Final Drainage Report
for
Rolling Hills Ranch Standalone Grading
at
Meridian Ranch

MERIDIAN RANCH
A GOLF & RECREATIONAL COMMUNITY

EL PASO COUNTY, COLORADO

March 2020

Prepared For:

GTL DEVELOPMENT, INC.
P.O. Box 80036
San Diego, CA 92138

Prepared By:
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PCD Project No. EGP203

CERTIFICATIONS

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.

_______________________________________ _________________
Thomas A. Kerby, P.E. #31429 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.

_______________________________________ _______________
Raul Guzman, Vice President Date
GTL Development, Inc.
P.O. Box 80036
San Diego, CA 92138

El Paso County:

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

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

Rolling Hills Ranch at Meridian Ranch PUD
Final Drainage Report

Table of Contents

Figures

Tables

Appendices:

EXECUTIVE SUMMARY

The purpose of the following Final Drainage Report (FDR) is to present the changes to the drainage patterns as a result the Rolling Hills Ranch Standalone Grading (Rolling Hills Ranch Grading) development. Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version).

This report based on the current version of the Meridian Ranch Sketch Plan amendment as adopted by the El Paso County Board of Commissioners on March 13, 2018. Hydrologic calculations follow method outlined in Chapter 6 of the 2014 version of the City of Colorado Springs Drainage Criteria Manual (COSDCM) as adopted by the El Paso County Board of County Commissioners by Resolution 15-042. Chapter 6 addresses the hydrologic calculation methods and includes an updated hydrograph to be used with storm drainage runoff. The Board adopted by the same resolution, Section 3.2.1 of Chapter 13 of the COSDCM referencing Full Spectrum Detention; the concept "provides better control of the full range of runoff rates that pass-through detention facilities than the convention multi-stage concept. This section of the COSDCM identifies the necessity to provide full spectrum detention but does not prescribe a methodology to reach such the detention requirements. This report includes hydrologic models from HEC-HMS for the historic, interim and future conditions for the 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr design storm frequencies. The interim and the future conditions include detention facilities sized and modeled such that *"frequent and infrequent inflows are released at rates approximating undeveloped conditions"*

Rolling Hills Ranch Grading encompasses 252± acres and is located in Sections 20 and 29, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

Rolling Hills Ranch is located within Gieck Ranch Drainage Basin. The Gieck Ranch Basin has been studied but has not received final approval from El Paso County. The developer has agreed to meet the requirements of the studied Gieck Ranch Basin but as yet to be approved Drainage Basin Study.

Based on the design parameters the development of the project will not adversely affect downstream properties.

INTRODUCTION

Purpose

The purpose of the following Final Drainage Report (FDR) is to present proposed changes to the drainage patterns as a result of the development of Rolling Hills Ranch Grading. The report outlines the proposed drainage mitigation based on calculated developed flows in excess of allowable exiting runoff discharge.

Scope

The scope of this report includes:

- Location and description of the proposed development stating the proposed land use, density, acreage and adjacent features to the site.
- Calculations for design peak flows from all off-site tributary drainage areas.
- Calculations for design peak flows within the proposed project area for all drainage areas.
- Discussion of major drainage facilities required as a result of the development.
- Discussion and analysis of existing and proposed facilities.

Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and those portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version) adopted by Resolution 15-042 of the El Paso County Board of County Commissioners.

Background

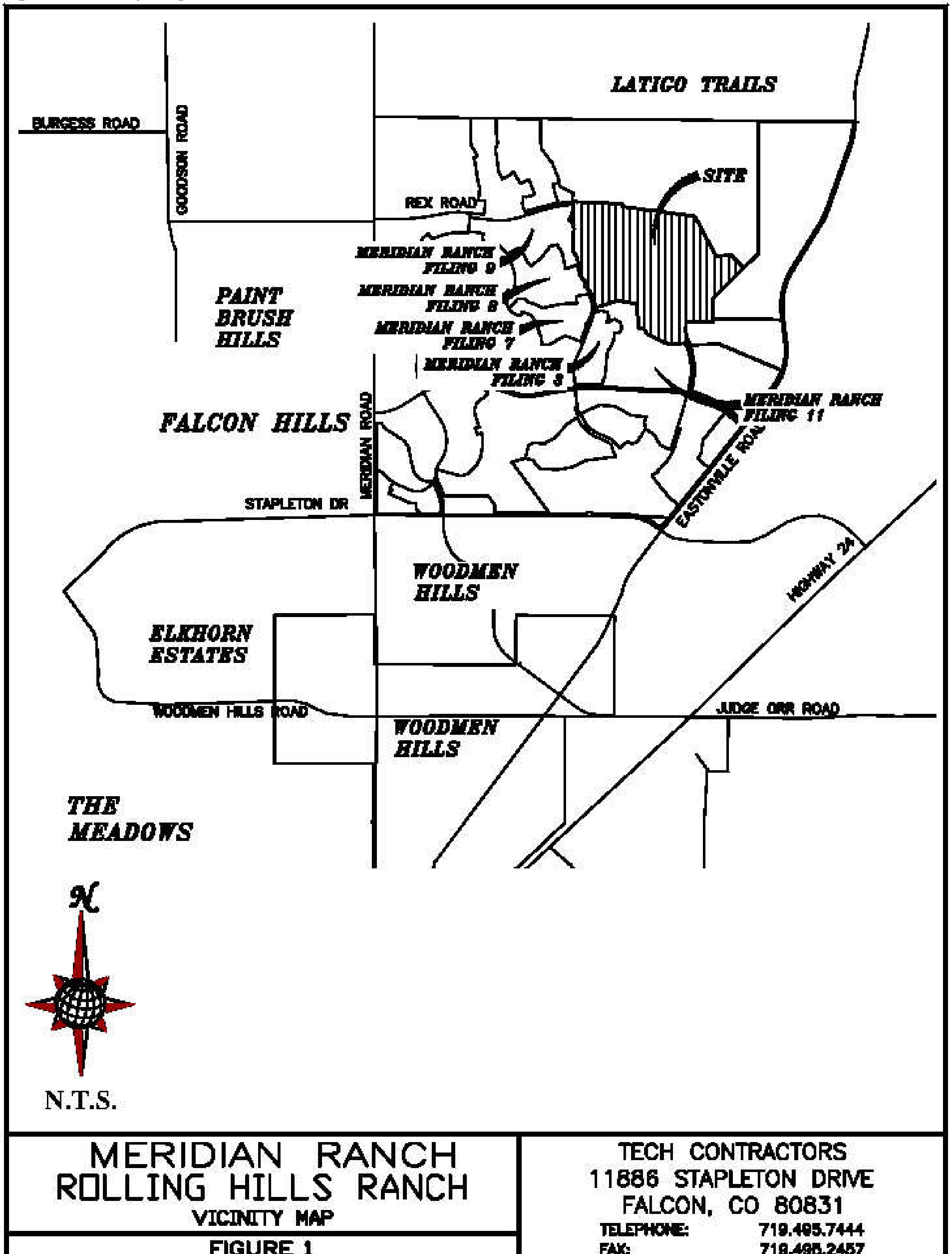
On November 16, 2000 the El Paso County Board of County Commissioners approved the rezoning of the Meridian Ranch project (PUD-00-010) from A-35 to PUD with several conditions. Condition number seven stated in part that "drainage plans shall release and/or retain at approximately eight percent (80%) of historic rates." At the time of the initial approvals there were no drainage improvements downstream of the Meridian Ranch project and the existing natural channels were shallow and undefined.

The Sketch Plan Amendment (SKP-17-001) was processed and approved in 2018 by the El Paso County Board of County Commissioners by resolution 18-104 for Meridian Ranch. The resolution eliminated the required restriction of 80% of historic peak flow rates mentioned above. The detention pond proposed with this project will release at historic or less peak flow rates as per the current El Paso County stormwater requirements.

No development has occurred downstream of this project except for portions of the Falcon Regional Park providing ballparks and associated parking. The Meridian Ranch MDDP and this report indicate the Eastonville Road culvert crossing located downstream of this project does not provide enough capacity for the historic flow rates. It is anticipated that this culvert will be upgraded at the time of the Eastonville Road construction.

Current calculations show the future design discharge of the proposed Pond G to the Falcon Regional Park to be below historic flow rates at full buildout for the full spectrum of design storms.

Figure 1: Vicinity Map



EXISTING CONDITIONS

General Location

Rolling Hills Ranch Grading project encompasses 252± acres and is located in Sections 20 and 29, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

Land Use

Historically, ranching dominated the area surrounding Meridian Ranch; however, currently urbanization has occurred in the general vicinity. Most notably, urbanization is occurring to the north with Latigo Trails, to the south in the Woodmen Hills Subdivision, to the east in Four Way Ranch, to the west in the Falcon Hills subdivision, and to the northwest in the Paint Brush Hills subdivision.

Climate

Mild summers and winter, light precipitation; high evaporation and moderately high wind velocities characterize the climate of the study area. The average annual monthly temperature is 48.4 F with an average monthly low of 30.3 F in the winter and an average monthly high of 68.1 F in the summer. Two years in ten will have maximum temperature higher than 98 F and a minimum temperature lower than –16 F. Precipitation averages 15.73" annually, with 80% of this occurring during the months of April through September. The average annual Class A pan evaporation is 45 inches. (Soil Survey of El Paso County Area, Colorado).

Topography and Floodplains

The topography of the site is typical of a high desert, short prairie grass with relatively flat slopes generally ranging from 2% to 4%. The project site drains generally from the northwest to southeast and is tributary to the Black Squirrel Creek.

The Flood Insurance Rate Maps (FIRM No. 08041C0552G, dated 12/07/2018) indicates there is a portion of the project located within a designated floodplain. Please see Figure 2: Rolling Hills Ranch Grading Federal Emergency Management Agency (FEMA) Floodplain Map.

The designated floodplain is located within a drainage open space identified as Tract C. The floodplain is identified as a Zone AE with an elevation of 7060 based on the NAVD88 Datum. The topography is based on the NGVD29 Datum, therefore an adjustment of 3.9-ft. to the base flood elevation shown in the map is required. The net result is a base flood elevation of 7056 for this location.

Geology

The National Resources Conservation Service (NRCS) soil survey records indicate that the service area is predominately covered by soils classified in the Columbine (65 ac.) and Stapleton series (188 ac.). These series are categorized in the Hydrological Soil Groups A & B.

The Columbine (19) gravelly sandy loam is a deep, well-drained to excessively drained soil formed in coarse textured material on alluvial terraces, fans and flood plains. Permeability of

Figure 2: FEMA Floodplain Map

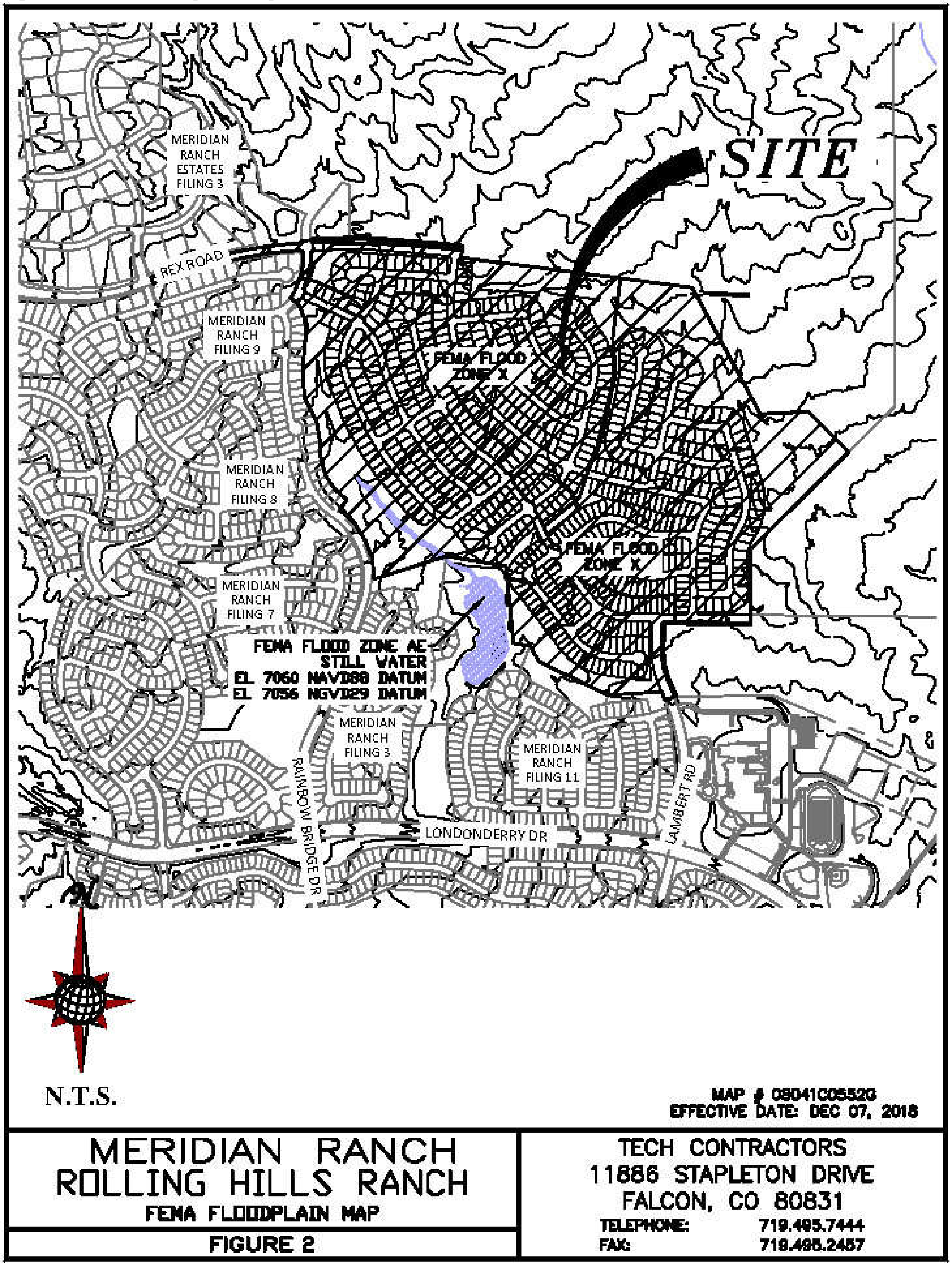
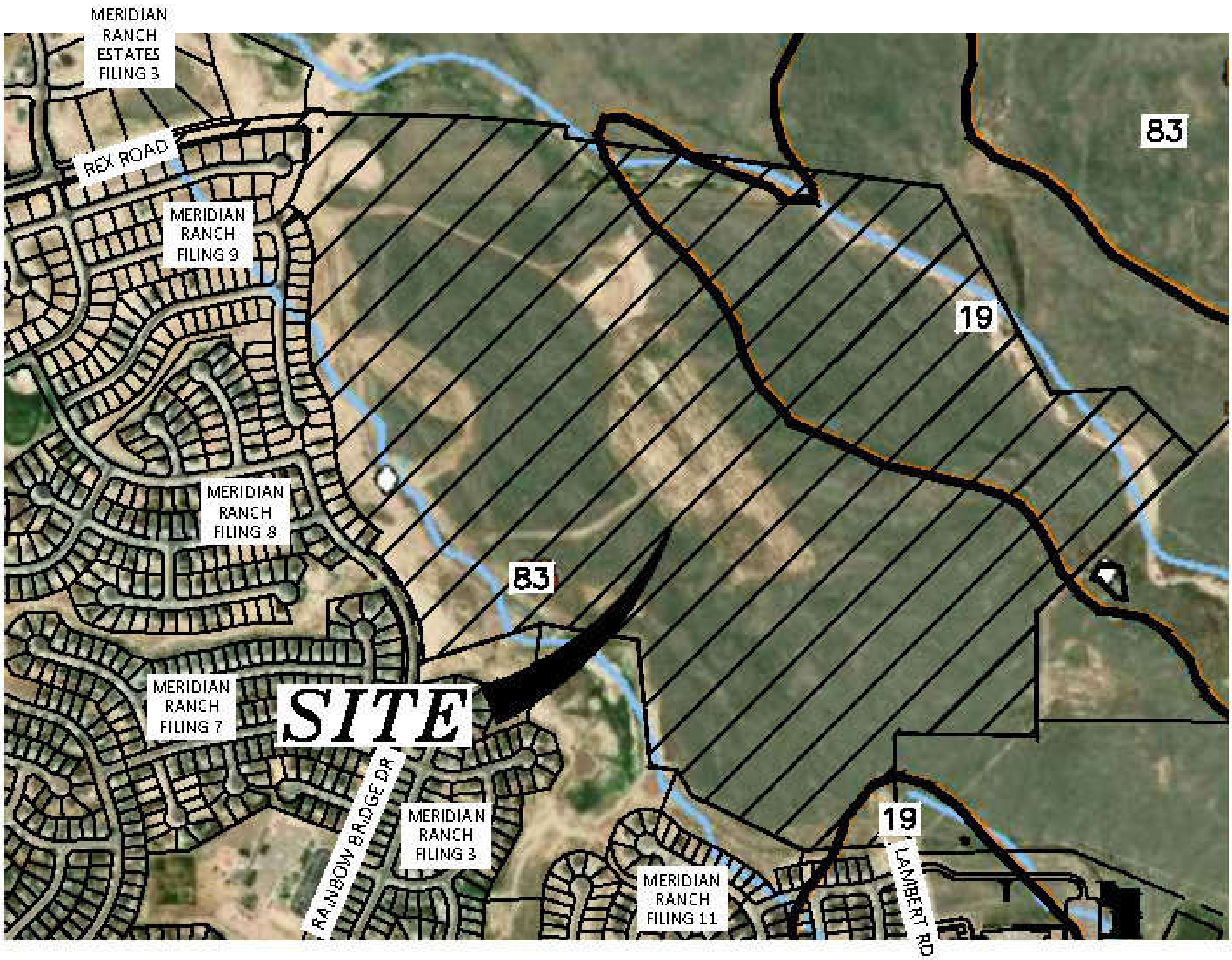


Figure 3: Soils Map



N.T.S.

MERIDIAN RANCH
ROLLING HILLS RANCH
SOILS MAP

FIGURE 3

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this soil is very rapid. Available water capacity is low to moderate, surface runoff is slow, and the hazard of erosion is slight to moderate. The Columbine series is categorized as a Hydrological Soil Group A.

This soil is used mainly for grazing livestock, for wildlife habitat and for home sites. The main limitation of this soil for urban development is a hazard of flooding in some areas.

The Stapleton (83) sandy loam is a deep, non-calcareous, well-drained soil formed in alluvium derived from arkosic bedrock on uplands. Permeability of this soil is rapid. Available water capacity is moderate, surface runoff is slow, and the hazard of erosion and soil blowing is moderate. The Stapleton series is categorized as a Hydrological Soil Group B.

This soil is suited to habitat for open land and rangeland wildlife. The main limitation of this soil for urban development is frost-action potential.

Typically, these soils are well-drained, gravelly sandy loams that form on alluvial terraces and fans and exhibit high permeability and low available water capacity with depth to bedrock greater than 6 feet.

Note: (#) indicates Soil Conservation Survey soil classification number. See Figure 3 Rolling Hills Ranch Grading – Soils Map.

Natural Hazards Analysis

Natural hazards analysis indicates that no unusual surface or subsurface hazards are located near the vicinity. However, because the soils are cohesionless, sloughing of steep banks during drilling and/or excavation could occur. By citing improvements in a manner that provides an opportunity to lay the banks of excavations back at a 1:1 slope during construction, the problems associated with sloughing soils can be minimized.

<u>DRAINAGE BASINS AND SUB-BASINS</u>

The site is near the top of the Gieck Ranch Drainage Basin and accepts flow from areas north of the project site within portions of Meridian Ranch.

Three different scenarios were analyzed for the drainage conditions for the project.

The first scenario analyzes the historic conditions for Meridian Ranch. This condition has all of Meridian Ranch in the pre-development state; where the entirety of Meridian Ranch is modeled in its undeveloped, undisturbed condition, alternatively called the historic condition.

The second scenario is the interim conditions scenario and it consists of the current existing conditions for all tributary areas whether developed or undeveloped/historic with the addition of Rolling Hills Ranch Grading in the proposed developed condition. The current existing conditions assume all approved projects tributary to Rolling Hills Ranch and the Rolling Hills Ranch Grading are at full buildout. This condition was analyzed to ensure the full spectrum of historic flow rates exiting the Meridian Ranch development are maintained after the development of Rolling Hills Ranch Grading is completed.

The interim scenario was analyzed to ensure that the historic flow rates at the outlets of the proposed Pond G (Design Point G12) located upstream of and adjacent to the Falcon Regional Park and Pond E (Design Points H08 & H09) located along Eastonville Road were maintained. The development of Rolling Hills Ranch will complete the development of the areas tributary to Ponds D & E.

The final scenario analyzes the future build out conditions for the entirety of Meridian Ranch to ensure the storm drain facilities located at the discharge points of the project are able to properly convey the full spectrum of historic peak flow rates as the storm drainage exits the Meridian Ranch project along Eastonville Road and/or the Falcon Regional Park.

DRAINAGE DESIGN CRITERIA

SCS Hydrograph Procedure

The US Army Corp of Engineers HEC-HMS computer program was used to model the Soil Conservation Service (SCS) Hydrograph procedure to determine final design parameters for the major drainage facilities within the project. Onsite basin areas were calculated using aerial topography of the site and approved final design data. Times of concentration were estimated using the SCS procedures described in the DCM. Based upon the hydrologic soil type, the natural conditions found in the basins and the runoff curve numbers (CN) chart from Table 6-10 of the City of Colorado Springs DCM for Antecedent Runoff Condition II (ARC II), the following CN values were used for the given conditions.

Table 1: SCS Runoff Curve Numbers

Condition	CN*
Residential Lots (5 acre)	63
Residential Lots (2.5 acre)	66
Residential Lots (1 acre)	68
Residential Lots (1/2 acre)	70
Residential Lots (1/3 acre)	72
Residential Lots (1/4 acre)	75
Residential Lots (1/5 acre)	78
Residential Lots (1/6 acre)	80

School	80
Parks/Open Space	62
Commercial	85
Roadways	98
Graded	67
Golf Course	62
Latigo Undeveloped	65
Undeveloped	61

*Curve Numbers were interpolated and based on amount of impervious area per lot. The 24 hour storm precipitation values were selected from the NOAA Atlas 14, Volume 8, Version 2 for the Meridian Ranch location (Latitude 38.9783°, Longitude -104.5842°, Elevation 7054 ft). These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs. See the table for all the design storm events in Appendix A. These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs.

Full Spectrum Design

The City of Colorado Springs adopted a new Drainage Criteria Manual (DCM) in 2014 which incorporated the use of *Full Spectrum Design* for storm drainage analysis for projects located within the city limits. El Paso County adopted portions of the City's 2014 DCM by resolution in January 2015; the County resolution adopted Chapter 6 (Hydrology) and Section 3.2.1 of Chapter 13 (Full Spectrum Detention) for projects outside of the City of

Colorado Springs establishing a 1 year review period to analyze the impacts of the Full Spectrum Design on the storm drainage analysis of projects. This report has incorporated the use of full spectrum in the analysis using the SCS Method to determine the size requirements for the detention pond during the interim and future conditions.

The idea behind full spectrum detention is to release the developed runoff flow rates that will approximate those of the pre-developed condition. The design of Pond G and the outlet control structure meets or exceeds the intent and spirit of the concept.

Table 2: Detention Pond Summary:

POND G				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
GRADING CONDITIONS				
2-YEAR STORM	7	3.8	2.4	7026.0
5-YEAR STORM	33	10	6.8	7027.1
10-YEAR STORM	77	29	8.9	7027.6
50-YEAR STORM	337	211	17.3	7028.9
100-YEAR STORM	533	366	21.3	7029.7
FUTURE CONDITIONS				
2-YEAR STORM	28	5.2	4.8	7026.7
5-YEAR STORM	79	21	8.2	7027.4
10-YEAR STORM	145	54	10.9	7027.9
50-YEAR STORM	457	328	20.3	7029.5
100-YEAR STORM	690	476	25.6	7030.3

DRAINAGE CALCULATIONS

SCS General Overview

The project is located within the Gieck Ranch Drainage Basin; storm water runoff will be conveyed across the site overland and within existing and proposed storm drain networks to existing and proposed detention ponds. Those portions of the site tributary the existing Detention Pond D will be directed to an existing sedimentation pond to be located upstream of the pond then conveyed to the pond. Portions of the site are tributary the existing Detention Pond E; runoff will be directed to an existing sedimentation pond to be located upstream at the existing northern terminus of Lambert Road, collected then conveyed via an existing storm drain system to the pond. Portions of the site tributary to the proposed Detention Pond G will be directed to temporary sedimentation pond before being released into the existing natural channel and conveyed to the proposed pond. Additionally, the proposed detention Pond G will be utilized as a combination sedimentation/detention pond until such time as the tributary areas establish sufficient ground cover or development in the area is complete.

The detention facilities have been adequately sized such that the developed flows detained and released will approximate the historic flow rates for the various design storm events as outlined in the El Paso County DCM and those sections of the City of Colorado Springs DCM-1 adopted by the El Paso County Board of County Commissioners. Existing facilities located downstream of the proposed development have been designed and/or constructed to accept the given release flow rates from Meridian Ranch. Those existing facilities have been reviewed sufficiently to verify the capacity to convey the storm flow rates from Meridian Ranch. See approved Meridian Ranch MDDP, dated January 2018.

Rear lots adjacent to the Falcon Regional Park will drain into open space and then will be directed via a shallow swale to the proposed detention pond prior to exiting the site.

The analysis shows the portion of the site tributary to existing Pond E releasing the developed peak flows below the historic flow rates for the full spectrum of design storms using the newly adopted unit hydrograph from the City DCM-1.

Figure 5: Meridian Ranch SCS Calculations – Historic Conditions Map, Figure 6: Meridian Ranch SCS Calculations – Interim Conditions Map and Figure 7: Meridian Ranch SCS Calculations – Future Conditions Map depict the historic, interim and future general drainage patterns for Rolling Hills Ranch Grading.

The purpose of this report is to show that the development of Rolling Hills Ranch Grading will not adversely impact the existing drainage facilities adjacent to and downstream of the developed area and the existing Ponds D & E are properly sized for the anticipated future development of Rolling Hills Ranch.

SCS Calculations

<u>Historic Drainage - SCS Calculation Method</u>

Following is a tabulation of the surface drainage characteristics under Existing Conditions using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations - Historic Basin Map.

Table 3: Historic Drainage Basins – SCS

HISTORIC MDDP (Full Spectrum)							
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	81	53	31	12	3.9	0.5
OS06-G02	0.1313	79	52	31	12	3.8	0.5
OS05	0.0578	40	26	16	5.9	1.8	0.2
OS05-G01	0.0578	38	26	16	5.7	1.8	0.2
HG01	0.0547	33	21	13	4.8	1.6	0.2
G01	0.1125	71	47	28	10	3.3	0.5
G01-G02	0.1125	70	47	27	10	3.3	0.5
HG02	0.0906	46	30	18	6.9	2.4	0.4
G02	0.3344	194	129	76	28	9.4	1.4
G02-G03	0.3344	192	127	75	28	9.3	1.4
HG03	0.1828	79	51	31	12	4.4	0.8
OS07	0.0328	25	17	11	4.6	1.7	0.3
OS07-G03	0.0328	24	17	9.9	4.4	1.7	0.3

HISTORIC MDDP (Full Spectrum)							
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G03	0.55	295	195	115	44	15	2.4
G03-G04	0.55	286	192	113	43	15	2.4
OS09	0.1547	92	64	41	19	8.5	2.0
OS09-G04	0.1547	91	63	41	19	8.5	2.0
HG04	0.0891	40	27	16	6.1	2.2	0.4
HG05	0.1125	50	33	19	7.6	2.7	0.5
OS08	0.0406	36	25	17	7.9	3.5	0.8
OS08-G04	0.0406	34	24	15	7.6	3.5	0.8
G04	0.9469	502	336	200	78	28	4.9
G04-G05	0.9469	496	322	193	78	28	4.9
HG06A	0.1375	50	33	20	7.8	2.9	0.5
G05	1.0844	544	355	212	86	31	5.4
G05-G06	1.0844	530	353	211	86	31	5.4
HG06B	0.1031	34	22	13	5.4	2.1	0.4
G06	1.1875	561	375	225	91	33	5.8
HG07	0.0984	47	31	18	7.1	2.4	0.4
HG07-G11	0.0984	47	31	18	7.0	2.4	0.4
HG08	0.1328	73	48	28	11	3.6	0.5
G11	0.2312	115	75	44	17	5.7	0.9
G11-G12	0.2312	114	75	44	17	5.6	0.9
HG09	0.1781	73	48	29	11	4.1	0.7
G12	0.4093	187	122	72	28	9.7	1.6
G12-H08	0.4093	183	121	71	28	9.7	1.6
HG10	0.1375	39	26	16	6.5	2.6	0.5
H08	0.5468	216	142	85	34	12	2.1
HG14	0.2297	81	53	32	13	4.8	0.9
HG13	0.0844	55	37	23	9.8	3.9	0.7
G07	0.0844	55	37	23	9.8	3.9	0.7
G07-G08	0.0844	54	37	23	9.7	3.8	0.7
G08	0.3141	119	78	48	20	7.6	1.5
HG15	0.2563	70	46	28	12	4.7	0.9
H13	0.2563	70	46	28	12	4.7	0.9
HG11	0.2047	77	51	30	12	4.5	0.8
H09	0.2047	77	51	30	12	4.5	0.8
HG12	0.1297	57	38	22	8.7	3.1	0.5
H10	0.1297	57	38	22	8.7	3.1	0.5

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Interim Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the interim conditions using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations – Interim Basins Map

Table 4: Interim Drainage Basins-SCS

GRADING MDDP (Full Spectrum)							
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	30	12	3.8	0.5
G1a	0.1313	80	52	30	12	3.8	0.5
G1a-G2	0.1313	79	52	30	11	3.6	0.5
OS05	0.0578	39	26	15	5.6	1.8	0.2
OS05-G1	0.0578	39	25	15	5.5	1.7	0.2
FG01	0.0531	31	22	14	6.9	3.3	0.9
FG01-G1	0.0531	31	22	14	6.9	3.3	0.9
G1	0.1109	61	41	25	11	4.8	1.1
G1-G2	0.1109	60	41	25	11	4.8	1.1
FG02	0.0391	32	22	14	6.2	2.6	0.5

GRADING MDDP (Full Spectrum)							
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G2	0.2813	166	112	67	27	10	1.9
G2-G3	0.2813	163	108	66	27	10	1.9
FG03	0.0203	24	17	12	5.9	0.8	0.8
FG04	0.0172	22	16	11	5.8	3.1	0.9
G3	0.3188	184	123	74	31	11	2.4
G3-POND F	0.3188	183	121	74	31	11	2.4
FG06	0.0658	46	32	20	9.1	3.9	0.8
OS07a-POND F	0.0170	13	9.0	5.7	2.4	0.9	0.1
POND F IN	0.4596	285	193	120	53	21	4.6
POND F	0.4596	177	121	60	16	7.7	2.1
POND F-G7	0.4596	176	120	60	16	7.7	2.1
FG22	0.0658	51	36	24	12	5.6	1.4
FG23a	0.0166	17	12	8.0	3.9	1.9	0.4
OS07b	0.0156	15	10.0	6.2	2.6	1.0	0.1
OS07b-G7	0.0156	13	9.2	5.4	2.3	0.9	0.1
G7	0.5576	211	142	71	21	10	2.7
G7-G10	0.5576	211	142	71	21	10	2.7
FG24	0.2503	110	73	43	17	6.2	1.1
OS09	0.1527	90	62	39	18	8.2	1.9
OS09-G10	0.1527	88	61	39	18	8.2	1.9
OS08	0.0397	35	24	16	7.5	3.4	0.7
OS08-G8	0.0397	34	24	15	7.2	3.3	0.7
G8	0.4427	227	154	94	41	17	3.4
G8-G10	0.4427	225	151	94	41	17	3.4
FG23b	0.0359	21	14	8.4	3.3	1.2	0.2
G10	1.0362	439	282	143	58	24	5.3
G10-G11	1.0362	437	280	142	58	24	5.3
FG23c	0.0070	5.8	4.2	2.8	1.4	0.7	0.2
G11	1.0432	440	282	143	59	24	5.4
FG28	0.0673	38	26	16	7	3	0.5
FG25A	0.0666	52	37	25	12.3	5.9	1.6
FG25A-FG25B	0.0666	52	37	24	12	6	2
FG25B	0.0391	29	21	14	7	3	0.9
POND G IN	1.2162	533	337	184	77	33	7.2
POND G	1.2162	366	211	102	29	10	3.7
G12	1.2162	366	211	102	28.6	10.2	3.7
G12-G06	1.2162	366	211	102	28.6	10.2	3.7
FG29	0.0997	60	39	23	8.7	2.8	0.4
FG32	0.0402	29	19	11	4	1	0.2
FG32-G06	0.0402	28	19	11	4	1	0.2
G06	1.3561	386	223	108	31	11	4
FG08A	0.0750	116	90	66	41	27	13
FG08A-G05	0.0750	110	86	64	41	27	13
FG08B	0.0630	86	67	49	31	20	10
FG08B-G05	0.0630	84	65	48	29	19	10.0
FG11	0.0625	75	59	44	28	18.6	9.8
FG09	0.0484	48	36	25	14	8.3	3.2
FG09-G05	0.0484	48	36	25	14	8.0	3.2
FG10A	0.0446	33	23	15	7	4	1
FG10B	0.0416	42	31	22	12.2	7.0	2.7
FG10C	0.0339	27	19	12	6	3	0.8
G05	0.3690	411	311	223	133	84	40
FG13	0.0534	34	24	15	7	4	0.9
FG12	0.0328	50	40	30	20	14	7.8
POND D IN	0.4552	487	368	264.0	156.4	98.4	47.2
POND D	0.4552	125	83	42.2	16.7	9.7	3.0
POND D-G17	0.4552	125	83	42	17	10	3.0
FG15	0.0103	15	12	9	6	4	2.1
FG15-G17A	0.0103	15	12	9	6	4	2
G17A	0.4655	127	85	43	17	10	3
FG14	0.1019	94	67	45	22	11	3
G17	0.5674	148	98	58	30	15	5
G17-G18	0.5674	148	98	57	29	15	5
FG16	0.0791	133	104	78	50	34	18
G18	0.6465	243	181	127	74.5	45.7	21.6
G18-POND E	0.6465	243	181	127	74.2	45.3	21.4

GRADING MDDP (Full Spectrum)							
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
FG31	0.0922	116	92	69	45	31	17.2
FG30	0.0389	30	20	12	4	1	0
FG30-PONDHS	0.0389	28	19	11	4	1	0.2
POND HS	0.1311	112	63	40	28	19	10.0
FG17a	0.0694	101	78	57	35	23	11.7
FG17a-POND E	0.0694	99	76	56	35	23	11.6
FG18	0.0644	56	42	30	17.6	10.6	4.7
FG18-POND E	0.0644	56	42	30	17	11	4.6
FG19	0.0527	84	66	50	33	23	13.1
FG17c	0.0313	31	22	14	7	3	0.5
FG17b	0.0214	39	31	24	16	11	6.1
POND E IN	1.0168	561	428	308	186	118	59.3
POND E	1.0168	209	127	61	23	11	5
H08	1.0168	181	114	54	18	8	3.1
FG20	0.0109	28	23	19	15	12	8.5
H08A	1.0277	183	116	54	18	12	8.6
H08-4W4-4	1.0277	183	116	54	18	12	8
4W-H6B	0.0344	38	27	17	8	3	0
4W4-4	1.0621	186	117	55	21	14	8.7
4W4-4-4W4-1	1.0621	186	117	55.4	20.5	13.4	9
4W-B	0.0806	134	102	75	46.9	30.4	15
FG19A	0.0077	10	8	6	3.4	2.2	1.0
H09	0.0000	27	12	7	5.2	3.4	2
H09-4W4-3	0.0000	27	12	7	5.2	3.4	2.1
4W4-3	0.0883	142	109	80	50.0	32.3	16.0
4W-4-3-4W4-1	0.0883	142	108	79	48.6	30.6	14.5
4W-C	0.0827	81	56	36	15.7	6.1	0.9
4W4-1	1.2331	285	210	146	80.6	47.5	22.0
4W4-1-4W4	1.2331	272	204	142	77.2	46.7	21.0
4W-D	0.0558	50	35	22	9.5	4.0	0.6
4W4	1.2889	318	236	162	86.7	50.2	21.6
FG34	0.0836	48	32	18.7	7.0	2.3	0.3
G14	0.0836	48	32	19	7.0	2.3	0.3
G14-G15	0.0836	48	32	18	7.0	2.3	0.3
FG35	0.0586	19	13	7	3.0	1.2	0.2
G15	0.1422	60	39	22.9	8.9	3.1	0.6
G15-G08	0.1422	59	39	22.7	8.8	3.1	0.6
FG37	0.1203	44	29	17	7	2.5	0.5
FG36	0.0281	16	10	6	2	0.9	0.1
FG36-G08	0.0281	15	10	6	2	0.9	0.1
G08	0.2906	114	75	44	18	6.4	1.1

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Future Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the future conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

Table 5: Future Drainage Basins-SCS

FUTURE MDDP (Full Spectrum)							
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	30	12	3.8	0.5
G1a	0.1313	80	52	30	12	3.8	0.5
G1a-G2	0.1313	79	52	30	11	3.6	0.5
OS05	0.0578	39	26	15	5.6	1.8	0.2
OS05-G1	0.0578	39	25	15	5.5	1.7	0.2
FG01	0.0538	31	22	14	7.0	3.4	0.9
FG01-G1	0.0538	31	22	14	7.0	3.4	0.9
G1	0.1116	61	41	25	11	4.9	1.1
G1-G2	0.1116	61	41	25	11	4.8	1.1
FG02	0.0391	32	22	14	6.4	2.7	0.5
G2	0.2820	167	112	67	27	10	1.9
G2-G3	0.2820	163	109	66	27	10	1.9
FG03	0.0203	24	17	12	5.9	0.8	0.8
FG04	0.0172	22	16	11	5.8	3.1	0.9
G3	0.3195	185	123	74	31	11	2.4
G3-POND F	0.3195	183	121	74	31	11	2.4
FG06	0.0675	56	40	26	12	5.8	1.3
FG05	0.0580	45	33	23	12	6.7	2.4
OS07a	0.0170	14	9.2	5.7	2.5	0.9	0.1
OS07a-POND F	0.0170	13	9.0	5.7	2.4	0.9	0.1
POND F IN	0.4620	293	200	123	54	22	5.0
POND F	0.4620	179	125	63	17	8.2	2.3
POND F-G7	0.4620	179	123	63	17	8.2	2.3
FG21b	0.0170	26	20	16	10.2	7.0	4.0
FG21a	0.0072	6.1	4.1	2.4	0.9	0.3	0.0
FG21a-G7	0.0072	5.8	3.4	2.2	0.8	0.3	0.0
G7	0.4862	188	129	66	18	8.9	4.0
G7-G8	0.4862	188	129	66	18	8.9	3.8
FG22	0.1380	102	73	47	24	12	3.3
OS08	0.0406	35	25	16	7.7	3.4	0.7
OS08-G8	0.0406	34	24	15	7.5	3.4	0.7
FG23a	0.0216	21	15	10	5.2	2.7	0.8
OS07b	0.0156	15	10	6.2	2.6	1.0	0.1
OS07b-G7	0.0156	14	9.7	6.0	2.4	0.9	0.1
G8	0.7020	296	191	96	47	25	7.8
G8-G10	0.7020	293	190	95	47	24	7.8
OS09	0.1527	90	62	39	18	8.2	1.9
OS09-G10	0.1527	88	62	39	18	8.2	1.9
FG24	0.1373	105	76	50	26	13	4.0
G9	0.2900	180	125	81	38	17	4.4
G9-G10	0.2900	178	125	79	37	17	4.4
FG23b	0.0286	23	16	10	4.6	2.0	0.4
G10	1.0206	483	311	175	80	39	12
G10-G11	1.0206	479	309	174	79	39	12
FG23c	0.0122	12	8.7	5.7	3.0	1.5	0.4
G11	1.0328	484	312	176	81	40	12
FG25	0.1086	85	64	46	27	17	7.5
FG26	0.0863	78	58	40	22	12	4.6
FG26-POND G	0.0863	77	57	39	22	12	4.5
FG27	0.0500	52	40	29	17	11	5.0
FG28	0.0245	18	13	8.5	4.1	2.0	0.5
POND G IN	1.3022	690	457	287	145	79	28
POND G	1.3022	476	328	170	54	21	5.1

FUTURE MDDP (Full Spectrum)							
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G12	1.3022	476	328	170	54	21	5.1
G12-G06	1.3022	476	325	170	54	21	5.1
FG29	0.0997	60	39	23	8.7	2.8	0.4
FG32	0.0402	72	57	44	29	20	11
FG32-G06	0.0402	69	54	41	27	18	11
G06	1.4421	503	345	181	58	23	11
FG08A	0.0750	116	90	66	41	27	13.4
FG08A-G05	0.0750	110	86	64	41	27	13
FG08B	0.0630	86	67	49	31	20	10
FG08B-G05	0.0630	84	65	48	29	19	10
FG09	0.0484	48	36	25	14	8	3
FG09-G05	0.0484	48	36	25	14	8	3.2
FG10B	0.0416	42	31	22	12	7.0	2.7
G05	0.2280	282	215	156	94	58.8	28.7
FG10A	0.0806	81	61	43	25	15.0	6.5
FG11	0.0625	75	59	44	28	19	10
FG13	0.0534	34	24	15	7.5	3.6	0.9
FG12	0.0328	50	40	30	20	14	7.8
POND D IN	0.4573	509	387	280	168	107	52
POND D	0.4573	133	90	49	18	11	3.7
POND D-G17	0.4573	133	90	49	18	11	3.7
FG15	0.0103	15	12	9.0	5.8	3.9	2.1
FG15-G17A	0.0103	15	12	9.0	5.8	3.9	2.1
G17A	0.4676	136	91	50	18	11	3.8
FG14	0.1000	98	74	53	32	20	9.2
G17	0.5676	195	129	75	41	25	12
G17-G18	0.5676	194	128	74	41	25	12
FG16	0.0791	133	104	78	50	34	18
G18	0.6467	238	178	127	78	50	25
G18-POND E	0.6467	238	176	126	77	49	25
FG31	0.0922	116	92	69	45	31	17
FG30	0.0389	73	57	44	29	20	11
FG30-PONDHS	0.0389	70	56	42	27	18	11
POND HS	0.1311	153	106	53	36	26	15
FG17a	0.0694	101	78	57	35	23	12
FG17a-POND E	0.0694	99	76	56	35	23	12
FG18	0.0644	56	42	30	18	11	4.7
FG18-POND E	0.0644	56	42	30	17	11	4.6
FG19	0.0527	84	66	50	33	23	13
FG17c	0.0313	31	22	14	6.5	2.9	0.5
FG17b	0.0214	39	31	24	16	11	6.1
POND E IN	1.0170	608	432	317	196	126	64
POND E	1.0170	239	149	77	28	14	5.8
H08	1.0170	203	134	69	22	10	3.5
H09	0.0000	36	15	8.0	5.7	3.8	2.3
FG34	0.0600	34	23	13	5.5	2.0	0.3
G14	0.0600	34	23	13	5.5	2.0	0.3
G14-G15	0.0600	34	22	13	5.4	2.0	0.3
FG35	0.0344	20	13	8.3	3.5	1.5	0.3
G15	0.0944	53	36	21	8.7	3.3	0.6
G15-G08	0.0944	52	35	21	8.7	3.3	0.6
FG37	0.0797	41	27	16	6.0	2.0	0.3
FG36	0.0281	14	9.4	5.5	2.1	0.7	0.1
FG36-G08	0.0281	14	9.3	5.4	2.1	0.7	0.1
G08	0.2022	106	69	41	16	5.8	1.0

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Rational Calculations

The Rational Hydrologic Calculation Method is typically used to estimate the total runoff from the 5-year and the 100-year design storm to establish the storm drainage system design. Using the rational calculation methodology outlined in the Hydrology Section (Ch 6) of the COSDCM coupled with the El Paso County EPCDCM the storm drainage patterns established as a result of the Rolling Hills Ranch Grading has been analized. The storm drainage swales and temporary sedimentation basins have been designed such that the minor storm will be captured by the inlets and conveyed by the storm drain pipes such that the proposed temporary structures will not adversely impact the surround property and waters of the state.

The site is located within the Gieck Ranch Drainage Basin; the project will discharge the collected surface flow from the project into an existing natural drainage courses so as to safely convey the storm water flows away from the project without damaging adjacent property.

