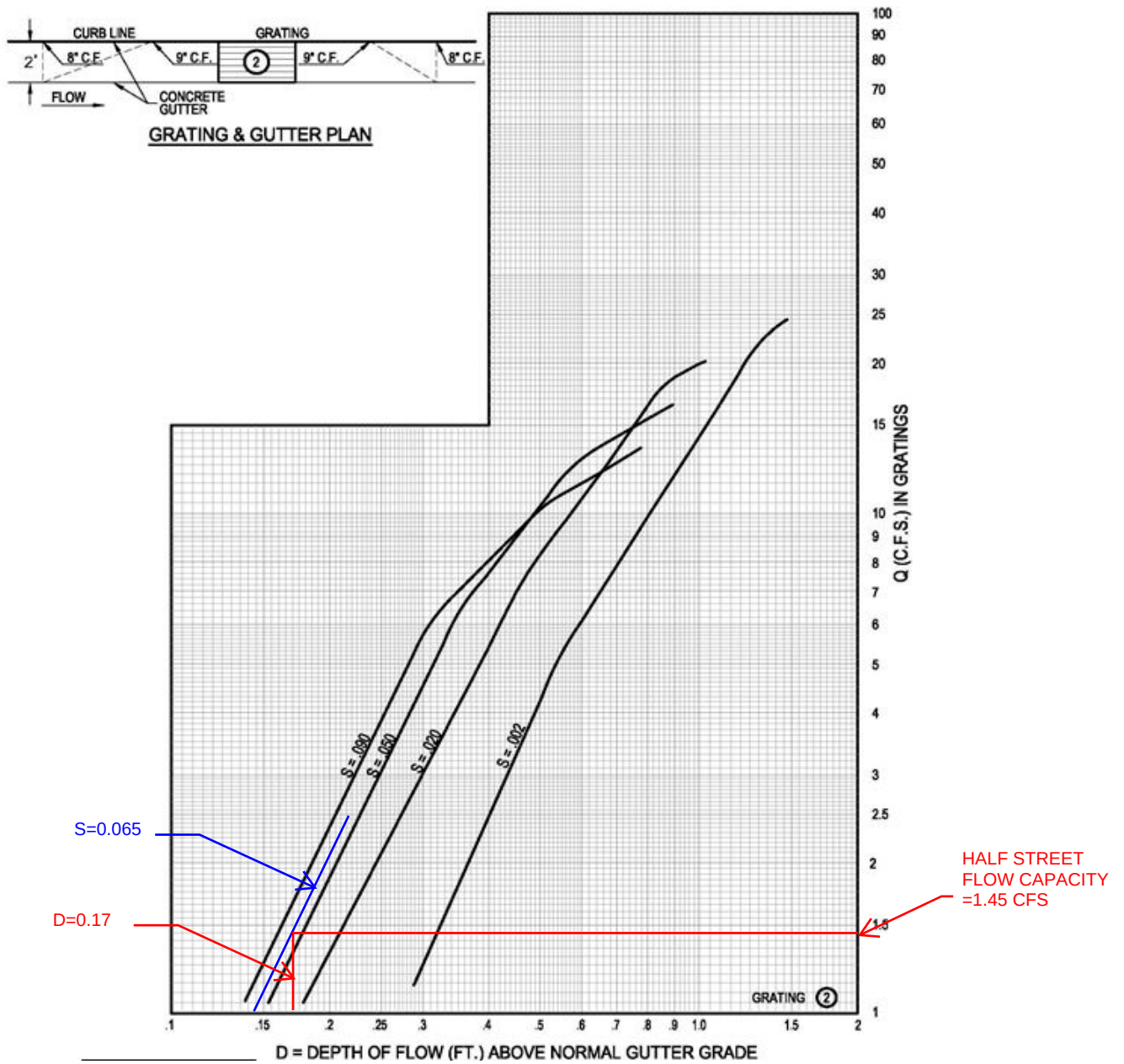
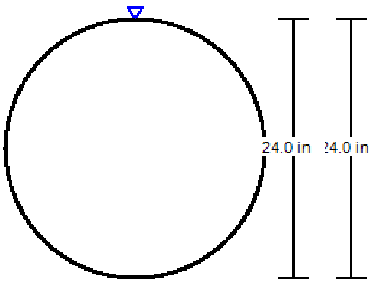


FIGURE 6.9.9 Grate Capacities for Types "A," "C," and "D"



STORM DRAIN PIPE A CAPACITY

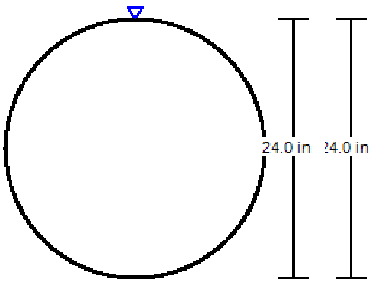
Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.040 ft/ft
Normal Depth	24.0 in
Diameter	24.0 in
Discharge	45.24 cfs



V: 1
H: 1

STORM DRAIN PIPE B CAPACITY

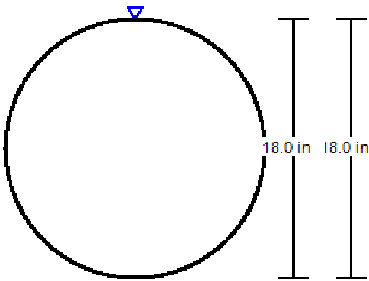
Project Description	
Friction Method	Manning
	Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.021 ft/ft
Normal Depth	24.0 in
Diameter	24.0 in
Discharge	32.78 cfs



V: 1
H: 1

STORM DRAIN PIPE C CAPACITY

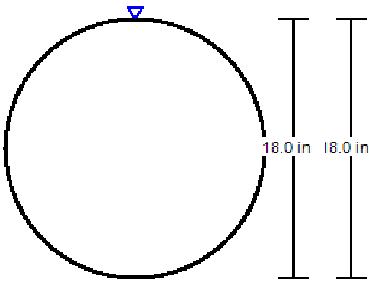
Project Description	
Friction Method	Manning
	Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.023 ft/ft
Normal Depth	18.0 in
Diameter	18.0 in
Discharge	15.93 cfs



V: 1
H: 1

STORM DRAIN PIPE D CAPACITY

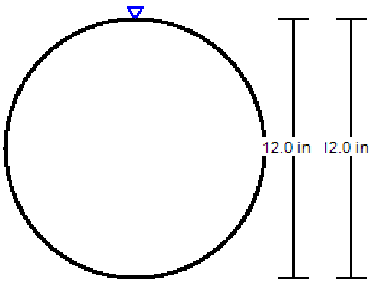
Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.020 ft/ft
Normal Depth	18.0 in
Diameter	18.0 in
Discharge	14.85 cfs



V: 1
H: 1

STORM DRAIN PIPE E CAPACITY

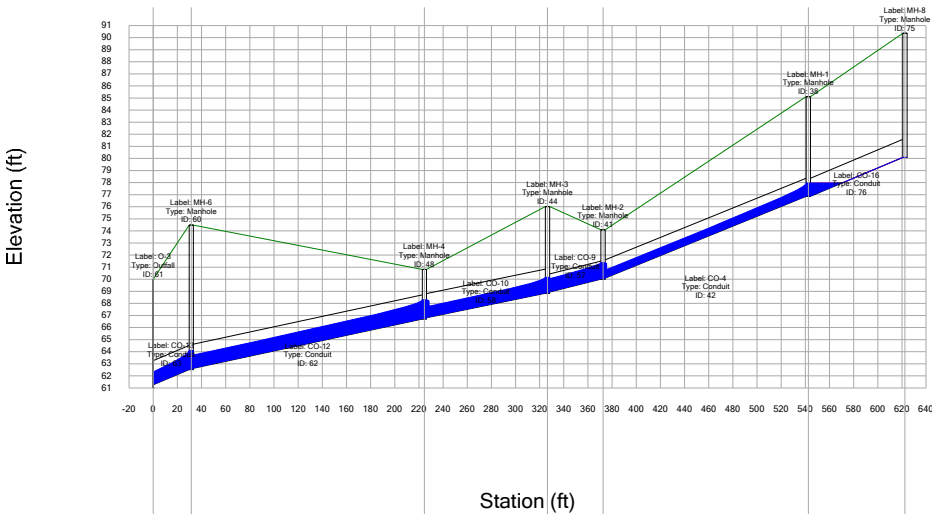
Project Description	
Friction Method	Manning
	Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.010
Channel Slope	0.030 ft/ft
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	8.02 cfs