The PUD area has been divided into five drainage areas and analyzed with the rational hydrologic calculations and hydraulic calculations have been provided to size temporary drainage swales and permanent drainage facilities as needed. Additional hydrologic and hydraulic calculations will be provided in the final drainage report at final plat. The storm drain runoff will be collected then conveyed through the project and discharged either into an existing storm drain system located within Lambert Road discharged into the existing Pond E, directly into Pond D or into the proposed Pond G.

Rational Narrative

The following is a detailed narrative of the storm drainage located in Rolling Hills Ranch Grading. The description is organized by system beginning on the northwest in the portion of Rolling Hills Ranch and ending on the southeast portion of the project.

<u>Offsite Storm Drain System</u>

- Basin OS1 (4.4 acres, Q_5= 1.3 CFS, Q_{100} = 8.6 CFS) is located north the existing Meridian Service Metropolitan District Water Filtration Building on land that will remain in undeveloped. Underlying the land are major transmission watermains and the master plan for this area is to remain undeveloped in its natural condition. The area will receive no developed runoff and the surface runoff will sheet flow will collect in an existing swale and traverse the area in a southerly direction toward a proposed Type C inlet CB4. All of the runoff is captured by the inlet and conveyed toward the future rip-rap lined channel to be constructed with Rolling Hills Ranch Filing 1 located adjacent and south of the filtration building. The captured flow is conveyed downstream via a 24” RCP.

Make sure to explain in the narrative for the tributary subbasin or within the temp sediment pond section why 42" pipe is used. Review engineer is assuming this is designed/constructed based on subdivision buildout and will remain in place after the temp pond is removed. Be advised this is installed at the developers risk. Final approval of design/construction will be based on the subsequent subdivision plat's approved drainage report and construction plans.

Unresolved. Original comment was in the GEC Plan. Add a narrative for Area B temp sediment basin 1 outfall pipe.

Storm Drain Area B

Area B (30 acres, Q_5= 11 CFS, Q_{100} = 23 CFS) is located in the western part of the project adjacent to an existing drainage swale. The surface runoff will sheet flow toward the south to the proposed sedimentation pond #1 prior to being releasing to the drainage swale.

Storm Drain Area C

Area C (22 acres, Q_5= 8.0 CFS, Q_{100} = 17 CFS) is located near the center of the project east of Area B. The surface runoff will sheet flow toward the south to a low spot where future sump inlets will be installed. This low/sump location should be sufficient to act as a sedimentation basin during the minor storm events. Should this area become inundated during larger storm events, the surface flow will continue southerly through area E and into the proposed sedimentation pond located at the northern terminus of Lambert Road prior to being conveyed in an existing storm drain system to the existing Pond E.

Storm Drain Area D

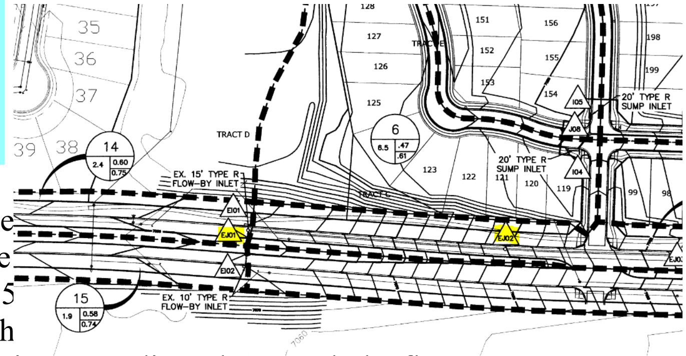
Basin D01 (43 acres, Q_5= 18 CFS, Q_{100} = 37 CFS) is located near the center of the project east of Area C and west of the natural arroyo. The surface runoff will sheet flow toward the south to a low spot where future sump inlets will be installed. This low/sump location should be sufficient to act as a sedimentation basin during the minor storm events. Should this area become inundated during larger storm events, the surface flow will continue southerly through area D2 and onto the proposed sedimentation pond #2 prior to being released to proposed Pond G.

Area D2 (25 acres, Q_5= 11 CFS, Q_{100} = 22 CFS) is located in the northwestern part of the project adjacent to the future extension of Rex Rd and Sunrise Ridge Rd. The surface runoff will sheet flow toward the east to the proposed sedimentation pond #6 prior to being releasing to proposed Pond G. Should Area D1 overtop the high point the combined Q_{100} will be approximately 45 CFS entering the sedimentation pond.

Storm Drain Area E

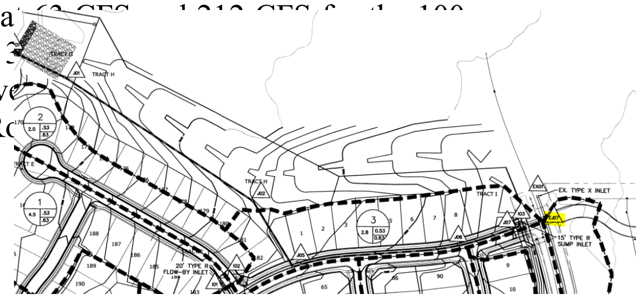
Area E (63 acres, Q_5= 27 CFS, Q_{100} = 66 CFS) is located in the northwestern part of the project adjacent to the future extension of Rex Rd and Sunrise Ridge Rd. The surface runoff will sheet flow toward the south to the proposed sedimentation pond located at the northern terminus of Lambert Road prior to being conveyed in an existing storm drain system to the existing Pond E. Should Area C overtop the high point the combined Q_{100} will not be greater than Q_{100} flow of 66 CFS from the Area E due to time of concentration delays.

double check manhole reference. Per the Filing 11 drainage report EJ01 and EJ02 is located at Londondery at the southwest corner of Fil 11. The manhole nearest the Lambert Rd Temp Sedimentation is labeled EJ07



The existing storm drain system at existing manhole
parts of Meridian Ranch Filing 11A and the discharge
of EJ01 as from the SCS model are 12 CFS for the 5
year storm. The coefficient-area (CA) figure from th
Meridian Ranch Filing 11A and the time of concentration was adjusted to match the flow rate from the SCS Model to replicate the flow rate in the storm drain. The total flow from Meridian Ranch Filing 11A from MH EJ01 to EJ02 is 22 CFS for the 5-year storm and 140 CFS for the 100-year storm.

The total combined storm flow at MH EJ02 from Rolling Hills, Meridian Ranch Filing 11A and the discharge from Pond D is 30 CFS for the 5-year storm and 161 CFS for the 100-year storm. The existing storm drain located within Lambert Rd was installed with the construction of the Falcon High School in 2007. The anticipated 10-year flow rate at 128 CFS and the 100-year flow rate for the storm drain was 245 CFS per the approved 2007 Londonderry-Lambert Final Drainage Report. The approved Final Drainage Report for Meridian Ranch Filing 11A shows the 5-year flow rate a
year storm. These calculations result in flow rates (Q_5= 3
previously approved drainage reports, therefore this deve
impacts on the existing storm drain located in Lambert Ro



DETENTION PONDS

Existing Pond D Detention Storage Criteria

The existing Detention Pond D is located east of Rainbow Bridge Dr., northeast of Meridian Ranch Filing 3, and was constructed as a part of the Meridian Ranch Filing 3 Improvements; the pond is owned and maintained by the Meridian Service Metropolitan District (MSMD). It has been in operation since 2012 with no reported issues. A maintenance agreement between the Meridian Service Metropolitan District and El Paso County has been recorded as a part of the Meridian Ranch Filing 3 Final Plat process.

The SCS calculation method was used to determine inflow and outflow from the detention pond to ensure the developed runoff does not overcharge the pond and the discharges do not adversely impact drainage patterns downstream. Pond D and existing Pond E work in series such that the peak flow rates from the Meridian Ranch development do not adversely affect the drainage patterns downstream of Eastonville Road. Storm drainage runoff will enter the pond from upstream development via existing pipe networks and overland from existing rear lots adjacent to the pond. The ultimate future build-out design of the tributary areas was analyzed to ensure the sizing of the pond would be adequate after development of Meridian Ranch is complete. This SCS calculation can be found in the appendix.

An analysis of the SCS calculations show the development of Rolling Hills Ranch and the discharge flow rates from Pond D do not adversely impact the downstream drainage patterns. No additional improvements or modifications are necessary to this pond as a result of the full buildout of Rolling Hills Ranch Grading. Table 6 provides summary data for the various design storms for the completed development for all areas tributary to Pond D including Rolling Hills Ranch Grading. Rolling Hills Ranch completes the development of all areas tributary to Pond E.

Water quality (WQCV) was added to the required storage volume when the pond was designed and constructed in 2012. The pond was constructed to meet the final build out condition. The WQCV of 1.0 ac-ft. was added to the detention of the minor storm and half (0.5 ac-ft.) was added to the detention volume of the major storm. This was accomplished with respect to the HEC-HMS computer run by providing a starting detention volume of 1.0 ft. for the 5-year storm and 0.5 ft. for the 100-year storm. The resulting storage elevations remain well below the emergency spillway elevation. See Appendix B for more information.

The WQCV was calculated by using the equations found in Volume 2, of the Drainage Criteria Manual (DCM). The release rate from the WQCV is generally very small, which helps minimize downstream impacts. Detaining the WQCV also serves to cleanse the "first flush" of runoff from the higher initial concentration of sediment and pollutants by allowing for settlement to occur. This greatly improves the quality of runoff, leaving the facility and reduces the potential for erosion. The positive impact on water quality is expected to be significant, particularly during the construction phase of the development.

Table 6: Existing Pond D Summary Data

EXISTING POND D				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
GRADING CONDITIONS				
2-YEAR STORM	47	3.0	4.4	7053.0
5-YEAR STORM	98	10	6.7	7053.7
10-YEAR STORM	156	17	10.0	7054.5
50-YEAR STORM	368	83	19.1	7056.2
100-YEAR STORM	487	125	24.3	7056.9
FUTURE CONDITIONS				
2-YEAR STORM	52	3.7	4.6	7053.1
5-YEAR STORM	107	11	6.9	7053.8
10-YEAR STORM	168	18	10.7	7054.6
50-YEAR STORM	387	90	20.0	7056.3
100-YEAR STORM	509	133	25.3	7057.0

Existing Pond E Detention Storage Criteria

Existing Detention Pond E is located south of Londonderry and west of Eastonville, and was constructed as a part of the Meridian Ranch Filing 11 Grading, the is owned and maintained by the Meridian Service Metropolitan District (MSMD). It has been in operation since 2013 with no reported issues. A maintenance agreement between the Meridian Service Metropolitan District and El Paso County has been recorded as a part of the Meridian Ranch Filing 11A Final Plat process.

The SCS calculation method was used to determine inflow and outflow from the detention pond to ensure the developed runoff does not overcharge the pond and the discharges do not adversely impact drainage patterns downstream of Eastonville Road. Storm drainage runoff will enter the pond from upstream development via existing pipe networks and overland from existing rear lots adjacent to the pond. The ultimate future build-out design of the tributary areas was analyzed to insure the sizing of the pond would be adequate after development of Meridian Ranch is complete. This SCS calculation can be found in the appendix.

An analysis of the SCS calculations show the development of Rolling Hills Ranch and the discharge flow rates from Pond E approximate those of the historic flow rates at Eastonville Road. No additional improvements or modifications are necessary to this pond as a result of the full buildout of Rolling Hills Ranch Grading. Table 7 provides summary data for the various design storms for the completed development for all areas tributary to Pond E including Rolling Hills Ranch Grading. Rolling Hills Ranch completes the development of all areas tributary to Pond E.

Table 7: Existing Pond E Summary Data

EXISTING POND E				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
GRADING CONDITIONS				
2-YEAR STORM	59	5.2	9.1	6970.3
5-YEAR STORM	118	11	16.1	6971.2
10-YEAR STORM	186	23	21.2	6971.7
50-YEAR STORM	428	127	34.5	6972.9
100-YEAR STORM	561	209	39.7	6973.3
FUTURE CONDITIONS				
2-YEAR STORM	64	5.8	9.9	6970.5
5-YEAR STORM	126	14	17.2	6971.3
10-YEAR STORM	196	28	22.4	6971.8
50-YEAR STORM	432	149	36.1	6973.0
100-YEAR STORM	608	239	42.1	6973.5

Water quality (WQCV) was added to the required storage volume when the pond was designed and constructed in 2013. The pond was constructed to meet the final build out condition. The WQCV of 1.5 ac-ft. was added to the detention of the minor storm and half (0.75 ac-ft.) was added to the detention volume of the major storm. This was accomplished with respect to the HEC-HMS computer run by providing a starting detention volume of 1.5 ft. for the 5-year storm and 0.75 ft. for the 100-year storm. The resulting storage elevations remain well below the emergency spillway elevation. See Appendix B for more information.

The WQCV was calculated by using the equations found in Volume 2, of the Drainage Criteria Manual (DCM). The release rate from the WQCV is generally very small, which helps minimize downstream impacts. Detaining the WQCV also serves to cleanse the "first flush" of runoff from the higher initial concentration of sediment and pollutants by allowing for settlement to occur. This greatly improves the quality of runoff, condition. The WQCV of 1.5 ac-ft. was added to the detention of the minor storm and half (0.75 ac-ft.) was added to the detention volume of the major storm. This was accomplished with respect to the HEC-HMS computer run by providing a starting detention volume of 1.5 ft. for the 5-year storm and 0.75 ft. for the 100-year storm. The resulting storage elevations remain well below the emergency spillway elevation. See Appendix B for more information.

The WQCV was calculated by using the equations found in Volume 2, of the Drainage Criteria Manual (DCM). The release rate from the WQCV is generally very small, which helps minimize downstream impacts. Detaining the WQCV also serves to cleanse the "first flush" of runoff from the higher initial concentration of sediment and pollutants by allowing for settlement to occur. This greatly improves the quality of runoff, leaving the facility and reduces the potential for erosion. The positive impact on water quality is expected to be significant, particularly during the construction phase of the development.

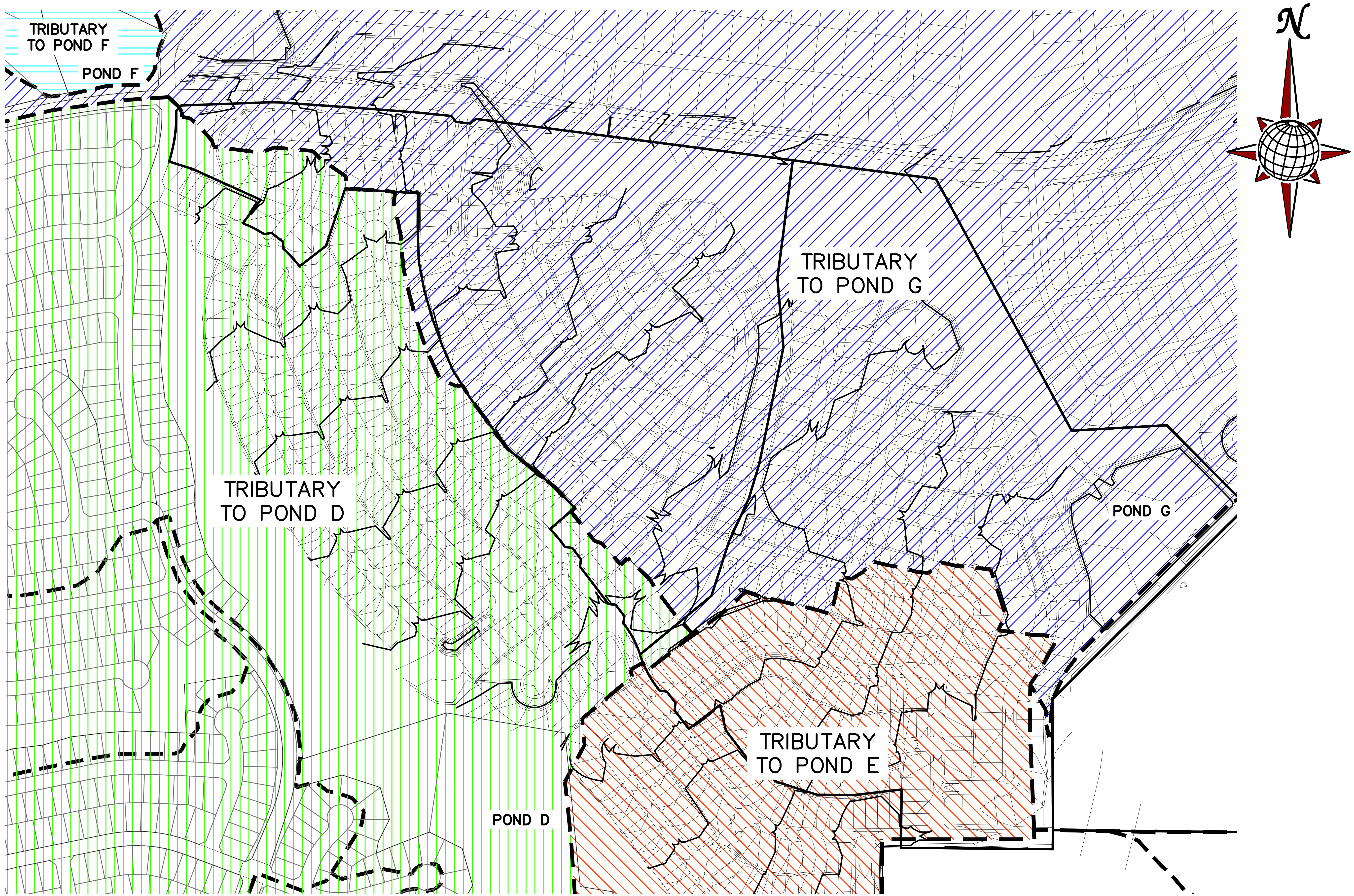
Pond G Detention Storage Criteria

Detention Pond G is to be constructed with Rolling Hills Ranch Grading grading in anticipation of the future development of the Rolling Hills Ranch Grading in accordance with the approved Sketch Plan. The pond will be located within the Gieck Ranch Drainage Basin in the eastern portion of Rolling Hills Ranch adjacent to the Falcon Regional Park. The pond will be owned and maintained by the Meridian Service Metropolitan District (MSMD) and a maintenance agreement between the Meridian Service Metropolitan District and El Paso County will be recorded with the Rolling Hills Ranch Filing 1 final plat.

Table 8: Pond G Summary Data

POND G				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
GRADING CONDITIONS				
2-YEAR STORM	7	3.8	2.4	7026.0
5-YEAR STORM	33	10	6.8	7027.1
10-YEAR STORM	77	29	8.9	7027.6
50-YEAR STORM	337	211	17.3	7028.9
100-YEAR STORM	533	366	21.3	7029.7
FUTURE CONDITIONS				
2-YEAR STORM	28	5.2	4.8	7026.7
5-YEAR STORM	79	21	8.2	7027.4
10-YEAR STORM	145	54	10.9	7027.9
50-YEAR STORM	457	328	20.3	7029.5
100-YEAR STORM	690	476	25.6	7030.3

Pond G and existing Pond F located upstream of Rolling Hills Ranch work in series such that the peak flow rates from the Meridian Ranch development do not adversely affect the drainage patterns downstream of the Meridian Ranch project. The pond is designed to accommodate the developed final inflow from all of the remaining areas to be developed



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POND TRIBUTARY AREAS

ROLLING HILLS RANCH

MERIDIAN RANCH

Drawn by	TAK
Checked by	-
Date	MAR 2020
Scale	AS SHOWN
Sheet Number	A

update narrative. Pond G outfall is DP G12 and is not a riser pipe.

within Meridian Ranch minus the areas tributary to Ponds D and E. Permanent concrete control structure has been designed to handle full build out of the tributary area and reduce the developed flows to approximate the historic peak flow rates for the full spectrum of design storms.

WQCV calculations were completed for Pond G based on proposed future development of the proposed tributary area to the pond; this analysis shows that Pond G will require 0.9 acre-ft of storage for water quality for all the areas tributary to the pond. The control structure at DP H12 is proposed to consist of a 12" diameter water quality control riser with a trash grate having a top elevation of 7025.20 to achieve the required 0.9 ac-ft of storage.

The WQCV was calculated by using the equations found in Volume 2, of the Drainage Criteria Manual (DCM). The release rate from the WQCV is generally very small, which helps minimize downstream impacts. Detaining the WQCV also serves to cleanse the "first flush" of runoff from the higher initial concentration of sediment and pollutants by allowing for settlement to occur. This greatly improves the quality of runoff, leaving the facility and reduces the potential for erosion. The positive impact on water quality is expected to be significant, particularly during the construction phase of the development.

The proposed concrete control structure the outlet of Pond G will attenuate the peak developed flow rates to approximately historic peak rates for the full spectrum of design storms as per the requirements set forth in Resolution 15-042 adopted by the Board of County Commissioners, County of El Paso. The control structure consists of a water quality control standpipe, a rectangular slotted orifice located on the front and a grated top to reduce the developed peak flow rates. Table 8 provides summary data for the various design storms for the completed development for all areas tributary to Pond G including Rolling Hills Ranch Grading.

Downstream Analysis

The outlets (DP H08 & H09) for Pond E located along Eastonville Road upstream of 4-Way Ranch Filing 1 were analyzed in detail with the 2018 MDDP associated with the most recent Meridian Ranch Sketch Plan Amendment. The information can be found in Appendix D of the January 2018 Meridian Ranch MDDP. Below you will find a summary table providing release rates of flow for each Pond E outlet. See the Downstream Channel Analysis Appendix in the WindingWalk Filing 1 Final Drainage Report for a letter to the El Paso County Engineer regarding channel stability and analysis.

The outlet (DP G12) for Pond G is located west of the Falcon Regional Park, upstream of Eastonville Rd (DP G06). Pond G will discharge 479 CFS during the 100-yr storm event into an existing natural drainage course that traverses the regional park. The 100-year historical peak flow rate at the western boundary of the regional park is 544 CFS. The calculated 100-year developed flow rate will be 88% of the historic flow rate. The developed peak flow rate for the full spectrum of design storms are calculated to be below that of the corresponding historic peak flow rates. See Table 9 for a complete comparative list of the peak flow rates for the key design points impacted by the development of Rolling Hills Ranch.

Table 9: Key Design Point Comparison - SCS

MERIDIAN RANCH DISCHARGE KEY DESIGN POINTS (FUTURE)						
		PEAK DISCHARGE Q_{100} (CFS)	PEAK DISCHARGE Q_{50} (CFS)	PEAK DISCHARGE Q_{25} (CFS)	PEAK DISCHARGE Q_{10} (CFS)	PEAK DISCHARGE Q_5 (CFS)
G12 - POND G OUTLET REGIONAL PARK (G05 - HISTORIC)	Historic	544	355	212	86	31
	Future	476	328	170	54	21
	% of Historic	87%	92%	80%	63%	68%
G06 - EASTONVILLE ROAD[1]	Historic	561	375	225	91	33
	Future	503	344	180	58.8	23
	% of Historic	90%	92%	80%	65%	70%
H08 - EASTONVILLE ROAD (POND E NORTH OUTLET)	Historic	216	142	85	34	12
	Future	203	134	69	22	10
	% of Historic	94%	94%	81%	66%	84%
H09 - EASTONVILLE ROAD (POND E SOUTH OUTLET)	Historic	77	51	30	12	4.5
	Future	36	15	8.0	5.7	3.8
	% of Historic	46%	30%	26%	47%	85%
G14 - REGIONAL PARK (G07 - HISTORIC)	Historic	55	37	23	9.8	3.9
	Future	34	23	13	5.5	2.0
	% of Historic	62%	61%	58%	56%	51%
G08 - EASTONVILLE ROAD[1]	Historic	119	78	48	20	7.6
	Future	106	69	41	16	5.8
	% of Historic	90%	89%	87%	82%	77%

[1] Flow rate at Eastonville Rd. listed for reference only

POND F – POND G CHANNEL

Methodology and Background

The drainage way within the proposed development is best characterized as wide sandy bottom natural arroyo, with some amounts of vegetation along the side embankments. The drainage way conveys the storm runoff released from existing Pond F and surrounding areas easterly to the proposed Pond G. The drainage course conveys water only during runoff events. The arroyo will require relocation and shaping immediately downstream of Pond F as it runs along the north side of future Rex Road. The channel will remain in its natural condition between Rex Road and Pond G. A HecRas hydraulic analysis for this drainage course will be included within the Rolling Hills Ranch Filing 1 Final Drainage Report for the purpose of demonstrating the stability of the sandy bottom channel after development occurs in the surrounding area.

Due to the nature and conditions of the existing channel, efforts will be made to preserve it as close to the natural conditions outside the limits of the development. This natural drainage way can be defined as a ‘straight’ channel, it does not follow sinuous course. It is not braided or excessively meandering. The drainage path does have some minor meanderings but does not have multiple channels divided by bars and islands or large alternating S-shaped bends with deep scour pools.

Development will always alter the natural drainage system, such as increasing the peak flow rates, decreasing the sediment load, encroaching into the floodplain, etc. This drainage way has experienced a decreased sediment load with the construction of Pond F at the upstream end. The flow rates at the upper end are slightly less than historic and higher at the lower end prior to entering the proposed Pond G detention pond. The flow rates are then lowered as they are released from Pond G.

The channel immediately downstream of the existing Pond F will be regraded and rip rap lined. See Appendix F for hydraulic analysis for the simple trapezoidal section at the various slopes of the channel section adjacent to and crossing future Rex Road. The section crossing Rex Road will be replaced with an appropriately sized box culvert at the time when Rex Road is extended easterly.

State who will own and maintain the trapezoidal section.

Update the drainage report and provide a narative for this channel. Is this final design or temporay?

Unresolved. Original comment from GEC sheet 16.

Unclear if the man-made section between pond F and future Rex Rd crossing is permanent.

EROSION CONTROL DESIGN

General Concept

Historically, erosion on this property has been held to a minimum by a variety of natural features and agricultural practices including:

- Substantial prairie grass growth
- Construction of drainage arresting berms
- Construction of multiple stock ponds along drainage courses

Existing temporary sediment ponds will also help to minimize erosion by reducing both the volume and velocity of the peak runoff.

During construction, best management practices (BMP) for erosion control will be employed based on El Paso county Criteria. BMP's will be utilized as deemed necessary by the contractor and/or engineer and are not limited to the measures shown on the construction drawing set. The contractor shall minimize the amount of area disturbed during all construction activities.

In general the following shall be applied in developing the sequence of major activities:

- Install down-slope and side-slope perimeter BMP's before the land disturbing activity occurs.
- Do not disturb an area until it is necessary for the construction activity to proceed
- Cover or stabilize as soon as possible.
- Time the construction activities to reduce the impacts from seasonal climatic changes or weather events.
- The construction of filtration BMP's should wait until the end of the construction project when upstream drainage areas have been stabilized.
- Do not remove the temporary perimeter controls until after all upstream areas are stabilized.

Four Step Process

The following four step process is recommended for selecting structural BMP's in developing urban areas:

Step 1: Employ Runoff Reduction Practices

This development incorporates wider rights-of-way than other developments, thus decreasing the amount area devoted to pavement. The rights-of-way within Meridian Ranch are 20% wider, 60 ft. instead of 50 ft., creating more landscaped area within the development.

The project has over ten acres of open space, accounting for over 20% of the entire project, creating a lower density development.

Homeowners and builders are encouraged to direct roof drains to the sideyards where the runoff will travel overland to the streets and creating an opportunity to allow the runoff to infiltrate into the ground.

The development has been designed to direct surface sheet flow from rear yard space toward the natural open space between the home sites and the drainage courses (see below) thus increasing the infiltration and serving to reduce the total runoff from the project site.

Step 2: Stabilize Drainageways

The drainage swale located on the west side of the project was designed to have a wide flat bottom and slope reducing the velocity of the concentrated flow traveling along the drainageway. The construction of the swale also included erosion control mat along the entire length of the swale. At steeper sections of the swale straw logs or rip-rap has been installed to reduce velocities and erosion. This swale discharges directly into an existing extended detention pond with WQCV built into the design.

A natural arroyo drainage course exists adjacent to the project on the northeast side. This natural sandy bottom arroyo will readily infiltrate runoff during lower intensity, more frequent rain events; decreasing the total stormwater volume leaving the sight.

Step 3: Provide Water Quality Capture Volume (WQCV)

An existing extended detention pond with water quality capture volume is located to the east of the project that was designed to accommodate the runoff from this development.

The project includes a proposed extended detention pond along the eastern boundary of the project. The WQCV within the proposed detention pond is of sufficient size to accommodate the runoff from this project and all future projects tributary to the proposed detention pond.

Step 4: Consider Need for Industrial and Commercial BMP's

This project is neither industrial nor commercial and therefore this section does not apply.

The measures from Steps 1, 2, & 3 incorporated into the design of the project work together to promote greater infiltration rates and reduce the total volume of storm runoff from the project. A key component of the design is the overland sheet flow directed toward the drainage swales, this allows the runoff to move across the land at a lower rate and increase the likelihood of infiltration. By directing the runoff toward the sandy bottom arroyo, the water has increased chances to infiltrate. By providing a regional water quality facility the design provides greater flexibility to direct the runoff to natural swales to convey to the facility as opposed to conveyance through storm drain pipe.

Temporary Sedimentation Pond

Temporary sedimentation ponds installed during the overlot grading process will act as the primary water quality control for the areas upstream during construction. Runoff will travel overland toward the existing sedimentation ponds, collected and diverted into the proposed storm drain system and discharged into existing downstream systems. The pond will provide initial sediment control over exposed upstream areas.

Detention Pond

The existing and proposed detention ponds will act as the primary water quality control for the areas within the project boundaries. Runoff will travel overland toward the natural drainage swales or be collected by the proposed storm drainage system and diverted into the detention pond where practical. The pond will serve a dual purpose: first, by facilitating the settling of sediment in runoff during and after construction (by means of the WQCV) and, second, by maintaining runoff at or below existing levels.

Silt Fence

Silt fence will be place along downstream limits of disturbed areas. This will prevent suspended sediment from leaving the site during infrastructure construction. Silt fencing is to remain in place until vegetation is reestablished.

Erosion Bales

Erosion bales will be placed ten (10) feet from the inlet of all culverts during construction to prevent culverts from filling with sediment. Erosion bales will remain in place until vegetation is reestablished. Erosion bale checks will be used on slopes greater than 1 percent to reduce flow velocities until vegetation is reestablished.

Miscellaneous

Best erosion control practices will be utilized as deemed necessary by the Contractor or Engineer and are not limited to the measures described above.

REFERENCES

1. "City of Colorado Springs/El Paso County Drainage Criteria Manual" September 1987, Revised November 1991, Revised October 1994.

2. Chapter 6, Hydrology and Chapter 11, Storage, Section 3.2.1 of the "City of Colorado Springs Drainage Criteria Manual" May 2014.

3. "Volume 2, El Paso County/City of Colorado Springs Drainage Criteria Manual-Stormwater Quality Policies, Procedures and Best Management Practices" November 1, 2002.

4. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

5. Soils Survey of El Paso County area, Natural Resources Conservation Services of Colorado.

6. Master Development Drainage Plan Meridian Ranch. August 2000. Prepared by URS Corp.

7. Revision to Master Development Drainage Plan Meridian Ranch. May 2015. Prepared by Tech Contractors.

8. Master Development Drainage Plan Latigo Trails. October 2001. Prepared by URS Corp.

9. Final Drainage Report for Meridian Ranch Filing 1. November 2001. Prepared by URS Corp.

10. Preliminary Drainage Plan for Meridian Ranch Phase II. September 2003. Prepared by URS.

11. Final Drainage Plan for The Trails Filing No.7. March 2005. Prepared by URS.

12. Final Drainage Report for Meridian Ranch Filing 3. August 2011. Prepared by Tech Contractors.

13. Preliminary and Final Drainage Report for Meridian Ranch Filing 7. June 2012. Prepared by Tech Contractors.

14. Final Drainage Report for Meridian Ranch Estates Filing 2. July 2013. Prepared by Tech Contractors.

15. Final Drainage Report for Meridian Ranch Filing 11A. March 2014. Prepared by Tech Contractors.

16. Preliminary and Final Drainage Report for Meridian Ranch Filing 8. December 2014. Prepared by Tech Contractors.

17. Preliminary and Final Drainage Report for Meridian Ranch Filing 4B. April 2014. Prepared by Tech Contractors.

18. Final Drainage Report for Stonebridge Filing 1 at Meridian Ranch. June 2014. Prepared by Tech Contractors.

19. Final Drainage Report for Meridian Ranch Filing 9. May 2015. Prepared by Tech Contractors.

20. Revision to Master Development Drainage Plan Meridian Ranch. July 2015. Prepared by Tech Contractors.

21. Final Drainage Report for Meridian Ranch Estates Filing 3. October 2015. Prepared by Tech Contractors.

22. Final Drainage Report for the Vistas Filing 1 at Meridian Ranch. July 2016. Prepared by Tech Contractors.

23. Final Drainage Report for Stonebridge Filing 2 at Meridian Ranch. September 2016. Prepared by Tech Contractors.

24. Final Drainage Report for Stonebridge Filing 3 at Meridian Ranch. April 2017. Prepared by Tech Contractors.

25. Interim Drainage Report for WindingWalk Grading. February 2018. Prepared by Tech Contractors.

26. Revision to Master Development Drainage Plan Meridian Ranch. January 2018. Prepared by Tech Contractors.

27. Preliminary Drainage Report for WindingWalk Filings 1 & 2 PUD and Final Drainage Report for WindingWalk Filing 1 at Meridian Ranch. April 2018. Prepared by Tech Contractors.

28. Final Drainage Report for WindingWalk Filing 2 at Meridian Ranch. August 2018. Prepared by Tech Contractors.

29. Final Drainage Report for Stonebridge Filing 4 at Meridian Ranch. September 2018. Prepared by Tech Contractors.

30. "Urban Storm Drainage Criteria Manual" September 1969, Revised January 2016.

31. Design Guidelines & Criteria – Channels & Hydraulic Structures on Sandy Soil, June 1981 by Simons, Li & Associates.

Appendices

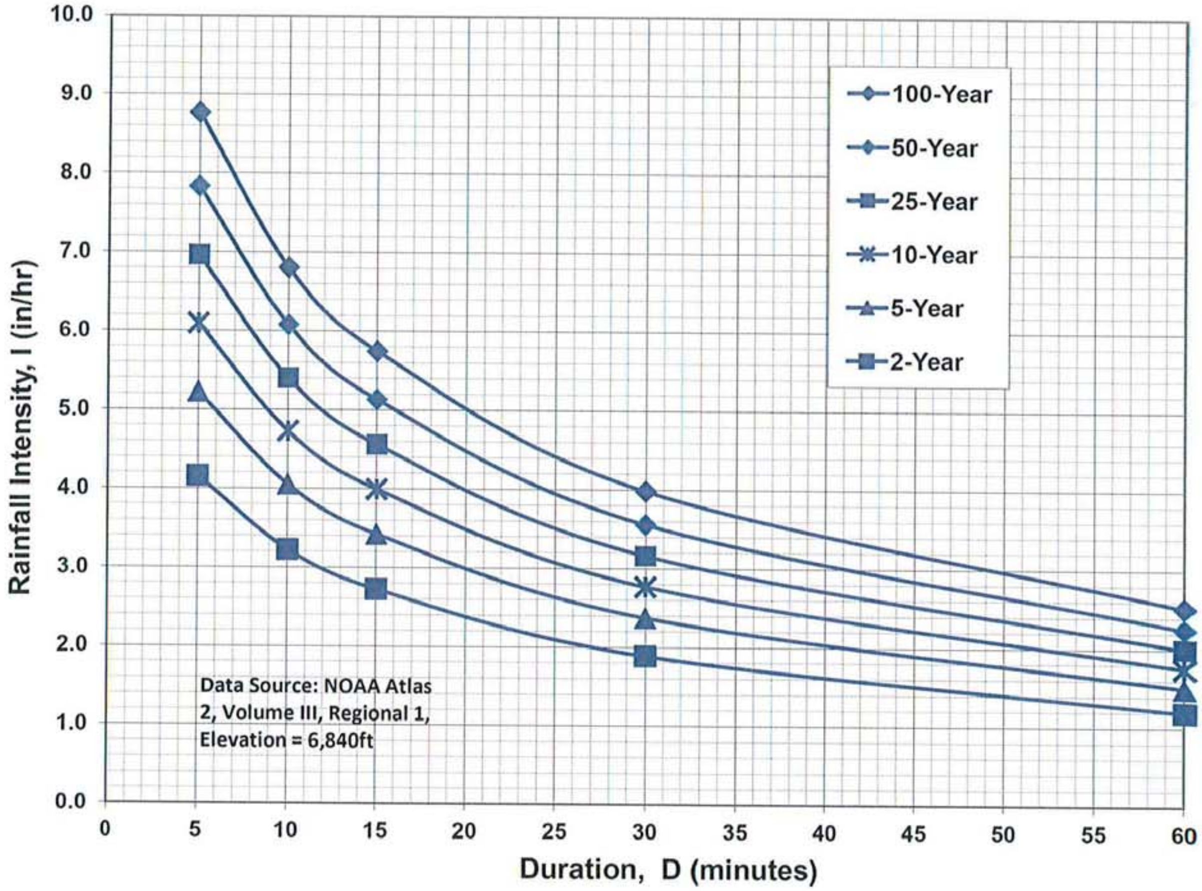
Appendix A – Rational Calculations

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_{5} = -1.50 \ln(D) + 7.583$$

$$I_{2} = -1.19 \ln(D) + 6.035$$

Note: Values calculated by equations may not precisely duplicate values read from figure.

COMPOSITE 'C' FACTORS

PROJECT: **Rolling Hills Ranch Standalone Grading** 3/30/2020

BASIN DESIGNATION	AREA (AC.)									COMPOSITE FACTOR		Percent Impervious
	UNDEV	GRADED	1 DU/AC	2 DU/AC	4 DU/AC	5 DU/AC	STREETS	OPEN SPACE PARKS/GC	TOTAL	5-year	100-year	
OS1	4.4								4.4	**0.09**	**0.36**	**0.0%**
AREA A		11							11	**0.20**	**0.25**	**0.0%**
AREA B		30					0.3		30	**0.21**	**0.26**	**1.0%**
AREA C		22							22	**0.20**	**0.25**	**0.0%**
AREA D1		43							43	**0.20**	**0.25**	**0.0%**
AREA D2		25							25	**0.20**	**0.25**	**0.0%**
AREA E	9.4	53				0.8			63	**0.19**	**0.27**	**0.6%**
											Composite:	**0.3%**
TOTAL	13.8	182.7	0.0	0.0	0.0	0.8	0.3	0.0	197.6	**0.19**	**0.26**	**0.3%**

TIME OF CONCENTRATION

PROJECT: **Rolling Hills Ranch Standalone Grading** DATE: 3/30/2020

TIME OF CONCENTRATION															
SUBBASIN DATA			INIT./OVERLAND TIME (T_i)				TRAVEL TIME (T_t)							TOTAL	FINAL T_c
BASIN DESIGNATION	C_5	AREA (AC)	LENGTH (FT)	ΔH	SLOPE %	Ti (Min.)*	LENGTH (FT)	ΔH	SLOPE %	CONVEYANCE TYPE	CONVEYANCE COEF.	VEL. (FPS)	Tt(Min.)**	Ti+Tt(Min.)	(min)
OS1	0.09	4.4	185	6.0	3.2%	17.0	1275	34	2.7%	L	7	1.1	18.6	35.6	**35.6**
AREA A	0.20	10.5	325	12.0	3.7%	19.2	975	23	2.4%	B	10	1.5	10.6	29.8	**29.8**
AREA B	0.21	30.4	510	16.0	3.1%	25.3	2085	42	2.0%	B	10	1.4	24.5	49.7	**49.7**
AREA C	0.20	21.7	355	10.0	2.8%	22.0	2050	43	2.1%	B	10	1.4	23.6	45.6	**45.6**
AREA D1	0.20	42.6	61	2.0	3.3%	8.7	2300	36	1.6%	B	10	1.3	30.6	39.3	**39.3**
AREA D2	0.20	25.0	150	4.0	2.7%	14.6	1825	32	1.8%	B	10	1.3	23.0	37.5	**37.5**
AREA E	0.19	63.0	145	3.0	2.1%	15.8	2100	78	3.7%	B	10	1.9	18.2	34.0	**34.0**

TYPE OF SURFACE		C_V
HEAVY MEADOW	H	2.5
TILLAGE/FIELD	T	5
RIPRAP (not buried)	R	6.5
SHORT PASTURE AND LAWNS	L	7
NEARLY BARE GROUND	B	10
GRASSED WATERWAY	G	15
PAVED AREAS	P	20

Notes:

$$* Ti = \frac{* Ti = 0.395\,(1.1 - C5) L^{0.5}}{S^{0.33}}$$

$$V = C_V S_W^{0.5}$$

$$** Tt = L \times V$$

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
SURFACE ROUTING

PROJECT: **Rolling Hills Ranch Standalone Grading** Date: 3/30/2020

DESIGN POINT	DIRECT RUNOFF											TOTAL RUNOFF							OVERLAND TRAVEL TIME						
	BASIN	AREA (AC)	Tc (Min.)	I (in./ hr.)		COEFF. ©		CA		Q			I (in./ hr.)		CA		Q								
				(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	DESTINATION DP	CONVEYANCE TYPE	COEFFICIENT C_V	SLOPE %	VEL. (FPS)	LENGTH (FT)	TRAVEL TIME Tt
	DEVELOPED																								
CB4	OS1	4.4	35.6	2.22	3.73	0.09	0.36	0.40	1.58	0.9	5.9						**0.9**	**5.9**							
SED6	AREA A	11	29.8	2.49	4.18	0.20	0.25	2.10	2.63	5.2	11						**5.2**	**11**							
SED1	AREA B	30	49.7	1.72	2.89	0.21	0.26	6.29	7.81	11	23						**11**	**23**							
SUMP	AREA C	22	45.6	1.85	3.11	0.20	0.25	4.34	5.43	8.0	17						**8.0**	**17**	LAM	B	10.0	2.20%	1.5	1910	21.5
SUMP	AREA D1	43	39.3	2.08	3.48	0.20	0.25	8.52	10.65	18	37						**18**	**37**	SED2	B	10.0	2.10%	1.4	1330	15.3
SED2	AREA D2	25	37.5	2.14	3.60	0.20	0.25	5.00	6.25	11	22	54.6	1.58	2.65	13.52	16.90	**21**	**45**							
LAMBERT	AREA E	63.0	34.0	2.29	3.85	0.19	0.27	11.70	17.02	27	66	67.1	1.27	2.14	16.04	22.45	**27**	**66**							

TYPE OF SURFACE		C_V
HEAVY MEADOW	H	3
TILLAGE/FIELD	T	5
RIPRAP (not buried)	R	7
SHORT PASTURE AND LAWNS	L	7
NEARLY BARE GROUND	B	10
GRASSED WATERWAY	G	15
PAVED AREAS	P	20

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
PIPE ROUTING

PROJECT: **Rolling Hills Ranch Standalone Grading** Date: 3/30/2020

UPSTREAM DESIGN POINT	UPSTREAM BASIN	INLET FLOW							SYSTEM FLOW							TRAVEL TIME						
			I (in./ hr.)		CA		Q			I (in./ hr.)		CA		Q								
		Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	PIPE DIA	ROUGHNESS (n)	DESTINATION DP	SLOPE %	LENGTH (FT)	VEL. (FPS) (Estimate)*	TRAVEL TIME Tt
CB4	OS1	35.6	2.2	3.7	0.40	1.58	0.9	5.9						**0.9**	**5.9**	24.0	0.013	OSJ1	1.02%	229	7.3	0.5
OSJ1									36.1	2.20	3.70	0.40	1.58	**0.9**	**5.9**	24.0	0.013	OSJ2	1.99%	396	10.2	0.6
OSJ2									36.8	2.18	3.65	0.40	1.58	**0.9**	**5.8**	24.0	0.013	OS5	4.67%	177	15.6	0.2
OS5									37.0	2.17	3.64	0.40	1.58	**0.9**	**5.8**							
LAMBERT	AREA E	34.0	2.29	3.85	11.70	17.02	27	66						**27**	**66**							
CA's FROM MERIDIAN RANCH FILING 11A FDR, TIME OF CONCENTRATION ADJUSTED TO MATCH FLOW RATE FROM SCS METHOD									87.5	0.88	1.47	22.47	92.72	**20**	**136**							
EJ02									87.5	0.88	1.47	34.17	109.74	**30**	**161**	54	0.013	EJ01	0.49%	67	9	0.1

* Velocity estimated for calculation of travel time. Refer to Hydraulics for calculated velocity.