V: 1
H: 1

Profile Report
Profile: Profile - 1

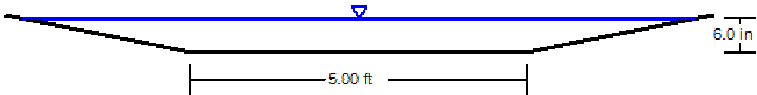
FULLY DEVELOPED CONDITION
Profile - 1 - Base



ID/Label	63 \ CO-13	62 \ CO-12	58 \ CO-10	57 \ CO-9	42 \ CO-4	76 \ CO-16
Link Length (ft)	31.5	193.0	102.0	46.0	170.0	80.0
Rise (in)/Material	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	18.0 \ Concrete	18.0 \ Concrete	18.0 \
Flow (cfs)	19.50	19.50	13.54	13.54	8.09	0.00
Slope (ft/ft)	0.040	0.021	0.020	0.023	0.040	0.040
ID/Label	61 \ CO-80 \ MH-6	48 \ MH-4	44 \ MH-3 \ 41 \ MH-2	38 \ MH-1	75 \ MH-8	
Ground (ft)	70.00	74.48	70.81	76.01	74.10	85.11
Invert (ft)	61.00	62.52	66.71	68.84	70.00	76.85
Station (ft)	0.0	31.5	224.5	325.5	372.5	542.5

EMERGENCY SPILLWAY CAPACITY

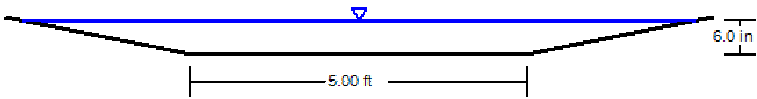
Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.041
Channel Slope	0.100 ft/ft
Normal Depth	6.0 in
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	5.00 ft
Discharge	22.20 cfs



V: 1
H: 1

ROCK SWALE CAPACITY

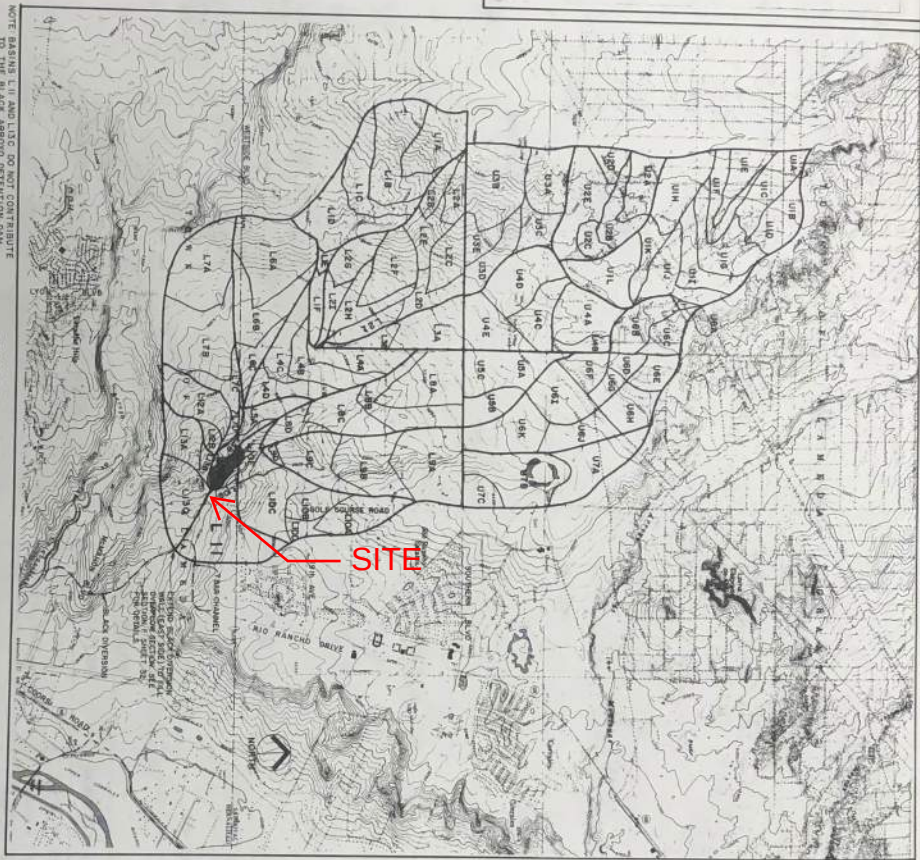
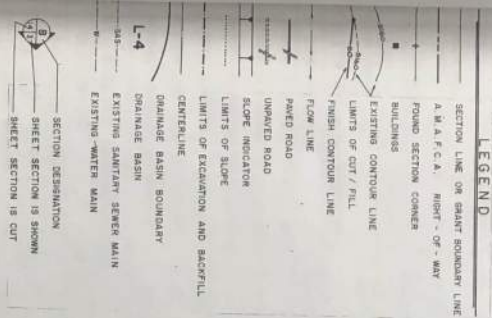
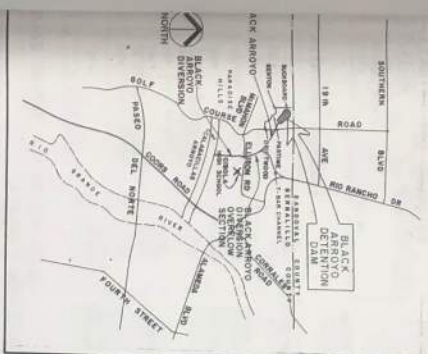
Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.041
Channel Slope	0.020 ft/ft
Normal Depth	6.0 in
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	5.00 ft
Discharge	9.93 cfs



V: 1
H: 1

APPENDIX C

PAGES FROM BLACK ARROYO DRAINAGE REPORT



NOTE: BASINS I, II AND LIST DO NOT CONTRIBUTE TO BLACK ARROYO DETENTION DAM WATERSHED.

DRAINAGE AREA MAP

Scale: 1" = 1,000'

GENERAL NOTES

1. New Mexico State Highway Department Standard Specifications for Road and Bridge Construction, Edition of 1987, and supplemental sheets and amendments thereto shall govern construction of this project.
2. Gravel pit borrow areas shall be approved by the State Engineer.
3. All drawings for the San and Chama refer to the approved horizontal distance, left and right of stationing are shown in the location of crossing notes.
4. Elevation are shown in feet above mean sea level datum.
5. Where site fence is shown along property lines, construct the property line of the fence posts 416 (6) inches to the inside of the fence.
6. When coordinates are shown, herein (N.T.C.) they refer to the new Mexico State Plane Coordinate system. Coordinates are based on the ground 0.999993, and state grid bearings. Grid distance - field distance + 0.000007.
7. Additional construction at site gates and only gates shall be considered incidental to the cost of the construction of the fence.
8. All construction shall be in accordance with the plans for this project.
9. All materials from excavation or borrow which require more than one haul shall be transported to the site in accordance with the plans for this project. No separate payment shall be made for haul for unsatisfied excavation. No separate payment shall be made for haul for unsatisfied excavation. No separate payment shall be made for haul for unsatisfied excavation. No separate payment shall be made for haul for unsatisfied excavation.
10. Contractors' campers, and any other detached areas not included on the plans shall be treated with Class "C" seedling, and no movement of soil shall be made.
11. The Air Pollution Control Board of the Albuquerque Metropolitan County Air Quality Control Board limit emission of the construction to satisfy these restrictions. It is the responsibility of the contractor to obtain the necessary permits from the Air Pollution Control Board prior to substantial of bids to avoid conflict with existing, as required for construction and dust control shall be provided. No separate payment shall be made for dust control equipment for dust pollution abatement as directed by the Air Pollution Control Board. No separate payment shall be made for dust pollution abatement as directed by the Air Pollution Control Board.
12. The contractor will be responsible to replace at his own expense any property or crops destroyed in the process of construction. All property shall be replaced to its original condition. All property shall be replaced to its original condition. All property shall be replaced to its original condition.
13. No person, other than the owner, shall be allowed to dispose of material on the site.
14. All construction shall be in accordance with the plans for this project.
15. The contractor shall supply all labor, equipment, materials, insurance, bonds and permits necessary to carry out the removal of material from the site. The contractor shall be responsible for the removal of material from the site. The contractor shall be responsible for the removal of material from the site.
16. This project is constructed under the authority of the State Engineer, State of New Mexico. The State Engineer, or his designated representative, shall have the right to inspect and approve all construction, and full power to act if specifications are not during construction, and full power to act if specifications are not during construction, and full power to act if specifications are not during construction.
17. Minor changes in elevation and slopes for excavation and fill may be made to suit field conditions as approved by the Project Manager.

RECORD DRAWINGS

DATE: 11/1/82

BLACK ARROYO DETENTION DAM
DRAINAGE AREA MAP
GENERAL NOTES & LEGEND

ALBUQUERQUE METROPOLITAN AIR QUALITY CONTROL AUTHORITY

30/03/202 10:00 AM 7/30

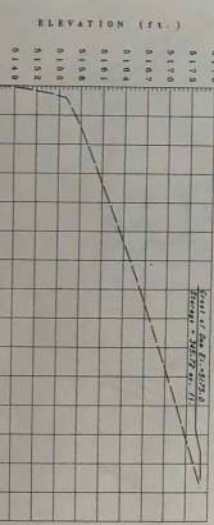
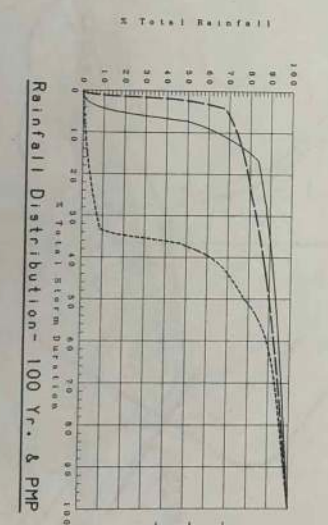
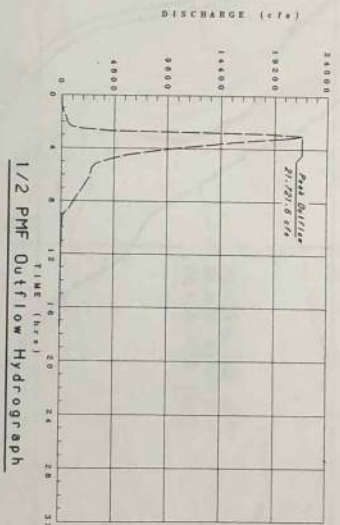
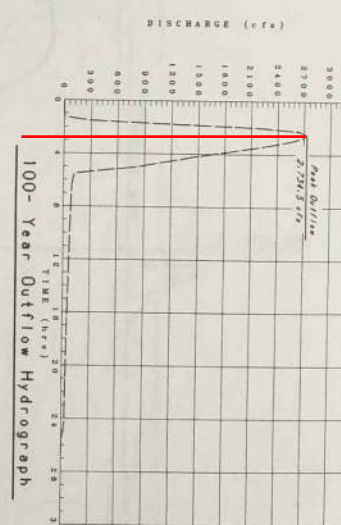
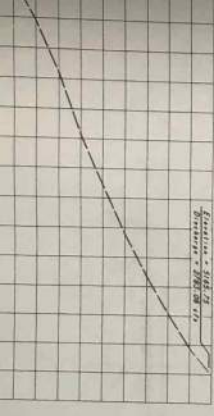
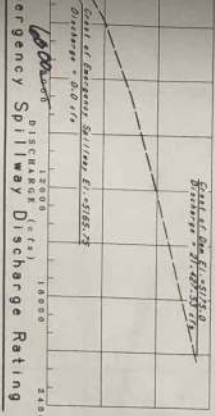
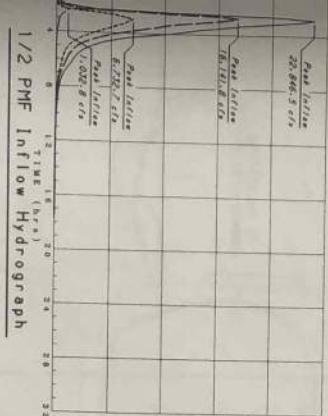
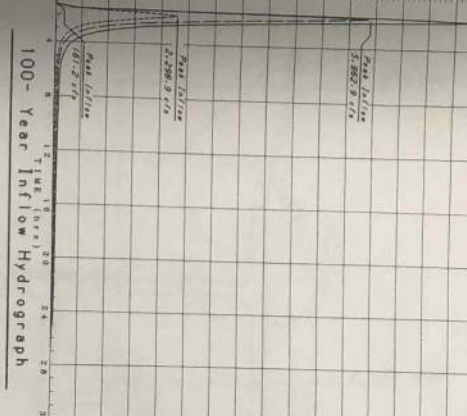
TABLE 6
ULTIMATE DEVELOPMENT CONDITION
DISCHARGE TABLE
HYDROLOGIC ANALYSIS FOR BLACK ARROYO

BASIN	AREA (SQ. MI.)	TIME TO PEAK (HRS.)	CN=95 IMPERVIOUS AREA (SQ. MI.)			SCS CURVE NO. (PERV.)	100-YEAR DISCHARGE RATE (CFS)			
			SCE.1	SCE.2	SCE.3		SCEN. 1	SCEN. 2	SCEN. 3	SCEN. 4
U1	1.20	.591	.42	.42	.42	69	808	808	808	808
U2	.48	.292	.17	.17	.17	64	481	481	481	481
U3	.66	.325	.23	.23	.23	67	655	655	655	655
U4	.59	.300	.21	.21	.21	67	624	624	624	624
U5	.31	.239	.11	.11	.11	67	372	372	372	372
U6	.95	.523	.33	.33	.33	67	673	673	673	673
U7	.39	.401	.14	.14	.14	67	344	344	344	344
L1	.781	.447	.172	.258	.344	70	526	649	774	371
L2	.804	.409	.177	.265	.354	65	517	659	805	337
L3	.194	.331	.043	.064	.085	67	145	184	223	96
L4	.388	.298	.09	.128	.171	65	290	373	463-120*	179
L5	.074	.169	.016	.024	.033	63	67	88	112	41
L6	.524	.288	.115	.173	.231	66	409	528	647	264
L7	.574	.334	.126	.189	.253	63	366	492	619	212
L12	.194	.271	.043	.064	.085	59	124	173	223	62
L8	.554	.438	.122	.183	.244	65	316	414	512	193
L9	.534	.433	.117	.176	.235	66	318	411	506	202
L10	.574	.387	.126	.189	.253	68	399	503	610	270
L13	.264	.265	.058	.087	.116	64	201	265	330	122
L11	.214	.239	.047	.071	.094	63	166	222	277	98