Storm Drain Hydraulics:

STORM DRAINAGE SYSTEM DESIGN
HYDRAULICS

PROJECT: **Rolling Hills Ranch Standalone Grading** Date: 3/30/2020

Label	Upstrm Node	Dnstrm Node	Intlet CA (acres)	Inlet Tc (min)	Inlet Flow (ft³/s)	System CA (acres)	System Flow Time (min)	System Intensity (in/hr)	Section Size (in)	Length (ft)	Slope (%)	Capacity (Full Flow) (ft³/s)	System Flow (ft³/s)	Velocity (Ave) (ft/s)	Elevation Ground (Upstrm) (ft)	Hydraulic Grade Line (Upstrm) (ft)	Invert (Upstrm) (ft)	Elevation Ground (Dnstrm) (ft)	Hydraulic Grade Line (Dnstrm) (ft)	Invert (Dnstrm) (ft)
P99	CB4	OSJ1	1.58	35.6	5.9	1.58	35.6	3.73	229	24.00	1.01%	23	5.9	6.1	7142.00	7137.6	7136.75	7139.93	7135.3	7134.45
P100	OSJ1	OSJ2				1.58	36.2	3.69	396	24.00	1.99%	32	5.9	7.8	7139.93	7135.3	7134.45	7132.00	7127.4	7126.55
P101	OSJ2	OS5				1.58	37.1	3.63	183	24.00	4.67%	49	5.8	10.4	7132.00	7127.4	7126.55	7123.00	7118.5	7118.00

Show and label the pipe and nodes on the rational map. Sheet 3 of the map only shows DP CB4.

Appendix B - HEC-HMS Data

Input Data

Rolling Hills Ranch Standalone Grading

BASIN	AREA		CURVE NO.	LAG TIME (min)
	(acre)	(mi^2)		
HISTORIC				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07	21	0.0328	63.1	15.4
OS08	26	0.0406	65.7	15.9
OS09	98	0.1527	65.0	29.5
HG01	35	0.0547	61.0	19.6
HG02	58	0.0906	61.0	25.4
HG03	117	0.1828	61.1	33.8
HG04	57	0.0891	61.0	30.7
HG05	72	0.1125	61.0	31.8
HG06A	88	0.1375	61.0	43.2
HG06B	66	0.1031	61.0	49.5
HG07	63	0.0984	61.0	28.3
HG08	85	0.1328	61.0	22.9
HG09	114	0.1781	61.0	35.6
HG10	88	0.1375	61.0	61.4
HG11	131	0.2047	61.0	40.4
HG12	83	0.1297	61.0	32.0
HG13	54	0.0844	63.1	21.2
HG14	147	0.2297	61.0	45.1
HG15	164	0.2563	61.0	65.1
HG18	21	0.0328	61.0	14.1
HG19	3	0.0047	61.0	6.1
HG20	1	0.0016	61.0	6.9
HG21	14	0.0219	61.0	13.8

BASIN	AREA		CURVE NO.	LAG TIME (min)
	(acre)	(mi^2)		
GRADING				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07a	11	0.0170	63.1	13.9
OS07b	10	0.0156	63.1	10.9
OS08	25	0.0397	65.7	15.9
OS09	98	0.1527	65.0	29.5
FG01	34	0.0531	66.4	33.8
FG02	25	0.0391	64.4	16.1
FG03	13	0.0203	68.0	11.6
FG04	11	0.0172	68.0	7.6
FG05	37	0.0580	70.1	28.7
FG06	39	0.0608	65.4	18.2
FG08A	48	0.0750	76.8	13.3
FG08B	40	0.0630	76.7	16.6
FG09	31	0.0484	71.7	20.8
FG10a	30	0.0466	66.9	24.5
FG10b	27	0.0416	71.4	20.0
FG10c	22	0.0339	67.0	21.8
FG11	40	0.0625	78.2	23.2
FG12	21	0.0328	80.0	16.1
FG13	34	0.0534	66.3	29.6
FG14	65	0.1019	66.6	15.1
FG15	7	0.0103	78.6	15.6
FG16	51	0.0791	78.8	13.0
FG17a	44	0.0694	76.5	14.4
FG17b	14	0.0214	79.9	11.4
FG17c	20	0.0313	65.2	11.8
FG18	41	0.0644	73.5	29.9
FG19	34	0.0527	80.3	15.3
FG19a	5	0.0077	75.2	16.4
FG20	7	0.0109	92.9	10.1
FG22	42	0.0658	64.5	20.9
FG23a	11	0.0166	66.7	12.7
FG23b	23	0.0359	61.8	21.5
FG23c	5	0.0070	67.8	20.6
FG24	160	0.2503	61.3	32.3
FG25a	43	0.0666	67.0	21.4
FG25b	25	0.0391	67.0	23.9
FG28	43	0.0673	63.0	28.0
FG29	64	0.0997	61.0	19.1
FG30	25	0.0389	61.0	12.0
FG31	59	0.0922	80.0	24.0
FG32	26	0.0402	61.0	13.6
FG33	19	0.0302	69.2	19.3
FG34	54	0.0836	61.0	20.1
FG35	38	0.0586	61.1	50.0
FG36	18	0.0281	61.6	24.3
FG37	77	0.1203	61.0	41.6

BASIN	AREA		CURVE NO.	LAG TIME (min)
	(acre)	(mi^2)		
FUTURE				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07a	11	0.0170	63.1	13.9
OS07b	10	0.0156	63.1	10.9
OS08	26	0.0406	65.7	15.9
OS09	98	0.1527	65.0	29.5
FG01	34	0.0538	66.4	33.8
FG02	25	0.0391	64.6	16.1
FG03	13	0.0203	68.0	11.6
FG04	11	0.0172	68.0	7.6
FG05	37	0.0580	70.1	28.7
FG06	39	0.0608	65.4	18.4
FG08A	48	0.0750	76.8	13.3
FG08B	40	0.0630	76.7	16.6
FG09	31	0.0484	71.7	20.8
FG10a	52	0.0806	73.2	23.3
FG10b	27	0.0416	71.4	20.0
FG11	40	0.0625	78.2	23.2
FG12	21	0.0328	80.0	16.1
FG13	34	0.0534	66.3	29.6
FG14	64	0.1000	74.6	26.4
FG15	7	0.0103	78.6	15.6
FG16	51	0.0791	78.8	13.0
FG17a	44	0.0694	76.5	14.4
FG17b	14	0.0214	79.9	11.4
FG17c	20	0.0313	65.2	11.8
FG18	41	0.0644	73.5	29.9
FG19	34	0.0527	80.3	15.3
FG19a	5	0.0077	75.2	16.4
FG20	7	0.0109	92.9	10.1
FG21a	5	0.0072	63.9	10.1
FG21b	11	0.0170	78.5	15.3
FG22	88	0.1380	67.3	24.8
FG23a	14	0.0216	68.6	18.0
FG23b	18	0.0286	64.7	16.5
FG23c	8	0.0122	67.3	14.0
FG24	88	0.1373	68.1	24.9
FG25	70	0.1086	74.1	36.6
FG26	55	0.0863	70.7	23.1
FG27	32	0.0500	74.7	23.9
FG28	16	0.0245	66.6	23.0
FG29	64	0.0997	61.0	19.1
FG30	25	0.0389	80.0	10.9
FG31	59	0.0922	80.0	24.0
FG32	26	0.0402	80.0	12.1
FG33	19	0.0302	73.5	19.3
FG34	38	0.0600	62.0	23.5
FG35	22	0.0344	63.4	26.4
FG36	18	0.0281	61.0	25.0
FG37	51	0.0797	61.0	24.7

NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 38.9783°, Longitude: -104.5842°
Elevation: 7054.14 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

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	**0.239** (0.190-0.301)	**0.291** (0.232-0.367)	**0.381** (0.302-0.482)	**0.460** (0.363-0.585)	**0.576** (0.442-0.764)	**0.670** (0.501-0.899)	**0.770** (0.556-1.06)	**0.875** (0.606-1.23)	**1.02** (0.680-1.48)	**1.14** (0.737-1.66)
10-min	**0.349** (0.278-0.441)	**0.426** (0.339-0.538)	**0.558** (0.443-0.706)	**0.674** (0.532-0.857)	**0.843** (0.647-1.12)	**0.982** (0.734-1.32)	**1.13** (0.814-1.55)	**1.28** (0.888-1.80)	**1.50** (0.996-2.16)	**1.67** (1.08-2.44)
15-min	**0.426** (0.340-0.538)	**0.519** (0.413-0.656)	**0.680** (0.540-0.861)	**0.822** (0.648-1.04)	**1.03** (0.789-1.36)	**1.20** (0.895-1.61)	**1.37** (0.993-1.89)	**1.56** (1.08-2.20)	**1.82** (1.22-2.64)	**2.03** (1.31-2.97)
30-min	**0.608** (0.485-0.768)	**0.741** (0.590-0.936)	**0.969** (0.769-1.23)	**1.17** (0.923-1.49)	**1.46** (1.12-1.94)	**1.70** (1.27-2.28)	**1.95** (1.41-2.68)	**2.21** (1.53-3.12)	**2.58** (1.72-3.73)	**2.87** (1.86-4.20)
60-min	**0.778** (0.620-0.982)	**0.934** (0.744-1.18)	**1.21** (0.962-1.54)	**1.47** (1.16-1.86)	**1.84** (1.42-2.46)	**2.16** (1.62-2.91)	**2.50** (1.81-3.44)	**2.87** (1.99-4.05)	**3.38** (2.26-4.91)	**3.80** (2.46-5.56)
2-hr	**0.948** (0.762-1.19)	**1.13** (0.905-1.41)	**1.46** (1.16-1.83)	**1.76** (1.40-2.22)	**2.23** (1.73-2.96)	**2.62** (1.99-3.51)	**3.05** (2.23-4.18)	**3.52** (2.47-4.95)	**4.19** (2.82-6.04)	**4.73** (3.09-6.87)
3-hr	**1.04** (0.839-1.29)	**1.22** (0.986-1.52)	**1.57** (1.26-1.96)	**1.90** (1.51-2.38)	**2.41** (1.90-3.21)	**2.86** (2.18-3.83)	**3.35** (2.47-4.59)	**3.90** (2.75-5.47)	**4.68** (3.18-6.75)	**5.33** (3.50-7.71)
6-hr	**1.21** (0.980-1.49)	**1.40** (1.14-1.73)	**1.78** (1.44-2.21)	**2.16** (1.74-2.68)	**2.76** (2.19-3.65)	**3.29** (2.53-4.38)	**3.88** (2.88-5.28)	**4.53** (3.23-6.34)	**5.49** (3.76-7.88)	**6.29** (4.17-9.04)
12-hr	**1.39** (1.14-1.70)	**1.62** (1.33-1.98)	**2.06** (1.68-2.53)	**2.48** (2.02-3.06)	**3.16** (2.53-4.14)	**3.76** (2.92-4.96)	**4.42** (3.31-5.97)	**5.15** (3.70-7.14)	**6.22** (4.30-8.85)	**7.10** (4.75-10.1)
24-hr	**1.61** (1.33-1.95)	**1.88** (1.55-2.29)	**2.39** (1.97-2.92)	**2.88** (2.35-3.52)	**3.63** (2.91-4.69)	**4.27** (3.34-5.58)	**4.98** (3.75-6.66)	**5.75** (4.17-7.90)	**6.87** (4.78-9.70)	**7.79** (5.25-11.1)
2-day	**1.86** (1.55-2.24)	**2.19** (1.83-2.64)	**2.79** (2.31-3.36)	**3.33** (2.75-4.04)	**4.15** (3.35-5.30)	**4.85** (3.81-6.25)	**5.59** (4.25-7.39)	**6.40** (4.67-8.70)	**7.55** (5.30-10.6)	**8.49** (5.77-12.0)
3-day	**2.04** (1.71-2.45)	**2.41** (2.01-2.88)	**3.05** (2.54-3.66)	**3.63** (3.01-4.38)	**4.51** (3.65-5.71)	**5.24** (4.14-6.72)	**6.03** (4.59-7.92)	**6.87** (5.03-9.29)	**8.07** (5.69-11.2)	**9.04** (6.18-12.7)
4-day	**2.20** (1.85-2.62)	**2.58** (2.16-3.08)	**3.25** (2.72-3.89)	**3.86** (3.21-4.63)	**4.77** (3.87-6.01)	**5.53** (4.38-7.06)	**6.34** (4.85-8.31)	**7.22** (5.31-9.73)	**8.46** (5.98-11.7)	**9.46** (6.50-13.2)
7-day	**2.60** (2.20-3.08)	**3.00** (2.54-3.56)	**3.71** (3.13-4.41)	**4.36** (3.65-5.20)	**5.33** (4.36-6.67)	**6.14** (4.89-7.78)	**7.00** (5.40-9.11)	**7.93** (5.87-10.6)	**9.26** (6.59-12.8)	**10.3** (7.14-14.4)
10-day	**2.96** (2.51-3.48)	**3.39** (2.88-4.00)	**4.16** (3.52-4.92)	**4.85** (4.08-5.76)	**5.88** (4.82-7.31)	**6.73** (5.38-8.48)	**7.63** (5.91-9.88)	**8.61** (6.39-11.5)	**9.97** (7.13-13.7)	**11.1** (7.70-15.4)
20-day	**3.95** (3.38-4.61)	**4.55** (3.89-5.32)	**5.57** (4.75-6.52)	**6.44** (5.46-7.58)	**7.68** (6.32-9.39)	**8.67** (6.97-10.8)	**9.69** (7.54-12.4)	**10.8** (8.04-14.1)	**12.2** (8.79-16.6)	**13.3** (9.36-18.4)
30-day	**4.75** (4.09-5.51)	**5.49** (4.72-6.38)	**6.70** (5.74-7.81)	**7.72** (6.58-9.04)	**9.12** (7.52-11.1)	**10.2** (8.24-12.6)	**11.3** (8.83-14.3)	**12.4** (9.32-16.2)	**13.9** (10.1-18.7)	**15.0** (10.6-20.6)
45-day	**5.73** (4.96-6.62)	**6.62** (5.72-7.65)	**8.05** (6.93-9.33)	**9.21** (7.89-10.7)	**10.8** (8.91-12.9)	**12.0** (9.68-14.6)	**13.1** (10.3-16.5)	**14.3** (10.7-18.5)	**15.8** (11.4-21.1)	**16.9** (12.0-23.0)
60-day	**6.56** (5.70-7.55)	**7.55** (6.55-8.69)	**9.12** (7.88-10.5)	**10.4** (8.92-12.0)	**12.1** (9.98-14.4)	**13.3** (10.8-16.1)	**14.5** (11.4-18.1)	**15.6** (11.8-20.2)	**17.1** (12.5-22.8)	**18.2** (12.9-24.8)

[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

HISTORIC MDDP (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	81	01Jul2015, 12:12	9.4
OS06-G02	0.1313	79	01Jul2015, 12:24	9.3
OS05	0.0578	40	01Jul2015, 12:12	4.2
OS05-G01	0.0578	38	01Jul2015, 12:12	4.1
HG01	0.0547	33	01Jul2015, 12:12	3.9
G01	0.1125	71	01Jul2015, 12:12	8.0
G01-G02	0.1125	70	01Jul2015, 12:24	7.9
HG02	0.0906	46	01Jul2015, 12:24	6.5
G02	0.3344	194	01Jul2015, 12:24	23.7
G02-G03	0.3344	192	01Jul2015, 12:30	23.4
HG03	0.1828	79	01Jul2015, 12:30	13.1
OS07	0.0328	25	01Jul2015, 12:12	2.6
OS07-G03	0.0328	24	01Jul2015, 12:30	2.5
G03	0.5500	295	01Jul2015, 12:30	38.9
G03-G04	0.5500	286	01Jul2015, 12:30	38.6
OS09	0.1547	92	01Jul2015, 12:24	13.3
OS09-G04	0.1547	91	01Jul2015, 12:30	13.2
HG04	0.0891	40	01Jul2015, 12:30	6.3
HG05	0.1125	50	01Jul2015, 12:30	8.0
OS08	0.0406	36	01Jul2015, 12:12	3.6
OS08-G04	0.0406	34	01Jul2015, 12:30	3.5
G04	0.9469	502	01Jul2015, 12:30	69.6
G04-G05	0.9469	496	01Jul2015, 12:36	69.3
HG06A	0.1375	50	01Jul2015, 12:42	9.7
G05	1.0844	544	01Jul2015, 12:36	79.1
G05-G06	1.0844	530	01Jul2015, 12:36	78.6
HG06B	0.1031	34	01Jul2015, 12:48	7.3
G06	1.1875	561	01Jul2015, 12:36	85.9
HG07	0.0984	47	01Jul2015, 12:24	7.0
HG07-G11	0.0984	47	01Jul2015, 12:30	7.0
HG08	0.1328	73	01Jul2015, 12:18	9.5
G11	0.2312	115	01Jul2015, 12:24	16.5
G11-G12	0.2312	114	01Jul2015, 12:30	16.3
HG09	0.1781	73	01Jul2015, 12:30	12.7
G12	0.4093	187	01Jul2015, 12:30	29.0
G12-H08	0.4093	183	01Jul2015, 12:36	28.3
HG10	0.1375	39	01Jul2015, 13:06	9.6
H08	0.5468	216	01Jul2015, 12:42	38.0
HG14	0.2297	81	01Jul2015, 12:42	16.2
HG13	0.0844	55	01Jul2015, 12:18	6.7
G07	0.0844	55	01Jul2015, 12:18	6.7
G07-G08	0.0844	54	01Jul2015, 12:18	6.6
G08	0.3141	119	01Jul2015, 12:30	22.9
HG15	0.2563	70	01Jul2015, 13:06	17.9
H13	0.2563	70	01Jul2015, 13:06	17.9
HG11	0.2047	77	01Jul2015, 12:36	14.5
H09	0.2047	77	01Jul2015, 12:36	14.5
HG12	0.1297	57	01Jul2015, 12:30	9.2
H10	0.1297	57	01Jul2015, 12:30	9.2

Highlighted green rows reference key design points (Typical all charts this section)

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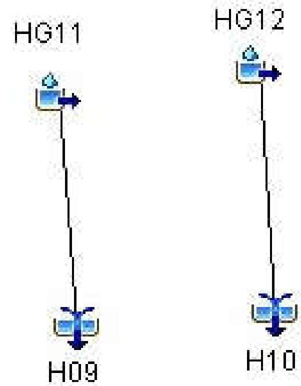

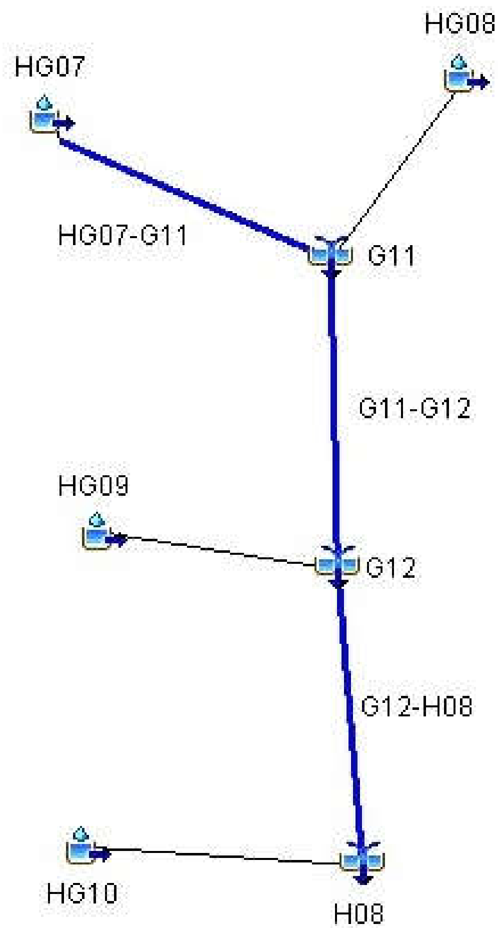

HISTORIC MDDP (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	53	01Jul2015, 12:12	6.6
OS06-G02	0.1313	52	01Jul2015, 12:24	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G01	0.0578	26	01Jul2015, 12:18	2.9
HG01	0.0547	21	01Jul2015, 12:18	2.8
G01	0.1125	47	01Jul2015, 12:18	5.6
G01-G02	0.1125	47	01Jul2015, 12:24	5.5
HG02	0.0906	30	01Jul2015, 12:24	4.5
G02	0.3344	129	01Jul2015, 12:24	16.6
G02-G03	0.3344	127	01Jul2015, 12:30	16.3
HG03	0.1828	51	01Jul2015, 12:30	9.2
OS07	0.0328	17	01Jul2015, 12:12	1.9
OS07-G03	0.0328	17	01Jul2015, 12:30	1.8
G03	0.5500	195	01Jul2015, 12:30	27.3
G03-G04	0.5500	192	01Jul2015, 12:36	27.0
OS09	0.1547	64	01Jul2015, 12:24	9.7
OS09-G04	0.1547	63	01Jul2015, 12:36	9.5
HG04	0.0891	27	01Jul2015, 12:30	4.5
HG05	0.1125	33	01Jul2015, 12:30	5.6
OS08	0.0406	25	01Jul2015, 12:12	2.6
OS08-G04	0.0406	24	01Jul2015, 12:36	2.5
G04	0.9469	336	01Jul2015, 12:36	49.1
G04-G05	0.9469	322	01Jul2015, 12:42	48.9
HG06A	0.1375	33	01Jul2015, 12:42	6.8
G05	1.0844	355	01Jul2015, 12:42	55.7
G05-G06	1.0844	353	01Jul2015, 12:42	55.3
HG06B	0.1031	22	01Jul2015, 12:54	5.1
G06	1.1875	375	01Jul2015, 12:42	60.4
HG07	0.0984	31	01Jul2015, 12:24	4.9
HG07-G11	0.0984	31	01Jul2015, 12:30	4.9
HG08	0.1328	48	01Jul2015, 12:18	6.7
G11	0.2312	75	01Jul2015, 12:24	11.6
G11-G12	0.2312	75	01Jul2015, 12:30	11.4
HG09	0.1781	48	01Jul2015, 12:36	8.9
G12	0.4093	122	01Jul2015, 12:30	20.3
G12-H08	0.4093	121	01Jul2015, 12:42	19.8
HG10	0.1375	26	01Jul2015, 13:06	6.7
H08	0.5468	142	01Jul2015, 12:42	26.6
HG14	0.2297	53	01Jul2015, 12:48	11.4
HG13	0.0844	37	01Jul2015, 12:18	4.8
G07	0.0844	37	01Jul2015, 12:18	4.8
G07-G08	0.0844	37	01Jul2015, 12:24	4.7
G08	0.3141	78	01Jul2015, 12:30	16.1
HG15	0.2563	46	01Jul2015, 13:12	12.5
H13	0.2563	46	01Jul2015, 13:12	12.5
HG11	0.2047	51	01Jul2015, 12:42	10.2
H09	0.2047	51	01Jul2015, 12:42	10.2
HG12	0.1297	38	01Jul2015, 12:30	6.5
H10	0.1297	38	01Jul2015, 12:30	6.5

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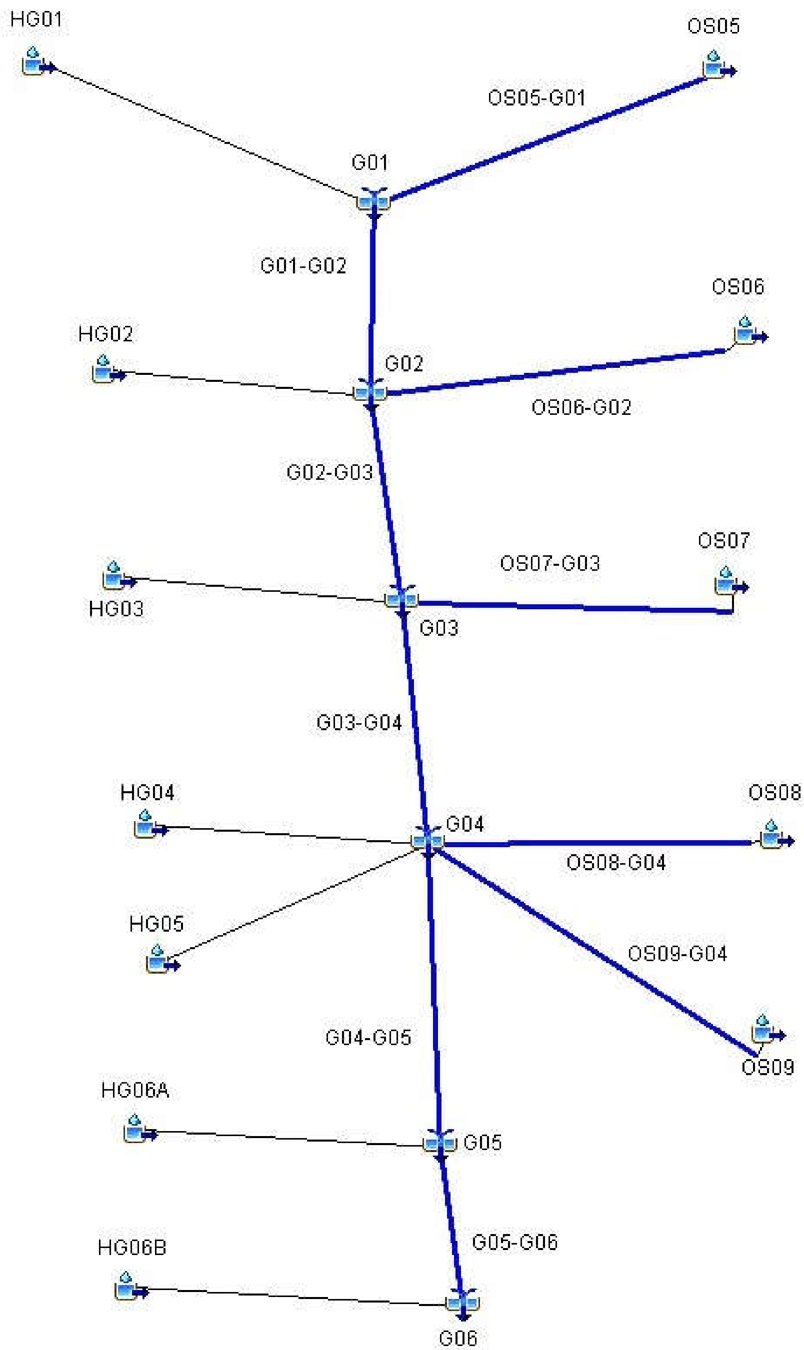
GIECK. HISTORIC



HISTORIC MDDP (25-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q25 (CFS)	TIME OF PEAK	TOTAL VOLUME Q25 (AC. FT.)
OS06	0.1313	31	01Jul2015, 12:18	4.4
OS06-G02	0.1313	31	01Jul2015, 12:24	4.3
OS05	0.0578	16	01Jul2015, 12:12	1.9
OS05-G01	0.0578	16	01Jul2015, 12:18	1.9
HG01	0.0547	13	01Jul2015, 12:18	1.8
G01	0.1125	28	01Jul2015, 12:18	3.7
G01-G02	0.1125	27	01Jul2015, 12:24	3.7
HG02	0.0906	18	01Jul2015, 12:24	3.0
G02	0.3344	76	01Jul2015, 12:24	11.0
G02-G03	0.3344	75	01Jul2015, 12:36	10.7
HG03	0.1828	31	01Jul2015, 12:36	6.1
OS07	0.0328	11	01Jul2015, 12:12	1.3
OS07-G03	0.0328	9.9	01Jul2015, 12:36	1.2
G03	0.5500	115	01Jul2015, 12:36	18.0
G03-G04	0.5500	113	01Jul2015, 12:42	17.8
OS09	0.1547	41	01Jul2015, 12:30	6.7
OS09-G04	0.1547	41	01Jul2015, 12:36	6.5
HG04	0.0891	16	01Jul2015, 12:30	2.9
HG05	0.1125	19	01Jul2015, 12:30	3.7
OS08	0.0406	17	01Jul2015, 12:12	1.8
OS08-G04	0.0406	15	01Jul2015, 12:42	1.8
G04	0.9469	200	01Jul2015, 12:42	32.8
G04-G05	0.9469	193	01Jul2015, 12:42	32.6
HG06A	0.1375	20	01Jul2015, 12:48	4.5
G05	1.0844	212	01Jul2015, 12:42	37.1
G05-G06	1.0844	211	01Jul2015, 12:48	36.8
HG06B	0.1031	13	01Jul2015, 12:54	3.4
G06	1.1875	225	01Jul2015, 12:48	40.2
HG07	0.0984	18	01Jul2015, 12:30	3.3
HG07-G11	0.0984	18	01Jul2015, 12:30	3.2
HG08	0.1328	28	01Jul2015, 12:18	4.4
G11	0.2312	44	01Jul2015, 12:24	7.6
G11-G12	0.2312	44	01Jul2015, 12:30	7.5
HG09	0.1781	29	01Jul2015, 12:36	5.9
G12	0.4093	72	01Jul2015, 12:36	13.4
G12-H08	0.4093	71	01Jul2015, 12:48	13.0
HG10	0.1375	16	01Jul2015, 13:06	4.5
H08	0.5468	85	01Jul2015, 12:48	17.5
HG14	0.2297	32	01Jul2015, 12:48	7.5
HG13	0.0844	23	01Jul2015, 12:18	3.2
G07	0.0844	23	01Jul2015, 12:18	3.2
G07-G08	0.0844	23	01Jul2015, 12:24	3.2
G08	0.3141	48	01Jul2015, 12:36	10.7
HG15	0.2563	28	01Jul2015, 13:12	8.3
H13	0.2563	28	01Jul2015, 13:12	8.3
HG11	0.2047	30	01Jul2015, 12:42	6.7
H09	0.2047	30	01Jul2015, 12:42	6.7
HG12	0.1297	22	01Jul2015, 12:30	4.3
H10	0.1297	22	01Jul2015, 12:30	4.3

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HISTORIC MDDP (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
OS06-G02	0.1313	12	01Jul2015, 12:30	2.2
OS05	0.0578	5.9	01Jul2015, 12:12	1.0
OS05-G01	0.0578	5.7	01Jul2015, 12:24	1.0
HG01	0.0547	4.8	01Jul2015, 12:18	0.9
G01	0.1125	10	01Jul2015, 12:18	1.9
G01-G02	0.1125	10	01Jul2015, 12:36	1.8
HG02	0.0906	6.9	01Jul2015, 12:30	1.5
G02	0.3344	28	01Jul2015, 12:30	5.5
G02-G03	0.3344	28	01Jul2015, 12:48	5.4
HG03	0.1828	12	01Jul2015, 12:36	3.1
OS07	0.0328	4.6	01Jul2015, 12:12	0.7
OS07-G03	0.0328	4.4	01Jul2015, 12:42	0.7
G03	0.5500	44	01Jul2015, 12:48	9.1
G03-G04	0.5500	43	01Jul2015, 12:54	9.0
OS09	0.1547	19	01Jul2015, 12:30	3.7
OS09-G04	0.1547	19	01Jul2015, 12:42	3.6
HG04	0.0891	6.1	01Jul2015, 12:36	1.5
HG05	0.1125	7.6	01Jul2015, 12:36	1.9
OS08	0.0406	7.9	01Jul2015, 12:12	1.0
OS08-G04	0.0406	7.6	01Jul2015, 12:48	1.0
G04	0.9469	78	01Jul2015, 12:48	17.0
G04-G05	0.9469	78	01Jul2015, 12:54	16.8
HG06A	0.1375	7.8	01Jul2015, 12:54	2.3
G05	1.0844	86	01Jul2015, 12:54	19.1
G05-G06	1.0844	86	01Jul2015, 13:00	18.9
HG06B	0.1031	5.4	01Jul2015, 13:00	1.7
G06	1.1875	91	01Jul2015, 13:00	20.6
HG07	0.0984	7.1	01Jul2015, 12:30	1.6
HG07-G11	0.0984	7.0	01Jul2015, 12:36	1.6
HG08	0.1328	11	01Jul2015, 12:24	2.2
G11	0.2312	17	01Jul2015, 12:30	3.9
G11-G12	0.2312	17	01Jul2015, 12:42	3.8
HG09	0.1781	11	01Jul2015, 12:42	3.0
G12	0.4093	28	01Jul2015, 12:42	6.8
G12-H08	0.4093	28	01Jul2015, 13:00	6.5
HG10	0.1375	6.5	01Jul2015, 13:18	2.2
H08	0.5468	34	01Jul2015, 13:00	8.8
HG14	0.2297	13	01Jul2015, 12:54	3.8
HG13	0.0844	9.8	01Jul2015, 12:18	1.7
G07	0.0844	9.8	01Jul2015, 12:18	1.7
G07-G08	0.0844	9.7	01Jul2015, 12:30	1.7
G08	0.3141	20	01Jul2015, 12:36	5.5
HG15	0.2563	12	01Jul2015, 13:24	4.2
H13	0.2563	12	01Jul2015, 13:24	4.2
HG11	0.2047	12	01Jul2015, 12:48	3.4
H09	0.2047	12	01Jul2015, 12:48	3.4
HG12	0.1297	8.7	01Jul2015, 12:36	2.2
H10	0.1297	8.7	01Jul2015, 12:36	2.2

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HISTORIC MDDP (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.9	01Jul2015, 12:24	1.1
OS06-G02	0.1313	3.8	01Jul2015, 12:42	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G01	0.0578	1.8	01Jul2015, 12:30	0.5
HG01	0.0547	1.6	01Jul2015, 12:24	0.5
G01	0.1125	3.3	01Jul2015, 12:30	1.0
G01-G02	0.1125	3.3	01Jul2015, 12:42	0.9
HG02	0.0906	2.4	01Jul2015, 12:36	0.8
G02	0.3344	9.4	01Jul2015, 12:42	2.8
G02-G03	0.3344	9.3	01Jul2015, 13:00	2.7
HG03	0.1828	4.4	01Jul2015, 12:48	1.6
OS07	0.0328	1.7	01Jul2015, 12:18	0.4
OS07-G03	0.0328	1.7	01Jul2015, 13:00	0.4
G03	0.5500	15	01Jul2015, 13:00	4.7
G03-G04	0.5500	15	01Jul2015, 13:12	4.5
OS09	0.1547	8.5	01Jul2015, 12:36	2.1
OS09-G04	0.1547	8.5	01Jul2015, 12:48	2.0
HG04	0.0891	2.2	01Jul2015, 12:42	0.8
HG05	0.1125	2.7	01Jul2015, 12:42	1.0
OS08	0.0406	3.5	01Jul2015, 12:12	0.6
OS08-G04	0.0406	3.5	01Jul2015, 13:00	0.6
G04	0.9469	28	01Jul2015, 13:12	8.9
G04-G05	0.9469	28	01Jul2015, 13:18	8.8
HG06A	0.1375	2.9	01Jul2015, 13:00	1.2
G05	1.0844	31	01Jul2015, 13:18	9.9
G05-G06	1.0844	31	01Jul2015, 13:24	9.8
HG06B	0.1031	2.1	01Jul2015, 13:12	0.9
G06	1.1875	33	01Jul2015, 13:24	10.6
HG07	0.0984	2.4	01Jul2015, 12:42	0.8
HG07-G11	0.0984	2.4	01Jul2015, 12:48	0.8
HG08	0.1328	3.6	01Jul2015, 12:30	1.1
G11	0.2312	5.7	01Jul2015, 12:42	2.0
G11-G12	0.2312	5.6	01Jul2015, 12:54	1.9
HG09	0.1781	4.1	01Jul2015, 12:48	1.5
G12	0.4093	9.7	01Jul2015, 12:54	3.4
G12-H08	0.4093	9.7	01Jul2015, 13:18	3.3
HG10	0.1375	2.6	01Jul2015, 13:30	1.1
H08	0.5468	12	01Jul2015, 13:18	4.4
HG14	0.2297	4.8	01Jul2015, 13:06	1.9
HG13	0.0844	3.9	01Jul2015, 12:24	0.9
G07	0.0844	3.9	01Jul2015, 12:24	0.9
G07-G08	0.0844	3.8	01Jul2015, 12:36	0.9
G08	0.3141	7.6	01Jul2015, 12:54	2.8
HG15	0.2563	4.7	01Jul2015, 13:36	2.1
H13	0.2563	4.7	01Jul2015, 13:36	2.1
HG11	0.2047	4.5	01Jul2015, 13:00	1.7
H09	0.2047	4.5	01Jul2015, 13:00	1.7
HG12	0.1297	3.1	01Jul2015, 12:42	1.1
H10	0.1297	3.1	01Jul2015, 12:42	1.1

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HISTORIC MDDP (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.4
OS06-G02	0.1313	0.5	01Jul2015, 14:00	0.3
OS05	0.0578	0.2	01Jul2015, 13:18	0.2
OS05-G01	0.0578	0.2	01Jul2015, 13:36	0.2
HG01	0.0547	0.2	01Jul2015, 13:30	0.1
G01	0.1125	0.5	01Jul2015, 13:36	0.3
G01-G02	0.1125	0.5	01Jul2015, 14:00	0.3
HG02	0.0906	0.4	01Jul2015, 13:42	0.2
G02	0.3344	1.4	01Jul2015, 13:54	0.9
G02-G03	0.3344	1.4	01Jul2015, 14:30	0.8
HG03	0.1828	0.8	01Jul2015, 13:48	0.5
OS07	0.0328	0.3	01Jul2015, 12:54	0.1
OS07-G03	0.0328	0.3	01Jul2015, 14:12	0.1
G03	0.5500	2.4	01Jul2015, 14:18	1.4
G03-G04	0.5500	2.4	01Jul2015, 14:36	1.3
OS09	0.1547	2.0	01Jul2015, 12:54	0.8
OS09-G04	0.1547	2.0	01Jul2015, 13:18	0.8
HG04	0.0891	0.4	01Jul2015, 13:48	0.2
HG05	0.1125	0.5	01Jul2015, 13:48	0.3
OS08	0.0406	0.8	01Jul2015, 12:24	0.2
OS08-G04	0.0406	0.8	01Jul2015, 13:36	0.2
G04	0.9469	4.9	01Jul2015, 14:30	2.9
G04-G05	0.9469	4.9	01Jul2015, 14:42	2.8
HG06A	0.1375	0.5	01Jul2015, 14:12	0.4
G05	1.0844	5.4	01Jul2015, 14:42	3.2
G05-G06	1.0844	5.4	01Jul2015, 14:54	3.1
HG06B	0.1031	0.4	01Jul2015, 14:24	0.3
G06	1.1875	5.8	01Jul2015, 14:54	3.4
HG07	0.0984	0.4	01Jul2015, 13:42	0.3
HG07-G11	0.0984	0.4	01Jul2015, 14:00	0.3
HG08	0.1328	0.5	01Jul2015, 13:36	0.4
G11	0.2312	0.9	01Jul2015, 13:48	0.6
G11-G12	0.2312	0.9	01Jul2015, 14:12	0.6
HG09	0.1781	0.7	01Jul2015, 13:54	0.5
G12	0.4093	1.6	01Jul2015, 14:06	1.0
G12-H08	0.4093	1.6	01Jul2015, 14:54	0.9
HG10	0.1375	0.5	01Jul2015, 14:42	0.3
H08	0.5468	2.1	01Jul2015, 14:48	1.3
HG14	0.2297	0.9	01Jul2015, 14:18	0.6
HG13	0.0844	0.7	01Jul2015, 13:00	0.3
G07	0.0844	0.7	01Jul2015, 13:00	0.3
G07-G08	0.0844	0.7	01Jul2015, 13:18	0.3
G08	0.3141	1.5	01Jul2015, 13:54	0.9
HG15	0.2563	0.9	01Jul2015, 14:48	0.6
H13	0.2563	0.9	01Jul2015, 14:48	0.6
HG11	0.2047	0.8	01Jul2015, 14:06	0.5
H09	0.2047	0.8	01Jul2015, 14:06	0.5
HG12	0.1297	0.5	01Jul2015, 13:48	0.3
H10	0.1297	0.5	01Jul2015, 13:48	0.3

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GRADING MDDP (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
G1a	0.1313	80	01Jul2015, 12:12	9.3
G1a-G2	0.1313	79	01Jul2015, 12:18	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G1	0.0578	39	01Jul2015, 12:12	4.1
FG01	0.0531	31	01Jul2015, 12:30	4.8
FG01-G1	0.0531	31	01Jul2015, 12:30	4.8
G1	0.1109	61	01Jul2015, 12:18	8.9
G1-G2	0.1109	60	01Jul2015, 12:18	8.9
FG02	0.0391	32	01Jul2015, 12:12	3.3
G2	0.2813	166	01Jul2015, 12:18	21.4
G2-G3	0.2813	163	01Jul2015, 12:18	21.2
FG03	0.0203	24	01Jul2015, 12:06	2.0
FG04	0.0172	22	01Jul2015, 12:00	1.7
G3	0.3188	184	01Jul2015, 12:18	24.9
G3-POND F	0.3188	183	01Jul2015, 12:18	24.9
FG06	0.0658	46	01Jul2015, 12:18	5.5
OS07a-POND F	0.0170	13	01Jul2015, 12:18	1.3
POND F	0.4596	177	01Jul2015, 12:42	35.6
POND F-G7	0.4596	176	01Jul2015, 12:42	35.4
FG22	0.0658	51	01Jul2015, 12:18	6.0
FG23a	0.0166	17	01Jul2015, 12:06	1.5
OS07b	0.0156	15	01Jul2015, 12:06	1.2
OS07b-G7	0.0156	13	01Jul2015, 12:24	1.2
G7	0.5576	211	01Jul2015, 12:36	44.2
G7-G10	0.5576	211	01Jul2015, 12:42	43.8
FG24	0.2503	110	01Jul2015, 12:30	17.9
OS09	0.1527	90	01Jul2015, 12:24	13.0
OS09-G10	0.1527	88	01Jul2015, 12:30	12.9
OS08	0.0397	35	01Jul2015, 12:12	3.5
OS08-G8	0.0397	34	01Jul2015, 12:24	3.4
G8	0.4427	227	01Jul2015, 12:30	34.1
G8-G10	0.4427	225	01Jul2015, 12:30	34.0
FG23b	0.0359	21	01Jul2015, 12:18	2.6
G10	1.0362	439	01Jul2015, 12:36	80.5
G10-G11	1.0362	437	01Jul2015, 12:36	80.4
FG23c	0.0070	6	01Jul2015, 12:12	0.7
G11	1.0432	440	01Jul2015, 12:36	81.1
FG28	0.0673	38	01Jul2015, 12:18	5.2
FG25A	0.0666	52	01Jul2015, 12:18	6.2
FG25A-FG25B	0.0666	52	01Jul2015, 12:24	6.2
FG25B	0.0391	29	01Jul2015, 12:18	3.7
POND G IN	1.2162	533	01Jul2015, 12:36	96.2
POND G	1.2162	366	01Jul2015, 13:06	87.0
G12	1.2162	366	01Jul2015, 13:06	87.0
G12-G06	1.2162	366	01Jul2015, 13:06	86.4
FG29	0.0997	60	01Jul2015, 12:12	7.1
FG32	0.0402	29	01Jul2015, 12:06	2.9
FG32-G06	0.0402	28	01Jul2015, 12:12	2.8
G06	1.3561	386	01Jul2015, 13:06	96.3