Analysis Point 1	1345	1345	1345	1345
Analysis Point 2	624	624	624	624
Analysis Point 3	976	976	976	976
Analysis Point 4	2826	3298	3797-3579*	2278
Analysis Point 5	1691	1952	2206	1381
Analysis Point 6	4498	5239	5794-5759*	3639
Analysis Point 7	4506	5268	5826*	3608
		6061		

Downstream of Confluence with 7-Bar	5293	6095	6666* 6922	4319
---	------	------	---------------	------

* Error in L4



WATER SURFACE ELEVATION (ft.)	SURFACE AREA (ac.)	CUMULATIVE VOLUME (ac-ft.)
5146	0	0
5148	3.63	3.63
5150	8.80	12.43
5152	17.71	30.14
5154	27.12	57.26
5156	37.16	94.42
5158	47.80	142.22
5160	59.15	201.37
5162	71.21	272.58
5164	83.98	356.56
5165.75	97.45	454.01
5166	111.72	565.73
5168	126.80	692.53
5170	142.68	835.21
5172	159.35	994.56
5174	176.80	1171.36
5175	195.00	1366.36

NOTE: Future Configuration Hydrology assumes Fully Developed Conditions. See Reference 2 for further details.

* Includes sediment storage

** Does not include sediment storage

Sediment pool capacity = 34.50 ac-ft.

Flood water storage (1) = 269.53 ac-ft.

Flood water storage (2) = 440.00 ac-ft.

(1) To emergency spillway crest

(2) To top of dam

100-year pool elevation = 5165.20

1/2 PMF pool elevation = 5174.10

Top of dam effective elevation = 5175.00

Emergency spillway crest effective elevation = 5165

Sediment pool elevation = 5151.63

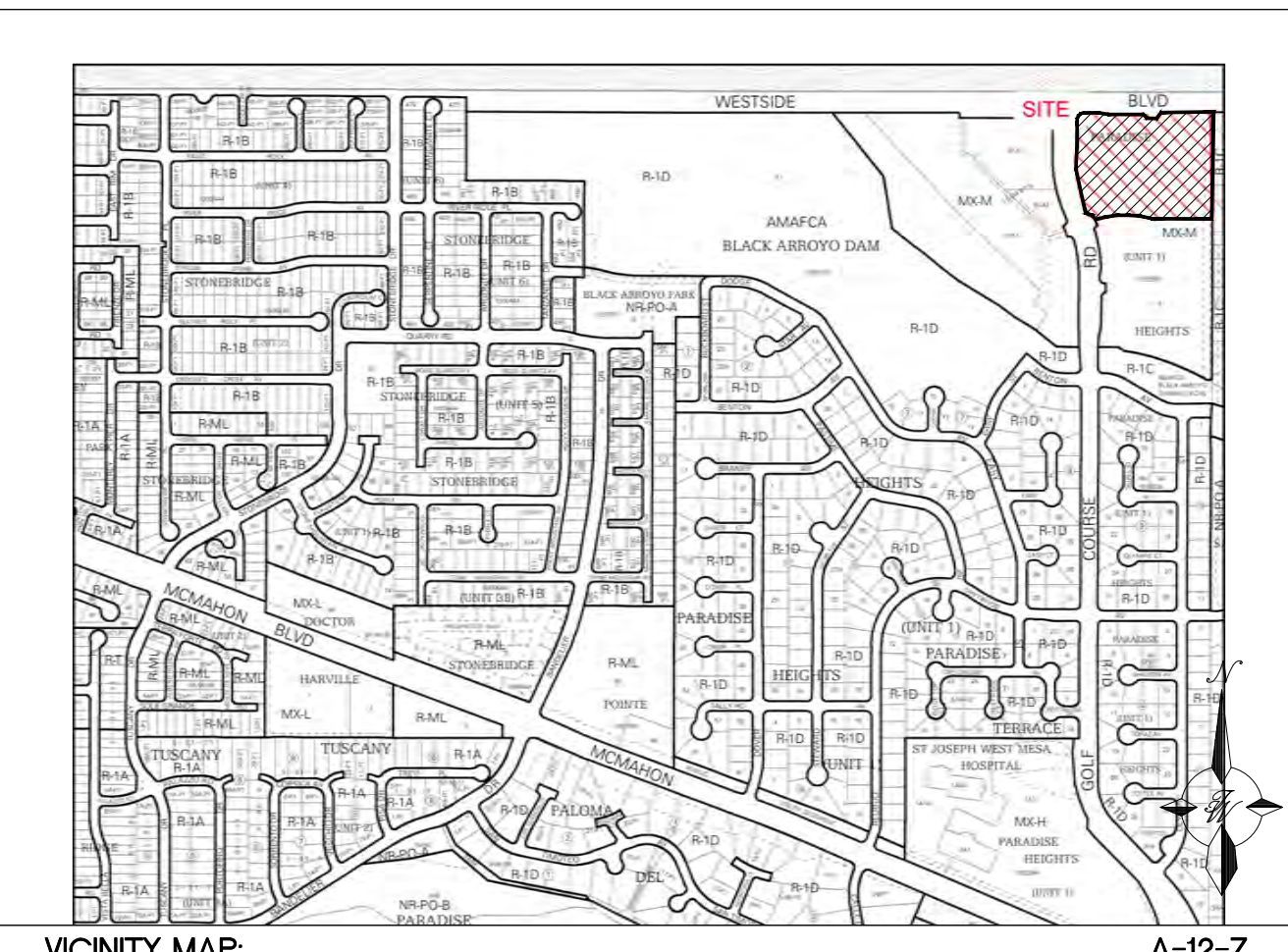
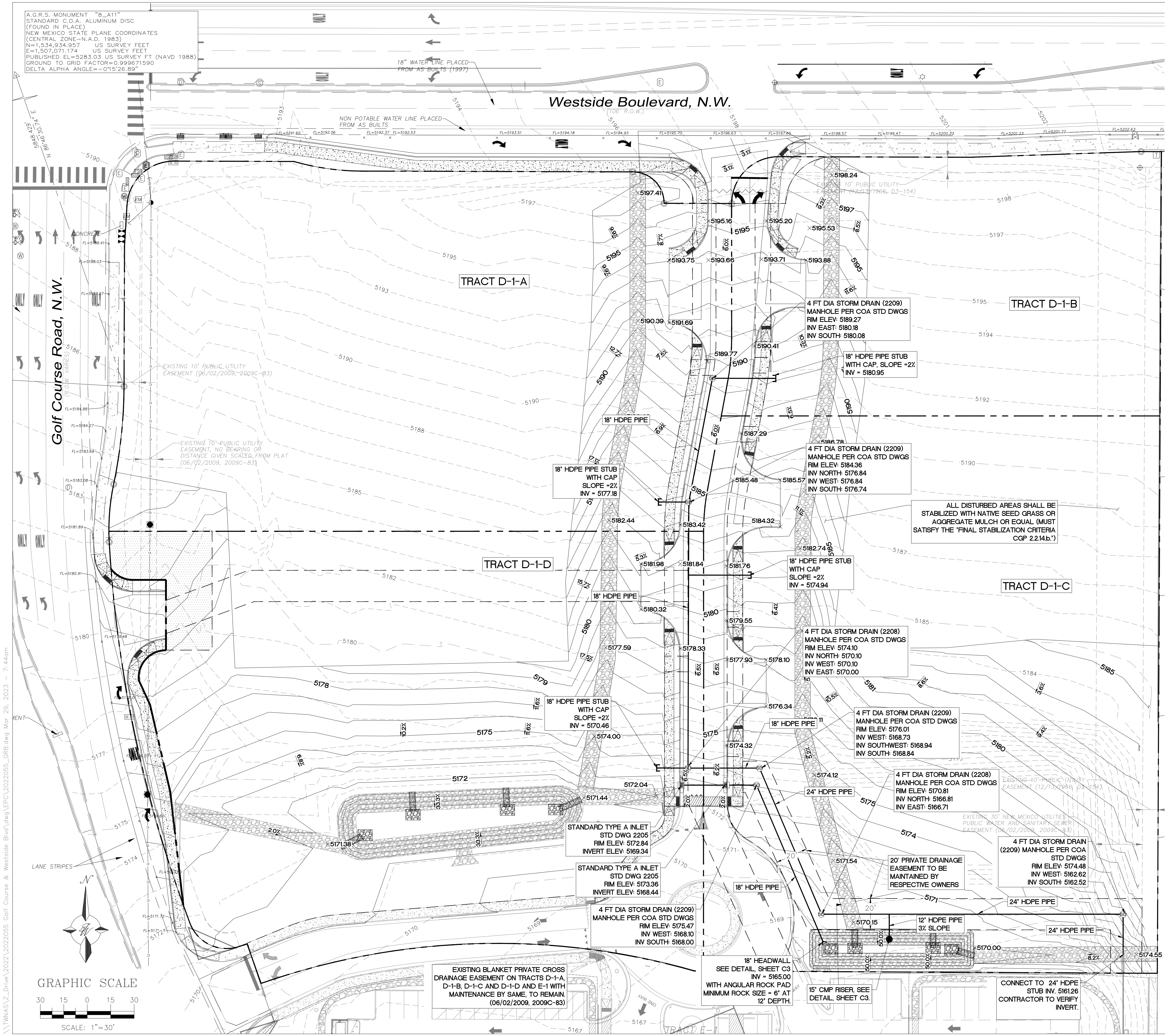
Principal spillway inlet elevation = 5146.00

- REFERENCES:**
- SECTION 22.2, HYDROLOGY OF THE DEVELOPMENT, PROCESS MANUAL VOLUME 2, DESIGN CRITERIA FOR THE CITY OF ALBUQUERQUE, NEW MEXICO, FEBRUARY 1991.
 - BLACK ARROYO FINAL HYDROLOGY, SEDIMENT ISSUES, BOHANNAN - HUSTON INC., AUGUST 1990.
 - GEOTECHNICAL INVESTIGATION BLACK ARROYO DETENTION BASIN, VINYARD & ASSOCIATES, INC., MAY 1991.
 - AN ANALYSIS OF THE BIOLOGY, ARCHAEOLOGY AND NATURAL HISTORY OF BLACK ARROYO, CALIFORNIA DEPARTMENT OF WATER RESOURCES, 1990.
 - BLACK ARROYO DETENTION BASIN ADDITIONAL CALCULATIONS, ADDENDUM TO FINAL, BLACK ARROYO PROJECT, COURSE ROAD TO NORTH OF THE COUNTY LINE, SEPTEMBER 1990.
 - "FINAL" BLACK ARROYO PROJECT, COURSE ROAD TO NORTH OF THE COUNTY LINE, BOHANNAN - HUSTON INC., SEPTEMBER 1990.
 - "FINAL" BLACK ARROYO DETENTION DAM FINAL CALCULATIONS.
 - "BLACK ARROYO DETENTION DAM FINAL CALCULATIONS."

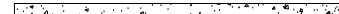
BLACK ARROYO DETENTION HYDROLOGY DATA

ALBUQUERQUE METEOROLOGICAL AUTHORITY

ARROYO FLOOD CONTROL AUTHORITY



LEGAL DESCRIPTION:
TR D-1 PLAT OF TRS D-1, E-1 AMAFCA BLACK ARROYOCHANNEL ROW PARADISE HEIGHTS UNIT 1 CONT 7.6716 AC

LEGEND		
	CURB & GUTTER	x 5048.25
	BOUNDARY LINE	
	EASEMENT	
	CENTERLINE	
	BUILDING	
	SIDEWALK	
	SCREEN WALL	x 5048.25
	CONTOUR MAJOR	
	CONTOUR MINOR	
		SPOT ELEVATION
		FLOW ARROW
		EXISTING CURB & GUTTER
		EXISTING BOUNDARY LINE
		EXISTING CONTOUR MAJOR
		EXISTING CONTOUR MINOR
		EXISTING SPOT ELEVATION
		STORM DRAIN (18"–24")
		GRADE BREAK