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
FG08A	0.0750	116	01Jul2015, 12:06	10.2
FG08A-G05	0.0750	110	01Jul2015, 12:12	10.2
FG08B	0.0630	86	01Jul2015, 12:12	8.5
FG08B-G05	0.0630	84	01Jul2015, 12:12	8.5
FG11	0.0625	75	01Jul2015, 12:18	8.9
FG09	0.0484	48	01Jul2015, 12:12	5.5
FG09-G05	0.0484	48	01Jul2015, 12:18	5.5
FG10A	0.0446	33	01Jul2015, 12:18	4.1
FG10B	0.0416	42	01Jul2015, 12:12	4.7
FG10C	0.0339	27	01Jul2015, 12:18	3.2
G05	0.3690	411	01Jul2015, 12:12	45.0
FG13	0.0534	34	01Jul2015, 12:24	4.8
FG12	0.0328	50	01Jul2015, 12:12	5.0
POND D IN	0.4552	487	01Jul2015, 12:12	54.7
POND D	0.4552	125	01Jul2015, 13:00	44.1
POND D-G17	0.4552	125	01Jul2015, 13:00	44.1
FG15	0.0103	15	01Jul2015, 12:06	1.5
FG15-G17A	0.0103	15	01Jul2015, 12:12	1.5
G17A	0.4655	127	01Jul2015, 13:00	45.6
FG14	0.1019	94	01Jul2015, 12:12	9.4
G17	0.5674	148	01Jul2015, 12:48	54.9
G17-G18	0.5674	148	01Jul2015, 12:48	54.9
FG16	0.0791	133	01Jul2015, 12:06	11.5
G18	0.6465	243	01Jul2015, 12:06	66.4
G18-POND E	0.6465	243	01Jul2015, 12:12	66.4
FG31	0.0922	116	01Jul2015, 12:18	13.9
FG30	0.0389	30	01Jul2015, 12:06	2.8
FG30-PONDHS	0.0389	28	01Jul2015, 12:18	2.7
POND HS	0.1311	112	01Jul2015, 12:30	16.6
FG17a	0.0694	101	01Jul2015, 12:06	9.4
FG17a-POND E	0.0694	99	01Jul2015, 12:06	9.4
FG18	0.0644	56	01Jul2015, 12:24	7.8
FG18-POND E	0.0644	56	01Jul2015, 12:24	7.8
FG19	0.0527	84	01Jul2015, 12:06	8.1
FG17c	0.0313	31	01Jul2015, 12:06	2.7
FG17b	0.0214	39	01Jul2015, 12:06	3.2
POND E IN	1.0168	561	01Jul2015, 12:12	114.0
POND E	1.0168	209	01Jul2015, 13:42	89.3
H08	1.0168	181	01Jul2015, 13:42	78.5
H09	0.0000	27	01Jul2015, 13:42	10.8
FG34	0.0836	48	01Jul2015, 12:18	5.9
G14	0.0836	48	01Jul2015, 12:18	5.9
G14-G15	0.0836	48	01Jul2015, 12:18	5.9
FG35	0.0586	19	01Jul2015, 12:48	4.1
G15	0.1422	60	01Jul2015, 12:24	10.0
G15-G08	0.1422	59	01Jul2015, 12:24	9.9
FG37	0.1203	44	01Jul2015, 12:42	8.4
FG36	0.0281	16	01Jul2015, 12:18	2.0
FG36-G08	0.0281	15	01Jul2015, 12:24	2.0
G08	0.2906	114	01Jul2015, 12:30	20.3

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
G1a	0.1313	52	01Jul2015, 12:12	6.5
G1a-G2	0.1313	52	01Jul2015, 12:18	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G1	0.0578	25	01Jul2015, 12:12	2.9
FG01	0.0531	22	01Jul2015, 12:30	3.5
FG01-G1	0.0531	22	01Jul2015, 12:30	3.5
G1	0.1109	41	01Jul2015, 12:18	6.4
G1-G2	0.1109	41	01Jul2015, 12:18	6.4
FG02	0.0391	22	01Jul2015, 12:12	2.4
G2	0.2813	112	01Jul2015, 12:18	15.2
G2-G3	0.2813	108	01Jul2015, 12:24	15.1
FG03	0.0203	17	01Jul2015, 12:06	1.5
FG04	0.0172	16	01Jul2015, 12:00	1.3
G3	0.3188	123	01Jul2015, 12:18	17.8
G3-POND F	0.3188	121	01Jul2015, 12:18	17.8
FG06	0.0658	32	01Jul2015, 12:18	4.0
OS07a-POND F	0.0170	9	01Jul2015, 12:18	0.9
POND F	0.4596	121	01Jul2015, 12:42	25.5
POND F-G7	0.4596	120	01Jul2015, 12:48	25.3
FG22	0.0658	36	01Jul2015, 12:18	4.4
FG23a	0.0166	12	01Jul2015, 12:06	1.1
OS07b	0.0156	10.0	01Jul2015, 12:06	0.9
OS07b-G7	0.0156	9	01Jul2015, 12:24	0.9
G7	0.5576	142	01Jul2015, 12:42	31.7
G7-G10	0.5576	142	01Jul2015, 12:48	31.5
FG24	0.2503	73	01Jul2015, 12:30	12.6
OS09	0.1527	62	01Jul2015, 12:24	9.4
OS09-G10	0.1527	61	01Jul2015, 12:36	9.3
OS08	0.0397	24	01Jul2015, 12:12	2.6
OS08-G8	0.0397	24	01Jul2015, 12:24	2.5
G8	0.4427	154	01Jul2015, 12:30	24.4
G8-G10	0.4427	151	01Jul2015, 12:30	24.3
FG23b	0.0359	14	01Jul2015, 12:18	1.9
G10	1.0362	282	01Jul2015, 12:42	57.6
G10-G11	1.0362	280	01Jul2015, 12:42	57.6
FG23c	0.0070	4.2	01Jul2015, 12:18	0.5
G11	1.0432	282	01Jul2015, 12:42	58.1
FG28	0.0673	26	01Jul2015, 12:24	3.7
FG25A	0.0666	37	01Jul2015, 12:18	4.6
FG25A-FG25B	0.0666	37	01Jul2015, 12:24	4.6
FG25B	0.0391	21	01Jul2015, 12:18	2.7
POND G IN	1.2162	337	01Jul2015, 12:42	69.0
POND G	1.2162	211	01Jul2015, 13:18	60.4
G12	1.2162	211	01Jul2015, 13:18	60.4
G12-G06	1.2162	210	01Jul2015, 13:18	60.0
FG29	0.0997	39	01Jul2015, 12:18	5.0
FG32	0.0402	19	01Jul2015, 12:12	2.0
FG32-G06	0.0402	19	01Jul2015, 12:12	2.0
G06	1.3561	223	01Jul2015, 13:18	66.9

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
FG08A	0.0750	90	01Jul2015, 12:06	7.9
FG08A-G05	0.0750	86	01Jul2015, 12:12	7.9
FG08B	0.0630	67	01Jul2015, 12:12	6.6
FG08B-G05	0.0630	65	01Jul2015, 12:12	6.6
FG11	0.0625	59	01Jul2015, 12:18	7.0
FG09	0.0484	36	01Jul2015, 12:12	4.1
FG09-G05	0.0484	36	01Jul2015, 12:18	4.1
FG10A	0.0446	23	01Jul2015, 12:18	3.1
FG10B	0.0416	31	01Jul2015, 12:12	3.5
FG10C	0.0339	19	01Jul2015, 12:18	2.3
G05	0.3690	311	01Jul2015, 12:12	34.5
FG13	0.0534	24	01Jul2015, 12:24	3.5
FG12	0.0328	40	01Jul2015, 12:12	3.9
POND D IN	0.4552	368	01Jul2015, 12:12	41.9
POND D	0.4552	83	01Jul2015, 13:06	32.3
POND D-G17	0.4552	83	01Jul2015, 13:12	32.3
FG15	0.0103	12	01Jul2015, 12:12	1.2
FG15-G17A	0.0103	12	01Jul2015, 12:12	1.2
G17A	0.4655	85	01Jul2015, 13:06	33.5
FG14	0.1019	67	01Jul2015, 12:12	6.9
G17	0.5674	98	01Jul2015, 12:54	40.4
G17-G18	0.5674	98	01Jul2015, 13:00	40.3
FG16	0.0791	104	01Jul2015, 12:06	9.0
G18	0.6465	181	01Jul2015, 12:12	49.3
G18-POND E	0.6465	181	01Jul2015, 12:12	49.3
FG31	0.0922	92	01Jul2015, 12:18	11.0
FG30	0.0389	20	01Jul2015, 12:06	1.9
FG30-PONDHS	0.0389	19	01Jul2015, 12:18	1.9
POND HS	0.1311	63	01Jul2015, 12:36	12.9
FG17a	0.0694	78	01Jul2015, 12:06	7.3
FG17a-POND E	0.0694	76	01Jul2015, 12:06	7.3
FG18	0.0644	42	01Jul2015, 12:24	5.9
FG18-POND E	0.0644	42	01Jul2015, 12:24	5.9
FG19	0.0527	66	01Jul2015, 12:06	6.4
FG17c	0.0313	22	01Jul2015, 12:06	2.0
FG17b	0.0214	31	01Jul2015, 12:06	2.6
POND E IN	1.0168	428	01Jul2015, 12:12	86.2
POND E	1.0168	127	01Jul2015, 14:12	62.4
H08	1.0168	114	01Jul2015, 14:12	54.6
H09	0.0000	12	01Jul2015, 14:12	7.7
FG34	0.0836	32	01Jul2015, 12:18	4.2
G14	0.0836	32	01Jul2015, 12:18	4.2
G14-G15	0.0836	32	01Jul2015, 12:24	4.1
FG35	0.0586	13	01Jul2015, 12:54	2.9
G15	0.1422	39	01Jul2015, 12:24	7.0
G15-G08	0.1422	39	01Jul2015, 12:30	6.9
FG37	0.1203	29	01Jul2015, 12:42	5.9
FG36	0.0281	10	01Jul2015, 12:18	1.4
FG36-G08	0.0281	10	01Jul2015, 12:24	1.4
G08	0.2906	75	01Jul2015, 12:30	14.3

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (25-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q25 (CFS)	TIME OF PEAK	TOTAL VOLUME Q25 (AC. FT.)
OS06	0.1313	30	01Jul2015, 12:18	4.3
G1a	0.1313	30	01Jul2015, 12:18	4.3
G1a-G2	0.1313	30	01Jul2015, 12:18	4.2
OS05	0.0578	15	01Jul2015, 12:12	1.9
OS05-G1	0.0578	15	01Jul2015, 12:12	1.9
FG01	0.0531	14	01Jul2015, 12:30	2.4
FG01-G1	0.0531	14	01Jul2015, 12:30	2.4
G1	0.1109	25	01Jul2015, 12:18	4.3
G1-G2	0.1109	25	01Jul2015, 12:24	4.3
FG02	0.0391	14	01Jul2015, 12:12	1.6
G2	0.2813	67	01Jul2015, 12:18	10.2
G2-G3	0.2813	66	01Jul2015, 12:24	10.1
FG03	0.0203	12	01Jul2015, 12:06	1.0
FG04	0.0172	11	01Jul2015, 12:00	0.9
G3	0.3188	74	01Jul2015, 12:24	12.0
G3-POND F	0.3188	74	01Jul2015, 12:24	12.0
FG06	0.0658	20	01Jul2015, 12:18	2.7
OS07a-POND F	0.0170	6	01Jul2015, 12:24	0.6
POND F	0.4596	60	01Jul2015, 12:54	17.1
POND F-G7	0.4596	60	01Jul2015, 13:00	16.9
FG22	0.0658	24	01Jul2015, 12:18	3.1
FG23a	0.0166	8	01Jul2015, 12:06	0.8
OS07b	0.0156	6.2	01Jul2015, 12:06	0.6
OS07b-G7	0.0156	5	01Jul2015, 12:30	0.6
G7	0.5576	71	01Jul2015, 13:00	21.4
G7-G10	0.5576	71	01Jul2015, 13:06	21.1
FG24	0.2503	43	01Jul2015, 12:30	8.3
OS09	0.1527	39	01Jul2015, 12:30	6.5
OS09-G10	0.1527	39	01Jul2015, 12:36	6.3
OS08	0.0397	16	01Jul2015, 12:12	1.8
OS08-G8	0.0397	15	01Jul2015, 12:24	1.7
G8	0.4427	94	01Jul2015, 12:30	16.3
G8-G10	0.4427	94	01Jul2015, 12:36	16.2
FG23b	0.0359	8	01Jul2015, 12:18	1.2
G10	1.0362	143	01Jul2015, 12:48	38.6
G10-G11	1.0362	142	01Jul2015, 12:54	38.6
FG23c	0.0070	2.8	01Jul2015, 12:18	0.4
G11	1.0432	143	01Jul2015, 12:54	38.9
FG28	0.0673	16	01Jul2015, 12:24	2.5
FG25A	0.0666	24.8	01Jul2015, 12:18	3.2
FG25A-FG25B	0.0666	24	01Jul2015, 12:30	3.2
FG25B	0.0391	14	01Jul2015, 12:18	1.9
POND G IN	1.2162	184	01Jul2015, 12:36	46.5
POND G	1.2162	102	01Jul2015, 13:42	38.6
G12	1.2162	102	01Jul2015, 13:42	38.6
G12-G06	1.2162	102	01Jul2015, 13:48	38.2
FG29	0.0997	23	01Jul2015, 12:18	3.3
FG32	0.0402	11	01Jul2015, 12:12	1.3
FG32-G06	0.0402	11	01Jul2015, 12:12	1.3
G06	1.3561	108	01Jul2015, 13:48	42.8

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (25-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q25 (CFS)	TIME OF PEAK	TOTAL VOLUME Q25 (AC. FT.)
FG08A	0.0750	66	01Jul2015, 12:06	5.9
FG08A-G05	0.0750	64	01Jul2015, 12:12	5.9
FG08B	0.0630	49	01Jul2015, 12:12	5.0
FG08B-G05	0.0630	48	01Jul2015, 12:12	4.9
FG11	0.0625	44	01Jul2015, 12:18	5.2
FG09	0.0484	25	01Jul2015, 12:18	3.0
FG09-G05	0.0484	25	01Jul2015, 12:18	3.0
FG10A	0.0446	15	01Jul2015, 12:18	2.1
FG10B	0.0416	22	01Jul2015, 12:12	2.5
FG10C	0.0339	12	01Jul2015, 12:18	1.6
G05	0.3690	223	01Jul2015, 12:12	25.3
FG13	0.0534	15	01Jul2015, 12:24	2.4
FG12	0.0328	30	01Jul2015, 12:12	3.0
POND D IN	0.4552	264.0	01Jul2015, 12:12	30.7
POND D	0.4552	42.2	01Jul2015, 13:36	22.4
POND D-G17	0.4552	42	01Jul2015, 13:36	22.3
FG15	0.0103	9	01Jul2015, 12:12	0.9
FG15-G17A	0.0103	9	01Jul2015, 12:12	0.9
G17A	0.4655	43	01Jul2015, 13:36	23.2
FG14	0.1019	45	01Jul2015, 12:12	4.8
G17	0.5674	58	01Jul2015, 12:12	28.0
G17-G18	0.5674	57	01Jul2015, 12:12	28.0
FG16	0.0791	78	01Jul2015, 12:06	6.8
G18	0.6465	127	01Jul2015, 12:12	34.8
G18-POND E	0.6465	127	01Jul2015, 12:12	34.8
FG31	0.0922	69	01Jul2015, 12:18	8.4
FG30	0.0389	12	01Jul2015, 12:06	1.3
FG30-PONDHS	0.0389	11	01Jul2015, 12:18	1.3
POND HS	0.1311	40	01Jul2015, 12:42	9.6
FG17a	0.0694	57	01Jul2015, 12:06	5.4
FG17a-POND E	0.0694	56	01Jul2015, 12:12	5.4
FG18	0.0644	30	01Jul2015, 12:24	4.3
FG18-POND E	0.0644	30	01Jul2015, 12:24	4.3
FG19	0.0527	50	01Jul2015, 12:06	4.9
FG17c	0.0313	14	01Jul2015, 12:06	1.4
FG17b	0.0214	24	01Jul2015, 12:06	1.9
POND E IN	1.0168	308	01Jul2015, 12:12	62.3
POND E	1.0168	61	01Jul2015, 15:00	39.6
H08	1.0168	54	01Jul2015, 15:00	33.3
H09	0.0000	7	01Jul2015, 15:00	6.3
FG34	0.0836	19	01Jul2015, 12:18	2.7
G14	0.0836	19	01Jul2015, 12:18	2.7
G14-G15	0.0836	18	01Jul2015, 12:24	2.7
FG35	0.0586	7	01Jul2015, 12:54	1.9
G15	0.1422	23	01Jul2015, 12:30	4.6
G15-G08	0.1422	23	01Jul2015, 12:30	4.5
FG37	0.1203	17	01Jul2015, 12:42	3.9
FG36	0.0281	6	01Jul2015, 12:24	1.0
FG36-G08	0.0281	6	01Jul2015, 12:30	0.9
G08	0.2906	44	01Jul2015, 12:36	9.3

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
G1a	0.1313	12	01Jul2015, 12:18	2.2
G1a-G2	0.1313	11	01Jul2015, 12:24	2.1
OS05	0.0578	6	01Jul2015, 12:12	1.0
OS05-G1	0.0578	6	01Jul2015, 12:18	1.0
FG01	0.0531	7	01Jul2015, 12:36	1.4
FG01-G1	0.0531	7	01Jul2015, 12:36	1.4
G1	0.1109	11	01Jul2015, 12:24	2.3
G1-G2	0.1109	11	01Jul2015, 12:30	2.3
FG02	0.0391	6	01Jul2015, 12:12	0.9
G2	0.2813	27	01Jul2015, 12:24	5.3
G2-G3	0.2813	27	01Jul2015, 12:30	5.3
FG03	0.0203	6	01Jul2015, 12:06	0.6
FG04	0.0172	6	01Jul2015, 12:06	0.5
G3	0.3188	31	01Jul2015, 12:30	6.4
G3-POND F	0.3188	31	01Jul2015, 12:30	6.4
FG06	0.0658	9	01Jul2015, 12:18	1.5
OS07a-POND F	0.0170	2	01Jul2015, 12:30	0.3
POND F	0.4596	16	01Jul2015, 13:48	9.0
POND F-G7	0.4596	16	01Jul2015, 13:54	8.9
FG22	0.0658	12	01Jul2015, 12:18	1.7
FG23a	0.0166	4	01Jul2015, 12:06	0.4
OS07b	0.0156	3	01Jul2015, 12:06	0.3
OS07b-G7	0.0156	2.3	01Jul2015, 12:36	0.3
G7	0.5576	21	01Jul2015, 13:00	11.4
G7-G10	0.5576	21	01Jul2015, 13:12	11.2
FG24	0.2503	17.0	01Jul2015, 12:36	4.2
OS09	0.1527	18	01Jul2015, 12:30	3.5
OS09-G10	0.1527	18	01Jul2015, 12:42	3.5
OS08	0.0397	8	01Jul2015, 12:12	1.0
OS08-G8	0.0397	7	01Jul2015, 12:30	1.0
G8	0.4427	41	01Jul2015, 12:36	8.6
G8-G10	0.4427	40.8	01Jul2015, 12:42	8.6
FG23b	0.0359	3.3	01Jul2015, 12:24	0.6
G10	1.0362	58	01Jul2015, 12:48	20.4
G10-G11	1.0362	58	01Jul2015, 12:48	20.4
FG23c	0.0070	1.4	01Jul2015, 12:18	0.2
G11	1.0432	59	01Jul2015, 12:48	20.6
FG28	0.0673	7	01Jul2015, 12:24	1.3
FG25A	0.0666	12.3	01Jul2015, 12:18	1.8
FG25A-FG25B	0.0666	12	01Jul2015, 12:30	1.8
FG25B	0.0391	7	01Jul2015, 12:24	1.1
POND G IN	1.2162	77	01Jul2015, 12:42	24.8
POND G	1.2162	29	01Jul2015, 15:36	17.7
G12	1.2162	28.6	01Jul2015, 15:36	17.7
G12-G06	1.2162	29	01Jul2015, 15:42	17.5
FG29	0.0997	9	01Jul2015, 12:18	1.6
FG32	0.0402	4	01Jul2015, 12:12	0.7
FG32-G06	0.0402	4	01Jul2015, 12:18	0.7
G06	1.3561	31	01Jul2015, 15:36	19.8

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
FG08A	0.0750	41	01Jul2015, 12:06	3.8
FG08A-G05	0.0750	41	01Jul2015, 12:12	3.8
FG08B	0.0630	31	01Jul2015, 12:12	3.2
FG08B-G05	0.0630	29	01Jul2015, 12:18	3.2
FG11	0.0625	28	01Jul2015, 12:18	3.4
FG09	0.0484	14	01Jul2015, 12:18	1.8
FG09-G05	0.0484	14	01Jul2015, 12:18	1.8
FG10A	0.0446	7	01Jul2015, 12:24	1.2
FG10B	0.0416	12.2	01Jul2015, 12:18	1.5
FG10C	0.0339	6	01Jul2015, 12:18	0.9
G05	0.3690	133	01Jul2015, 12:18	15.9
FG13	0.0534	7	01Jul2015, 12:30	1.4
FG12	0.0328	20	01Jul2015, 12:12	2.0
POND D IN	0.4552	156.4	01Jul2015, 12:12	19.3
POND D	0.4552	16.7	01Jul2015, 14:30	12.9
POND D-G17	0.4552	17	01Jul2015, 14:30	12.9
FG15	0.0103	6	01Jul2015, 12:12	0.6
FG15-G17A	0.0103	6	01Jul2015, 12:12	0.6
G17A	0.4655	17	01Jul2015, 14:24	13.5
FG14	0.1019	22	01Jul2015, 12:12	2.7
G17	0.5674	30	01Jul2015, 12:12	16.2
G17-G18	0.5674	29	01Jul2015, 12:12	16.1
FG16	0.0791	50	01Jul2015, 12:06	4.5
G18	0.6465	75	01Jul2015, 12:12	20.6
G18-POND E	0.6465	74	01Jul2015, 12:12	20.6
FG31	0.0922	45	01Jul2015, 12:18	5.6
FG30	0.0389	4	01Jul2015, 12:12	0.7
FG30-PONDHS	0.0389	4	01Jul2015, 12:24	0.6
POND HS	0.1311	28	01Jul2015, 12:42	6.2
FG17a	0.0694	35	01Jul2015, 12:06	3.5
FG17a-POND E	0.0694	35	01Jul2015, 12:12	3.5
FG18	0.0644	17.6	01Jul2015, 12:24	2.7
FG18-POND E	0.0644	17	01Jul2015, 12:30	2.7
FG19	0.0527	33	01Jul2015, 12:12	3.3
FG17c	0.0313	7	01Jul2015, 12:06	0.8
FG17b	0.0214	16	01Jul2015, 12:06	1.3
POND E IN	1.0168	186	01Jul2015, 12:12	38.3
POND E	1.0168	23	01Jul2015, 19:30	18.6
H08	1.0168	18	01Jul2015, 19:30	14.1
H09	0.0000	5	01Jul2015, 19:30	4.4
FG34	0.0836	7	01Jul2015, 12:18	1.4
G14	0.0836	7	01Jul2015, 12:18	1.4
G14-G15	0.0836	7	01Jul2015, 12:30	1.4
FG35	0.0586	3	01Jul2015, 13:00	1.0
G15	0.1422	9	01Jul2015, 12:36	2.3
G15-G08	0.1422	9	01Jul2015, 12:36	2.3
FG37	0.1203	7	01Jul2015, 12:48	2.0
FG36	0.0281	2	01Jul2015, 12:24	0.5
FG36-G08	0.0281	2	01Jul2015, 12:36	0.5
G08	0.2906	18	01Jul2015, 12:42	4.7

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
G1a	0.1313	3.8	01Jul2015, 12:24	1.1
G1a-G2	0.1313	3.6	01Jul2015, 12:36	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G1	0.0578	1.7	01Jul2015, 12:24	0.5
FG01	0.0531	3.3	01Jul2015, 12:36	0.8
FG01-G1	0.0531	3.3	01Jul2015, 12:36	0.8
G1	0.1109	4.8	01Jul2015, 12:36	1.3
G1-G2	0.1109	4.8	01Jul2015, 12:36	1.3
FG02	0.0391	2.6	01Jul2015, 12:18	0.5
G2	0.2813	10	01Jul2015, 12:30	2.9
G2-G3	0.2813	10	01Jul2015, 12:42	2.8
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	3.1	01Jul2015, 12:06	0.3
G3	0.3188	11	01Jul2015, 12:36	3.3
G3-POND F	0.3188	11	01Jul2015, 12:42	3.3
FG06	0.0658	3.9	01Jul2015, 12:24	0.8
OS07a-POND F	0.0170	0.9	01Jul2015, 12:36	0.2
POND F	0.4596	7.7	01Jul2015, 14:18	4.7
POND F-G7	0.4596	7.7	01Jul2015, 14:24	4.6
FG22	0.0658	5.6	01Jul2015, 12:18	1.0
FG23a	0.0166	1.9	01Jul2015, 12:12	0.3
OS07b	0.0156	1.0	01Jul2015, 12:12	0.2
OS07b-G7	0.0156	0.9	01Jul2015, 12:42	0.2
G7	0.5576	9.5	01Jul2015, 14:06	6.1
G7-G10	0.5576	9.5	01Jul2015, 14:18	5.9
FG24	0.2503	6.2	01Jul2015, 12:42	2.2
OS09	0.1527	8.2	01Jul2015, 12:36	2.0
OS09-G10	0.1527	8.2	01Jul2015, 12:48	2.0
OS08	0.0397	3.4	01Jul2015, 12:12	0.6
OS08-G8	0.0397	3.3	01Jul2015, 12:36	0.6
G8	0.4427	17.1	01Jul2015, 12:42	4.7
G8-G10	0.4427	17.1	01Jul2015, 12:48	4.7
FG23b	0.0359	1.2	01Jul2015, 12:30	0.3
G10	1.0362	24	01Jul2015, 12:48	10.9
G10-G11	1.0362	24	01Jul2015, 12:54	10.9
FG23c	0.0070	0.7	01Jul2015, 12:18	0.1
G11	1.0432	24	01Jul2015, 12:54	11.0
FG28	0.0673	3	01Jul2015, 12:30	0.7
FG25A	0.0666	5.9	01Jul2015, 12:24	1.1
FG25A-FG25B	0.0666	6	01Jul2015, 12:30	1.1
FG25B	0.0391	3	01Jul2015, 12:24	0.6
POND G IN	1.2162	33	01Jul2015, 12:48	13.4
POND G	1.2162	10	01Jul2015, 19:18	7.0
G12	1.2162	10.2	01Jul2015, 19:18	7.0
G12-G06	1.2162	10	01Jul2015, 19:30	6.8
FG29	0.0997	3	01Jul2015, 12:24	0.9
FG32	0.0402	1	01Jul2015, 12:18	0.3
FG32-G06	0.0402	1	01Jul2015, 12:24	0.3
G06	1.3561	11	01Jul2015, 19:36	7.9

Highlighted green rows reference key design points (Typical all charts this section)

GRADING MDDP (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
FG08A	0.0750	27	01Jul2015, 12:06	2.6
FG08A-G05	0.0750	27	01Jul2015, 12:12	2.6
FG08B	0.0630	20	01Jul2015, 12:12	2.2
FG08B-G05	0.0630	19	01Jul2015, 12:18	2.2
FG11	0.0625	19	01Jul2015, 12:18	2.4
FG09	0.0484	8	01Jul2015, 12:18	1.2
FG09-G05	0.0484	8	01Jul2015, 12:24	1.2
FG10A	0.0446	4	01Jul2015, 12:24	0.7
FG10B	0.0416	7	01Jul2015, 12:18	1.0
FG10C	0.0339	3	01Jul2015, 12:24	0.6
G05	0.3690	84	01Jul2015, 12:18	10.5
FG13	0.0534	4	01Jul2015, 12:30	0.8
FG12	0.0328	14	01Jul2015, 12:12	1.4
POND D IN	0.4552	98	01Jul2015, 12:18	12.7
POND D	0.4552	10	01Jul2015, 15:00	7.4
POND D-G17	0.4552	10	01Jul2015, 15:00	7.4
FG15	0.0103	4	01Jul2015, 12:12	0.4
FG15-G17A	0.0103	4	01Jul2015, 12:12	0.4
G17A	0.4655	10	01Jul2015, 14:54	7.8
FG14	0.1019	11	01Jul2015, 12:12	1.6
G17	0.5674	15	01Jul2015, 12:12	9.4
G17-G18	0.5674	15	01Jul2015, 12:18	9.4
FG16	0.0791	34	01Jul2015, 12:06	3.1
G18	0.6465	46	01Jul2015, 12:12	12.5
G18-POND E	0.6465	45	01Jul2015, 12:12	12.5
FG31	0.0922	31	01Jul2015, 12:18	3.9
FG30	0.0389	1	01Jul2015, 12:12	0.3
FG30-PONDHS	0.0389	1	01Jul2015, 12:36	0.3
POND HS	0.1311	19	01Jul2015, 12:42	4.3
FG17a	0.0694	23	01Jul2015, 12:12	2.4
FG17a-POND E	0.0694	23	01Jul2015, 12:12	2.4
FG18	0.0644	11	01Jul2015, 12:30	1.8
FG18-POND E	0.0644	11	01Jul2015, 12:30	1.8
FG19	0.0527	23	01Jul2015, 12:12	2.3
FG17c	0.0313	3	01Jul2015, 12:12	0.4
FG17b	0.0214	11	01Jul2015, 12:06	0.9
POND E IN	1.0168	118	01Jul2015, 12:12	24.5
POND E	1.0168	11	01Jul2015, 23:30	8.9
H08	1.0168	8	01Jul2015, 23:30	6.1
H09	0.0000	3	01Jul2015, 23:30	2.8
FG34	0.0836	2	01Jul2015, 12:24	0.7
G14	0.0836	2	01Jul2015, 12:24	0.7
G14-G15	0.0836	2	01Jul2015, 12:42	0.7
FG35	0.0586	1	01Jul2015, 13:12	0.5
G15	0.1422	3	01Jul2015, 12:48	1.2
G15-G08	0.1422	3	01Jul2015, 12:54	1.2
FG37	0.1203	3	01Jul2015, 13:00	1.0
FG36	0.0281	1	01Jul2015, 12:30	0.3
FG36-G08	0.0281	1	01Jul2015, 12:42	0.3
G08	0.2906	6	01Jul2015, 12:54	2.4

Highlighted green rows reference key design points (Typical all charts this section)

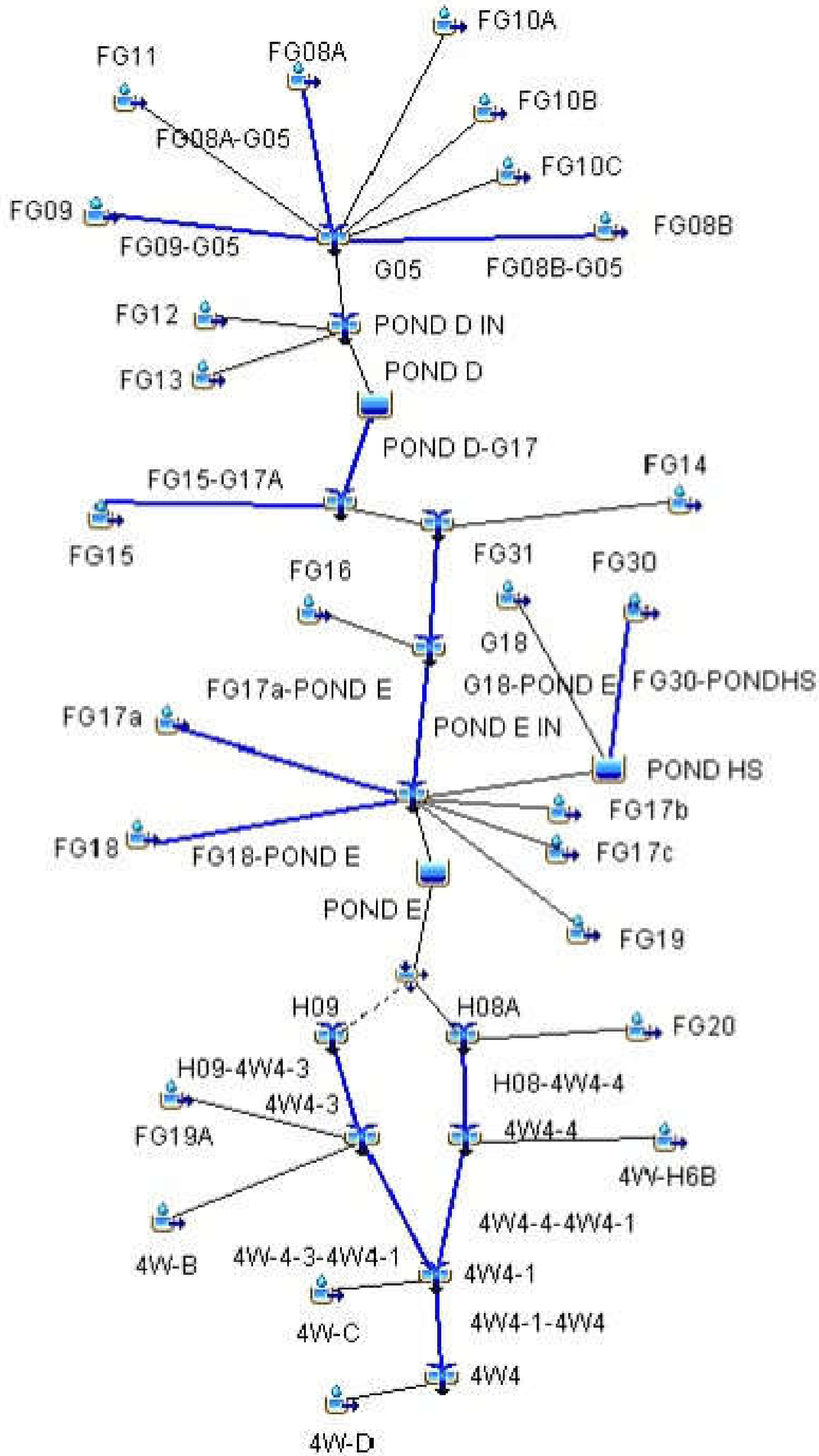
GRADING MDDP (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
G1a	0.1313	0.5	01Jul2015, 13:30	0.3
G1a-G2	0.1313	0.5	01Jul2015, 13:48	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G1	0.0578	0.2	01Jul2015, 13:30	0.2
FG01	0.0531	0.9	01Jul2015, 12:48	0.3
FG01-G1	0.0531	0.9	01Jul2015, 12:48	0.3
G1	0.1109	1.1	01Jul2015, 12:54	0.5
G1-G2	0.1109	1.1	01Jul2015, 13:00	0.5
FG02	0.0391	0.5	01Jul2015, 12:36	0.2
G2	0.2813	1.9	01Jul2015, 13:18	1.0
G2-G3	0.2813	1.9	01Jul2015, 13:30	1.0
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	0.9	01Jul2015, 12:06	0.1
G3	0.3188	2.4	01Jul2015, 13:24	1.3
G3-POND F	0.3188	2.4	01Jul2015, 13:30	1.3
FG06	0.0658	0.8	01Jul2015, 12:42	0.3
OS07a-POND F	0.0170	0.1	01Jul2015, 13:30	0.1
POND F	0.4596	2.1	01Jul2015, 17:06	1.6
POND F-G7	0.4596	2.1	01Jul2015, 17:18	1.6
FG22	0.0658	1.4	01Jul2015, 12:30	0.4
FG23a	0.0166	0.4	01Jul2015, 12:12	0.1
OS07b	0.0156	0.1	01Jul2015, 12:48	0.1
OS07b-G7	0.0156	0.1	01Jul2015, 13:42	0.1
G7	0.5576	2.7	01Jul2015, 16:36	2.2
G7-G10	0.5576	2.7	01Jul2015, 16:54	2.1
FG24	0.2503	1.1	01Jul2015, 13:48	0.7
OS09	0.1527	1.9	01Jul2015, 12:54	0.8
OS09-G10	0.1527	1.9	01Jul2015, 13:18	0.8
OS08	0.0397	0.7	01Jul2015, 12:24	0.2
OS08-G8	0.0397	0.7	01Jul2015, 12:54	0.2
G8	0.4427	3.4	01Jul2015, 13:24	1.7
G8-G10	0.4427	3.4	01Jul2015, 13:30	1.7
FG23b	0.0359	0.2	01Jul2015, 13:18	0.1
G10	1.0362	5.3	01Jul2015, 13:54	3.9
G10-G11	1.0362	5.3	01Jul2015, 14:00	3.8
FG23c	0.0070	0.2	01Jul2015, 12:24	0.1
G11	1.0432	5.4	01Jul2015, 14:00	3.9
FG28	0.0673	0.5	01Jul2015, 13:12	0.3
FG25A	0.0666	1.6	01Jul2015, 12:30	0.5
FG25A-FG25B	0.0666	1.6	01Jul2015, 12:36	0.5
FG25B	0.0391	0.9	01Jul2015, 12:30	0.3
POND G IN	1.2162	7.2	01Jul2015, 13:18	4.9
POND G	1.2162	3.8	02Jul2015, 00:00	2.5
G12	1.2162	3.8	02Jul2015, 00:00	2.5
G12-G06	1.2162	4	02Jul2015, 00:00	2.4
FG29	0.0997	0	01Jul2015, 13:36	0.3
FG32	0.0402	0	01Jul2015, 13:18	0.1
FG32-G06	0.0402	0.2	01Jul2015, 13:30	0.1
G06	1.3561	4	01Jul2015, 23:48	2.8

Highlighted green rows reference key design points (Typical all charts this section)

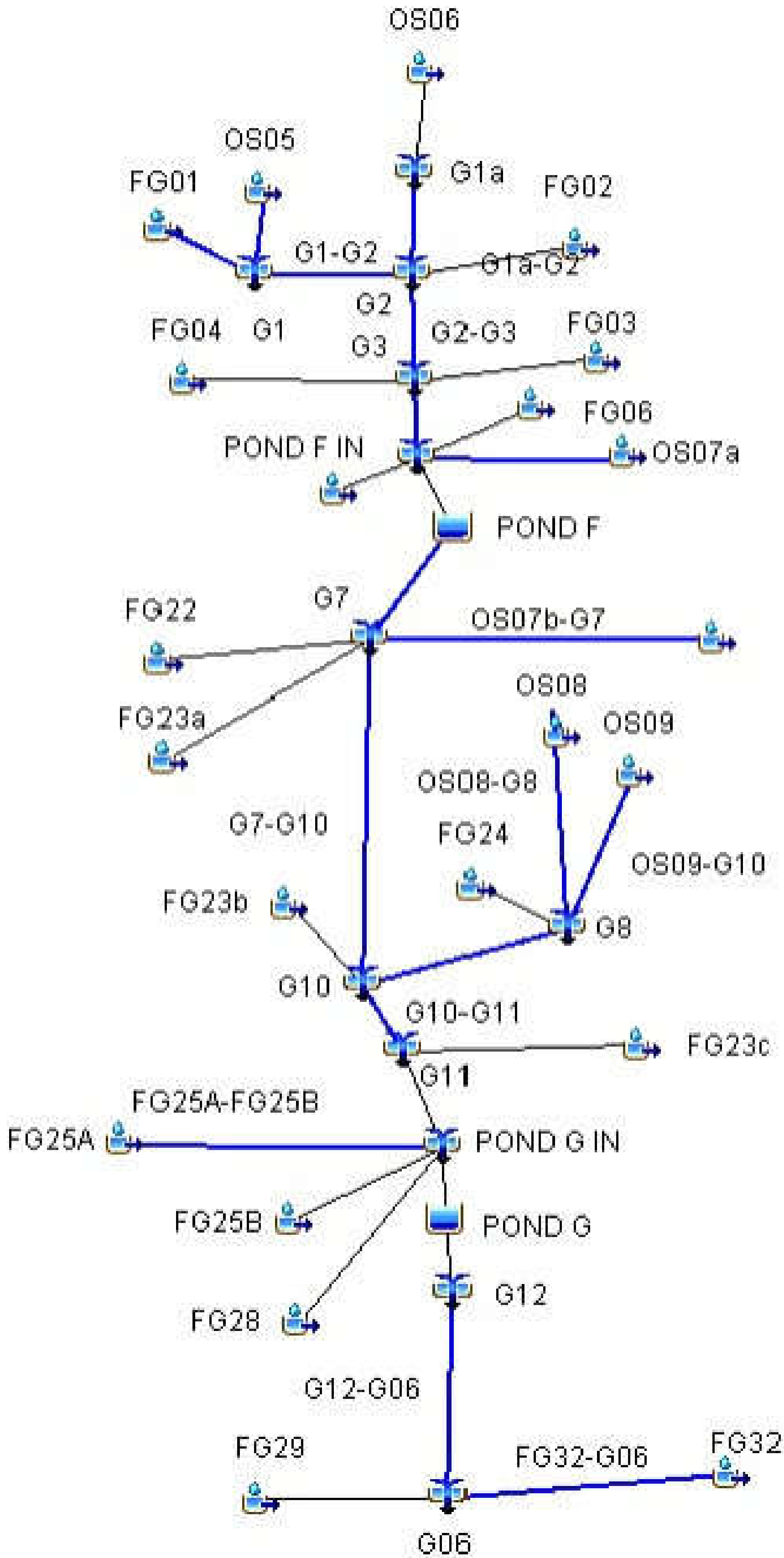
GRADING MDDP (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
FG08A	0.0750	13	01Jul2015, 12:12	1.5
FG08A-G05	0.0750	13	01Jul2015, 12:18	1.5
FG08B	0.0630	10	01Jul2015, 12:12	1.2
FG08B-G05	0.0630	10	01Jul2015, 12:18	1.2
FG11	0.0625	10	01Jul2015, 12:18	1.4
FG09	0.0484	3	01Jul2015, 12:18	0.6
FG09-G05	0.0484	3	01Jul2015, 12:24	0.6
FG10A	0.0446	1	01Jul2015, 12:30	0.3
FG10B	0.0416	3	01Jul2015, 12:18	0.5
FG10C	0.0339	1	01Jul2015, 12:30	0.2
G05	0.3690	40	01Jul2015, 12:18	5.7
FG13	0.0534	1	01Jul2015, 12:42	0.3
FG12	0.0328	8	01Jul2015, 12:12	0.8
POND D IN	0.4552	47	01Jul2015, 12:18	6.9
POND D	0.4552	3	01Jul2015, 20:18	2.6
POND D-G17	0.4552	3	01Jul2015, 20:18	2.6
FG15	0.0103	2	01Jul2015, 12:12	0.2
FG15-G17A	0.0103	2	01Jul2015, 12:12	0.2
G17A	0.4655	3	01Jul2015, 20:12	2.8
FG14	0.1019	3	01Jul2015, 12:18	0.7
G17	0.5674	5	01Jul2015, 12:18	3.5
G17-G18	0.5674	5	01Jul2015, 12:24	3.5
FG16	0.0791	18	01Jul2015, 12:06	1.9
G18	0.6465	22	01Jul2015, 12:12	5.3
G18-POND E	0.6465	21	01Jul2015, 12:12	5.3
FG31	0.0922	17	01Jul2015, 12:18	2.4
FG30	0.0389	0	01Jul2015, 13:18	0.1
FG30-PONDHS	0.0389	0	01Jul2015, 13:48	0.1
POND HS	0.1311	10	01Jul2015, 12:42	2.5
FG17a	0.0694	12	01Jul2015, 12:12	1.3
FG17a-POND E	0.0694	12	01Jul2015, 12:12	1.3
FG18	0.0644	5	01Jul2015, 12:30	0.9
FG18-POND E	0.0644	5	01Jul2015, 12:30	0.9
FG19	0.0527	13	01Jul2015, 12:12	1.4
FG17c	0.0313	1	01Jul2015, 12:18	0.2
FG17b	0.0214	6	01Jul2015, 12:06	0.6
POND E IN	1.0168	59	01Jul2015, 12:12	12.1
POND E	1.0168	5	02Jul2015, 00:00	4.4
H08	1.0168	3	02Jul2015, 00:00	2.6
H09	0.0000	2	02Jul2015, 00:00	1.8
FG34	0.0836	0	01Jul2015, 13:36	0.2
G14	0.0836	0	01Jul2015, 13:36	0.2
G14-G15	0.0836	0	01Jul2015, 14:00	0.2
FG35	0.0586	0	01Jul2015, 14:24	0.2
G15	0.1422	1	01Jul2015, 14:06	0.4
G15-G08	0.1422	1	01Jul2015, 14:18	0.4
FG37	0.1203	0	01Jul2015, 14:12	0.3
FG36	0.0281	0	01Jul2015, 13:30	0.1
FG36-G08	0.0281	0	01Jul2015, 13:48	0.1
G08	0.2906	1	01Jul2015, 14:12	0.7

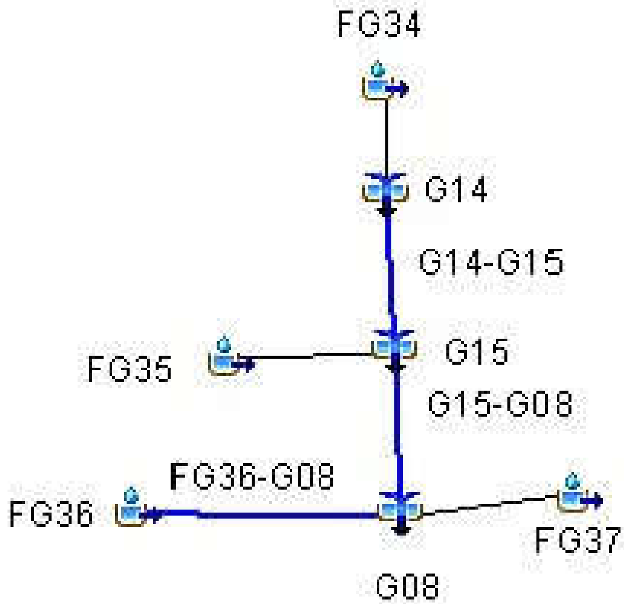
Highlighted green rows reference key design points (Typical all charts this section)

ROUTING PONDS D-E GRADED CONDITIONS



ROUTING PONDS F-G GRADED CONDITIONS




FG34
G14
G14-G15
FG35
G15
G15-G08
FG36-G08
FG36
FG37
G08

FUTURE MDDP (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
G1a	0.1313	80	01Jul2015, 12:12	9.3
G1a-G2	0.1313	79	01Jul2015, 12:18	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G1	0.0578	39	01Jul2015, 12:12	4.1
FG01	0.0538	31	01Jul2015, 12:30	4.9
FG01-G1	0.0538	31	01Jul2015, 12:30	4.9
G1	0.1116	61	01Jul2015, 12:18	9.0
G1-G2	0.1116	61	01Jul2015, 12:18	9.0
FG02	0.0391	32	01Jul2015, 12:12	3.3
G2	0.2820	167	01Jul2015, 12:18	21.5
G2-G3	0.2820	163	01Jul2015, 12:18	21.3
FG03	0.0203	24	01Jul2015, 12:06	2.0
FG04	0.0172	22	01Jul2015, 12:00	1.7
G3	0.3195	185	01Jul2015, 12:18	25.0
G3-POND F	0.3195	183	01Jul2015, 12:18	25.0
FG06	0.0675	56	01Jul2015, 12:12	6.1
FG05	0.0580	45	01Jul2015, 12:24	6.1
OS07a	0.0170	14	01Jul2015, 12:06	1.3
OS07a-POND F	0.0170	13	01Jul2015, 12:18	1.3
POND F IN	0.4620	293	01Jul2015, 12:18	38.5
POND F	0.4620	179	01Jul2015, 12:42	36.3
POND F-G7	0.4620	179	01Jul2015, 12:42	36.1
FG21b	0.0170	26	01Jul2015, 12:12	2.6
FG21a	0.0072	6	01Jul2015, 12:06	0.5
FG21a-G7	0.0072	6	01Jul2015, 12:18	0.5
G7	0.4862	188	01Jul2015, 12:42	39.1
G7-G8	0.4862	188	01Jul2015, 12:42	39.1
FG22	0.1380	102	01Jul2015, 12:18	13.0
OS08	0.0406	35	01Jul2015, 12:12	3.6
OS08-G8	0.0406	34	01Jul2015, 12:12	3.6
FG23a	0.0216	21	01Jul2015, 12:12	2.2
OS07b	0.0156	15	01Jul2015, 12:06	1.2
OS07b-G7	0.0156	14	01Jul2015, 12:12	1.2
G8	0.7020	296	01Jul2015, 12:30	59.1
G8-G10	0.7020	293	01Jul2015, 12:30	58.9
OS09	0.1527	90	01Jul2015, 12:24	13.0
OS09-G10	0.1527	88	01Jul2015, 12:36	12.8
FG24	0.1373	105	01Jul2015, 12:18	13.4
G9	0.2900	180	01Jul2015, 12:24	26.2
G9-G10	0.2900	178	01Jul2015, 12:30	26.2
FG23b	0.0286	23	01Jul2015, 12:12	2.4
G10	1.0206	483	01Jul2015, 12:30	87.5
G10-G11	1.0206	479	01Jul2015, 12:30	87.3
FG23c	0.0122	12	01Jul2015, 12:06	1.2
G11	1.0328	484	01Jul2015, 12:30	88.5
FG25	0.1086	85	01Jul2015, 12:30	13.3

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
FG26	0.0863	78	01Jul2015, 12:18	9.4
FG26-POND G	0.0863	77	01Jul2015, 12:18	9.4
FG27	0.0500	52	01Jul2015, 12:18	6.3
FG28	0.0245	18	01Jul2015, 12:18	2.3
POND G IN	1.3022	690	01Jul2015, 12:30	119.7
POND G	1.3022	476	01Jul2015, 12:54	110.2
G12	1.3022	476	01Jul2015, 12:54	110.2
G12-G06	1.3022	476	01Jul2015, 13:00	109.5
FG29	0.0997	60	01Jul2015, 12:12	7.1
FG32	0.0402	72	01Jul2015, 12:06	6.1
FG32-G06	0.0402	69	01Jul2015, 12:06	6.1
G06	1.4421	503	01Jul2015, 12:54	122.6
FG08A	0.0750	116	01Jul2015, 12:06	10.2
FG08A-G05	0.0750	110	01Jul2015, 12:12	10.2
FG08B	0.0630	86	01Jul2015, 12:12	8.5
FG08B-G05	0.0630	84	01Jul2015, 12:12	8.5
FG09	0.0484	48	01Jul2015, 12:12	5.5
FG09-G05	0.0484	48	01Jul2015, 12:18	5.5
FG10B	0.0416	42	01Jul2015, 12:12	4.7
G05	0.2280	282	01Jul2015, 12:12	28.8
FG10A	0.0806	81	01Jul2015, 12:18	9.6
FG11	0.0625	75	01Jul2015, 12:18	8.9
FG13	0.0534	34	01Jul2015, 12:24	4.8
FG12	0.0328	50	01Jul2015, 12:12	5.0
POND D IN	0.4573	509	01Jul2015, 12:12	57.0
POND D	0.4573	133	01Jul2015, 13:00	46.3
POND D-G17	0.4573	133	01Jul2015, 13:00	46.2
FG15	0.0103	15	01Jul2015, 12:06	1.5
FG15-G17A	0.0103	15	01Jul2015, 12:12	1.5
G17A	0.4676	136	01Jul2015, 13:00	47.7
FG14	0.1000	98	01Jul2015, 12:18	12.5
G17	0.5676	195	01Jul2015, 12:30	60.3
G17-G18	0.5676	194	01Jul2015, 12:36	60.2
FG16	0.0791	133	01Jul2015, 12:06	11.5
G18	0.6467	238	01Jul2015, 12:24	71.7
G18-POND E	0.6467	238	01Jul2015, 12:24	71.7
FG31	0.0922	116	01Jul2015, 12:18	13.9
FG30	0.0389	73	01Jul2015, 12:06	5.9
FG30-PONDHS	0.0389	70	01Jul2015, 12:12	5.8
POND HS	0.1311	153	01Jul2015, 12:24	19.7
FG17a	0.0694	101	01Jul2015, 12:06	9.4
FG17a-POND E	0.0694	99	01Jul2015, 12:06	9.4
FG18	0.0644	56	01Jul2015, 12:24	7.8
FG18-POND E	0.0644	56	01Jul2015, 12:24	7.8
FG19	0.0527	84	01Jul2015, 12:06	8.1
FG17c	0.0313	31	01Jul2015, 12:06	2.7
FG17b	0.0214	39	01Jul2015, 12:06	3.2

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
POND E IN	1.0170	608	01Jul2015, 12:18	122.4
POND E	1.0170	239	01Jul2015, 13:30	97.6
H08	1.0170	203	01Jul2015, 13:30	85.3
H09	0.0000	36	01Jul2015, 13:30	12.3
FG34	0.0600	34	01Jul2015, 12:18	4.5
G14	0.0600	34	01Jul2015, 12:18	4.5
G14-G15	0.0600	34	01Jul2015, 12:24	4.4
FG35	0.0344	20	01Jul2015, 12:24	2.7
G15	0.0944	53	01Jul2015, 12:24	7.1
G15-G08	0.0944	52	01Jul2015, 12:24	7.1
FG37	0.0797	41	01Jul2015, 12:18	5.6
FG36	0.0281	14	01Jul2015, 12:18	2.0
FG36-G08	0.0281	14	01Jul2015, 12:24	2.0
G08	0.2022	106	01Jul2015, 12:24	14.7

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
G1a	0.1313	52	01Jul2015, 12:12	6.5
G1a-G2	0.1313	52	01Jul2015, 12:18	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G1	0.0578	25	01Jul2015, 12:12	2.9
FG01	0.0538	22	01Jul2015, 12:30	3.6
FG01-G1	0.0538	22	01Jul2015, 12:30	3.6
G1	0.1116	41	01Jul2015, 12:18	6.4
G1-G2	0.1116	41	01Jul2015, 12:18	6.4
FG02	0.0391	22	01Jul2015, 12:12	2.4
G2	0.2820	112	01Jul2015, 12:18	15.3
G2-G3	0.2820	109	01Jul2015, 12:24	15.2
FG03	0.0203	17	01Jul2015, 12:06	1.5
FG04	0.0172	16	01Jul2015, 12:00	1.3
G3	0.3195	123	01Jul2015, 12:18	17.9
G3-POND F	0.3195	121	01Jul2015, 12:18	17.9
FG06	0.0675	40	01Jul2015, 12:12	4.4
FG05	0.0580	33	01Jul2015, 12:24	4.6
OS07a	0.0170	9	01Jul2015, 12:12	1.0
OS07a-POND F	0.0170	9	01Jul2015, 12:18	0.9
POND F IN	0.4620	200	01Jul2015, 12:18	27.9
POND F	0.4620	125	01Jul2015, 12:42	26.0
POND F-G7	0.4620	123	01Jul2015, 12:48	25.9
FG21b	0.0170	20	01Jul2015, 12:12	2.0
FG21a	0.0072	4	01Jul2015, 12:06	0.4
FG21a-G7	0.0072	3	01Jul2015, 12:18	0.4
G7	0.4862	129	01Jul2015, 12:48	28.2
G7-G8	0.4862	129	01Jul2015, 12:48	28.2
FG22	0.1380	73	01Jul2015, 12:18	9.6
OS08	0.0406	25	01Jul2015, 12:12	2.6
OS08-G8	0.0406	24	01Jul2015, 12:12	2.6
FG23a	0.0216	15	01Jul2015, 12:12	1.6
OS07b	0.0156	10	01Jul2015, 12:06	0.9
OS07b-G7	0.0156	10	01Jul2015, 12:12	0.9
G8	0.7020	191	01Jul2015, 12:36	42.9
G8-G10	0.7020	190	01Jul2015, 12:42	42.7
OS09	0.1527	62	01Jul2015, 12:24	9.4
OS09-G10	0.1527	62	01Jul2015, 12:36	9.3
FG24	0.1373	76	01Jul2015, 12:18	9.9
G9	0.2900	125	01Jul2015, 12:30	19.2
G9-G10	0.2900	125.0	01Jul2015, 12:30	19.2
FG23b	0.0286	16	01Jul2015, 12:12	1.8
G10	1.0206	311	01Jul2015, 12:36	63.6
G10-G11	1.0206	309	01Jul2015, 12:36	63.5
FG23c	0.0122	9	01Jul2015, 12:06	0.9
G11	1.0328	312	01Jul2015, 12:36	64.3
FG25	0.1086	64	01Jul2015, 12:30	10.2

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
FG26	0.0863	58	01Jul2015, 12:18	7.1
FG26-POND G	0.0863	57	01Jul2015, 12:18	7.0
FG27	0.0500	40	01Jul2015, 12:18	4.8
FG28	0.0245	13	01Jul2015, 12:18	1.7
POND G IN	1.3022	457	01Jul2015, 12:30	88.1
POND G	1.3022	328	01Jul2015, 13:00	79.1
G12	1.3022	328	01Jul2015, 13:00	79.1
G12-G06	1.3022	325	01Jul2015, 13:06	78.6
FG29	0.0997	39	01Jul2015, 12:18	5.0
FG32	0.0402	57	01Jul2015, 12:06	4.8
FG32-G06	0.0402	54	01Jul2015, 12:06	4.8
G06	1.4421	344	01Jul2015, 13:00	88.4
FG08A	0.0750	90	01Jul2015, 12:06	7.9
FG08A-G05	0.0750	86	01Jul2015, 12:12	7.9
FG08B	0.0630	67	01Jul2015, 12:12	6.6
FG08B-G05	0.0630	65	01Jul2015, 12:12	6.6
FG09	0.0484	36	01Jul2015, 12:12	4.1
FG09-G05	0.0484	36	01Jul2015, 12:18	4.1
FG10B	0.0416	31	01Jul2015, 12:12	3.5
G05	0.2280	215	01Jul2015, 12:12	22.1
FG10A	0.0806	61	01Jul2015, 12:18	7.3
FG11	0.0625	59	01Jul2015, 12:18	7.0
FG13	0.0534	24	01Jul2015, 12:24	3.5
FG12	0.0328	40	01Jul2015, 12:12	3.9
POND D IN	0.4573	387	01Jul2015, 12:12	43.9
POND D	0.4573	90	01Jul2015, 13:06	34.2
POND D-G17	0.4573	90	01Jul2015, 13:06	34.1
FG15	0.0103	12	01Jul2015, 12:12	1.2
FG15-G17A	0.0103	12	01Jul2015, 12:12	1.2
G17A	0.4676	91	01Jul2015, 13:06	35.3
FG14	0.1000	74	01Jul2015, 12:18	9.6
G17	0.5676	129	01Jul2015, 12:36	44.9
G17-G18	0.5676	128	01Jul2015, 12:36	44.9
FG16	0.0791	104	01Jul2015, 12:06	9.0
G18	0.6467	178	01Jul2015, 12:12	53.9
G18-POND E	0.6467	176	01Jul2015, 12:12	53.9
FG31	0.0922	92	01Jul2015, 12:18	11.0
FG30	0.0389	57	01Jul2015, 12:06	4.7
FG30-PONDHS	0.0389	56	01Jul2015, 12:12	4.6
POND HS	0.1311	106	01Jul2015, 12:30	15.5
FG17a	0.0694	78	01Jul2015, 12:06	7.3
FG17a-POND E	0.0694	76	01Jul2015, 12:06	7.3
FG18	0.0644	42	01Jul2015, 12:24	5.9
FG18-POND E	0.0644	42	01Jul2015, 12:24	5.9
FG19	0.0527	66	01Jul2015, 12:06	6.4
FG17c	0.0313	22	01Jul2015, 12:06	2.0
FG17b	0.0214	31	01Jul2015, 12:06	2.6

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
POND E IN	1.0170	432	01Jul2015, 12:12	93.5
POND E	1.0170	149	01Jul2015, 14:00	69.4
H08	1.0170	134	01Jul2015, 14:00	61.1
H09	0.0000	15	01Jul2015, 14:00	8.3
FG34	0.0600	23	01Jul2015, 12:18	3.2
G14	0.0600	23	01Jul2015, 12:18	3.2
G14-G15	0.0600	22	01Jul2015, 12:24	3.1
FG35	0.0344	13.4	01Jul2015, 12:24	2.0
G15	0.0944	35.6	01Jul2015, 12:24	5.1
G15-G08	0.0944	35	01Jul2015, 12:30	5.0
FG37	0.0797	27	01Jul2015, 12:24	4.0
FG36	0.0281	9	01Jul2015, 12:24	1.4
FG36-G08	0.0281	9	01Jul2015, 12:30	1.4
G08	0.2022	69	01Jul2015, 12:24	10.4

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (25-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q25 (CFS)	TIME OF PEAK	TOTAL VOLUME Q25 (AC. FT.)
OS06	0.1313	30	01Jul2015, 12:18	4.3
G1a	0.1313	30	01Jul2015, 12:18	4.3
G1a-G2	0.1313	30	01Jul2015, 12:18	4.2
OS05	0.0578	15	01Jul2015, 12:12	1.9
OS05-G1	0.0578	15	01Jul2015, 12:12	1.9
FG01	0.0538	14	01Jul2015, 12:30	2.5
FG01-G1	0.0538	14	01Jul2015, 12:30	2.5
G1	0.1116	25	01Jul2015, 12:18	4.4
G1-G2	0.1116	25	01Jul2015, 12:24	4.3
FG02	0.0391	14	01Jul2015, 12:12	1.6
G2	0.2820	67	01Jul2015, 12:18	10.2
G2-G3	0.2820	66	01Jul2015, 12:24	10.1
FG03	0.0203	12	01Jul2015, 12:06	1.0
FG04	0.0172	11	01Jul2015, 12:00	0.9
G3	0.3195	74	01Jul2015, 12:24	12.0
G3-POND F	0.3195	74	01Jul2015, 12:24	12.0
FG06	0.0675	26	01Jul2015, 12:12	3.1
FG05	0.0580	23	01Jul2015, 12:24	3.3
OS07a	0.0170	6	01Jul2015, 12:12	0.6
OS07a-POND F	0.0170	6	01Jul2015, 12:24	0.6
POND F IN	0.4620	123	01Jul2015, 12:24	19.0
POND F	0.4620	63	01Jul2015, 12:54	17.5
POND F-G7	0.4620	63	01Jul2015, 13:00	17.3
FG21b	0.0170	16	01Jul2015, 12:12	1.5
FG21a	0.0072	2	01Jul2015, 12:06	0.2
FG21a-G7	0.0072	2	01Jul2015, 12:24	0.2
G7	0.4862	66	01Jul2015, 13:00	19.1
G7-G8	0.4862	66	01Jul2015, 13:00	19.1
FG22	0.1380	47	01Jul2015, 12:18	6.7
OS08	0.0406	16	01Jul2015, 12:12	1.8
OS08-G8	0.0406	15	01Jul2015, 12:18	1.8
FG23a	0.0216	10	01Jul2015, 12:12	1.1
OS07b	0.0156	6	01Jul2015, 12:06	0.6
OS07b-G7	0.0156	6	01Jul2015, 12:12	0.6
G8	0.7020	96	01Jul2015, 12:54	29.3
G8-G10	0.7020	95	01Jul2015, 12:54	29.1
OS09	0.1527	39	01Jul2015, 12:30	6.5
OS09-G10	0.1527	39	01Jul2015, 12:36	6.3
FG24	0.1373	50	01Jul2015, 12:18	7.0
G9	0.2900	81	01Jul2015, 12:30	13.3
G9-G10	0.2900	79.0	01Jul2015, 12:30	13.3
FG23b	0.0286	10	01Jul2015, 12:12	1.2
G10	1.0206	175	01Jul2015, 12:30	43.6
G10-G11	1.0206	174	01Jul2015, 12:30	43.5
FG23c	0.0122	6	01Jul2015, 12:12	0.6
G11	1.0328	176	01Jul2015, 12:30	44.0
FG25	0.1086	45.9	01Jul2015, 12:30	7.5

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (25-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q25 (CFS)	TIME OF PEAK	TOTAL VOLUME Q25 (AC. FT.)
FG26	0.0863	40	01Jul2015, 12:18	5.1
FG26-POND G	0.0863	39	01Jul2015, 12:18	5.1
FG27	0.0500	29	01Jul2015, 12:18	3.6
FG28	0.0245	8	01Jul2015, 12:18	1.1
POND G IN	1.3022	287	01Jul2015, 12:30	61.3
POND G	1.3022	170	01Jul2015, 13:12	53.0
G12	1.3022	170	01Jul2015, 13:12	53.0
G12-G06	1.3022	170	01Jul2015, 13:18	52.6
FG29	0.0997	23	01Jul2015, 12:18	3.3
FG32	0.0402	44	01Jul2015, 12:06	3.7
FG32-G06	0.0402	41	01Jul2015, 12:06	3.7
G06	1.4421	180	01Jul2015, 13:18	59.5
FG08A	0.0750	66	01Jul2015, 12:06	5.9
FG08A-G05	0.0750	64	01Jul2015, 12:12	5.9
FG08B	0.0630	49	01Jul2015, 12:12	5.0
FG08B-G05	0.0630	48	01Jul2015, 12:12	4.9
FG09	0.0484	25	01Jul2015, 12:18	3.0
FG09-G05	0.0484	25	01Jul2015, 12:18	3.0
FG10B	0.0416	22	01Jul2015, 12:12	2.5
G05	0.2280	156	01Jul2015, 12:12	16.3
FG10A	0.0806	43	01Jul2015, 12:18	5.4
FG11	0.0625	44	01Jul2015, 12:18	5.2
FG13	0.0534	15	01Jul2015, 12:24	2.4
FG12	0.0328	30.2	01Jul2015, 12:12	3.0
POND D IN	0.4573	279.7	01Jul2015, 12:12	32.4
POND D	0.4573	49	01Jul2015, 13:24	23.8
POND D-G17	0.4573	49	01Jul2015, 13:30	23.8
FG15	0.0103	9	01Jul2015, 12:12	0.9
FG15-G17A	0.0103	9	01Jul2015, 12:12	0.9
G17A	0.4676	50	01Jul2015, 13:24	24.7
FG14	0.1000	53	01Jul2015, 12:18	7.1
G17	0.5676	75	01Jul2015, 12:24	31.8
G17-G18	0.5676	74	01Jul2015, 12:24	31.7
FG16	0.0791	78	01Jul2015, 12:06	6.8
G18	0.6467	127	01Jul2015, 12:12	38.6
G18-POND E	0.6467	126	01Jul2015, 12:12	38.5
FG31	0.0922	69	01Jul2015, 12:18	8.4
FG30	0.0389	44	01Jul2015, 12:06	3.6
FG30-PONDHS	0.0389	42	01Jul2015, 12:12	3.5
POND HS	0.1311	53	01Jul2015, 12:42	11.9
FG17a	0.0694	57	01Jul2015, 12:06	5.4
FG17a-POND E	0.0694	56	01Jul2015, 12:12	5.4
FG18	0.0644	30	01Jul2015, 12:24	4.3
FG18-POND E	0.0644	30	01Jul2015, 12:24	4.3
FG19	0.0527	50	01Jul2015, 12:06	4.9
FG17c	0.0313	14	01Jul2015, 12:06	1.4
FG17b	0.0214	24	01Jul2015, 12:06	1.9

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (25-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q25 (CFS)	TIME OF PEAK	TOTAL VOLUME Q25 (AC. FT.)
POND E IN	1.0170	317	01Jul2015, 12:12	68.3
POND E	1.0170	77	01Jul2015, 14:42	45.3
H08	1.0170	69	01Jul2015, 14:42	38.7
H09	0.0000	8	01Jul2015, 14:42	6.5
FG34	0.0600	13	01Jul2015, 12:24	2.1
G14	0.0600	13	01Jul2015, 12:24	2.1
G14-G15	0.0600	13	01Jul2015, 12:30	2.1
FG35	0.0344	8.3	01Jul2015, 12:24	1.3
G15	0.0944	21.3	01Jul2015, 12:30	3.4
G15-G08	0.0944	21	01Jul2015, 12:30	3.3
FG37	0.0797	16	01Jul2015, 12:24	2.6
FG36	0.0281	6	01Jul2015, 12:24	0.9
FG36-G08	0.0281	5	01Jul2015, 12:30	0.9
G08	0.2022	41	01Jul2015, 12:30	6.8

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
G1a	0.1313	12	01Jul2015, 12:18	2.2
G1a-G2	0.1313	11	01Jul2015, 12:24	2.1
OS05	0.0578	5.6	01Jul2015, 12:12	1.0
OS05-G1	0.0578	5.5	01Jul2015, 12:18	1.0
FG01	0.0538	7.0	01Jul2015, 12:36	1.4
FG01-G1	0.0538	7.0	01Jul2015, 12:36	1.4
G1	0.1116	11	01Jul2015, 12:24	2.3
G1-G2	0.1116	11	01Jul2015, 12:30	2.3
FG02	0.0391	6.4	01Jul2015, 12:12	0.9
G2	0.2820	27	01Jul2015, 12:24	5.4
G2-G3	0.2820	27	01Jul2015, 12:30	5.3
FG03	0.0203	5.9	01Jul2015, 12:06	0.6
FG04	0.0172	5.8	01Jul2015, 12:06	0.5
G3	0.3195	31	01Jul2015, 12:30	6.4
G3-POND F	0.3195	31	01Jul2015, 12:30	6.4
FG06	0.0675	12	01Jul2015, 12:18	1.7
FG05	0.0580	12.2	01Jul2015, 12:24	2.0
OS07a	0.0170	2	01Jul2015, 12:12	0.3
OS07a-POND F	0.0170	2	01Jul2015, 12:30	0.3
POND F IN	0.4620	53.7	01Jul2015, 12:30	10.4
POND F	0.4620	16.8	01Jul2015, 13:48	9.3
POND F-G7	0.4620	16.8	01Jul2015, 13:54	9.2
FG21b	0.0170	10.2	01Jul2015, 12:12	1.0
FG21a	0.0072	1	01Jul2015, 12:06	0.1
FG21a-G7	0.0072	1	01Jul2015, 12:30	0.1
G7	0.4862	18	01Jul2015, 13:42	10.3
G7-G8	0.4862	18.1	01Jul2015, 13:42	10.3
FG22	0.1380	24.0	01Jul2015, 12:24	3.8
OS08	0.0406	7.7	01Jul2015, 12:12	1.0
OS08-G8	0.0406	8	01Jul2015, 12:18	1.0
FG23a	0.0216	5	01Jul2015, 12:12	0.7
OS07b	0.0156	3	01Jul2015, 12:06	0.3
OS07b-G7	0.0156	2	01Jul2015, 12:18	0.3
G8	0.7020	47	01Jul2015, 12:18	16.1
G8-G10	0.7020	47	01Jul2015, 12:24	16.0
OS09	0.1527	18	01Jul2015, 12:30	3.5
OS09-G10	0.1527	18.1	01Jul2015, 12:42	3.5
FG24	0.1373	26	01Jul2015, 12:24	4.0
G9	0.2900	38	01Jul2015, 12:36	7.5
G9-G10	0.2900	36.8	01Jul2015, 12:36	7.5
FG23b	0.0286	5	01Jul2015, 12:12	0.7
G10	1.0206	80	01Jul2015, 12:30	24.1
G10-G11	1.0206	79	01Jul2015, 12:36	24.0
FG23c	0.0122	3	01Jul2015, 12:12	0.3
G11	1.0328	81	01Jul2015, 12:36	24.3
FG25	0.1086	27.1	01Jul2015, 12:36	4.7

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
FG26	0.0863	22	01Jul2015, 12:18	3.0
FG26-POND G	0.0863	22	01Jul2015, 12:24	3.0
FG27	0.0500	17	01Jul2015, 12:18	2.3
FG28	0.0245	4	01Jul2015, 12:18	0.7
POND G IN	1.3022	145	01Jul2015, 12:30	35.0
POND G	1.3022	54	01Jul2015, 14:00	27.6
G12	1.3022	54	01Jul2015, 14:00	27.6
G12-G06	1.3022	54	01Jul2015, 14:06	27.3
FG29	0.0997	9	01Jul2015, 12:18	1.6
FG32	0.0402	29	01Jul2015, 12:06	2.5
FG32-G06	0.0402	27	01Jul2015, 12:06	2.4
G06	1.4421	59	01Jul2015, 14:00	31.4
FG08A	0.0750	41	01Jul2015, 12:06	3.8
FG08A-G05	0.0750	41	01Jul2015, 12:12	3.8
FG08B	0.0630	31	01Jul2015, 12:12	3.2
FG08B-G05	0.0630	29	01Jul2015, 12:18	3.2
FG09	0.0484	14	01Jul2015, 12:18	1.8
FG09-G05	0.0484	14	01Jul2015, 12:18	1.8
FG10B	0.0416	12.2	01Jul2015, 12:18	1.5
G05	0.2280	94	01Jul2015, 12:12	10.3
FG10A	0.0806	25	01Jul2015, 12:18	3.3
FG11	0.0625	28	01Jul2015, 12:18	3.4
FG13	0.0534	7	01Jul2015, 12:30	1.4
FG12	0.0328	19.9	01Jul2015, 12:12	2.0
POND D IN	0.4573	168.0	01Jul2015, 12:18	20.4
POND D	0.4573	18	01Jul2015, 14:30	13.9
POND D-G17	0.4573	18	01Jul2015, 14:30	13.8
FG15	0.0103	6	01Jul2015, 12:12	0.6
FG15-G17A	0.0103	6	01Jul2015, 12:12	0.6
G17A	0.4676	18	01Jul2015, 14:18	14.4
FG14	0.1000	32	01Jul2015, 12:24	4.5
G17	0.5676	41	01Jul2015, 12:30	18.9
G17-G18	0.5676	41	01Jul2015, 12:30	18.9
FG16	0.0791	50	01Jul2015, 12:06	4.5
G18	0.6467	78	01Jul2015, 12:12	23.4
G18-POND E	0.6467	77	01Jul2015, 12:12	23.3
FG31	0.0922	45	01Jul2015, 12:18	5.6
FG30	0.0389	29	01Jul2015, 12:06	2.4
FG30-PONDHS	0.0389	27	01Jul2015, 12:12	2.3
POND HS	0.1311	36	01Jul2015, 12:42	7.9
FG17a	0.0694	35	01Jul2015, 12:06	3.5
FG17a-POND E	0.0694	35.1	01Jul2015, 12:12	3.5
FG18	0.0644	18	01Jul2015, 12:24	2.7
FG18-POND E	0.0644	17	01Jul2015, 12:30	2.7
FG19	0.0527	33	01Jul2015, 12:12	3.3
FG17c	0.0313	7	01Jul2015, 12:06	0.8
FG17b	0.0214	16	01Jul2015, 12:06	1.3

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
POND E IN	1.0170	196	01Jul2015, 12:12	42.7
POND E	1.0170	28	01Jul2015, 18:06	22.2
H08	1.0170	22.1	01Jul2015, 18:06	17.2
H09	0.0000	6	01Jul2015, 18:06	4.9
FG34	0.0600	5.5	01Jul2015, 12:24	1.1
G14	0.0600	5.5	01Jul2015, 12:24	1.1
G14-G15	0.0600	5.4	01Jul2015, 12:36	1.1
FG35	0.0344	3.5	01Jul2015, 12:30	0.7
G15	0.0944	8.7	01Jul2015, 12:36	1.8
G15-G08	0.0944	9	01Jul2015, 12:36	1.7
FG37	0.0797	6	01Jul2015, 12:24	1.3
FG36	0.0281	2	01Jul2015, 12:30	0.5
FG36-G08	0.0281	2	01Jul2015, 12:36	0.5
G08	0.2022	16	01Jul2015, 12:36	3.5

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
G1a	0.1313	3.8	01Jul2015, 12:24	1.1
G1a-G2	0.1313	3.6	01Jul2015, 12:36	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G1	0.0578	1.7	01Jul2015, 12:24	0.5
FG01	0.0538	3.4	01Jul2015, 12:36	0.8
FG01-G1	0.0538	3.4	01Jul2015, 12:36	0.8
G1	0.1116	4.9	01Jul2015, 12:36	1.3
G1-G2	0.1116	4.8	01Jul2015, 12:36	1.3
FG02	0.0391	2.7	01Jul2015, 12:18	0.5
G2	0.2820	10	01Jul2015, 12:30	2.9
G2-G3	0.2820	10	01Jul2015, 12:42	2.9
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	3.1	01Jul2015, 12:06	0.3
G3	0.3195	11	01Jul2015, 12:36	3.3
G3-POND F	0.3195	11	01Jul2015, 12:42	3.3
FG06	0.0675	5.8	01Jul2015, 12:18	1.0
FG05	0.0580	6.7	01Jul2015, 12:30	1.2
OS07a	0.0170	0.9	01Jul2015, 12:12	0.2
OS07a-POND F	0.0170	0.9	01Jul2015, 12:36	0.2
POND F IN	0.4620	22.3	01Jul2015, 12:36	5.7
POND F	0.4620	8.2	01Jul2015, 14:12	4.9
POND F-G7	0.4620	8.2	01Jul2015, 14:18	4.8
FG21b	0.0170	7.0	01Jul2015, 12:12	0.7
FG21a	0.0072	0.3	01Jul2015, 12:12	0.1
FG21a-G7	0.0072	0.3	01Jul2015, 12:42	0.1
G7	0.4862	9	01Jul2015, 14:12	5.6
G7-G8	0.4862	8.9	01Jul2015, 14:12	5.6
FG22	0.1380	12.0	01Jul2015, 12:24	2.3
OS08	0.0406	3.4	01Jul2015, 12:12	0.6
OS08-G8	0.0406	3	01Jul2015, 12:18	0.6
FG23a	0.0216	3	01Jul2015, 12:18	0.4
OS07b	0.0156	1.0	01Jul2015, 12:12	0.2
OS07b-G7	0.0156	0.9	01Jul2015, 12:18	0.2
G8	0.7020	25	01Jul2015, 12:18	9.0
G8-G10	0.7020	24	01Jul2015, 12:24	8.9
OS09	0.1527	8	01Jul2015, 12:36	2.0
OS09-G10	0.1527	8.2	01Jul2015, 12:48	2.0
FG24	0.1373	13	01Jul2015, 12:24	2.5
G9	0.2900	17	01Jul2015, 12:48	4.4
G9-G10	0.2900	16.9	01Jul2015, 12:48	4.4
FG23b	0.0286	2	01Jul2015, 12:18	0.4
G10	1.0206	39	01Jul2015, 12:24	13.7
G10-G11	1.0206	38.9	01Jul2015, 12:30	13.6
FG23c	0.0122	1.5	01Jul2015, 12:12	0.2
G11	1.0328	39.7	01Jul2015, 12:30	13.8
FG25	0.1086	16.7	01Jul2015, 12:36	3.1

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
FG26	0.0863	12	01Jul2015, 12:24	1.9
FG26-POND G	0.0863	12	01Jul2015, 12:24	1.9
FG27	0.0500	11	01Jul2015, 12:18	1.5
FG28	0.0245	2	01Jul2015, 12:24	0.4
POND G IN	1.3022	79	01Jul2015, 12:30	20.7
POND G	1.3022	21	01Jul2015, 15:30	13.9
G12	1.3022	21	01Jul2015, 15:30	13.9
G12-G06	1.3022	21	01Jul2015, 15:36	13.7
FG29	0.0997	3	01Jul2015, 12:24	0.9
FG32	0.0402	20	01Jul2015, 12:06	1.7
FG32-G06	0.0402	18	01Jul2015, 12:12	1.7
G06	1.4421	23	01Jul2015, 15:30	16.2
FG08A	0.0750	27	01Jul2015, 12:06	2.6
FG08A-G05	0.0750	27	01Jul2015, 12:12	2.6
FG08B	0.0630	20.1	01Jul2015, 12:12	2.2
FG08B-G05	0.0630	19.5	01Jul2015, 12:18	2.2
FG09	0.0484	8.3	01Jul2015, 12:18	1.2
FG09-G05	0.0484	8	01Jul2015, 12:24	1.2
FG10B	0.0416	7.0	01Jul2015, 12:18	1.0
G05	0.2280	59	01Jul2015, 12:18	6.9
FG10A	0.0806	15	01Jul2015, 12:18	2.2
FG11	0.0625	19	01Jul2015, 12:18	2.4
FG13	0.0534	4	01Jul2015, 12:30	0.8
FG12	0.0328	13.7	01Jul2015, 12:12	1.4
POND D IN	0.4573	107.0	01Jul2015, 12:18	13.6
POND D	0.4573	11	01Jul2015, 14:48	8.2
POND D-G17	0.4573	11	01Jul2015, 14:54	8.2
FG15	0.0103	4	01Jul2015, 12:12	0.4
FG15-G17A	0.0103	4	01Jul2015, 12:12	0.4
G17A	0.4676	11	01Jul2015, 14:42	8.6
FG14	0.1000	20	01Jul2015, 12:24	3.0
G17	0.5676	25	01Jul2015, 12:24	11.6
G17-G18	0.5676	25	01Jul2015, 12:24	11.6
FG16	0.0791	34	01Jul2015, 12:06	3.1
G18	0.6467	50	01Jul2015, 12:12	14.7
G18-POND E	0.6467	49	01Jul2015, 12:12	14.7
FG31	0.0922	31	01Jul2015, 12:18	3.9
FG30	0.0389	20	01Jul2015, 12:06	1.7
FG30-PONDHS	0.0389	18	01Jul2015, 12:12	1.6
POND HS	0.1311	26	01Jul2015, 12:36	5.6
FG17a	0.0694	23	01Jul2015, 12:12	2.4
FG17a-POND E	0.0694	22.9	01Jul2015, 12:12	2.4
FG18	0.0644	11	01Jul2015, 12:30	1.8
FG18-POND E	0.0644	11	01Jul2015, 12:30	1.8
FG19	0.0527	23	01Jul2015, 12:12	2.3
FG17c	0.0313	3	01Jul2015, 12:12	0.4
FG17b	0.0214	11	01Jul2015, 12:06	0.9

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
POND E IN	1.0170	126	01Jul2015, 12:12	28.0
POND E	1.0170	14	01Jul2015, 20:42	11.0
H08	1.0170	10.2	01Jul2015, 20:42	7.8
H09	0.0000	3.8	01Jul2015, 20:42	3.2
FG34	0.0600	2.0	01Jul2015, 12:30	0.6
G14	0.0600	2.0	01Jul2015, 12:30	0.6
G14-G15	0.0600	2.0	01Jul2015, 12:42	0.6
FG35	0.0344	1.5	01Jul2015, 12:30	0.4
G15	0.0944	3.3	01Jul2015, 12:42	0.9
G15-G08	0.0944	3.3	01Jul2015, 12:48	0.9
FG37	0.0797	2.0	01Jul2015, 12:36	0.7
FG36	0.0281	0.7	01Jul2015, 12:36	0.2
FG36-G08	0.0281	0.7	01Jul2015, 12:48	0.2
G08	0.2022	5.8	01Jul2015, 12:48	1.8

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE MDDP (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
G1a	0.1313	0.5	01Jul2015, 13:30	0.3
G1a-G2	0.1313	0.5	01Jul2015, 13:48	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G1	0.0578	0.2	01Jul2015, 13:30	0.2
FG01	0.0538	0.9	01Jul2015, 12:48	0.4
FG01-G1	0.0538	0.9	01Jul2015, 12:48	0.4
G1	0.1116	1.1	01Jul2015, 12:54	0.5
G1-G2	0.1116	1.1	01Jul2015, 13:00	0.5
FG02	0.0391	0.5	01Jul2015, 12:30	0.2
G2	0.2820	1.9	01Jul2015, 13:18	1.0
G2-G3	0.2820	1.9	01Jul2015, 13:30	1.0
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	0.9	01Jul2015, 12:06	0.1
G3	0.3195	2.4	01Jul2015, 13:24	1.3
G3-POND F	0.3195	2.4	01Jul2015, 13:30	1.3
FG06	0.0675	1.3	01Jul2015, 12:24	0.4
FG05	0.0580	2.4	01Jul2015, 12:30	0.6
OS07a	0.0170	0.1	01Jul2015, 12:48	0.1
OS07a-POND F	0.0170	0.1	01Jul2015, 13:30	0.1
POND F IN	0.4620	5.0	01Jul2015, 12:48	2.4
POND F	0.4620	2.3	01Jul2015, 16:48	1.7
POND F-G7	0.4620	2.3	01Jul2015, 17:00	1.7
FG21b	0.0170	4.0	01Jul2015, 12:12	0.4
FG21a	0.0072	0.0	01Jul2015, 13:06	0.0
FG21a-G7	0.0072	0.0	01Jul2015, 14:06	0.0
G7	0.4862	4.0	01Jul2015, 12:12	2.1
G7-G8	0.4862	3.8	01Jul2015, 12:12	2.1
FG22	0.1380	3.3	01Jul2015, 12:30	1.0
OS08	0.0406	0.7	01Jul2015, 12:24	0.2
OS08-G8	0.0406	0.7	01Jul2015, 12:30	0.2
FG23a	0.0216	0.8	01Jul2015, 12:18	0.2
OS07b	0.0156	0.1	01Jul2015, 12:48	0.1
OS07b-G7	0.0156	0.1	01Jul2015, 13:00	0.1
G8	0.7020	7.8	01Jul2015, 12:24	3.6
G8-G10	0.7020	7.8	01Jul2015, 12:30	3.6
OS09	0.1527	1.9	01Jul2015, 12:54	0.8
OS09-G10	0.1527	1.9	01Jul2015, 13:18	0.8
FG24	0.1373	4	01Jul2015, 12:30	1.1
G9	0.2900	4	01Jul2015, 13:12	1.9
G9-G10	0.2900	4.4	01Jul2015, 13:12	1.9
FG23b	0.0286	0	01Jul2015, 12:30	0.2
G10	1.0206	12.1	01Jul2015, 12:30	5.6
G10-G11	1.0206	12.0	01Jul2015, 12:36	5.5
FG23c	0.0122	0.4	01Jul2015, 12:18	0.1
G11	1.0328	12.3	01Jul2015, 12:36	5.6
FG25	0.1086	7.5	01Jul2015, 12:36	1.7

Highlighted green rows reference key design points (Typical all charts this section)

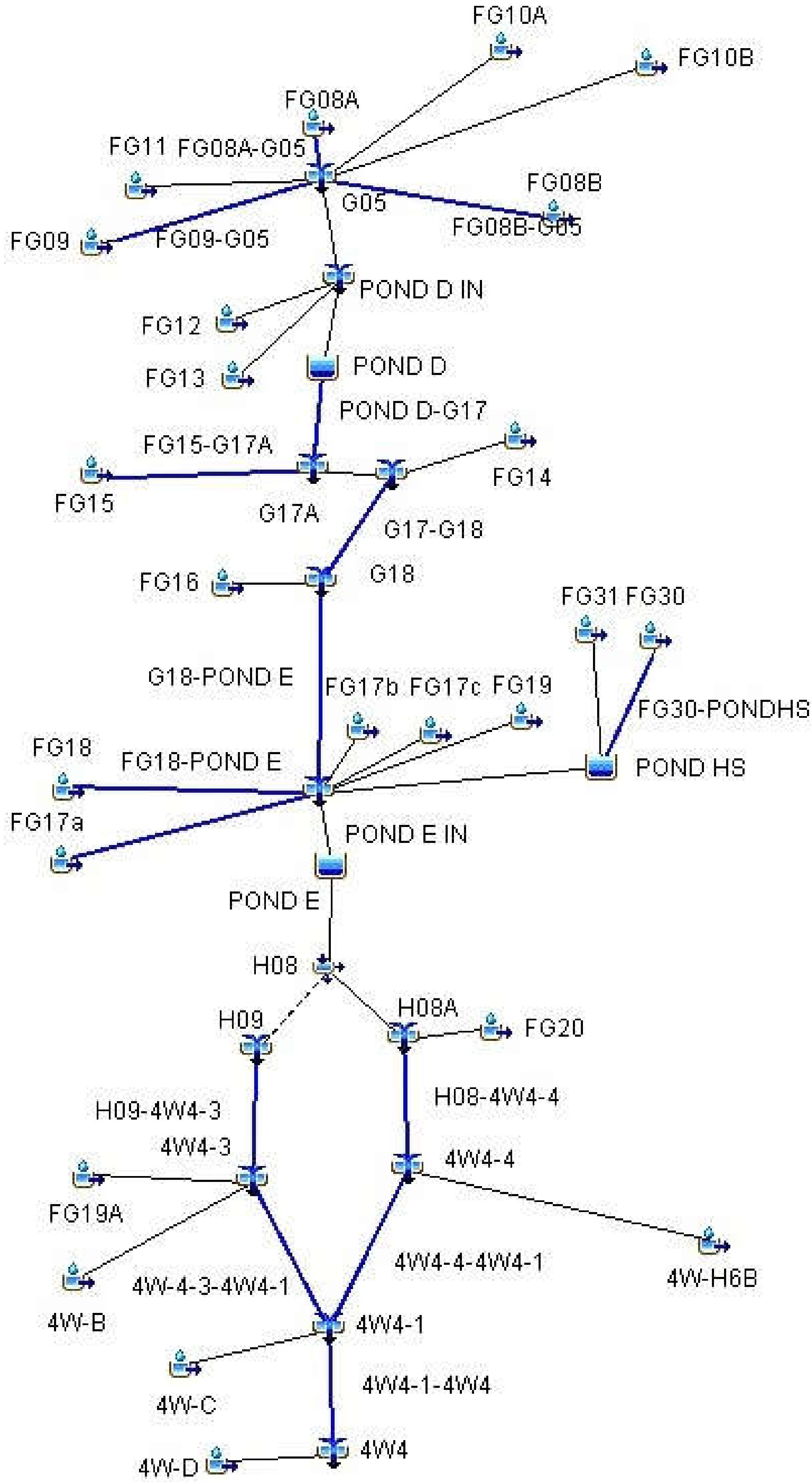
FUTURE MDDP (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
FG26	0.0863	5	01Jul2015, 12:24	1.0
FG26-POND G	0.0863	4.5	01Jul2015, 12:30	0.9
FG27	0.0500	5.0	01Jul2015, 12:24	0.8
FG28	0.0245	1	01Jul2015, 12:30	0.2
POND G IN	1.3022	28	01Jul2015, 12:30	9.2
POND G	1.3022	5	02Jul2015, 00:00	4.4
G12	1.3022	5	02Jul2015, 00:00	4.4
G12-G06	1.3022	5	02Jul2015, 00:00	4.3
FG29	0.0997	0.4	01Jul2015, 13:36	0.3
FG32	0.0402	11	01Jul2015, 12:06	1.0
FG32-G06	0.0402	11	01Jul2015, 12:12	1.0
G06	1.4421	11	01Jul2015, 12:12	5.6
FG08A	0.0750	13	01Jul2015, 12:12	1.5
FG08A-G05	0.0750	13.1	01Jul2015, 12:18	1.5
FG08B	0.0630	10.2	01Jul2015, 12:12	1.2
FG08B-G05	0.0630	10.0	01Jul2015, 12:18	1.2
FG09	0.0484	3.2	01Jul2015, 12:18	0.6
FG09-G05	0.0484	3	01Jul2015, 12:24	0.6
FG10B	0.0416	2.7	01Jul2015, 12:18	0.5
G05	0.2280	28.7	01Jul2015, 12:18	3.8
FG10A	0.0806	7	01Jul2015, 12:24	1.1
FG11	0.0625	9.8	01Jul2015, 12:18	1.4
FG13	0.0534	0.9	01Jul2015, 12:42	0.3
FG12	0.0328	7.8	01Jul2015, 12:12	0.8
POND D IN	0.4573	52.1	01Jul2015, 12:18	7.5
POND D	0.4573	3.7	01Jul2015, 19:54	3.0
POND D-G17	0.4573	3.7	01Jul2015, 19:54	3.0
FG15	0.0103	2	01Jul2015, 12:12	0.2
FG15-G17A	0.0103	2	01Jul2015, 12:12	0.2
G17A	0.4676	4	01Jul2015, 19:48	3.3
FG14	0.1000	9	01Jul2015, 12:24	1.6
G17	0.5676	12	01Jul2015, 12:24	4.9
G17-G18	0.5676	12	01Jul2015, 12:30	4.9
FG16	0.0791	18	01Jul2015, 12:06	1.9
G18	0.6467	25	01Jul2015, 12:12	6.7
G18-POND E	0.6467	25	01Jul2015, 12:12	6.7
FG31	0.0922	17	01Jul2015, 12:18	2.4
FG30	0.0389	11	01Jul2015, 12:06	1.0
FG30-PONDHS	0.0389	10.9	01Jul2015, 12:18	1.0
POND HS	0.1311	14.8	01Jul2015, 12:42	3.3
FG17a	0.0694	12	01Jul2015, 12:12	1.3
FG17a-POND E	0.0694	11.6	01Jul2015, 12:12	1.3
FG18	0.0644	4.7	01Jul2015, 12:30	0.9
FG18-POND E	0.0644	5	01Jul2015, 12:30	0.9
FG19	0.0527	13.1	01Jul2015, 12:12	1.4
FG17c	0.0313	0.5	01Jul2015, 12:18	0.2
FG17b	0.0214	6.1	01Jul2015, 12:06	0.6