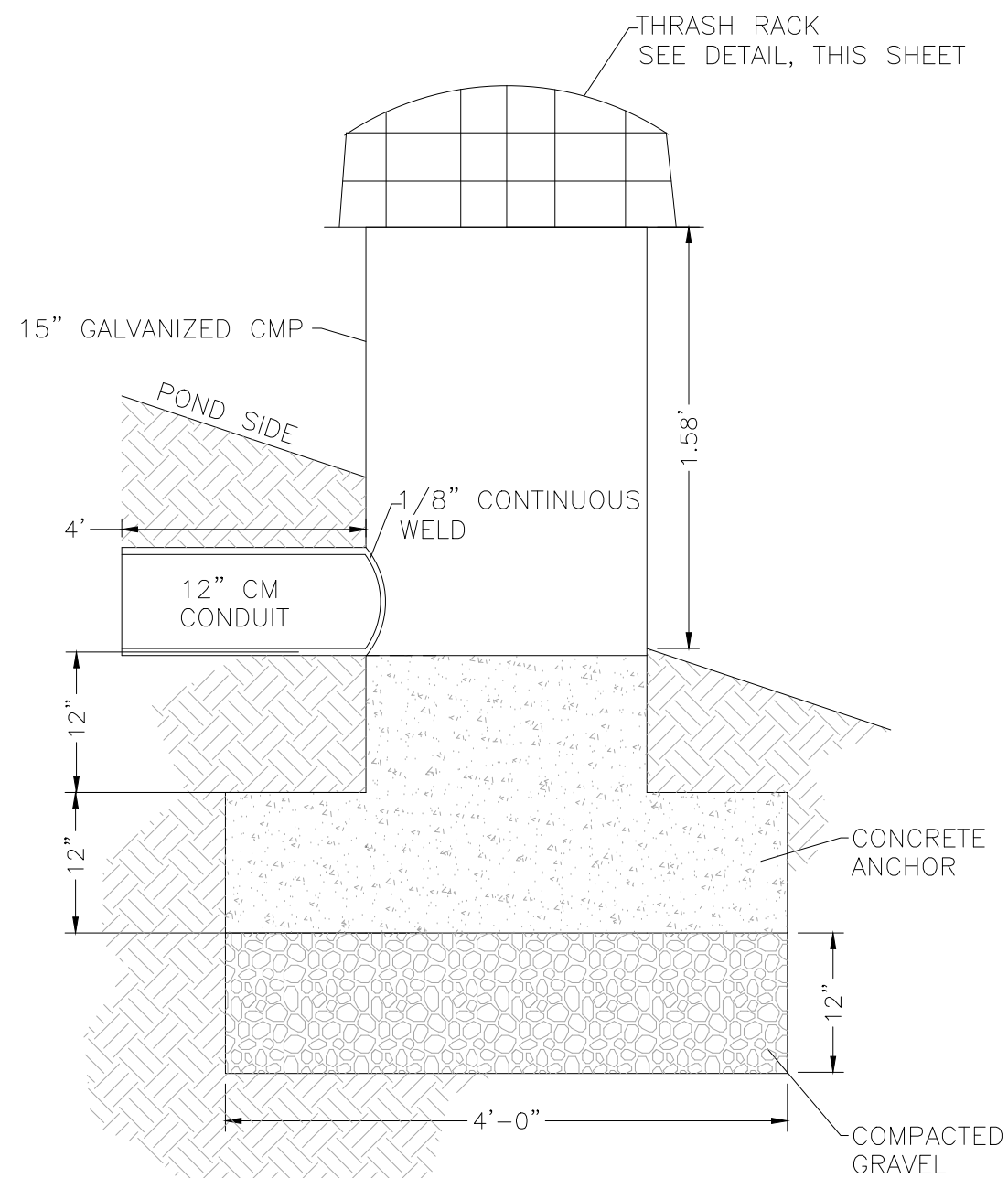
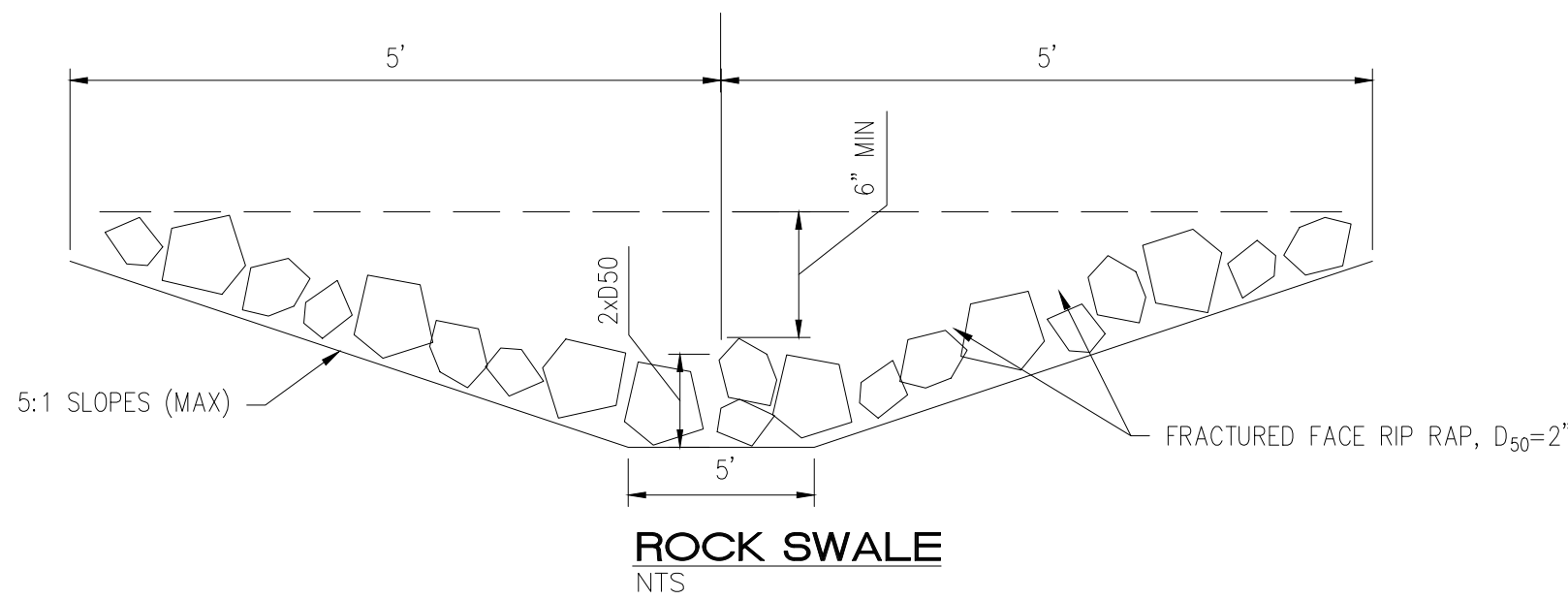
- NOTICE TO CONTRACTORS**
- ALL WORK IN THE RIGHT-OF-WAY SHALL BE INCLUDED IN A WORK ORDER.
 - BUILD SIDEWALK CULVERT PER COA STD DWG 2236.
 - CONTACT STORM DRAIN MAINTENANCE AT (505) 857-8033 TO SCHEDULE A MEETING PRIOR TO FORMING.
 - AN EXCAVATION PERMIT WILL BE REQUIRED BEFORE BEGINNING ANY WORK WITHIN CITY RIGHT-OF-WAY.
 - ALL WORK ON THIS PROJECT SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL LAWS, RULES AND REGULATIONS CONCERNING CONSTRUCTION SAFETY AND HEALTH.
 - TWO WORKING DAYS PRIOR TO ANY EXCAVATION, THE CONTRACTOR MUST CONTACT **NEW MEXICO ONE CALL, DIAL "811"** (OR (505) 260-1990) FOR THE LOCATION OF EXISTING UTILITIES.
 - PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL EXCAVATE AND VERIFY THE LOCATIONS OF ALL OBSTRUCTIONS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL NOTIFY THE ENGINEER SO THAT THE CONFLICT CAN BE RESOLVED WITH A MINIMUM AMOUNT OF DELAY.
 - BACKFILL COMPACTION SHALL BE ACCORDING TO TRAFFIC/STREET USE.
 - MAINTENANCE OF THE FACILITY SHALL BE THE RESPONSIBILITY OF THE OWNER OF THE PROPERTY BEING SERVED.
 - WORK ON ARTERIAL STREETS MAY BE REQUIRED ON A 24-HOUR BASIS.
 - CONTRACTOR MUST CONTACT STORM DRAIN MAINTENANCE AT (505) 857-8033 TO SCHEDULE A CONSTRUCTION INSPECTION. FOR EXCAVATING AND BARRICADING INSPECTIONS, CONTACT CONSTRUCTION COORDINATION AT (505) 924-3416.

SPOT ELEVATION NOTE:
ALL SPOT ELEVATIONS ARE FLOW LINE UNLESS OTHERWISE NOTED.

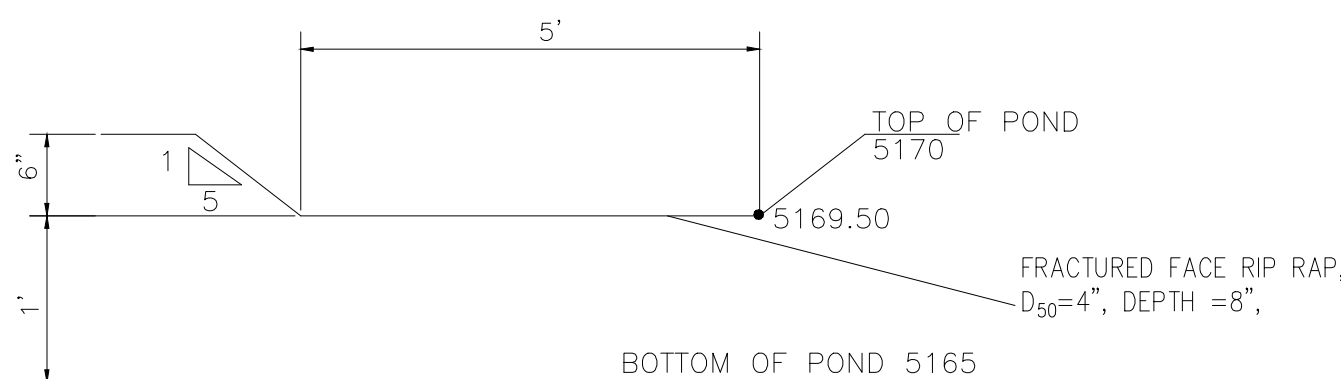
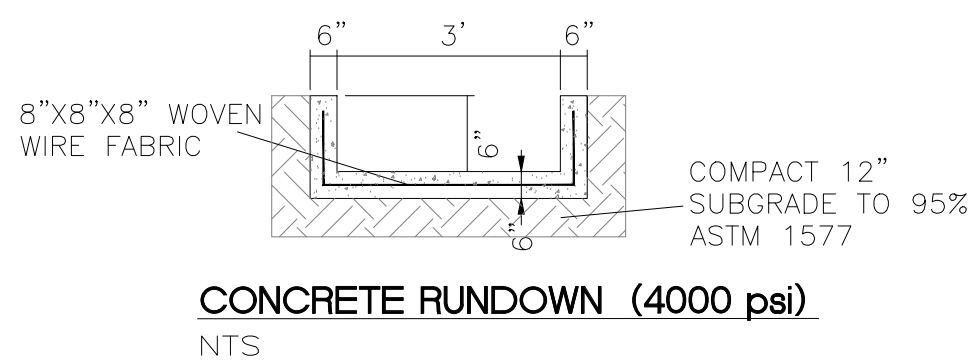
CAUTION
ALL EXISTING UTILITIES/TOPOGRAPHY SHOWN WERE OBTAINED FROM RESEARCH, AS-BUILTS, SURVEYS OR INFORMATION PROVIDED BY OTHERS. IT SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO CONDUCT ALL NECESSARY FIELD INVESTIGATIONS PRIOR TO AND INCLUDING ANY EXCAVATION, TO DETERMINE THE ACTUAL LOCATION OF UTILITIES AND OTHER IMPROVEMENTS, PRIOR TO STARTING THE WORK. ANY CHANGES FROM THIS PLAN SHALL BE COORDINATED WITH AND APPROVED BY THE ENGINEER.