Highlighted green rows reference key design points (Typical all charts this section)

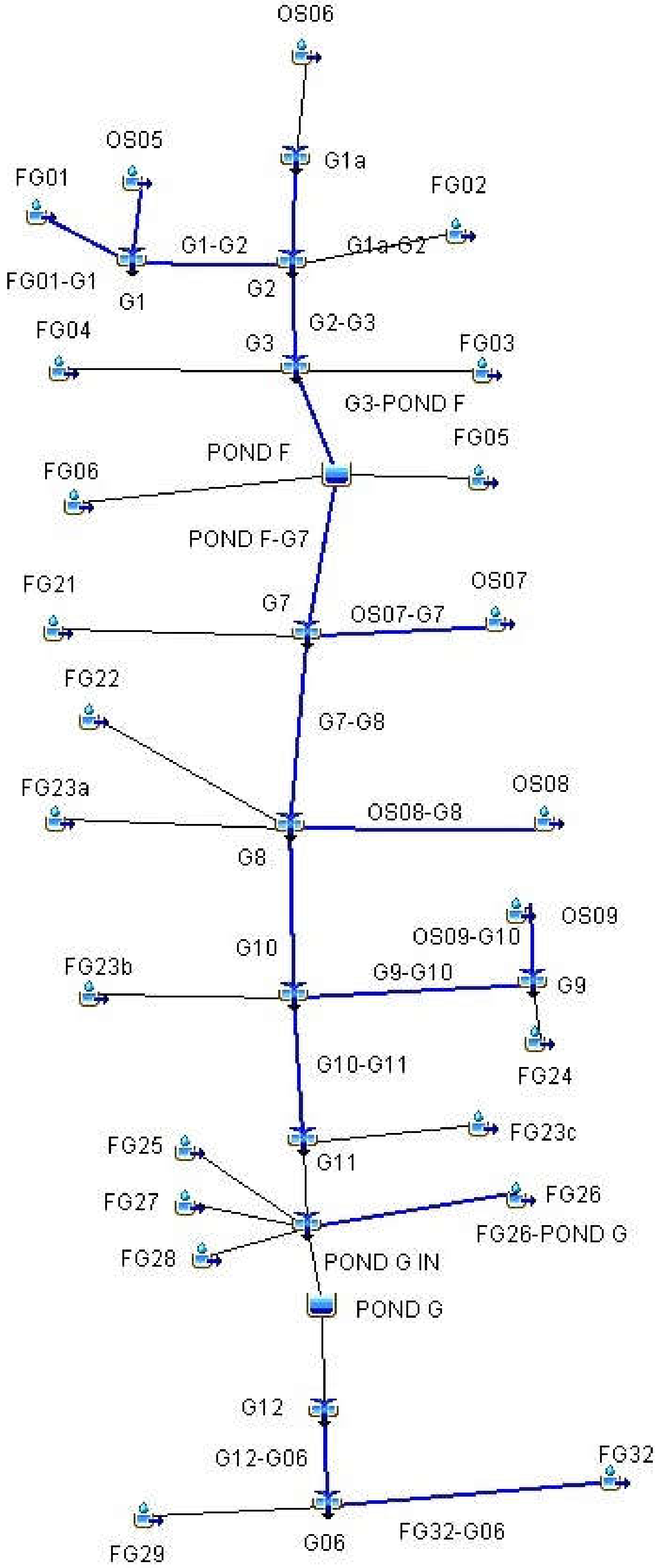
FUTURE MDDP (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
POND E IN	1.0170	63.6	01Jul2015, 12:12	14.4
POND E	1.0170	5.8	02Jul2015, 00:00	4.9
H08	1.0170	3.5	02Jul2015, 00:00	3.0
H09	0.0000	2.3	02Jul2015, 00:00	2.0
FG34	0.0600	0.3	01Jul2015, 13:18	0.2
G14	0.0600	0.3	01Jul2015, 13:18	0.2
G14-G15	0.0600	0.3	01Jul2015, 13:48	0.2
FG35	0.0344	0.3	01Jul2015, 13:06	0.1
G15	0.0944	0.6	01Jul2015, 13:36	0.3
G15-G08	0.0944	0.6	01Jul2015, 13:48	0.3
FG37	0.0797	0.3	01Jul2015, 13:42	0.2
FG36	0.0281	0.1	01Jul2015, 13:42	0.1
FG36-G08	0.0281	0.1	01Jul2015, 14:00	0.1
G08	0.2022	1.0	01Jul2015, 13:48	0.6

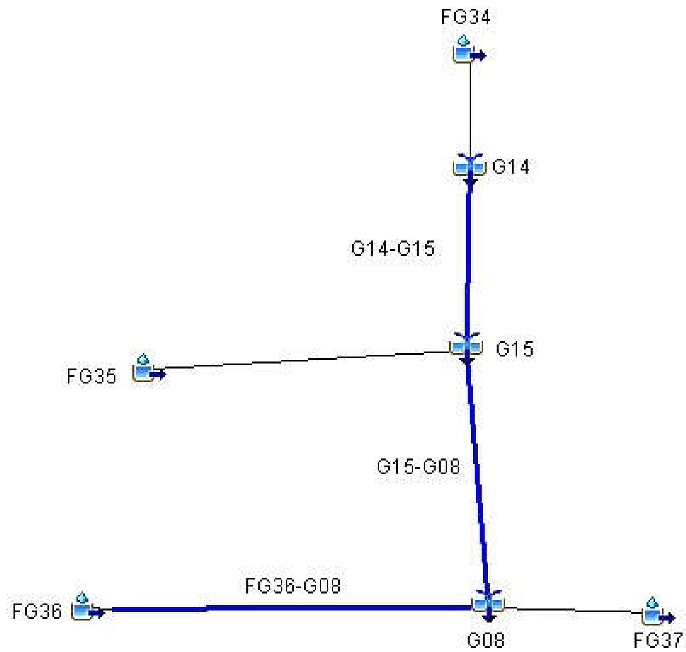
Highlighted green rows reference key design points (Typical all charts this section)

HAEGLER FUTURE CONDITIONS



GIECK FUTURE CONDITIONS




FG34
G14
G14-G15
G15
FG35
G15-G08
FG36-G08
FG36
G08
FG37

Appendix C - Detention Pond Information

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond D - RHR GRADED CONDITION

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	710
embankment elev =	7060
spillway length =	100
spillway elevation =	7058
100 year storage elev.=	7056.9
100 year storage vol.=	24.3
100 year discharge=	125
5 year storage elev.=	7053.7
5 year storage vol.=	6.7
5 year discharge=	9.7
WQCV storage vol.=	1.0
WQCV depth =	2.42
1/2 WQCV storage vol.=	0.50

Data for outlet pipe and grate:

Type			Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular		Orifice 1:	0.03	2.42		Area =	0.072	Elev to cl =	7050.21
Circular		Orifice 2:			8	Area =	0.349	Elev to cl =	7051.42
Rectangular		Orifice 3:	5	0.5		Area =	2.500	Elev to cl =	7053.35
None Selected		Orifice 4:				Area =	0.000	Elev to cl =	
Stand Pipe Dimensions									
Rec Grate		6	x	4.25	Elev =	7054.9			
Circ. Grate			dia.		Elev =				
Outlet Culvert Dimensions									
		Width (ft.)		Height (ft.)	Dia. (ft.)	Type			
Outlet Culvert			x		4	**Circular**			
Area		12.6		TOP					
Outlet I. E.		7048.1		7052.5					
Wall Thick.		5	in.						

50 year storage vol.=	19.1
50 year storage elev.=	7056.2
50 year discharge=	83
10 year storage vol.=	10.0
10 year storage elev.=	7054.5
10 year discharge=	17
2 year storage vol.=	4.4
2 year storage elev.=	7053.0
2 year discharge=	3.0

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF BANK	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft			1	2	3	4	**Rectangular**	1	2		
7049	0	0	0.0	0.00	0.00			-								
7050	1	10705	0.2	0.1	0.12	-	-	0.2	-	-	-	-	13		0.2	0.15
7051	2	36676	0.8	0.5	0.67	-	-	0.3	-	-	-	-	33		0.3	0.31
7052	3	71989	1.7	1.2	1.91	-	-	0.5	1.3	-	-	-	60		1.8	1.8
7053	4	133440	3.1	2.4	4.27	-	-	0.6	2.1	-	-	-	90		2.7	2.7
7054	5	178828	4.1	3.6	7.86	-	-	0.7	2.7	9.7	-	-	119		13.1	13
7055	6	221269	5.1	4.6	12.45	-	-	0.8	3.2	15.5	-	1.4	139		21	21
7055.5	6.5	245509	5.6	2.7	15.13	-	-	0.8	3.4	17.7	-	20.2	148		42	42
7056	7	269749	6.2	5.6	18.08	-	-	0.8	3.6	20	-	50	157		74	74
7058	9	337508	7.7	13.9	32.03	-	-	1.0	4.3	26	-	216	188		188	188
7060	11	405520	9.3	31.0	49.09	-	848.5	1.1	4.9	31	-	277	214		214	1,063
						-	-	-	-	-	-	-			-	-

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Existing Detention Pond E- RHR GRADED CONDITION (TOTAL FLOWS)

Gieck Basin - El Paso County, Colorado

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6973.3
100 year storage vol.=	39.7
100 year discharge=	209
5 year storage elev.=	6971.2
5 year storage vol.=	16.1
5 year discharge=	11
WQCV storage elev.=	6968.9
WQCV storage vol.=	1.5
WQCV depth =	1.9
1/2 WQCV storage elev.=	6968.3
1/2 WQCV storage vol.=	0.75

50 year storage elev.=	6972.9
50 year storage vol.=	34.5
50 year discharge=	127
10 year storage elev.=	6971.7
10 year storage vol.=	21.2
10 year discharge=	23
2 year storage elev.=	6970.3
2 year storage vol.=	9.1
2 year discharge=	5.2

STAGE		STORAGE				TOTAL DISCHARGE											
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)		PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Rectangular		1	2	OUTFLOW	FLOW
6967	0	1808	0.04	0.0	0.00			-	-	-	-	-	-	1.4	-	-	-
6967.5	0.5	16136.5	0.37	0.1	0.10	-	-	0.0	-	-	-	-	-	13	-	0.03	0.03
6968	1	30465	0.70	0.3	0.37	-	-	0.1	-	-	-	-	-	26	-	0.11	0.11
6968.5	1.5	81028.5	1.86	0.6	1.01	-	-	0.2	-	-	-	-	-	47	-	0.23	0.23
6969	2	131592	3.02	1.2	2.23	-	-	0.4	-	-	-	-	-	77	-	0.4	0.37
6969.5	2.5	201294.5	4.62	1.9	4.14	-	-	0.5	-	3.0	-	-	-	110	-	3.5	3.5
6970	3	270997	6.22	4.6	6.85	-	-	0.6	-	4	-	-	-	146	-	5	4.9
6970.5	3.5	329360	7.56	3.4	10.30	-	-	0.6	0.2	5	-	-	-	183	-	6	6.1
6970.75	3.75	358540.75	8.23	2.0	12.27			0.7	1.2	6	-	-	-	203	-	8	7.6
6971	4	387722	8.90	7.6	14.41	-	-	0.7	3.1	6	-	-	-	218	-	10	9.8
6971.25	4.25	408751	9.38	2.3	16.70	-	-	0.7	5.5	6	0.20	-	-	236	-	13	13
6971.5	4.5	429780	9.87	4.7	19.10	-	-	0.7	8	7	3.0	-	-	252	-	18	18
6971.75	4.75	450809	10.35	2.5	21.63	-	-	0.8	10	7	7.3	-	-	266	-	25	25
6972	5	471838	10.83	5.2	24.28	-	-	0.8	12	7	13	2.4	-	280	-	35	35
6972.25	5.25	482595.75	11.08	2.7	27.02	-	-	0.8	13	8	17	16	-	292	-	54	54
6972.5	5.5	493354	11.33	5.5	29.82	-	-	0.8	14	8	20	35	-	304	-	78	78
6973	6	514869	11.82	5.8	35.60	-	-	0.9	16	9	30	87	-	327	-	142	142
6973.25	6.25	518272	11.90	3.0	38.57	-	-	0.9	17	9	35	121	-	338	-	183	183
6973.5	6.5	521675	11.98	5.9	41.55	-	-	0.9	18	9	41	163	-	349	-	232	232
6974	7	528481	12.13	12.0	47.58	-	-	1.0	20	10	53	259	-	369	-	307	307
6976	9	553685	12.71	24.8	72.42	-	1,102	1.1	25	11	83	729	-	443	-	443	1,545

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Existing Detention Pond E-RHR GRADED CONDITION (H08)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974
100 year storage elev.=	6973.3
100 year storage vol.=	39.7
100 year discharge=	181
5 year storage elev.=	6971.2
5 year storage vol.=	16.1
5 year discharge=	8.1
WQCV storage elev.=	6968.9
WQCV storage vol.=	1.5
1/2 WQCV storage elev.=	6968.3
1/2 WQCV storage vol.=	0.8

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0248	1.65		Area =	0.041	Invert Elev =	6967.18
Rectangular	Orifice 2:	V	2	0.8		Area =	1.600	Invert Elev =	6970.40
Circular	Orifice 3:	H			10	Area =	0.545	Invert Elev =	6969.00
Rectangular	Orifice 4:	V	6	0.7		Area =	4.200	Invert Elev =	6971.20

Stand Pipe Dimensions

Rec Grate		11	x	7	Elev =	6971.90
Circ. Grate			dia.		Elev =	6971.90

50 year storage elev.=	6972.9
50 year discharge=	114
10 year storage elev.=	6971.7
10 year discharge=	18
2 year storage elev.=	6970.3
2 year discharge=	3.1

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.58		
Wall Thick.	4	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
6967	0	1808	0.04	0.0	0.0			-	-	-	-	-	0.91		-	-
6967.5	0.5	16136.5	0.37	0.1	0.1			0.0	-	-	-	-	8.0		0.01	0.01
6968	1	30465	0.70	0.3	0.4			0.1	-	-	-	-	18		0.06	0.06
6968.5	1.5	81028.5	1.86	0.6	1.0			0.1	-	-	-	-	30		0.11	0.11
6969	2	131592	3.02	1.2	2.2			0.2	-	-	-	-	52		0.2	0.2
6969.5	2.5	201294.5	4.62	1.9	4.1			0.2	-	1.9	-	-	75		2.1	2.1
6970	3	270997	6.22	4.6	6.9			0.3	-	2.6	-	-	97		2.9	2.9
6970.5	3.5	329359.5	7.56	3.4	10			0.3	0.2	3.2	-	-	122		3.7	3.7
6970.75	3.75	358540.75	8.23	2.0	12.3			0.3	1.2	3.5	-	-	135		5	5.0
6971	4	387722	8.90	7.6	14			0.3	2.8	3.7	-	-	146		7	6.8
6971.25	4.25	408751	9.38	2.3	17			0.4	4.7	3.9	0.2	-	157		9	9.2
6971.5	4.5	429780	9.87	4.7	19			0.4	6.4	4	3.0	-	167		14	14
6971.75	4.75	450809	10.35	2.5	22			0.4	7.5	4	7.3	-	176		20	20
6972	5	471838	10.83	5.2	24			0.4	8	5	13	2	185		29	29
6972.25	5.25	482595.75	11.08	2.7	27			0.4	9	5	17	16	193		47	47
6972.5	5.5	493354	11.33	5.5	30			0.4	10	5	20	35	201		70	70
6973	6	514869	11.82	5.8	36			0.4	11	5	24	87	217		128	128
6973.25	6.25	518272	11.90	3.0	39			0.5	12	5	26	118	224		162	162
6973.5	6.5	521675	11.98	5.9	42			0.5	13	6	28	152	231		199	199
6974	7	528481	12.13	12.0	48			0.5	14	6	32	228	244		244	244
6976	9	553685	12.71	24.8	72			0.6	18	7	43	623	291		291	291

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Existing Detention Pond E-RHR GRADED CONDITION (H09)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6973.3
100 year storage vol.=	39.7
100 year discharge=	27
5 year storage elev.=	6971.2
5 year storage vol.=	16.1
5 year discharge=	3.4
WQCV storage elev.=	6968.9
WQCV storage vol.=	1.5
1/2 WQCV storage elev.=	6968.3
1/2 WQCV storage vol.=	0.75

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0248	1.65		Area =	0.041	Invert Elev =	6967.18
Rectangular	Orifice 2:	V	0.75	1		Area =	0.750	Invert Elev =	6970.75
Circular	Orifice 3:	H			8	Area =	0.349	Invert Elev =	6969.00
Rectangular	Orifice 4:	V	3.5	1.25		Area =	4.375	Invert Elev =	6971.75

Stand Pipe Dimensions

Rec Grate		4.25	x	3	Elev =	6973.00
Circ. Grate			dia.		Elev =	6973.00

50 year storage elev.=	6972.9
50 year discharge=	12
10 year storage elev.=	6971.7
10 year discharge=	5.2
2 year storage elev.=	6970.3
2 year discharge=	2.1

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.7		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA sqft	acre	VOLUME acft	cum acft	TOP OF BANK	SPILLWAY	ORIFICE (max outflow) 1	2	3	4	GRATE (max outflow) **Rectangular**	PIPE 1	2	REALIZED CULVERT OUTFLOW	TOTAL FLOW
6967	0	1808	0.04	0.0	0.0			-	-	-	-	-	0.45		-	-
6967.5	0.5	16136.5	0.37	0.1	0.1			0.0	-	-	-	-	5.0		0.01	0.01
6968	1	30465	0.70	0.3	0.4			0.1	-	-	-	-	8.8		0.06	0.06
6968.5	1.5	81028.5	1.86	0.6	1.0			0.1	-	-	-	-	17		0.11	0.11
6969	2	131592	3.02	1.2	2.2			0.2	-	-	-	-	26		0.2	0.18
6969.5	2.5	201294.5	4.62	1.9	4.1			0.2	-	1.2	-	-	35		1.4	1.4
6970	3	270997	6.22	4.6	6.9			0.3	-	1.7	-	-	48		2.0	2.0
6970.5	3.5	329359.5	7.56	3.4	10.3			0.3	-	2.1	-	-	61		2.4	2.4
6970.75	3.75	358540.75	8.23	2.0	12.3			0.3	-	2.2	-	-	68		2.6	2.6
6971	4	387722	8.90	7.6	14.4			0.3	0.3	2.4	-	-	73		3.0	3.0
6971.25	4.25	408751	9.38	2.3	16.7			0.4	0.8	2.5	-	-	79		3.7	3.7
6971.5	4.5	429780	9.87	4.7	19.1			0.4	1.5	2.7	-	-	85		4.5	4.5
6971.75	4.75	450809	10.35	2.5	21.6			0.4	2.3	2.8	-	-	90		5.4	5.4
6972	5	471838	10.83	5.2	24.3			0.4	3.1	2.9	-	-	95		6.4	6.4
6972.25	5.25	482595.75	11.08	2.7	27.0			0.4	3.6	3.0	-	-	99		7.0	7.0
6972.5	5.5	493354	11.33	5.5	29.8			0.4	4.0	3.1	0.5	-	103		8	8.1
6973	6	514869	11.82	5.8	35.6			0.4	4.8	3.4	5.2	-	111		14	14
6973.25	6.25	518272	11.90	3.0	38.6			0.5	5.1	3.5	8.6	4	114		21	21
6973.5	6.5	521675	11.98	5.9	41.6			0.5	5.4	3.6	13	11	118		33	33
6974	7	528481	12.13	12.0	47.6			0.5	6.0	3.8	22	31	125		63	63
6976	9	553685	12.71	24.8	72.4			0.6	7.9	4.4	40	106	151		151	151

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond F RHR GRADED CONDITION

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	285
embankment elev =	7138.5
spillway length =	87
spillway elevation =	7137.5
100 year storage elev.=	7136.0
100 year storage vol.=	8.8
100 year discharge=	177
5 year storage elev.=	7131.2
5 year storage vol.=	1.8
5 year discharge=	7.7
WQCV storage elev.=	7129.1
WQCV storage vol.=	0.3
1/2 WQCV storage elev.=	7128.6
1/2 WQCV storage vol.=	0.15

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0131	1.25		Area =	0.016	Elev to cl =	7128.45
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	7130.75
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	7129.20
None Selected	Orifice 4:					Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	3	Elev =	7133
Circ. Grate			dia.		Elev =	7133

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7126.6		7131.0		
Wall Thick.	5	in.			

50 year storage vol.=	6.7
50 year storage elev.=	7134.9
50 year discharge=	121
10 year storage vol.=	3.4
10 year storage elev.=	7132.6
10 year discharge=	16
2 year storage vol.=	0.9
2 year storage elev.=	7130.1
2 year discharge=	2.1

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2		
7127.7	0	0	0.00	0.00	0.00			-	-	-	-	-				
7128	0.3	2170	0.05	0.01	0.01	-	-	0.0	-	-	-	-	11		0.0	0.0
7129	1.3	17730	0.41	0.23	0.24	-	-	0.1	-	-	-	-	31		0.1	0.1
7130	2.3	33290	0.76	0.59	0.82	-	-	0.1	-	1.5	-	-	57		1.6	1.6
7131	3.3	39060	0.90	0.83	1.65	-	-	0.1	4.2	2.3	-	-	117		6.6	6.6
7132	4.3	44830	1.03	0.96	2.61	-	-	0.1	10.8	2.8	-	-	117		14	14
7133	5.3	55137.5	1.27	1.15	3.76	-	-	0.2	14.4	3.3	-	-	142		18	18
7134	6.3	65445	1.50	1.38	5.15	-	-	0.2	17.4	3.7	-	36	162		57	57
7135	7.3	79535	1.83	1.66	6.81	-	-	0.2	19.9	4.0	-	102	175		126	126
7136	8.3	93625	2.15	1.99	8.80	-	-	0.2	22.1	4.4	-	150	187		177	177
7137	9.3	111620	2.56	2.36	11.15	-	-	0.2	24.1	4.7	-	173	200		200	200
7138	10.3	129615	2.98	2.77	13.92	-	92.3	0.2	25.9	5.0	-	194	211		211	303
7138.5	10.8					-	261.0	0.3	26.8	5.1	-	203	211		-	261

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond G-RHR GRADED CONDITION (G12)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	500
embankment elev =	7034
spillway length =	130
spillway elevation =	7031.5
100 year storage elev.=	7029.7
100 year storage vol.=	21.3
100 year discharge=	366
5 year storage elev.=	7027.1
5 year storage vol.=	6.8
5 year discharge=	10
WQCV storage elev.=	7025.8
WQCV storage vol.=	0.9
1/2 WQCV storage elev.=	7024.9
1/2 WQCV storage vol.=	0.45

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)			
Circular	Orifice 1:	V			3	Area =	0.049	Elev to cl =		7023.43
Rectangular	Orifice 2:	V	8.5	1.1		Area =	9.350	Elev to cl =		7027.55
Rectangular	Orifice 3:	V	2	0.43		Area =	0.860	Elev to cl =		7025.34
Rectangular	Orifice 4:	V	4	0.6		Area =	2.400	Elev to cl =		7027.80
Rectangular	Orifice 5:	V	8.5	1.1		Area =	9.350	Elev to cl =		7027.55

Stand Pipe Dimensions

Rec Grate		20	x	8	Elev =	7028.10
Circ. Grate			dia.		Elev =	7028.10

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert	10	x	4		**Rectangular**
Area	40.0		TOP		
Outlet I. E.	7022.5		7027.50		
Wall Thick.	12	in.			

50 year storage vol.=	17.3
50 year storage elev.=	7028.9
50 year discharge=	211
10 year storage vol.=	8.9
10 year storage elev.=	7027.6
10 year discharge=	29
2 year storage vol.=	2.4
2 year storage elev.=	7026.0
2 year discharge=	3.8

STAGE		STORAGE				DISCHARGE												
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)					GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	5	**Rectangular**	1	2		
7023.3	0	0	0.00	0.0	0.00			-	-	-	-	-	-	12		-	-
7024	0.7	2232	0.05	0.0	0.02	-	-	0.18	-	-	-	-	-	51		0.2	0.18
7025	1.7	39917	0.92	0.5	0.50	-	-	0.30	-	-	-	-	-	111		0.3	0.30
7026	2.7	126469	2.90	1.9	2.41	-	-	0.38	-	3.4	-	-	-	184		3.8	3.8
7026.5	3.2	166675	3.83	3.6	4.06	-	-	0.41	-	4.5	-	-	-	224		4.9	4.9
7027	3.7	206880	4.75	2.1	6.20	-	-	0.45	-	5.3	-	-	-	268		5.8	5.8
7027.5	4.2	232032	5.33	4.6	8.64	-	-	0.48	9.0	6.1	-	9.0	-	304		25	25
7028	4.7	257183	5.90	5.3	11.53	-	-	0.51	25.5	6.8	4.2	25.5	-	337		63	63
7028.5	5.2	264196	6.07	5.7	14.33	-	-	0.53	43.9	7.4	9.7	43.9	27	373		133	133
7029	5.7	271209	6.23	6.1	17.59	-	-	0.56	54.2	7.9	12.7	54.2	92	406		222	222
7029.5	6.2	276106	6.34	11.7	20.30	-	-	0.61	62.9	8.5	15.1	62.9	179	436		329	329
7030	6.7	281003	6.45	9.4	23.72	-	-	0.63	70.5	8.9	17.1	70.5	283	464		450	450
7030.5	7.2	286003	6.57	6.5	26.75	-	-	0.63	77.3	9.4	19.0	77.3	402	491		491	491
7031	7.7	291002	6.68	6.6	30.28	-	-	0.65	83.6	9.9	20.7	83.6	533	516		516	516
7031.5	8.2	296443	6.81	6.7	33.44	-	-	0.67	89.5	10.3	22.2	89.5	677	540		540	540
7032	8.7	301883	6.93	3.4	36.87	137.9	137.9	0.69	95.0	10.7	23.7	95.0	832	563		563	701
7032.5	9.2	309236	7.10	7.0	40.39	390.0	390.0	0.71	100.2	11.1	25.1	100.2	997	586		586	976
7033	9.7	316589	7.27	3.6	44.0	716.5	716.5	0.73	105.1	11.5	26.4	105.1	1,171	607		607	1,323

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond D - Future AS-BUILT

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	710
embankment elev =	7060
spillway length =	100
spillway elevation =	7058
100 year storage elev.=	7057.0
100 year storage vol.=	25.3
100 year discharge=	133
5 year storage elev.=	7053.8
5 year storage vol.=	6.9
5 year discharge=	11
WQCV storage vol.=	1.0
WQCV depth =	2.42
1/2 WQCV storage vol.=	0.50

Data for outlet pipe and grate:

Type			Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular		Orifice 1:	0.03	2.42		Area =	0.072	Elev to cl =	7050.21
Circular		Orifice 2:			8	Area =	0.349	Elev to cl =	7051.42
Rectangular		Orifice 3:	5	0.5		Area =	2.500	Elev to cl =	7053.35
None Selected		Orifice 4:				Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	4.25	Elev =	7054.9
Circ. Grate			dia.		Elev =	

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7048.1		7052.5		
Wall Thick.	5	in.			

50 year storage vol.=	20.0
50 year storage elev.=	7056.3
50 year discharge=	90
10 year storage vol.=	10.7
10 year storage elev.=	7054.6
10 year discharge=	18
2 year storage vol.=	4.6
2 year storage elev.=	7053.1
2 year discharge=	3.7

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
7049	0	0	0.0	0.00	0.00			-								
7050	1	10705	0.2	0.1	0.12	-	-	0.2	-	-	-	-	13		0.2	0.15
7051	2	36676	0.8	0.5	0.67	-	-	0.3	-	-	-	-	33		0.3	0.31
7052	3	71989	1.7	1.2	1.91	-	-	0.5	1.3	-	-	-	60		1.8	1.8
7053	4	133440	3.1	2.4	4.27	-	-	0.6	2.1	-	-	-	90		2.7	2.7
7054	5	178828	4.1	3.6	7.86	-	-	0.7	2.7	9.7	-	-	119		13.1	13
7055	6	221269	5.1	4.6	12.45	-	-	0.8	3.2	15.5	-	1.4	139		21	21
7055.5	6.5	245509	5.6	2.7	15.13	-	-	0.8	3.4	17.7	-	20.2	148		42	42
7056	7	269749	6.2	5.6	18.08	-	-	0.8	3.6	20	-	50	157		74	74
7058	9	337508	7.7	13.9	32.03	-	-	1.0	4.3	26	-	216	188		188	188
7060	11	405520	9.3	31.0	49.09	-	848.5	1.1	4.9	31	-	277	214		214	1,063
						-	-	-	-	-	-	-			-	-

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Existing Detention Pond E- FINAL FUTURE (TOTAL FLOWS)

Gieck Basin - El Paso County, Colorado

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6973.5
100 year storage vol.=	42.1
100 year discharge=	239
5 year storage elev.=	6971.3
5 year storage vol.=	17.2
5 year discharge=	14
WQCV storage elev.=	6968.9
WQCV storage vol.=	1.5
WQCV depth =	1.9
1/2 WQCV storage elev.=	6968.3
1/2 WQCV storage vol.=	0.75

50 year storage elev.=	6973.0
50 year storage vol.=	36.1
50 year discharge=	149
10 year storage elev.=	6971.8
10 year storage vol.=	22.4
10 year discharge=	28
2 year storage elev.=	6970.5
2 year storage vol.=	9.9
2 year discharge=	5.8

STAGE		STORAGE				TOTAL DISCHARGE											
ELEV	HEIGHT	AREA		VOLUME		TOP OF BANK	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)		PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft			1	2	3	4	**Rectangular**		1	2		
6967	0	1808	0.04	0.0	0.00			-	-	-	-	-	-	1.4	-	-	-
6967.5	0.5	16136.5	0.37	0.1	0.10	-	-	0.0	-	-	-	-	-	13	-	0.03	0.03
6968	1	30465	0.70	0.3	0.37	-	-	0.1	-	-	-	-	-	26	-	0.11	0.11
6968.5	1.5	81028.5	1.86	0.6	1.01	-	-	0.2	-	-	-	-	-	47	-	0.23	0.23
6969	2	131592	3.02	1.2	2.23	-	-	0.4	-	-	-	-	-	77	-	0.4	0.37
6969.5	2.5	201294.5	4.62	1.9	4.14	-	-	0.5	-	3.0	-	-	-	110	-	3.5	3.5
6970	3	270997	6.22	4.6	6.85	-	-	0.6	-	4	-	-	-	146	-	5	4.9
6970.5	3.5	329360	7.56	3.4	10.30	-	-	0.6	0.2	5	-	-	-	183	-	6	6.1
6970.75	3.75	358540.75	8.23	2.0	12.27			0.7	1.2	6	-	-	-	203	-	8	7.6
6971	4	387722	8.90	7.6	14.41	-	-	0.7	3.1	6	-	-	-	218	-	10	9.8
6971.25	4.25	408751	9.38	2.3	16.70	-	-	0.7	5.5	6	0.20	-	-	236	-	13	13
6971.5	4.5	429780	9.87	4.7	19.10	-	-	0.7	8	7	3.0	-	-	252	-	18	18
6971.75	4.75	450809	10.35	2.5	21.63	-	-	0.8	10	7	7.3	-	-	266	-	25	25
6972	5	471838	10.83	5.2	24.28	-	-	0.8	12	7	13	2.4	-	280	-	35	35
6972.25	5.25	482595.75	11.08	2.7	27.02	-	-	0.8	13	8	17	16	-	292	-	54	54
6972.5	5.5	493354	11.33	5.5	29.82	-	-	0.8	14	8	20	35	-	304	-	78	78
6973	6	514869	11.82	5.8	35.60	-	-	0.9	16	9	30	87	-	327	-	142	142
6973.25	6.25	518272	11.90	3.0	38.57	-	-	0.9	17	9	35	121	-	338	-	183	183
6973.5	6.5	521675	11.98	5.9	41.55	-	-	0.9	18	9	41	163	-	349	-	232	232
6974	7	528481	12.13	12.0	47.58	-	-	1.0	20	10	53	259	-	369	-	307	307
6976	9	553685	12.71	24.8	72.42	-	1,102	1.1	25	11	83	729	-	443	-	443	1,545

Notes: 1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

Submit the MH-Detention worksheet.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Existing Detention Pond E-FINAL FUTURE (H08)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974
100 year storage elev.=	6973.5
100 year storage vol.=	42.1
100 year discharge=	203
5 year storage elev.=	6971.3
5 year storage vol.=	17.2
5 year discharge=	10
WQCV storage elev.=	6968.9
WQCV storage vol.=	1.5
1/2 WQCV storage elev.=	6968.3
1/2 WQCV storage vol.=	0.75

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0248	1.65		Area =	0.041	Invert Elev =	6967.18
Rectangular	Orifice 2:	V	2	0.8		Area =	1.600	Invert Elev =	6970.40
Circular	Orifice 3:	H			10	Area =	0.545	Invert Elev =	6969.00
Rectangular	Orifice 4:	V	6	0.7		Area =	4.200	Invert Elev =	6971.20

Stand Pipe Dimensions

Rec Grate	11	x	7	Elev =	6971.90
Circ. Grate		dia.		Elev =	6971.90

50 year storage elev.=	6973.0
50 year discharge=	134
10 year storage elev.=	6971.8
10 year discharge=	22
2 year storage elev.=	6970.5
2 year discharge=	3.5

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.58		
Wall Thick.	4	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
6967	0	1808	0.04	0.0	0.0			-	-	-	-	-	0.91		-	-
6967.5	0.5	16136.5	0.37	0.1	0.1			0.0	-	-	-	-	8.0		0.01	0.01
6968	1	30465	0.70	0.3	0.4			0.1	-	-	-	-	18		0.06	0.06
6968.5	1.5	81028.5	1.86	0.6	1.0			0.1	-	-	-	-	30		0.11	0.11
6969	2	131592	3.02	1.2	2.2			0.2	-	-	-	-	52		0.2	0.2
6969.5	2.5	201294.5	4.62	1.9	4.1			0.2	-	1.9	-	-	75		2.1	2.1
6970	3	270997	6.22	4.6	6.9			0.3	-	2.6	-	-	97		2.9	2.9
6970.5	3.5	329359.5	7.56	3.4	10			0.3	0.2	3.2	-	-	122		3.7	3.7
6970.75	3.75	358540.75	8.23	2.0	12.3			0.3	1.2	3.5	-	-	135		5	5.0
6971	4	387722	8.90	7.6	14			0.3	2.8	3.7	-	-	146		7	6.8
6971.25	4.25	408751	9.38	2.3	17			0.4	4.7	3.9	0.2	-	157		9	9.2
6971.5	4.5	429780	9.87	4.7	19			0.4	6.4	4	3.0	-	167		14	14
6971.75	4.75	450809	10.35	2.5	22			0.4	7.5	4	7.3	-	176		20	20
6972	5	471838	10.83	5.2	24			0.4	8	5	13	2	185		29	29
6972.25	5.25	482595.75	11.08	2.7	27			0.4	9	5	17	16	193		47	47
6972.5	5.5	493354	11.33	5.5	30			0.4	10	5	20	35	201		70	70
6973	6	514869	11.82	5.8	36			0.4	11	5	24	87	217		128	128
6973.25	6.25	518272	11.90	3.0	39			0.5	12	5	26	118	224		162	162
6973.5	6.5	521675	11.98	5.9	42			0.5	13	6	28	152	231		199	199
6974	7	528481	12.13	12.0	48			0.5	14	6	32	228	244		244	244
6976	9	553685	12.71	24.8	72			0.6	18	7	43	623	291		291	291

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Existing Detention Pond E-FINAL FUTURE (H09)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6973.5
100 year storage vol.=	42.1
100 year discharge=	36
5 year storage elev.=	6971.3
5 year storage vol.=	17.2
5 year discharge=	3.8
WQCV storage elev.=	6968.9
WQCV storage vol.=	1.5
1/2 WQCV storage elev.=	6968.3
1/2 WQCV storage vol.=	0.8

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0248	1.65		Area =	0.041	Invert Elev =	6967.18
Rectangular	Orifice 2:	V	0.75	1		Area =	0.750	Invert Elev =	6970.75
Circular	Orifice 3:	H			8	Area =	0.349	Invert Elev =	6969.00
Rectangular	Orifice 4:	V	3.5	1.25		Area =	4.375	Invert Elev =	6971.75

Stand Pipe Dimensions

Rec Grate		4.25	x	3	Elev =	6973.00
Circ. Grate			dia.		Elev =	6973.00

50 year storage elev.=	6973.0
50 year discharge=	15
10 year storage elev.=	6971.8
10 year discharge=	5.7
2 year storage elev.=	6970.5
2 year discharge=	2.3

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.7		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Rectangular	1	2		
6967	0	1808	0.04	0.0	0.0			-	-	-	-	-	0.45		-	-
6967.5	0.5	16136.5	0.37	0.1	0.1			0.0	-	-	-	-	5.0		0.01	0.01
6968	1	30465	0.70	0.3	0.4			0.1	-	-	-	-	8.8		0.06	0.06
6968.5	1.5	81028.5	1.86	0.6	1.0			0.1	-	-	-	-	17		0.11	0.11
6969	2	131592	3.02	1.2	2.2			0.2	-	-	-	-	26		0.2	0.18
6969.5	2.5	201294.5	4.62	1.9	4.1			0.2	-	1.2	-	-	35		1.4	1.4
6970	3	270997	6.22	4.6	6.9			0.3	-	1.7	-	-	48		2.0	2.0
6970.5	3.5	329359.5	7.56	3.4	10.3			0.3	-	2.1	-	-	61		2.4	2.4
6970.75	3.75	358540.75	8.23	2.0	12.3			0.3	-	2.2	-	-	68		2.6	2.6
6971	4	387722	8.90	7.6	14.4			0.3	0.3	2.4	-	-	73		3.0	3.0
6971.25	4.25	408751	9.38	2.3	16.7			0.4	0.8	2.5	-	-	79		3.7	3.7
6971.5	4.5	429780	9.87	4.7	19.1			0.4	1.5	2.7	-	-	85		4.5	4.5
6971.75	4.75	450809	10.35	2.5	21.6			0.4	2.3	2.8	-	-	90		5.4	5.4
6972	5	471838	10.83	5.2	24.3			0.4	3.1	2.9	-	-	95		6.4	6.4
6972.25	5.25	482595.75	11.08	2.7	27.0			0.4	3.6	3.0	-	-	99		7.0	7.0
6972.5	5.5	493354	11.33	5.5	29.8			0.4	4.0	3.1	0.5	-	103		8	8.1
6973	6	514869	11.82	5.8	35.6			0.4	4.8	3.4	5.2	-	111		14	14
6973.25	6.25	518272	11.90	3.0	38.6			0.5	5.1	3.5	8.6	4	114		21	21
6973.5	6.5	521675	11.98	5.9	41.6			0.5	5.4	3.6	13	11	118		33	33
6974	7	528481	12.13	12.0	47.6			0.5	6.0	3.8	22	31	125		63	63
6976	9	553685	12.71	24.8	72.4			0.6	7.9	4.4	40	106	151		151	151

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond F-Final

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	285
embankment elev =	7138.5
spillway length =	87
spillway elevation =	7137.5
100 year storage elev.=	7136.0
100 year storage vol.=	8.9
100 year discharge=	179
5 year storage elev.=	7131.2
5 year storage vol.=	1.9
5 year discharge=	8.2
WQCV storage elev.=	7129.1
WQCV storage vol.=	0.3
1/2 WQCV storage elev.=	7128.6
1/2 WQCV storage vol.=	0.15

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0131	1.25		Area =	0.016	Elev to cl =	7128.45
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	7130.75
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	7129.20
None Selected	Orifice 4:					Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	3	Elev =	7133
Circ. Grate			dia.		Elev =	7133

50 year storage vol.=	6.8
50 year storage elev.=	7135.0
50 year discharge=	125
10 year storage vol.=	3.5
10 year storage elev.=	7132.7
10 year discharge=	17
2 year storage vol.=	0.9
2 year storage elev.=	7130.1
2 year discharge=	2.3

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7126.6		7131.0		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2		
7127.7	0	0	0.00	0.00	0.00			-	-	-	-	-				
7128	0.3	2170	0.05	0.01	0.01	-	-	0.0	-	-	-	-	11		0.0	0.0
7129	1.3	17730	0.41	0.23	0.24	-	-	0.1	-	-	-	-	31		0.1	0.1
7130	2.3	33290	0.76	0.59	0.82	-	-	0.1	-	1.5	-	-	57		1.6	1.6
7131	3.3	39060	0.90	0.83	1.65	-	-	0.1	4.2	2.3	-	-	117		6.6	6.6
7132	4.3	44830	1.03	0.96	2.61	-	-	0.1	10.8	2.8	-	-	117		14	14
7133	5.3	55137.5	1.27	1.15	3.76	-	-	0.2	14.4	3.3	-	-	142		18	18
7134	6.3	65445	1.50	1.38	5.15	-	-	0.2	17.4	3.7	-	36	162		57	57
7135	7.3	79535	1.83	1.66	6.81	-	-	0.2	19.9	4.0	-	102	175		126	126
7136	8.3	93625	2.15	1.99	8.80	-	-	0.2	22.1	4.4	-	150	187		177	177
7137	9.3	111620	2.56	2.36	11.15	-	-	0.2	24.1	4.7	-	173	200		200	200
7138	10.3	129615	2.98	2.77	13.92	-	92.3	0.2	25.9	5.0	-	194	211		211	303
7138.5	10.8					-	261.0	0.3	26.8	5.1	-	203	211		-	261

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond G-FINAL FUTURE DESIGN (G12)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	500
embankment elev =	7033.5
spillway length =	130
spillway elevation =	7031.5
100 year storage elev.=	7030.3
100 year storage vol.=	25.6
100 year discharge=	476
5 year storage elev.=	7027.4
5 year storage vol.=	8.2
5 year discharge=	21
WQCV storage elev.=	7025.2
WQCV storage vol.=	0.9
1/2 WQCV storage elev.=	7024.9
1/2 WQCV storage vol.=	0.45

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)			
Circular	Orifice 1:	V			3	Area =	0.049	Elev to cl =		7023.43
Rectangular	Orifice 2:	V	8.5	1.1		Area =	9.350	Elev to cl =		7027.55
Rectangular	Orifice 3:	V	2	0.43		Area =	0.860	Elev to cl =		7025.34
Rectangular	Orifice 4:	V	4	0.6		Area =	2.400	Elev to cl =		7027.80
Rectangular	Orifice 5:	V	8.5	1.1		Area =	9.350	Elev to cl =		7027.55

Stand Pipe Dimensions

Rec Grate		20	x	8	Elev =	7028.10
Circ. Grate			dia.		Elev =	7028.10

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert	10	x	4		**Rectangular**
Area	40.0		TOP		
Outlet I. E.	7022.5		7027.50		
Wall Thick.	12	in.			

50 year storage vol.=	20.3
50 year storage elev.=	7029.5
50 year discharge=	328
10 year storage vol.=	10.9
10 year storage elev.=	7027.9
10 year discharge=	54
2 year storage vol.=	4.8
2 year storage elev.=	7026.7
2 year discharge=	5.2

STAGE		STORAGE				DISCHARGE											
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)					GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	5	**Rectangular**	1	2		
7023.3	0	0	0.00	0.0	0.00			-	-	-	-	-	-	12		-	-
7024	0.7	2232	0.05	0.0	0.02	-	-	0.18	-	-	-	-	-	51		0.2	0.18
7025	1.7	39917	0.92	0.5	0.50	-	-	0.30	-	-	-	-	-	111		0.3	0.30
7026	2.7	126469	2.90	1.9	2.41	-	-	0.38	-	3.4	-	-	-	184		3.8	3.8
7026.5	3.2	166675	3.83	3.6	4.06	-	-	0.41	-	4.5	-	-	-	224		4.9	4.9
7027	3.7	206880	4.75	2.1	6.20	-	-	0.45	-	5.3	-	-	-	268		5.8	5.8
7027.5	4.2	232032	5.33	4.6	8.64	-	-	0.48	9.0	6.1	-	9.0	-	304		25	25
7028	4.7	257183	5.90	5.3	11.5	-	-	0.51	25.5	6.8	4.2	25.5	-	337		63	63
7028.5	5.2	264196	6.07	5.7	14.3	-	-	0.53	43.9	7.4	9.7	43.9	27	373		133	133
7029	5.7	271209	6.23	6.1	17.6	-	-	0.56	54.2	7.9	12.7	54.2	92	406		222	222
7029.5	6.2	276106	6.34	11.7	20.3	-	-	0.61	62.9	8.5	15.1	62.9	179	436		329	329
7030	6.7	281003	6.45	9.4	23.7	-	-	0.63	70.5	8.9	17.1	70.5	283	464		450	450
7030.5	7.2	286003	6.57	6.5	26.8	-	-	0.63	77.3	9.4	19.0	77.3	402	491		491	491
7031	7.7	291002	6.68	6.6	30.3	-	-	0.65	83.6	9.9	20.7	83.6	533	516		516	516
7031.5	8.2	296443	6.81	6.7	33.4	-	-	0.67	89.5	10.3	22.2	89.5	677	540		540	540
7032	8.7	301883	6.93	3.4	36.9	137.9	137.9	0.69	95.0	10.7	23.7	95.0	832	563		563	701
7032.5	9.2	309236	7.10	7.0	40.4	390.0	390.0	0.71	100.2	11.1	25.1	100.2	997	586		586	976
7033	9.7	316589	7.27	3.6	44.0	716.5	716.5	0.73	105.1	11.5	26.4	105.1	1,171	607		607	1,323

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

FUTURE POND G

WQCV Control Riser Calculations

TRIBUTARY AREA		577	acres
DRAIN TIME		40	hr
	a	1	
IMPERVIOUSNESS RATIO	*i*	0.18	
DEPTH OF OUTLET		1.9	
WQCV		0.11	inches
WQCV DESIGN VOL		**0.9**	ac-ft
	K_{40}	0.36	
AREA PER RISER[1]	a	7.67	in^2
No. of Columns		1	
No. of Holes		3	per column
Area per Hole		2.56	in^2
Hole size		1 3/4	in
Steel Plate Thickness		1/4	in

[1] AREA PER ROW PER RISER

Actual area per row per hole:	2.41	in^2
Actual area per riser:	7.2	in^2
Actual area per riser:	0.050	ft^2

TABLE SB-2

Hole Dia (in)		Area per Row (in^2)					
Holes per Row		1	2	3	4	5	6
Min steel thickness		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85

n = Number of columns of perforations

ROLLING HILLS RANCH GRADING INTERIM CONDITION

Simulation Run: RHR GRADED-100 YR Reservoir: POND D

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	487(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:12
Peak Outflow:	125 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:00
Total Inflow :	54.7 (AC-FT)	Peak Storage:	24.3 (AC-FT)
Total Outflow:	44.1 (AC-FT)	Peak Elevation:	7056.9 (FT)

Simulation Run: RHR GRADED -005 YR Reservoir: POND D

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	98 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	10 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 14:36
Total Inflow :	12.76 (AC-FT)	Peak Storage:	6.7 (AC-FT)
Total Outflow:	7.4 (AC-FT)	Peak Elevation:	7053.7 (FT)

Simulation Run: RHR GRADED -100 YR Reservoir: POND E

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	561 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	209 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:30
Total Inflow :	114.0 (AC-FT)	Peak Storage:	39.7 (AC-FT)
Total Outflow:	89.3 (AC-FT)	Peak Elevation:	6973.3 (FT)

Simulation Run: RHR GRADED -005 YR Reservoir: POND E

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	118 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:12
Peak Outflow:	11 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 20:00
Total Inflow :	24.5 (AC-FT)	Peak Storage:	16.1 (AC-FT)
Total Outflow:	8.9 (AC-FT)	Peak Elevation:	6971.2 (FT)

Simulation Run: RHR GRADED -100 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	286(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	177 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:42
Total Inflow :	37.9 (AC-FT)	Peak Storage:	8.8 (AC-FT)
Total Outflow:	35.6 (AC-FT)	Peak Elevation:	7136.0 (FT)

Simulation Run: RHR GRADED YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	21 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:36
Peak Outflow:	7.7 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 14:24
Total Inflow :	5.5 (AC-FT)	Peak Storage:	1.8 (AC-FT)
Total Outflow:	4.7 (AC-FT)	Peak Elevation:	7129.1 (FT)

Simulation Run: RHR GRADED -100 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	534 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:36
Peak Outflow:	366 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:06
Total Inflow :	96.2 (AC-FT)	Peak Storage:	21.3 (AC-FT)
Total Outflow:	87.0 (AC-FT)	Peak Elevation:	7029.7 (FT)

Simulation Run: RHR GRADED -005 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	WW Grading
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	33 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:48
Peak Outflow:	10 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 18:18
Total Inflow :	13.4(AC-FT)	Peak Storage:	6.8 (AC-FT)
Total Outflow:	6.9 (AC-FT)	Peak Elevation:	7027.1 (FT)

ROLLING HILLS RANCH GRADING FUTURE CONDITION
Simulation Run: F-100 YR Reservoir: POND D

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	509(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:12
Peak Outflow:	133 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:00
Total Inflow :	57.0 (AC-FT)	Peak Storage:	25.3 (AC-FT)
Total Outflow:	46.3 (AC-FT)	Peak Elevation:	7057.0 (FT)

Simulation Run: F-005 YR Reservoir: POND D

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:26:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	107 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	11 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 14:36
Total Inflow :	13.6 (AC-FT)	Peak Storage:	6.9 (AC-FT)
Total Outflow:	8.2 (AC-FT)	Peak Elevation:	7053.8 (FT)

Simulation Run: F-100 YR Reservoir: POND E

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	608 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	239 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:30
Total Inflow :	122.4 (AC-FT)	Peak Storage:	42.1 (AC-FT)
Total Outflow:	97.6 (AC-FT)	Peak Elevation:	6973.5 (FT)

Simulation Run: F-005 YR Reservoir: POND E

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:26:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	126 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:12
Peak Outflow:	14 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 20:00
Total Inflow :	28.0 (AC-FT)	Peak Storage:	17.2 (AC-FT)
Total Outflow:	11.0 (AC-FT)	Peak Elevation:	6971.3 (FT)

Simulation Run: F-100 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	293(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	179 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:42
Total Inflow :	35.3 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	33.4 (AC-FT)	Peak Elevation:	7136.0 (FT)

Simulation Run: F-005 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:26:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	22 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:36
Peak Outflow:	8.2 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 14:18
Total Inflow :	5.7 (AC-FT)	Peak Storage:	1.9 (AC-FT)
Total Outflow:	4.9 (AC-FT)	Peak Elevation:	7131.2 (FT)

Simulation Run: F-100 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	05Feb2020 13:11:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	690 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:06
Peak Outflow:	476 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:32
Total Inflow :	119.7 (AC-FT)	Peak Storage:	25.6 (AC-FT)
Total Outflow:	110.1 (AC-FT)	Peak Elevation:	7030.3 (FT)

Simulation Run: F-005 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
Compute Time:	05Feb2020 13:26:34	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	79 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	21 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 15:24
Total Inflow :	20.7 (AC-FT)	Peak Storage:	8.2 (AC-FT)
Total Outflow:	13.9 (AC-FT)	Peak Elevation:	7027.4 (FT)

Stormwater Detention and Infiltration Design Data Sheet

SDI-Design Data v2.00, Released January 2020

Stormwater Facility Name: **Meridian Ranch Pond G**

Facility Location & Jurisdiction: **Rolling Hills Ranch, MSMD, 38°59.2'N, 104°34.4W**

User Input: Watershed Characteristics

Extended Detention Basin (EDB)

	EDB	
Watershed Area =	829.00	acres
Watershed Length =	10,940	ft
Watershed Length to Centroid =	4,870	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	15.9%	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
Target WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths (use dropdown):

User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Once CUHP has been run and the Stage-Area-Discharge information has been provided, click 'Process Data' to interpolate the Stage-Area-Volume-Discharge data and generate summary results in the table below. Once this is complete, click 'Print to PDF'.

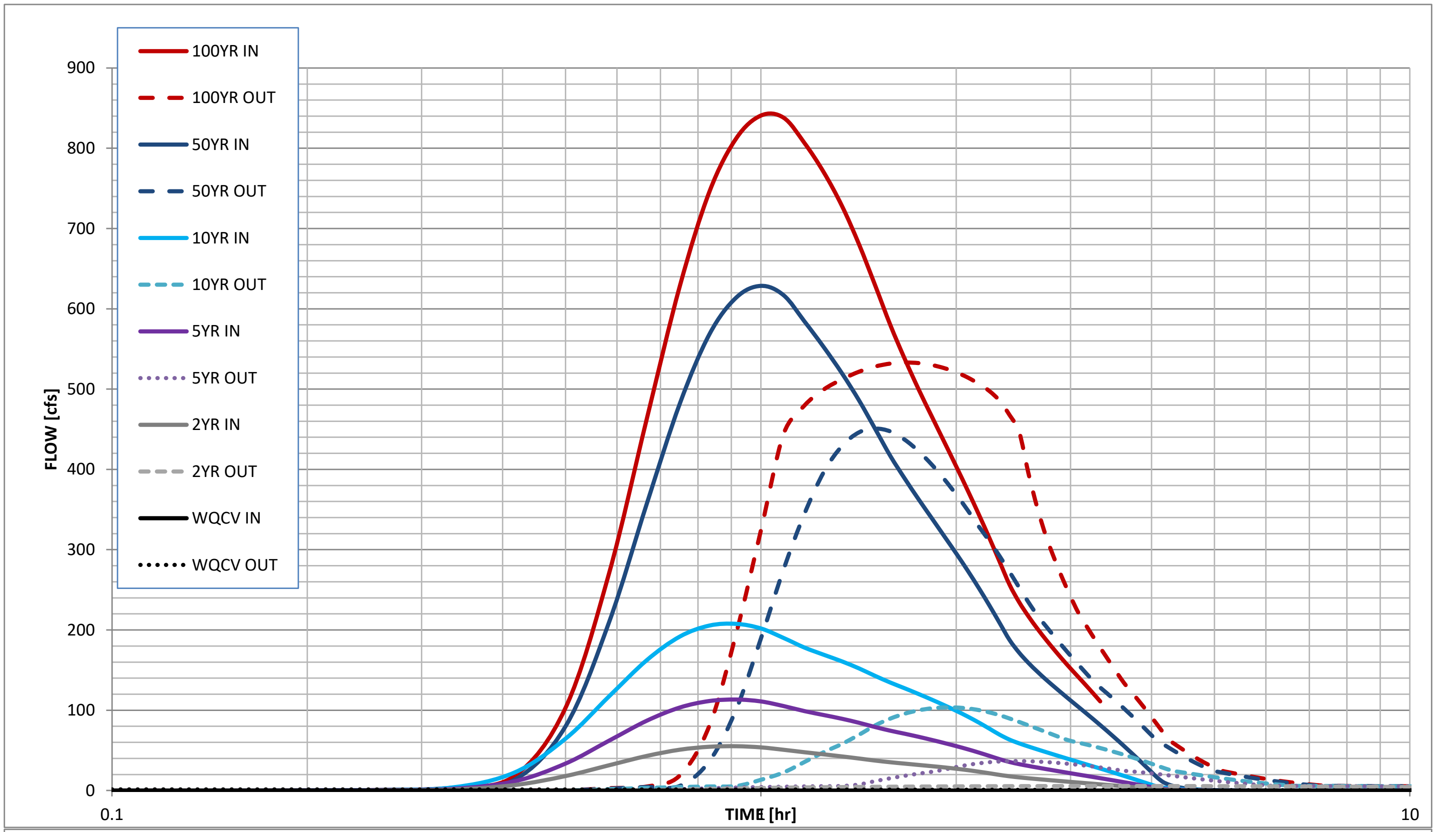
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.70	2,232	0.70	0.18
1.70	39,917	1.70	0.30
2.70	126,469	2.70	3.76
3.20	166,675	3.20	4.89
3.70	206,880	3.70	5.80
4.20	232,032	4.20	24.61
4.70	257,183	4.70	62.52
5.20	264,196	5.20	132.66
5.70	271,209	5.70	221.79
6.20	276,106	6.20	328.77
6.70	281,003	6.70	450.51
7.20	286,003	7.20	490.94
7.70	291,002	7.70	516.23
8.20	296,443	8.20	540.35
8.70	301,883	8.70	701.32
9.20	309,236	9.20	975.60
9.70	316,589	9.70	1323.45

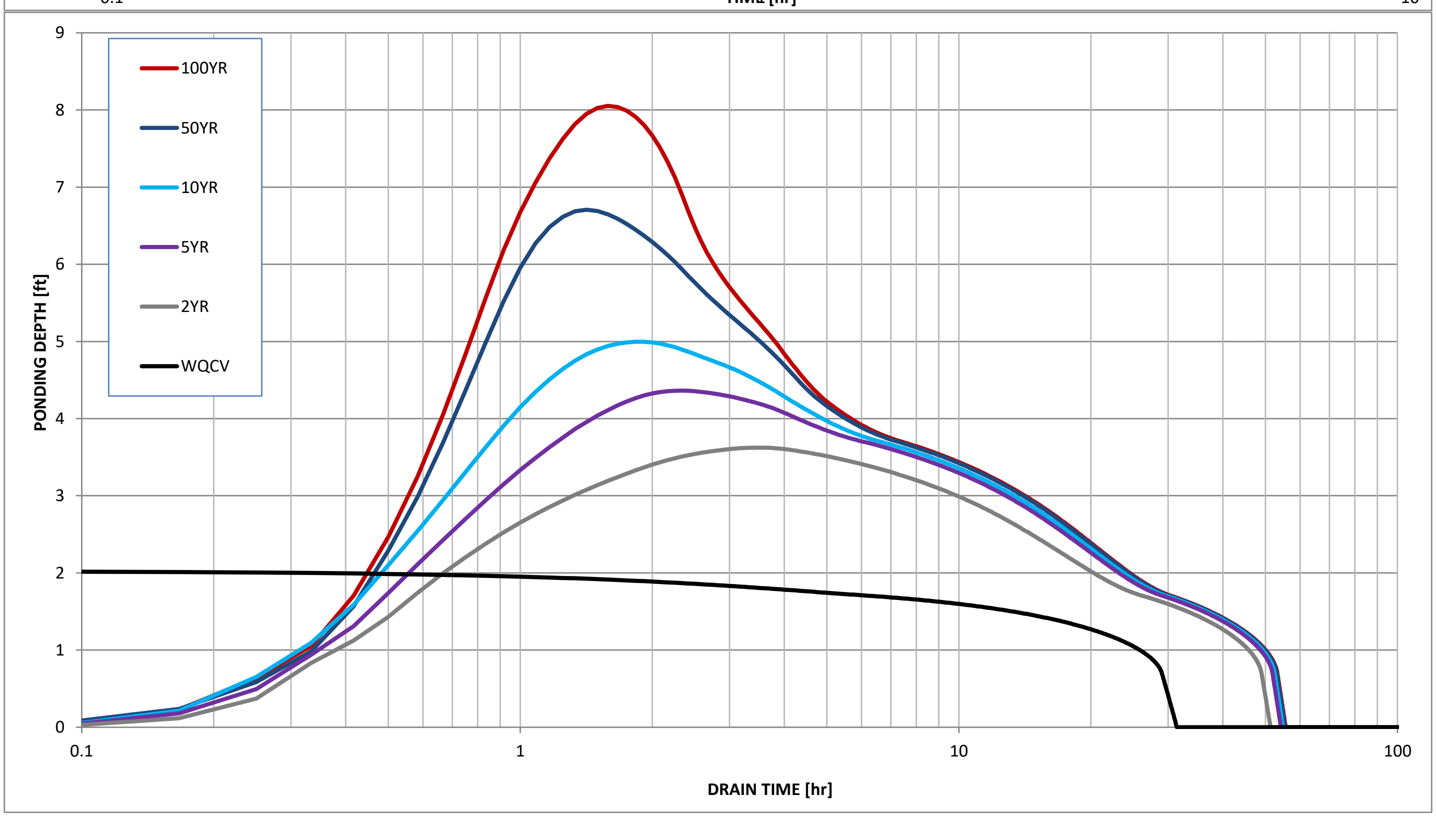
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
Create a new stormwater facility, and attach the PDF of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	N/A	0.93	1.21	1.47	2.16	2.50	in
CUHP Runoff Volume =	0.900	7.206	14.723	26.659	77.333	105.148	acre-ft
Inflow Hydrograph Volume =	N/A	7.206	14.723	26.659	77.333	105.148	acre-ft
Time to Drain 97% of Inflow Volume =	28.5	38.5	**31.6**	24.3	17.1	14.8	hours
Time to Drain 99% of Inflow Volume =	29.8	45.8	44.8	39.7	25.3	**23.1**	hours
Maximum Ponding Depth =	2.03	3.62	4.36	5.00	6.71	8.05	ft
Maximum Ponded Area =	1.56	4.58	5.51	6.00	6.45	**6.77**	acres
Maximum Volume Stored =	0.902	5.826	9.605	13.265	23.962	32.819	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Appendix D – Outlet Protection Design

Again, enter Figure HS-19a using the smaller d/D (or d/H) ratio to find the A/A_{full} ratio. Then,

$$A = \left(A/A_{full}\right)A_{full} \tag{HS-16c}$$

Finally,

$$V = Q/A \tag{HS-16d}$$

In which for Equations 16a through 16d above:

A_{full} = cross-sectional area of the pipe (ft^2)

A = area of the design flow in the end of the pipe (ft^2)

n = Manning's n for the pipe full depth

Q_{full} = pipe full discharge at its slope (cfs)

R = hydraulic radius of the pipe flowing full, ft [R_{full} = D/4 for circular pipes, R_{full} = A_{full}/(2H + 2w) for rectangular pipes, where D = diameter of a circular conduit, H = height of a rectangular conduit, and w = width of a rectangular conduit (ft)]

S_o = longitudinal slope of the pipe (ft/ft)

V = design flow velocity at the pipe outlet (ft/sec)

V_{full} = flow velocity of the pipe flowing full (ft/sec)

3.4.3.2 Riprap Size

For the design velocity, use Figure HS-20c to find the size and type of the riprap to use in the scour protection basin downstream of the pipe outlet (i.e., B18, H, M or L). First, calculate the riprap sizing design parameter, P_d , namely,

$$P_d = \left(V^2 + gd\right)^{1/2} \tag{HS-16e}$$

in which:

V = design flow velocity at pipe outlet (ft/sec)

g = acceleration due to gravity = 32.2 ft/sec^2

d = design depth of flow at pipe outlet (ft) necessary when the receiving or downstream channel may have little or no flow or tailwater at time when the pipe or culvert is in operation. Design criteria are provided in Figures HS-19a through HS-20c.

3.4.2 Objective

By providing a low tailwater basin at the end of a storm sewer conduit or culvert, the kinetic energy of the discharge is dissipated under controlled conditions without causing scour at the channel bottom. Photograph HS-12 shows a fairly large low tailwater basin.

3.4.3 Low Tailwater Basin Design

Low tailwater is defined as being equal to or less than ⅓ of the height of the storm sewer, that is:

$$y_t \leq \frac{D}{3} \quad \text{or} \quad y_t \leq \frac{H}{3}$$

in which:

y_t = tailwater depth at design

D = diameter of circular pipe (ft)

H = height of rectangular pipe (ft)

3.4.3.1 Finding Flow Depth and Velocity of Storm Sewer Outlet Pipe

The first step in the design of a scour protection basin at the outlet of a storm sewer is to find the depth and velocity of flow at the outlet. Pipe-full flow can be found using Manning's equation.

$$Q_{full} = \frac{1.49}{n} A_{full} \left(R_{full}\right)^{2/3} S_o^{1/2} \qquad \text{(HS-16a)}$$

Then and the pipe-full velocity can be found using the continuity equation.

$$V_{full} = Q_{full} / A_{full} \qquad \text{(HS-16a)}$$

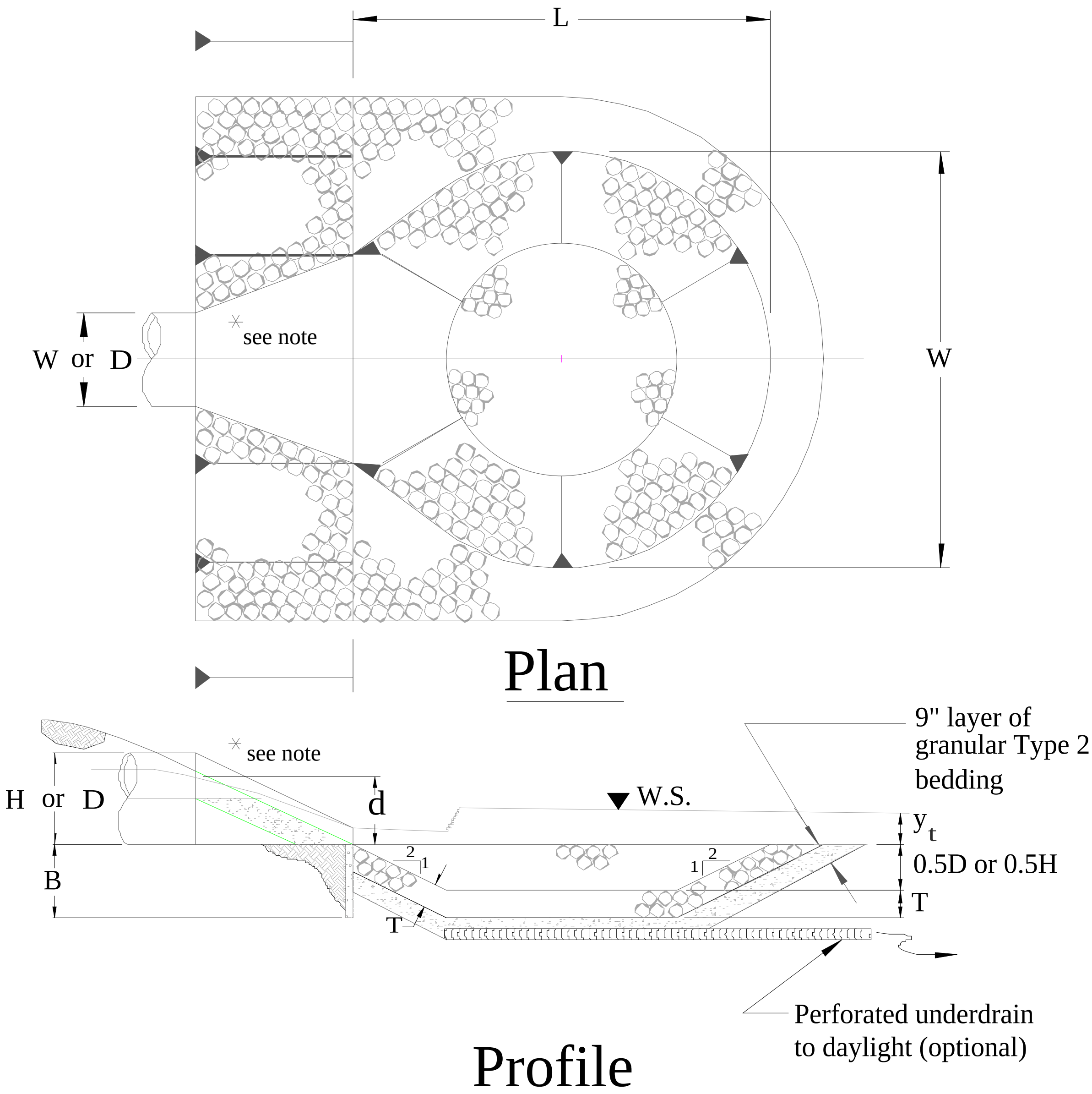
The normal depth of flow, d, and the velocity in a conduit can be found with the aid of Figure HS-20a and Figure HS-20b. Using the known design discharge, Q, and the calculated pipe-full discharge, Q_{full}, enter Figure HS-20a with the value of Q/Q_{full} and find d/D for a circular pipe of d/H for a rectangular pipe.

Compare the value of d/D (or d/H) with the one obtained from Figure HS-20b using the Froude parameter.

$$Q/D^{2.5} \quad \text{or} \quad Q/\left(wH^{1/5}\right) \qquad \text{(HS-16a)}$$

Choose the smaller of the two (d/D or d/H) ratios to calculate the flow depth at the end of the pipe.

$$d = D(d/D) \quad \text{or} \quad d = H(d/H) \qquad \text{(HS-16b)}$$



*Note: For rectangular conduits use a standard design for a headwall with wingwalls, paved bottom between the wingwalls, with an end cutoff wall extending to a minimum depth equal to B

Figure HS-19—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets— Low Tailwater Basin at Pipe Outlets
(Stevens and Urbonas 1996)

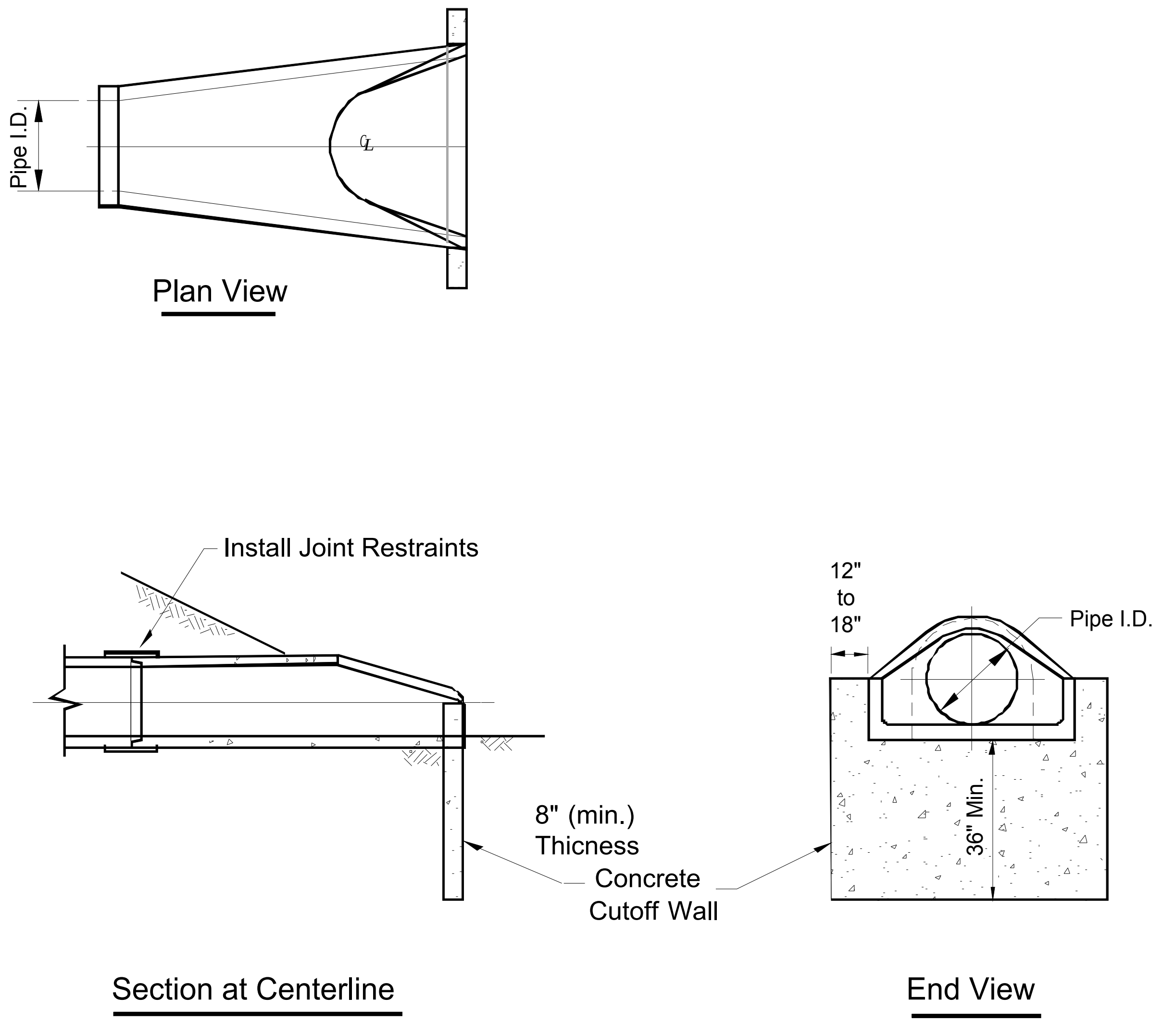


Figure HS-19a—Concrete Flared End Section with Cutoff Wall for all Pipe Outlets

Photograph HS-12—Upstream and downstream views of a low tailwater basin in Douglas County protecting downstream wetland area. Burying and revegetation of the rock would blend the structure better with the adjacent terrain.

When the riprap sizing design parameter indicates conditions that place the design above the Type H riprap line in Figure HS-20, use B18, or larger, grouted boulders. An alternative to a grouted boulder or loose riprap basin is to use the standard USBR Impact Basin VI or one of its modified versions, described earlier in this Chapter of the *Manual*.

After the riprap size has been selected, the minimum thickness of the riprap layer, T, in feet, in the basin is set at:

$$T = 1.75 D_{50} \qquad \text{(HS-17)}$$

in which:

D_{50} = the median size of the riprap (see Table HS-9.)

Table HS-9—Median (i.e., D_{50}) Size of District's Riprap/Boulder

Riprap Type	D_{50}—Median Rock Size (inches)
L	9
M	12
H	18
B18	18 (minimum dimension of grouted boulders)

3.4.3.3 Basin Length

The minimum length of the basin, L, in Figure HS-19, is defined as being the <u>greater</u> of the following:

for circular pipe: $$L = 4D \quad \text{or} \quad L = (D)^{1/2}\left(\frac{V}{2}\right) \qquad \text{(HS-18)}$$

for rectangular pipe: $L = 4H$ or $L = (H)^{1/2}\left(\frac{V}{2}\right)$ (HS-19)

in which:

L = basin length

H = height of rectangular conduit

V = design flow velocity at outlet

D = diameter of circular conduit

3.4.3.4 Basin Width

The minimum width, W, of the basin downstream of the pipe's flared end section is set as follows:

for circular pipes: $W = 4D$ (HS-20)

for rectangular pipe: $W = w + 4H$ (HS-21)

in which,

W = basin width (Figure HS-19)

D = diameter of circular conduit

w = width of rectangular conduit

3.4.3.5 Other Design Requirements

All slopes in the pre-shaped riprapped basin are 2H to 1V.

Provide pipe joint fasteners and a structural concrete cutoff wall at the end of the flared end section for a circular pipe or a headwall with wingwalls and a paved bottom between the walls, both with a cutoff wall that extends down to a depth of:

$$B = \frac{D}{2} + T \quad \text{or} \quad B = \frac{H}{2} + T \qquad \text{(HS-22)}$$

in which,

B = cutoff wall depth

D = diameter of circular conduit

T = Equation HS-17

The riprap must be extended up the outlet embankment's slope to the mid-pipe level.

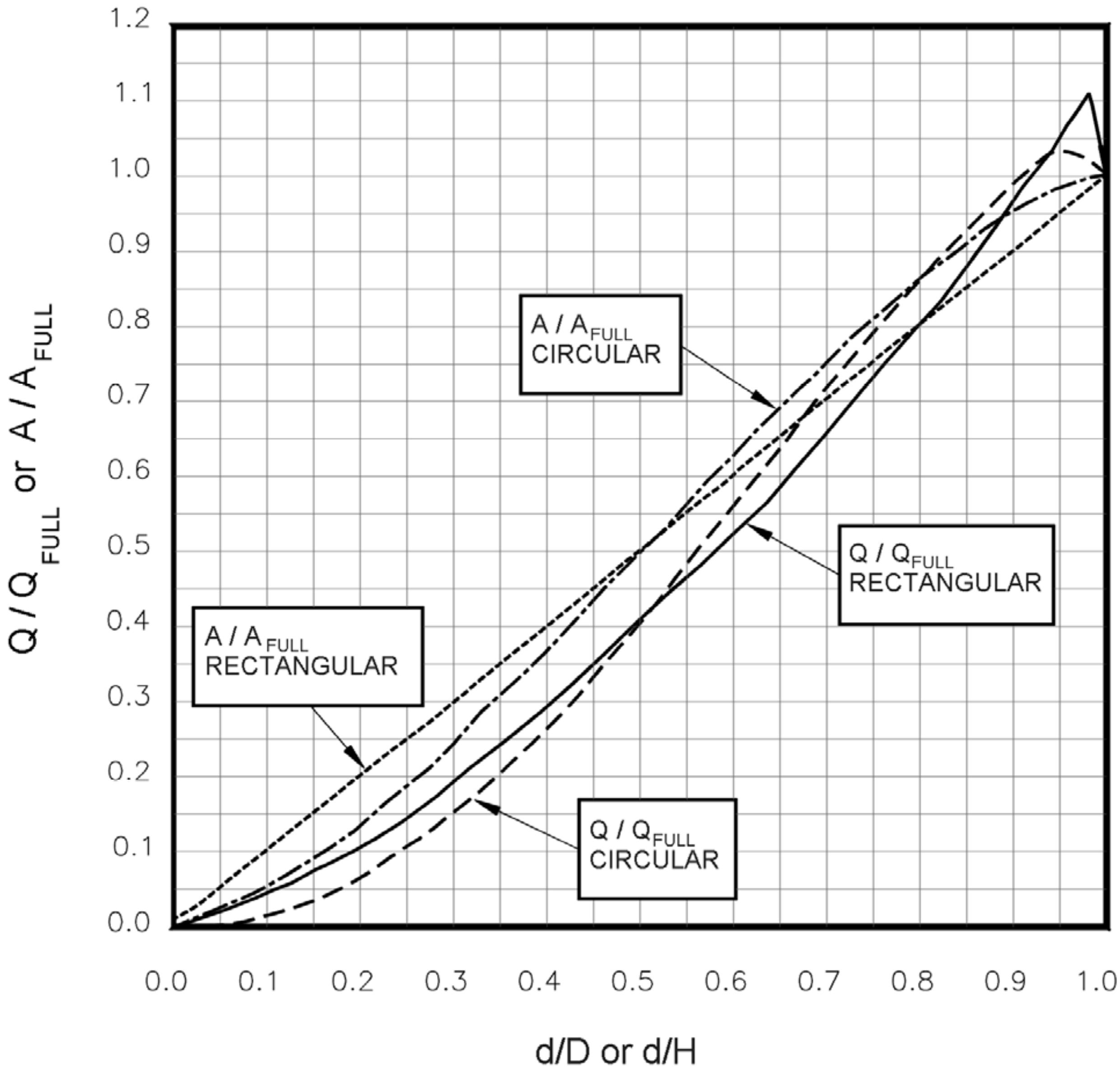


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—
Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's *n* Varying With Depth)
(Stevens and Urbonas 1996)

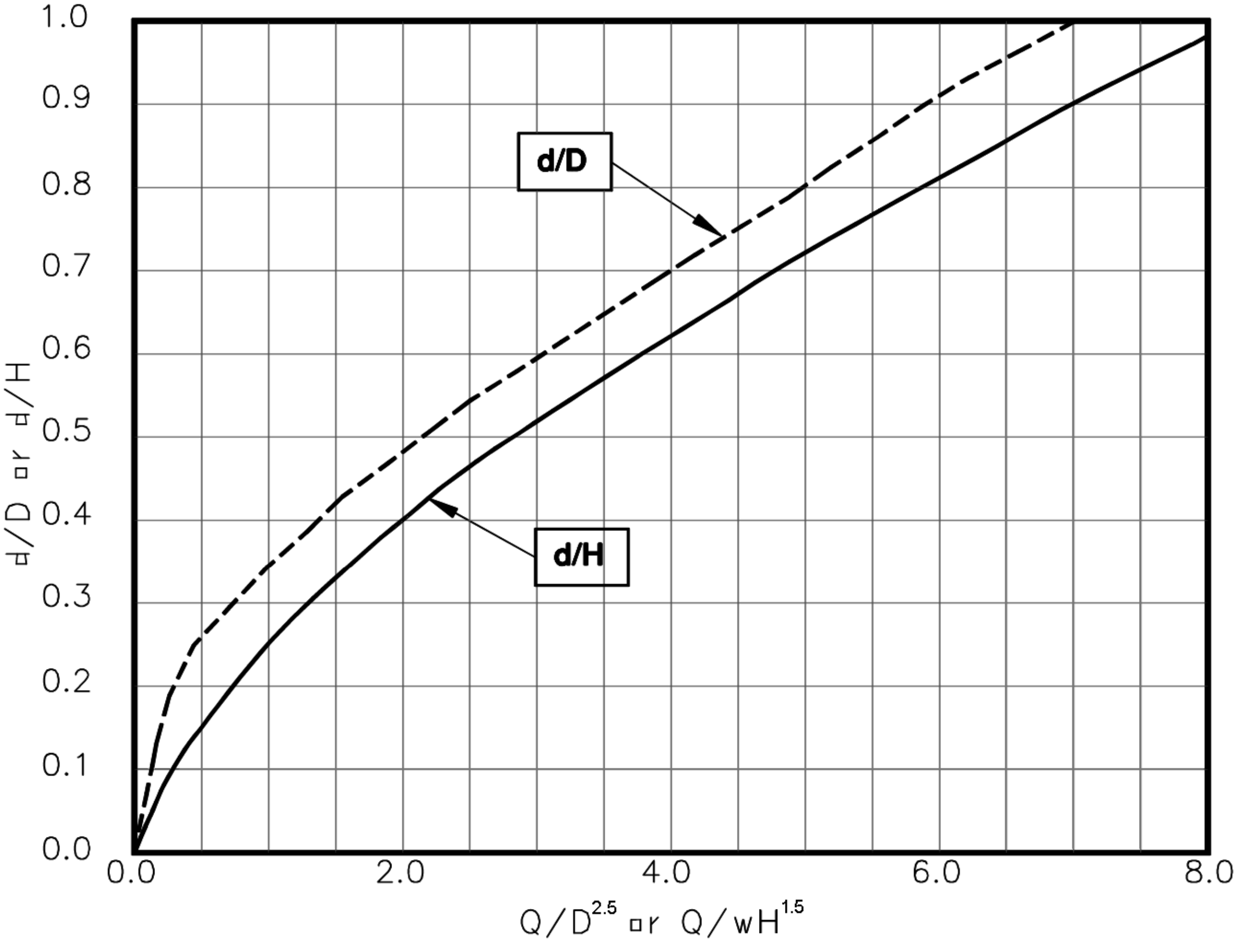


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

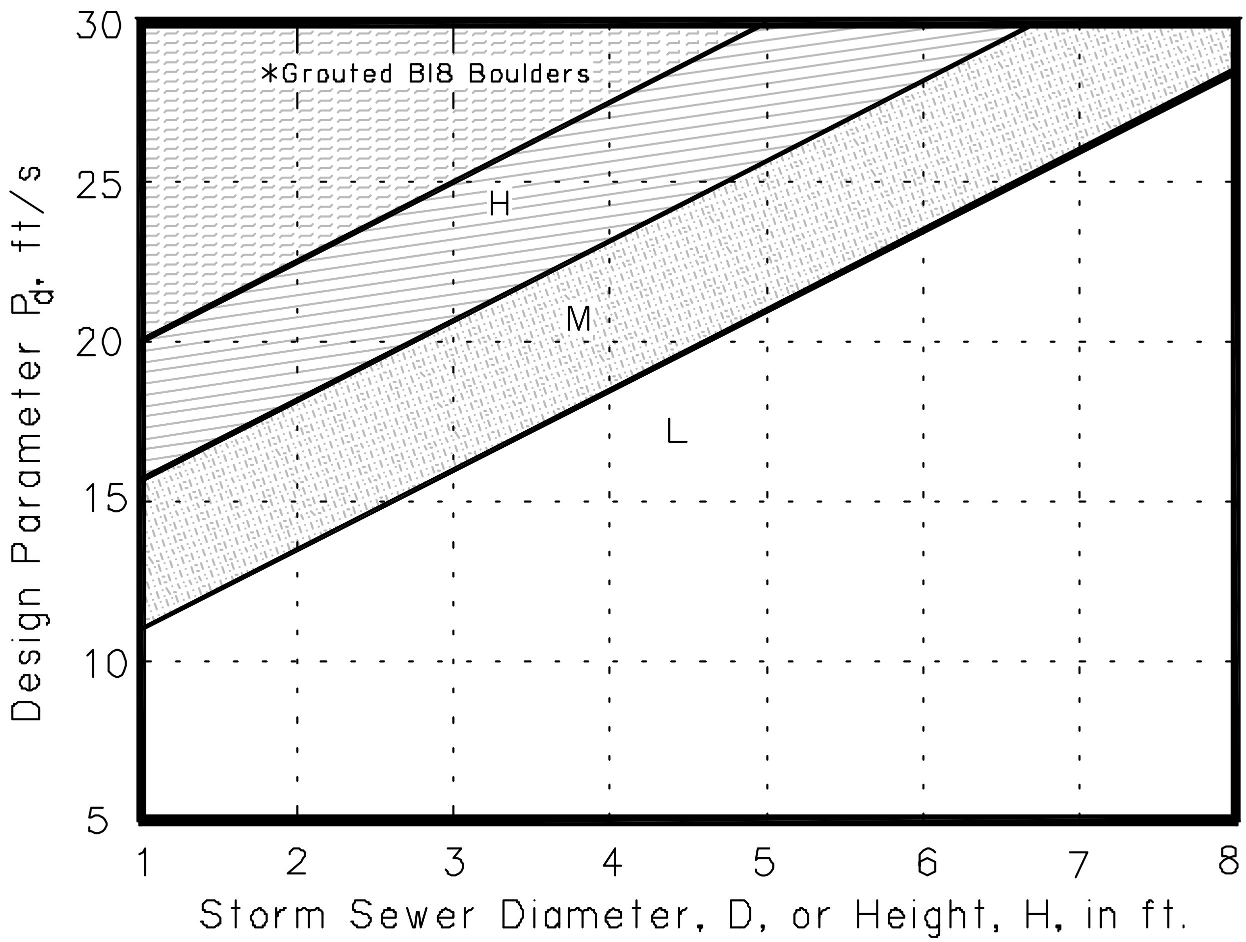


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

RIP RAP PLUNGE POOL

Urban Drainage & Flood Control District Pipe Outlet Design

Low Tailwater Design ($y_t \le D/3$)

OUTLET # OS-2

Outlet Size (D) :	42	in.	Discharge (q):	86	CFS
Capacity (Q): (full flow)	144	CFS	Flow depth (d): (calculated)	26.3	in.