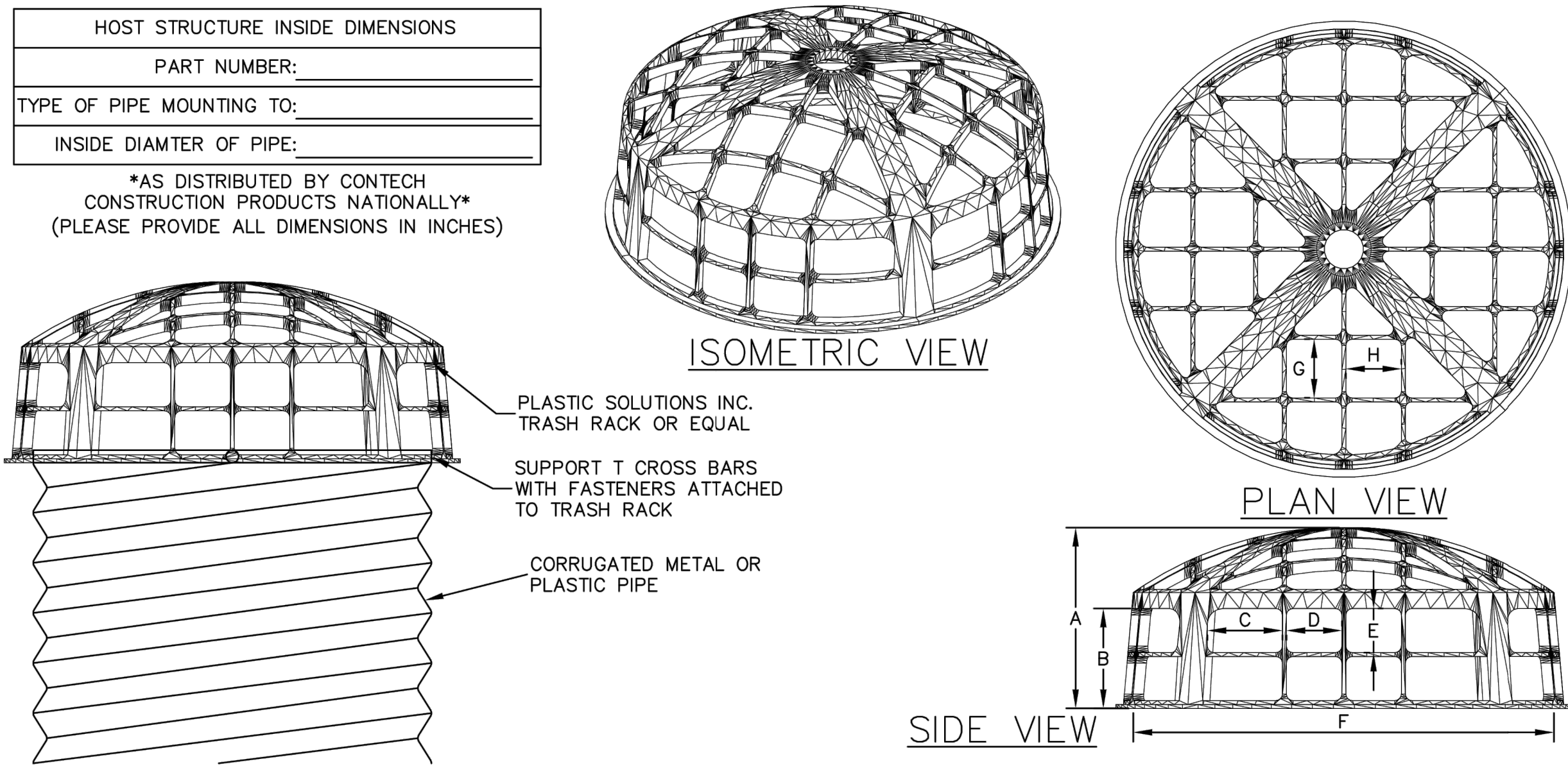
ENGINEER'S SEAL  RONALD R. BOHANNAN P.E. # 7868	GOLF COURSE + WESTSIDE ALBUQUERQUE, NM	DRAWN BY RG
	STORM DRAIN PLAN	DATE 03/14/2023
		2022055_GRB
03/29/2023	 TIERRA WEST, LLC 5571 MIDWAY PARK PLACE NE ALBUQUERQUE, NM 87109 (505) 858-3100 www.tierrawestllc.com	SHEET # C2
RONALD R. BOHANNAN P.E. # 7868		JOB # 2022055



CMP RISER DETAIL
NTS



DETENTION POND
EMERGENCY SPILLWAY DETAIL
NTS



ROUND SERIES TRASH RACKS										
RISER										
PART NO.	CONCRETE INSIDE DIA.	CMP OR HDPE NOMINAL DIA.	A	B	C	D	E	F	G	H
RS-24	24"ø	12"ø-18"ø	17 1/3"	13 1/3"	7 3/4"	6 1/4"	6 1/4"	27 1/2"	6 1/4"	7 1/2"
RS-36	36"ø	21"ø-30"ø	21 1/8"	13 1/2"	6 1/4"	6 1/4"	6 1/4"	40 1/2"	6 1/4"	7 1/2"
RS-48	48"ø	33"ø-42"ø	27 3/4"	17 3/4"	7"	8 1/2"	6 3/4"	54 1/4"	8 1/2"	9"
RS-60	60"ø	48"ø-54"ø	27 3/4"	17 3/4"	11 1/2"	8 1/2"	6 3/4"	67 1/2"	8 1/2"	9"



CUSTOMER:

PROJECT:

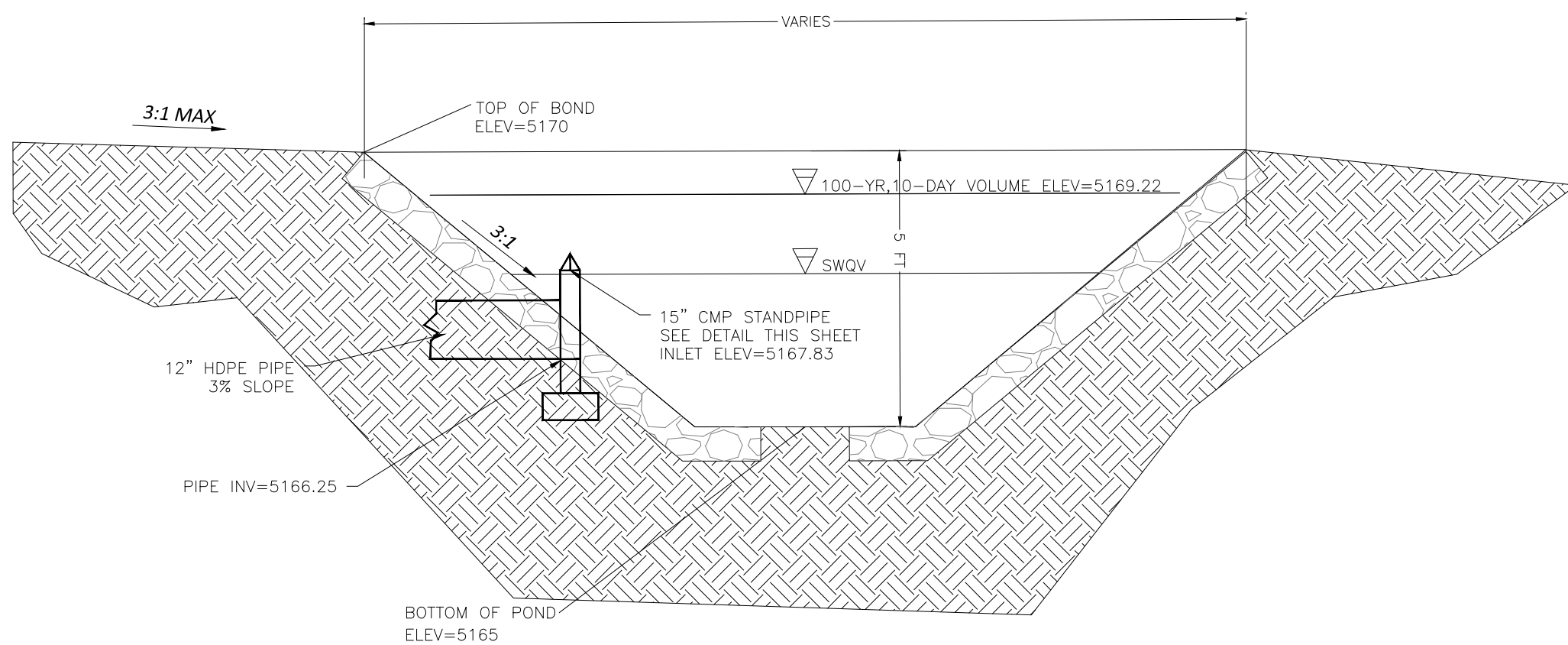
DATE:

DRAWN BY:

APP'D BY:

DETAIL:

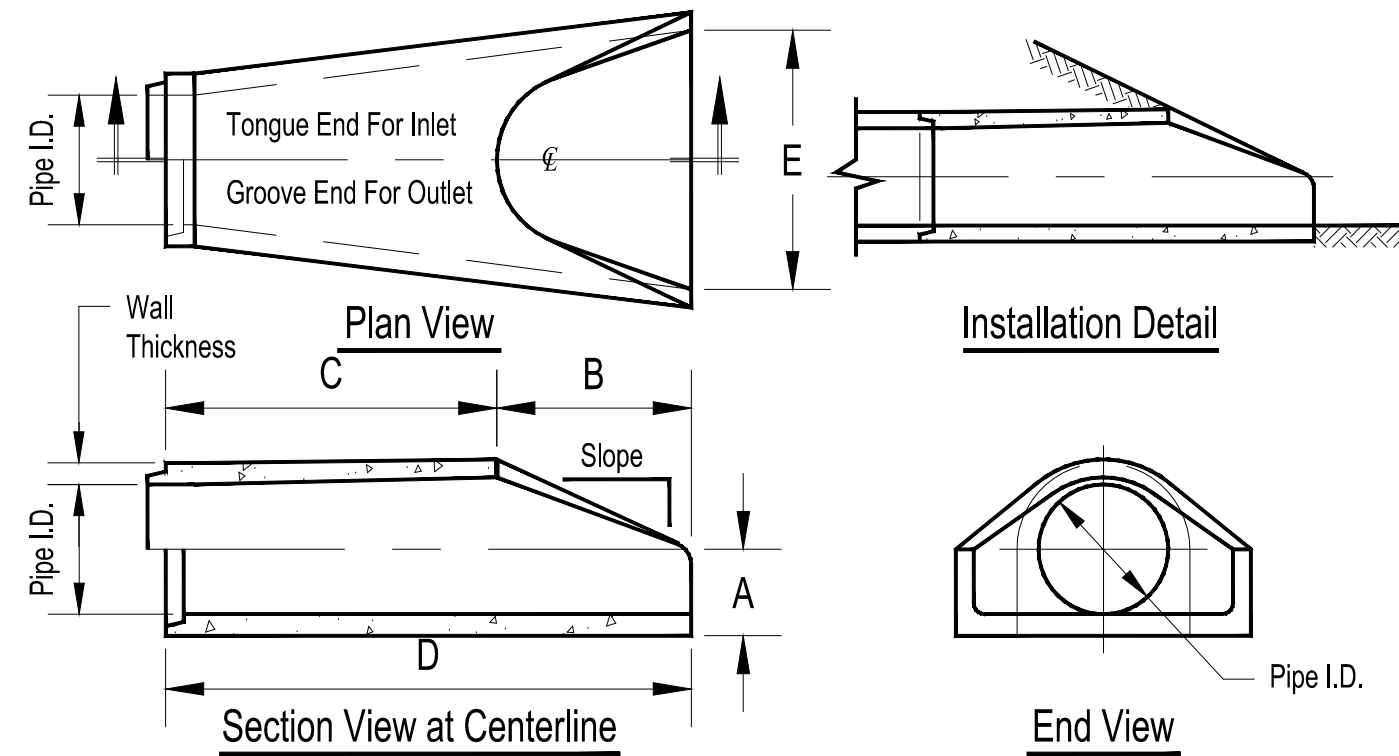
THRASH RACK (OR SIMILAR)
NTS



SECTION A (DETENTION POND DETAIL)
NTS



Flared End Section 12" - 72" Diameter Pipe



Pipe Inner Diameter (inches)	Wall Thickness (inches)	A (inches)	B (inches)	C (inches)	D (inches)	E (inches)	Slope
12	2	4	24	48 7/8	72 7/8	30	3:1
15	2 1/4	6	27	46	73	30	3:1
18	2 1/2	9	27	46	73	36	3:1
24	3	9 1/2	43 1/2	30	73 1/2	48	3:1
30	3 1/2	12	54	19 3/4	73 3/4	60	3:1
36	4	15	63	34 3/4	97 3/4	72	3:1
42	4 1/2	21	63	35	98	78	3:1
48	5	24	72	26	98	84	3:1
54	5 1/2	27	65	35	100	90	2.4:1
60	6	30	60	39	99	96	2:1
66	6 1/2	32	78	21	99	102	2:1
72	7	34	78	21	99	108	2:1

Dimensions may vary depending upon equipment availability.

- Notes:
- Produced to meet ASTM specifications.
 - Contact a Concrete Pipe Division representative for details not listed on this sheet.

CONCRETE FLARED END SECTION DETAIL NTS



	ENGINEER'S SEAL	GOLF COURSE + WESTSIDE ALBUQUERQUE, NM	DRAWN BY RG
			DATE 03/14/2023
		DETAILS	2022055_GRB
		TERRA WEST, LLC 5571 MIDWAY PARK PLACE NE ALBUQUERQUE, NM 87109 (505) 858-3100 www.tierrawestllc.com	SHEET # C3 JOB # 2022055