Q_{full} =	144 CFS	q/Q_{full} =	0.60
A_{full} =	9.6 SF		
V_{full} =	15.0 FPS	$Q/D^{2.5}$ =	3.8

d/D	0.63	from HS-20a using q/Q_{full}
d/D	0.68	from HS-20b using $Q/D^{2.5}$

A' (A/A_{full})	0.63	from HS-20a using smaller d/D from above	Flow Area ($a=A' \times A_{full}$)	6.0	SF

Outlet Velocity (V = q/a) 14.3 FPS

$P_d = (V^2 + gd)^{1/2}$ = 17

RIP-RAP SIZE: M from HS-20c

d_{50}= 12 in $T=1.75 x d_{50}$ 1.75 ft

Basin Length (L)	14.0 FT.	Cutoff Wall Depth (B=D/2+T)	3.5	FT
Basin Width (W)	14.0 FT.			

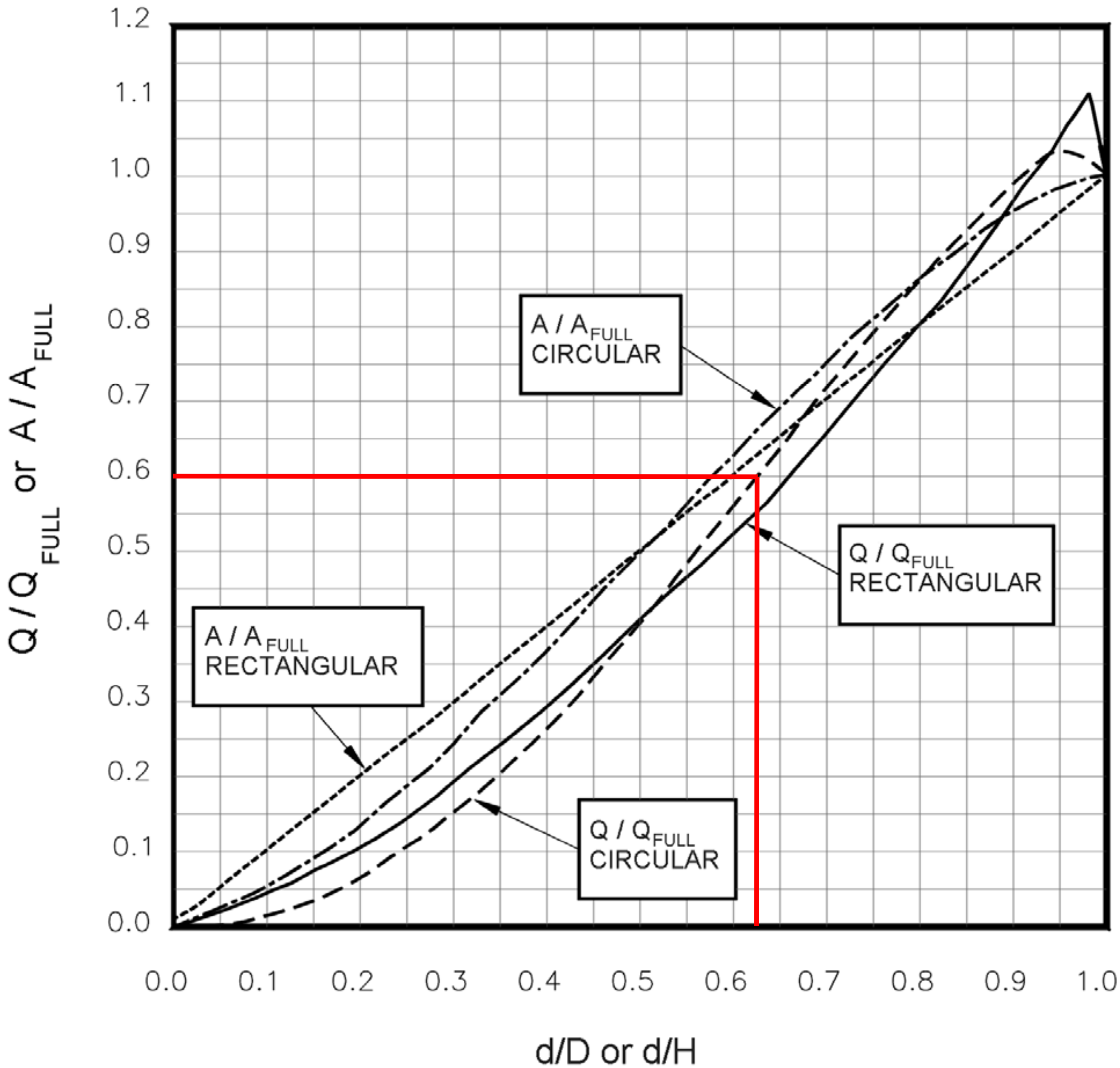


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets— Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's *n* Varying With Depth)
(Stevens and Urbonas 1996)

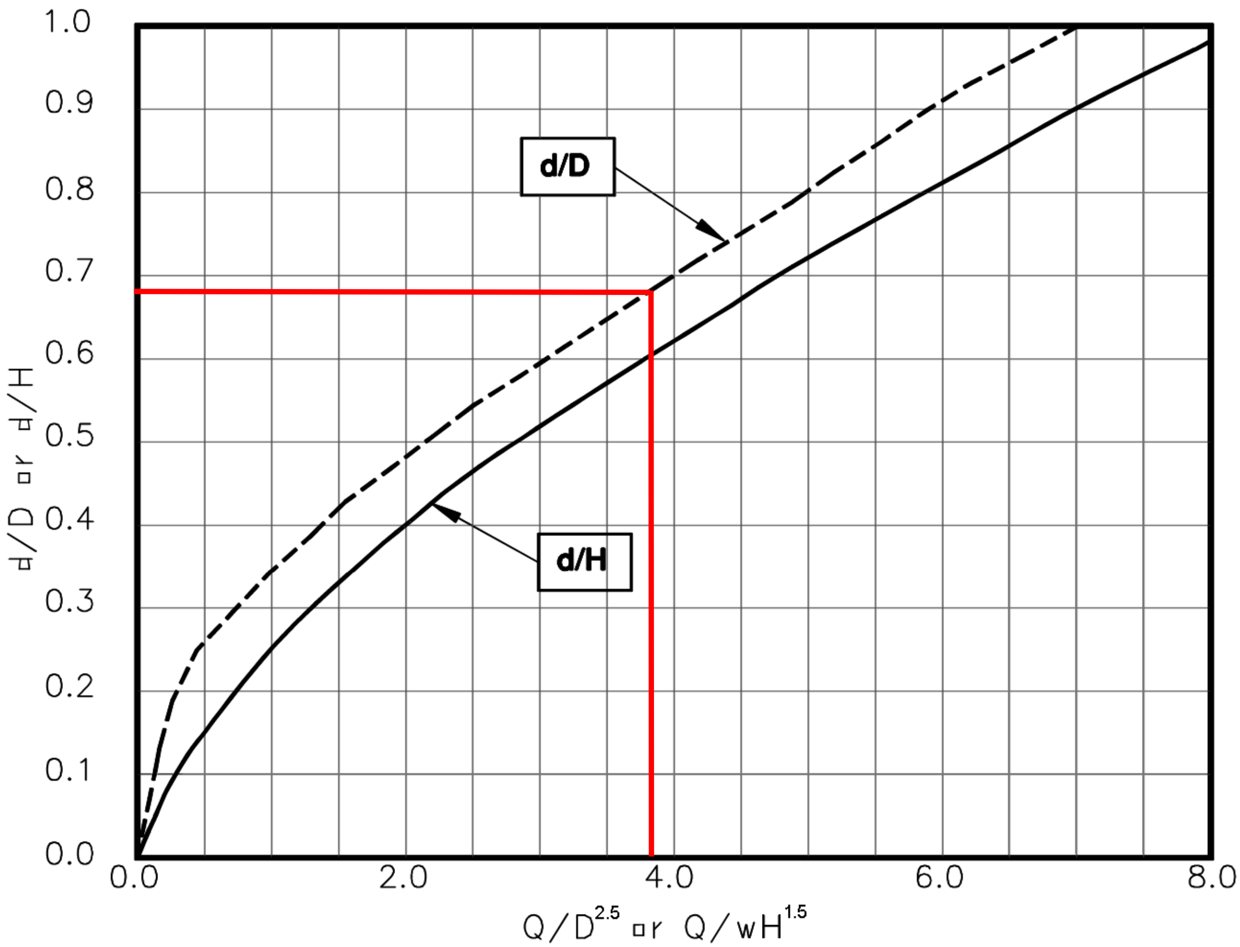


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

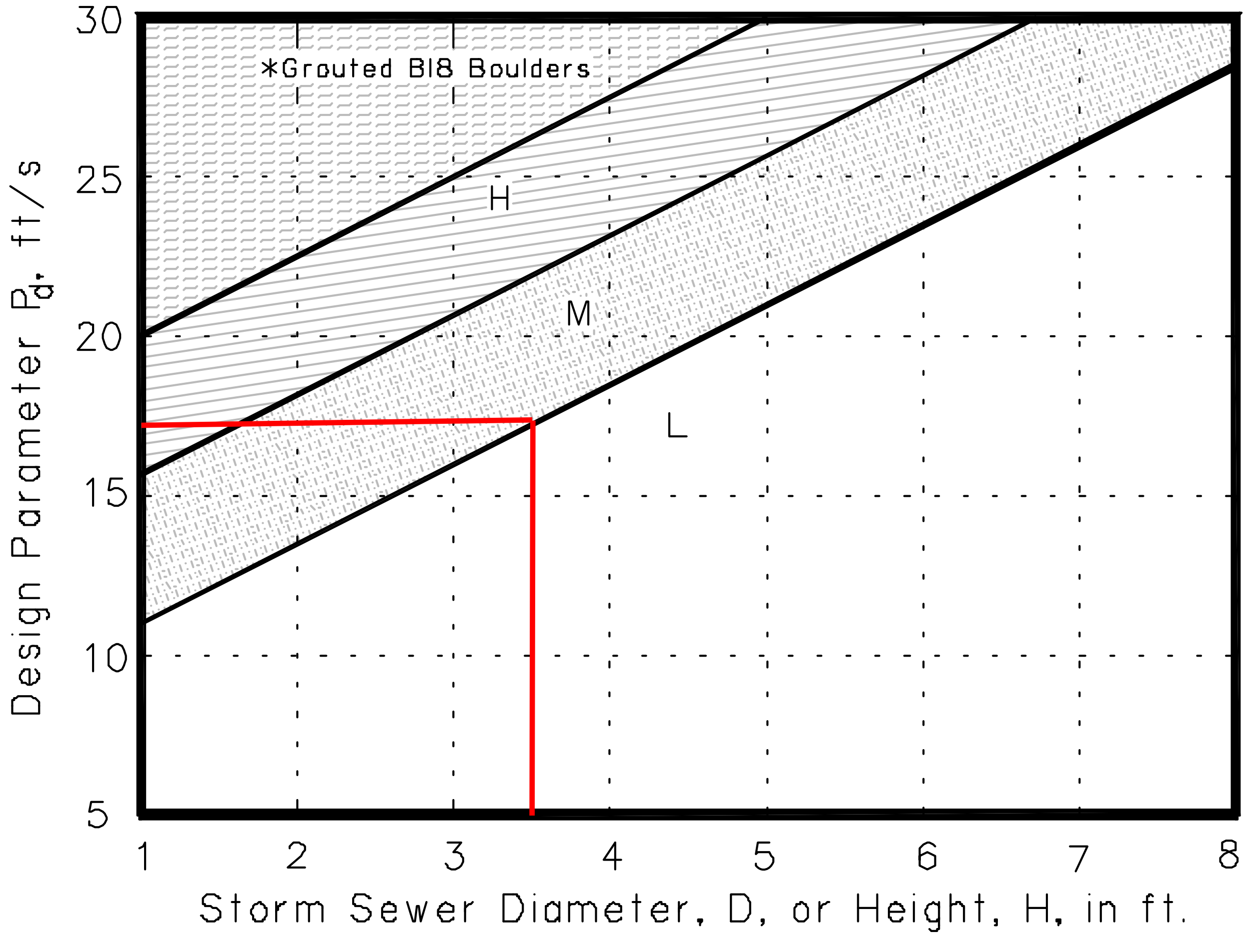


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

RIP RAP PLUNGE POOL

Urban Drainage & Flood Control District Pipe Outlet Design

Low Tailwater Design ($y_t \leq H/3$)

OUTLET # POND G

Outlet Size (H) :	48	in.		Discharge (q):	478	CFS
Capacity (Q): (full flow)	479	CFS		Flow depth (d): (calculated)	39.1	in.
Retangular Width	10					

Q_{full} =	479 CFS	q/Q_{full} =	1.00
A_{full} =	40.0 SF		
V_{full} =	12.0 FPS	$Q/wH^{1.5}$ =	6.0

d/H	1.00	from HS-20a using Q/Q_{full}
d/H	0.82	from HS-20b using $Q/wH^{1.5}$

A' (A/A_{full})	0.82	from HS-20a using smaller d/D from above	Flow Area ($a=A' \times A_{full}$)	32.6	SF

Outlet Velocity (V = q/a) 14.7 FPS

$P_d = (V^2 + gd)^{1/2}$ = 18

RIP-RAP SIZE: M from HS-20c

d_{50}= 12 in $T=1.75xd_{50}$ 1.75 ft

Basin Length (L)	16.0 FT.	Cutoff Wall Depth (B=H/2+T)	3.75	FT
Basin Width (W)	26.0 FT.			

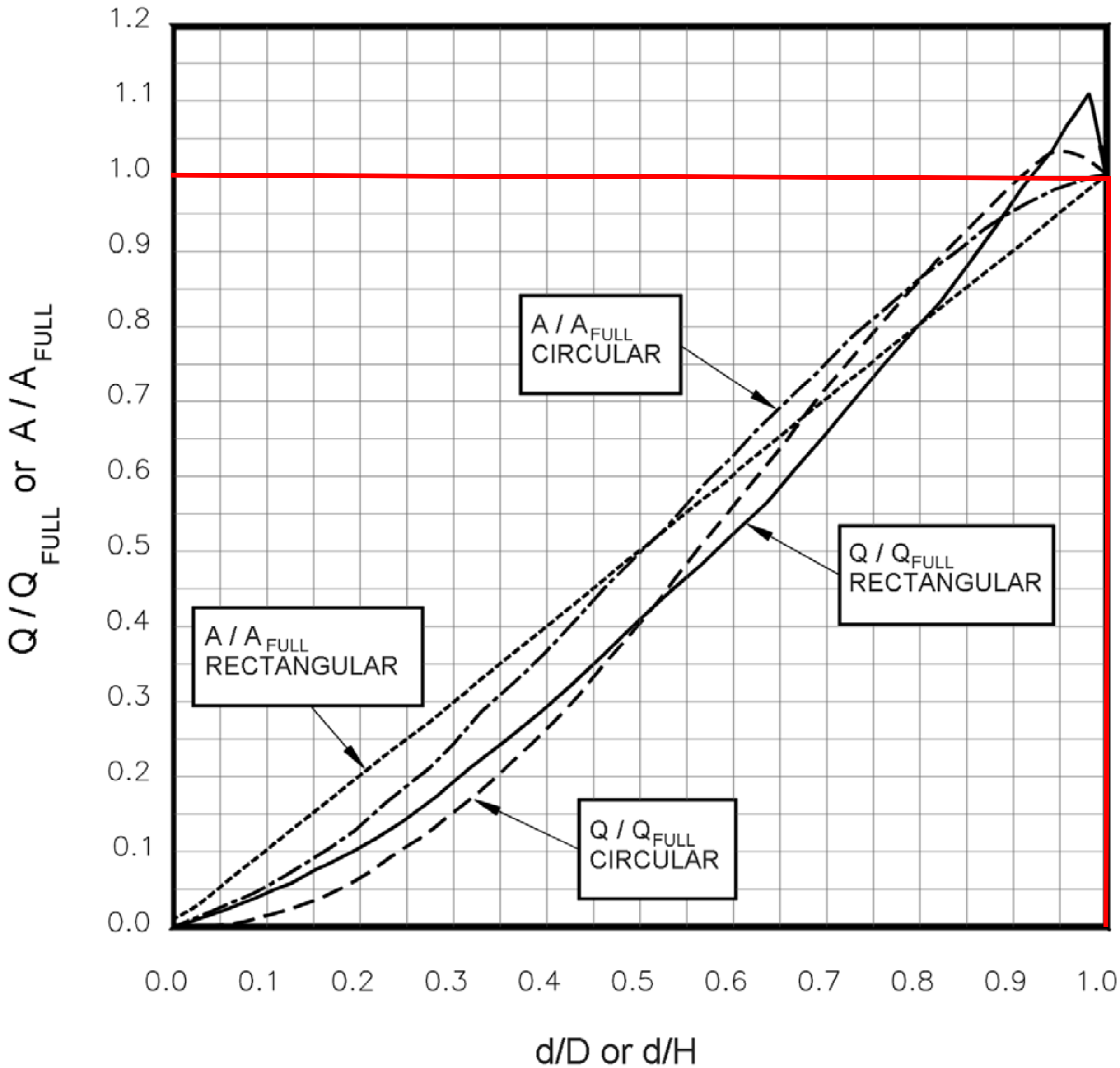


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—
Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's *n* Varying With Depth)
(Stevens and Urbonas 1996)

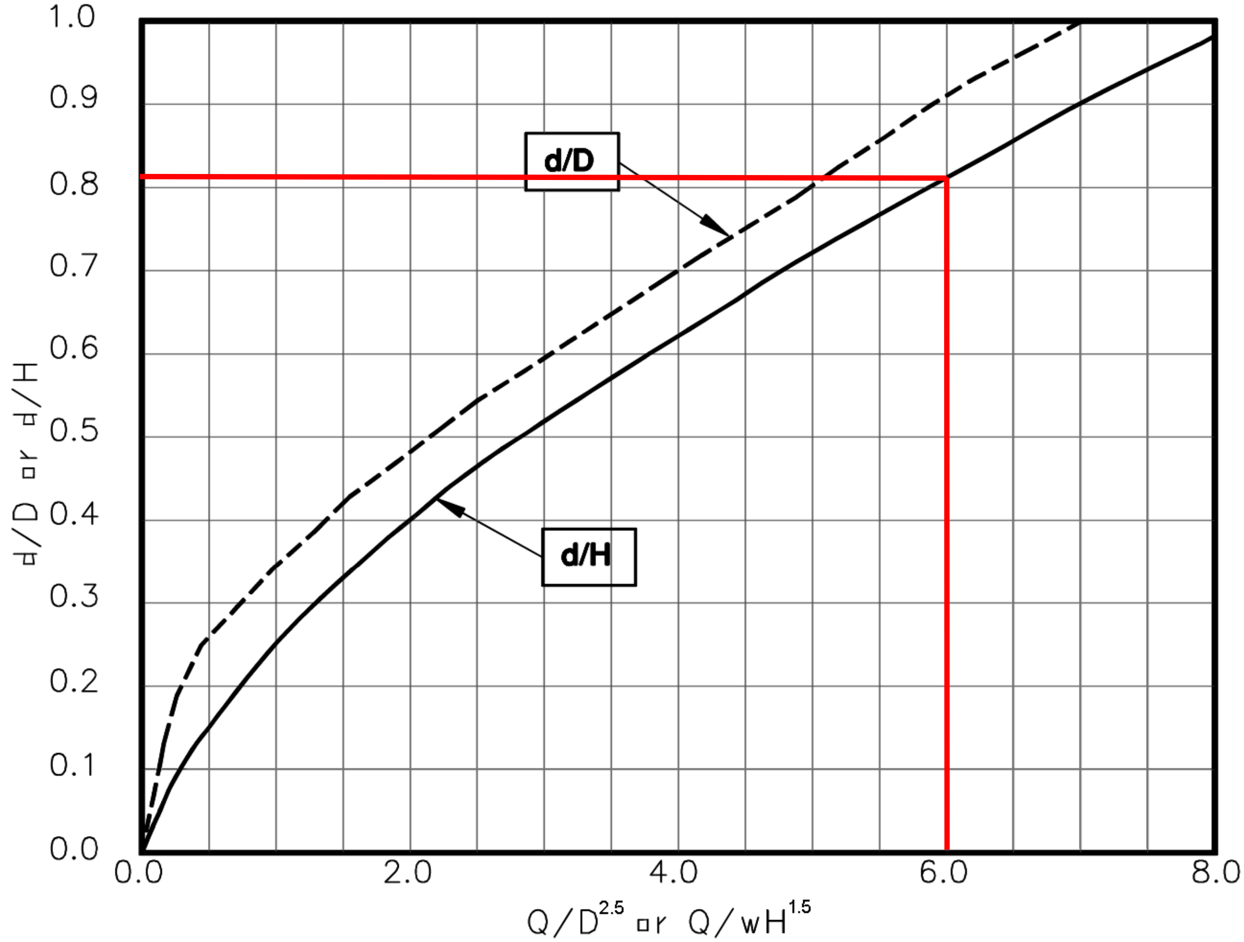


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

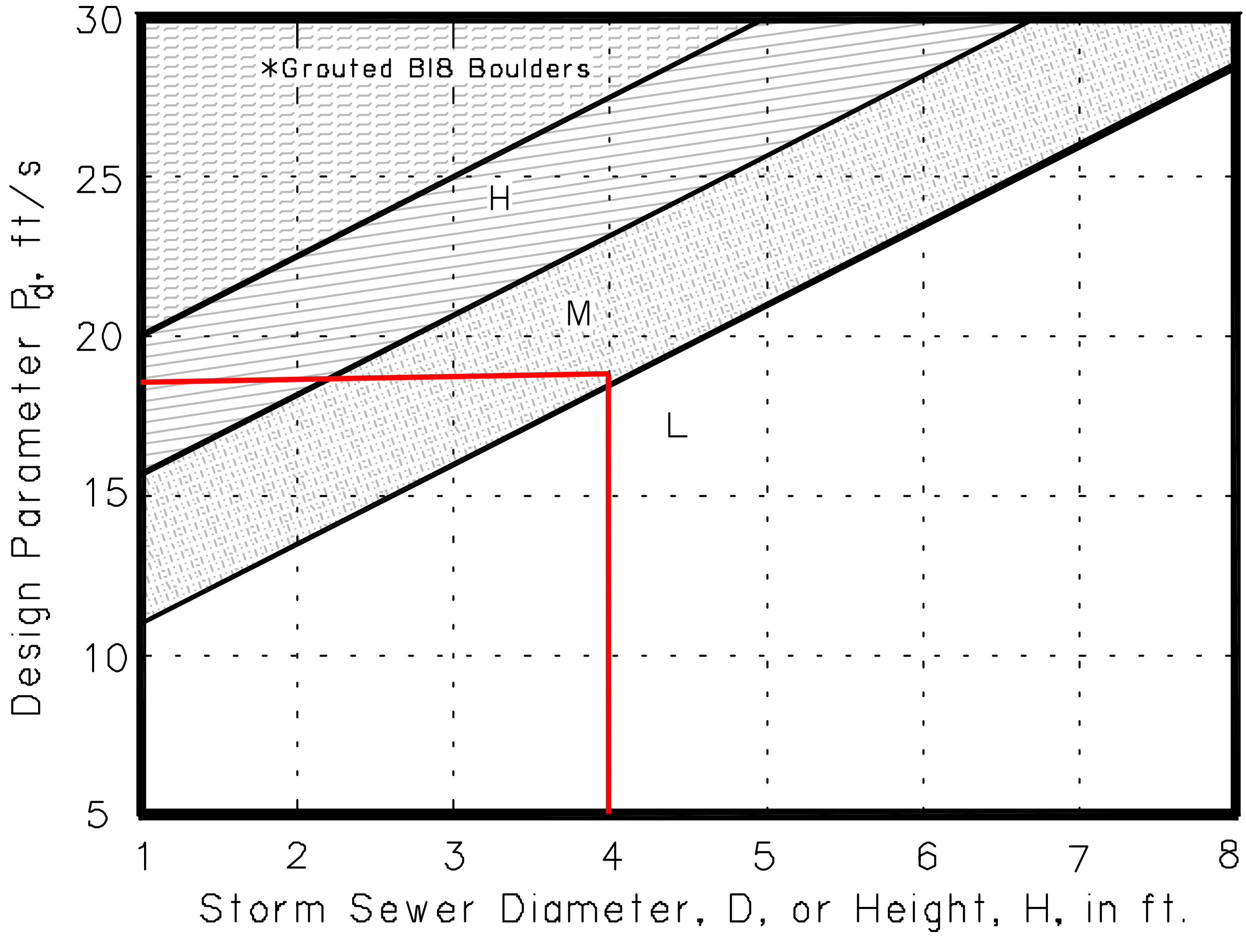


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

Appendix E – Temporary Sedimentation Ponds

ROLLING HILLS RANCH GRADING

TEMPORARY SEDIMENTATION SIZING

TEMP POND 1

Tributary Area:	Required Volume	Depth at Outlet
29.5 ac.	1.2 ac-ft	6.7 ft.

Area required per Row
1.0 in^2

WS Elev: 7075.2

No. of columns	Hole size
4	9/16 in

STAGE			STORAGE			
			AREA		VOLUME	
STAGE	ELEV	HEIGHT	sqft	acre	acft	cum acft
1	7068.5	0	30	0.001	0.000	0.00
2	7069	0.5	1364	0.03	0.01	0.01
3	7070	1.5	4094	0.09	0.06	0.07
4	7071	2.5	6862	0.16	0.13	0.20
5	7072	3.5	8467	0.19	0.18	0.37
6	7073	4.5	10128	0.23	0.21	0.59
7	7074	5.5	11846	0.27	0.25	0.84
8	7075	6.5	13620	0.31	0.29	1.13
9	7076	7.5	15452	0.35	1.10	1.47

TABLE SB-2							
Minimum steel thickness		1	2	3	**4**	5	6
		1/4	5/16	3/8	**3/8**	3/8	1/2
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	**0.99**	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	1.56	2.07	2.59	3.11
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
15/16	0.9375	0.69	1.38	2.07	2.76	3.45	4.14
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/16	1.0625	0.89	1.77	2.66	3.55	4.43	5.32

* 4 Columns of 13/16 holes existing.

ROLLING HILLS RANCH GRADING

TEMPORARY SEDIMENTATION SIZING

TEMP POND 2

Tributary Area:	Required Volume	Depth at Outlet
24.9 ac.	1.0 ac-ft	5.1 ft.

Area required per Row

0.9 in^2

WS Elev: 7036.6

No. of columns: 1

Hole size: 1 1/16 in

STAGE			STORAGE			
			AREA		VOLUME	
STAGE	ELEV	HEIGHT	sqft	acre	acft	cum acft
1	7031.5	0	10	0.000	0.000	0.00
2	7032	0.5	2660	0.06	0.02	0.02
3	7033	1.5	7570	0.17	0.12	0.13
4	7034	2.5	9179	0.21	0.19	0.33
5	7035	3.5	10861	0.25	0.23	0.56
6	7036	4.5	12614	0.29	0.27	0.82
7	7037	5.5	14438	0.33	0.31	1.13

TABLE SB-2

Minimum steel thickness		**1**	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	1.56	2.07	2.59	3.11
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
15/16	0.9375	0.69	1.38	2.07	2.76	3.45	4.14
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/16	1.0625	**0.89**	1.77	2.66	3.55	4.43	5.32

* 4 Columns of 13/16 holes existing.

ROLLING HILLS RANCH GRADING

TEMPORARY SEDIMENTATION SIZING

TEMP POND 3

Tributary Area:	Required Volume	Depth at Outlet
7.6 ac.	0.3 ac-ft	1.9 ft.

Area required per Row

0.8 in^2

WS Elev: 7063.4

No. of columns	Hole size
1	1 in

STAGE			STORAGE			
			AREA		VOLUME	
STAGE	ELEV	HEIGHT	sqft	acre	acft	cum acft
1	7061.5	0	10	0.000	0.000	0.00
2	7062	0.5	3807	0.09	0.02	0.02
3	7063	1.5	9900	0.23	0.16	0.18
4	7064	2.5	16892	0.39	0.31	0.49
5	7065	3.5	21531	0.49	0.44	0.93
6	7066	4.5	27137	0.62	0.56	1.49

TABLE SB-2							
Minimum steel thickness		**1**	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	1.56	2.07	2.59	3.11
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
15/16	0.9375	0.69	1.38	2.07	2.76	3.45	4.14
1	1.0000	**0.79**	1.57	2.36	3.14	3.93	4.71
1 1/16	1.0625	0.89	1.77	2.66	3.55	4.43	5.32

* 4 Columns of 13/16 holes existing.

ROLLING HILLS RANCH GRADING

TEMPORARY SEDIMENTATION SIZING

TEMP POND 4

Tributary Area:	Required Volume	Depth at Outlet
5.8 ac.	0.2 ac-ft	1.7 ft.

Area required per Row
0.8 in^2

WS Elev: 7057.2

No. of columns	Hole size
1	1 in

STAGE			STORAGE			
			AREA		VOLUME	
STAGE	ELEV	HEIGHT	sqft	acre	acft	cum acft
1	7055.5	0	10	0.000	0.000	0.00
2	7056	0.5	3763	0.09	0.02	0.02
3	7057	1.5	8129	0.19	0.14	0.16
4	7058	2.5	9414	0.22	0.20	0.36

TABLE SB-2

Minimum steel thickness		1	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	1.56	2.07	2.59	3.11
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
15/16	0.9375	0.69	1.38	2.07	2.76	3.45	4.14
1	1.0000	**0.79**	1.57	2.36	3.14	3.93	4.71
1 1/16	1.0625	0.89	1.77	2.66	3.55	4.43	5.32

* 4 Columns of 13/16 holes existing.

ROLLING HILLS RANCH GRADING

TEMPORARY SEDIMENTATION SIZING

TEMP POND 5

Tributary Area:	Required Volume	Depth at Outlet
4.5 ac.	0.2 ac-ft	2.2 ft.

Area required per Row

0.5 in^2

WS Elev: 7026.7

No. of columns: 2

Hole size: 9/16 in

STAGE			STORAGE			
			AREA		VOLUME	
STAGE	ELEV	HEIGHT	sqft	acre	acft	cum acft
1	7024.5	0	10	0.000	0.000	0.00
2	7025	0.5	785	0.02	0.00	0.00
3	7026	1.5	3560	0.08	0.05	0.05
4	7027	2.5	4630	0.11	0.09	0.15
5	7028	3.5	5785	0.13	0.21	0.27

TABLE SB-2							
Minimum steel thickness		1	**2**	3	4	5	6
		1/4	**5/16**	3/8	3/8	3/8	1/2
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	**0.50**	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	1.56	2.07	2.59	3.11
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
15/16	0.9375	0.69	1.38	2.07	2.76	3.45	4.14
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/16	1.0625	0.89	1.77	2.66	3.55	4.43	5.32

* 4 Columns of 13/16 holes existing.

ROLLING HILLS RANCH GRADING

SEDIMENTATION SIZING

PERMANENT POND 6

Tributary Area:	Required Volume	Depth at Outlet
12.5 ac.	0.5 ac-ft	3.7 ft.

Area required per Row
0.6 in^2

WS Elev: 7094.6

No. of columns	Hole size
1	7/8 in

STAGE			STORAGE			
STAGE	ELEV	HEIGHT	AREA		VOLUME	
			sqft	acre	acft	cum acft
1	7090.9	0	0	0.000	0.000	0.00
2	7091	0.1	44	0.00	0.00	0.00
3	7092	1.1	5600	0.13	0.06	0.06
4	7093	2.1	6835	0.16	0.14	0.21
5	7094	3.1	8170	0.19	0.17	0.38
6	7095	4.1	9606	0.22	0.20	0.58

TABLE SB-2

Minimum steel thickness		**1**	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	1.56	2.07	2.59	3.11
7/8	0.8750	**0.60**	1.20	1.80	2.41	3.01	3.61
15/16	0.9375	0.69	1.38	2.07	2.76	3.45	4.14
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/16	1.0625	0.89	1.77	2.66	3.55	4.43	5.32

* 4 Columns of 13/16 holes existing.

ROLLING HILLS RANCH GRADING

TEMPORARY SEDIMENTATION SIZING

LAMBERT POND

Tributary Area:	Required Volume	Depth at Outlet
53.5 ac.	2.2 ac-ft	8.7 ft.

Area required per Row

1.7 in^2

WS Elev: 7019.3

No. of columns	Hole size
3	13/16 in

STAGE			STORAGE			
STAGE	ELEV	HEIGHT	AREA		VOLUME	
			sqft	acre	acft	cum acft
1	7010.6	0	10	0.000	0.000	0.00
2	7011	0.4	810	0.02	0.00	0.00
3	7012	1.4	3352	0.08	0.05	0.05
4	7013	2.4	6498	0.15	0.11	0.16
5	7014	3.4	9562	0.22	0.18	0.35
6	7015	4.4	11631	0.27	0.57	0.57
7	7016	5.4	13756	0.32	0.79	0.84
8	7017	6.4	15939	0.37	1.03	1.19
9	7018	7.4	18178	0.42	1.27	1.62
10	7019	8.4	20473	0.47	0.44	2.07
11	7020	9.4	22825	0.52	0.50	2.56

TABLE SB-2

Minimum steel thickness		1	2	**3**	4	5	6
		1/4	5/16	**3/8**	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	**0.44**	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
13/16	0.8125	0.52	1.04	**1.56**	2.07	2.59	3.11

Appendix F – Rex Road Channel Hydraulics

The following hydraulic analysis for the rip rap lined channel located north of Rex Road is based upon a standard trapezoidal channel with 4:1 side slopes. A bottom width of 10’ and 20’ were analyzed as appropriate for the given channel centerline slope. The channel is lined with 6” rip rap with the appropriate Manning’s N value used. See the grading plans for the typical channel cross section and channel plan.

Worksheet for Rex Road Channel 1.1%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.073
Channel Slope	0.011 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft
Discharge	179.00 cfs

Value seems high. Provide a reference source data supporting this roughness value for the type L rip rap.

Results

Normal Depth	2.1 ft
Flow Area	60.8 ft²
Wetted Perimeter	37.6 ft
Hydraulic Radius	1.6 ft
Top Width	37.06 ft
Critical Depth	1.2 ft
Critical Slope	0.078 ft/ft
Velocity	2.94 ft/s
Velocity Head	0.13 ft
Specific Energy	2.27 ft
Froude Number	0.405
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.1 ft
Critical Depth	1.2 ft
Channel Slope	0.011 ft/ft
Critical Slope	0.078 ft/ft

Worksheet for Rex Road Channel 1.54%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.073
Channel Slope	0.015 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft
Discharge	179.00 cfs

Results	
Normal Depth	1.9 ft
Flow Area	54.1 ft²
Wetted Perimeter	36.0 ft
Hydraulic Radius	1.5 ft
Top Width	35.57 ft
Critical Depth	1.2 ft
Critical Slope	0.078 ft/ft
Velocity	3.31 ft/s
Velocity Head	0.17 ft
Specific Energy	2.12 ft
Froude Number	0.473
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.9 ft
Critical Depth	1.2 ft
Channel Slope	0.015 ft/ft
Critical Slope	0.078 ft/ft

Worksheet for Rex Road Channel 2.9%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.073
Channel Slope	0.029 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft
Discharge	179.00 cfs

Results	
Normal Depth	1.6 ft
Flow Area	43.4 ft²
Wetted Perimeter	33.5 ft
Hydraulic Radius	1.3 ft
Top Width	33.09 ft
Critical Depth	1.2 ft
Critical Slope	0.078 ft/ft
Velocity	4.12 ft/s
Velocity Head	0.26 ft
Specific Energy	1.90 ft
Froude Number	0.634
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.6 ft
Critical Depth	1.2 ft
Channel Slope	0.029 ft/ft
Critical Slope	0.078 ft/ft

Worksheet for Rex Road Channel 6.7%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.073
Channel Slope	0.067 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft
Discharge	179.00 cfs

Results

Normal Depth	1.3 ft
Flow Area	32.7 ft²
Wetted Perimeter	30.7 ft
Hydraulic Radius	1.1 ft
Top Width	30.38 ft
Critical Depth	1.2 ft
Critical Slope	0.078 ft/ft
Velocity	5.48 ft/s
Velocity Head	0.47 ft
Specific Energy	1.76 ft
Froude Number	0.931
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.3 ft
Critical Depth	1.2 ft
Channel Slope	0.067 ft/ft
Critical Slope	0.078 ft/ft

Worksheet for Rex Road Channel 1.0%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.073
Channel Slope	0.010 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	10.00 ft
Discharge	179.00 cfs

Results	
Normal Depth	2.8 ft
Flow Area	59.5 ft²
Wetted Perimeter	33.1 ft
Hydraulic Radius	1.8 ft
Top Width	32.44 ft
Critical Depth	1.7 ft
Critical Slope	0.075 ft/ft
Velocity	3.01 ft/s
Velocity Head	0.14 ft
Specific Energy	2.95 ft
Froude Number	0.392
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.8 ft
Critical Depth	1.7 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.075 ft/ft

Worksheet for Rex Road Channel 3.0%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.073
Channel Slope	0.030 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	10.00 ft
Discharge	179.00 cfs

Results

Normal Depth	2.1 ft
Flow Area	39.8 ft²
Wetted Perimeter	27.7 ft
Hydraulic Radius	1.4 ft
Top Width	27.16 ft
Critical Depth	1.7 ft
Critical Slope	0.075 ft/ft
Velocity	4.49 ft/s
Velocity Head	0.31 ft
Specific Energy	2.46 ft
Froude Number	0.654
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.1 ft
Critical Depth	1.7 ft
Channel Slope	0.030 ft/ft
Critical Slope	0.075 ft/ft

Appendix G – Soil Resource Report

United States Department of Agriculture

NRCS

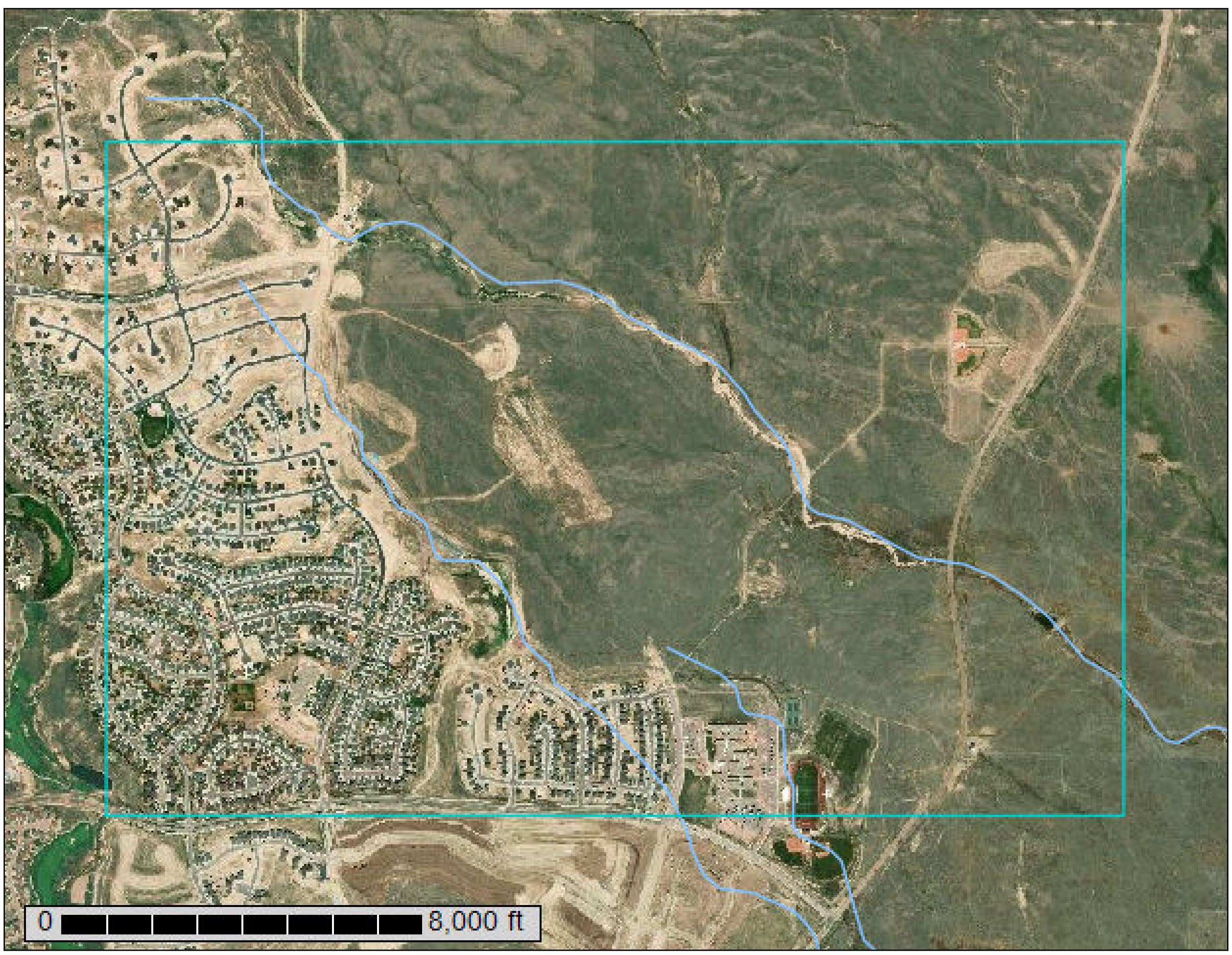
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado

ROLLING HILLS RANCH PUD



February 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

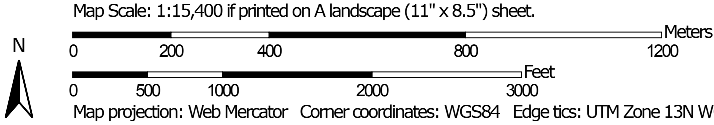
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:15,400 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 7, 2016—Aug 17, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	387.7	31.2%
83	Stapleton sandy loam, 3 to 8 percent slopes	855.6	68.8%
Totals for Area of Interest		**1,243.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

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

Pleasant

Percent of map unit:

Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

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

Typical profile

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Pleasant

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

Fluvaquentic haplaquolls

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

Other soils

Percent of map unit:
Hydric soil rating: No

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Appendix H – Drainage Maps

NOTE:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

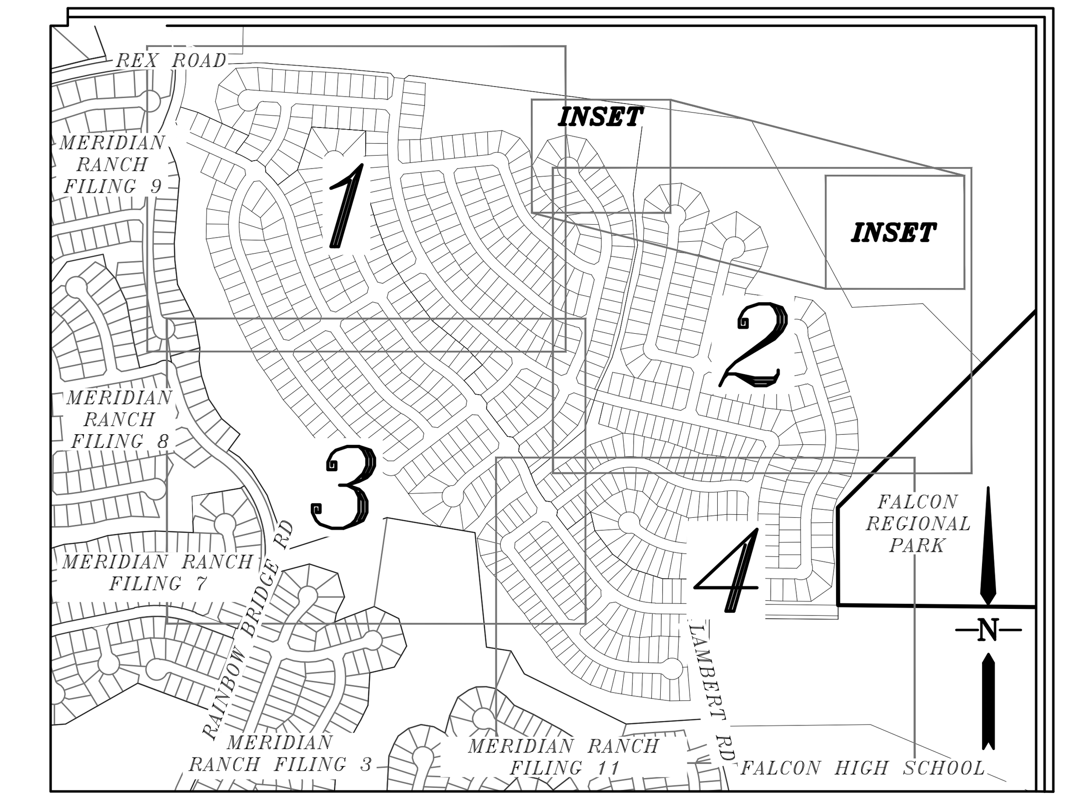
GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

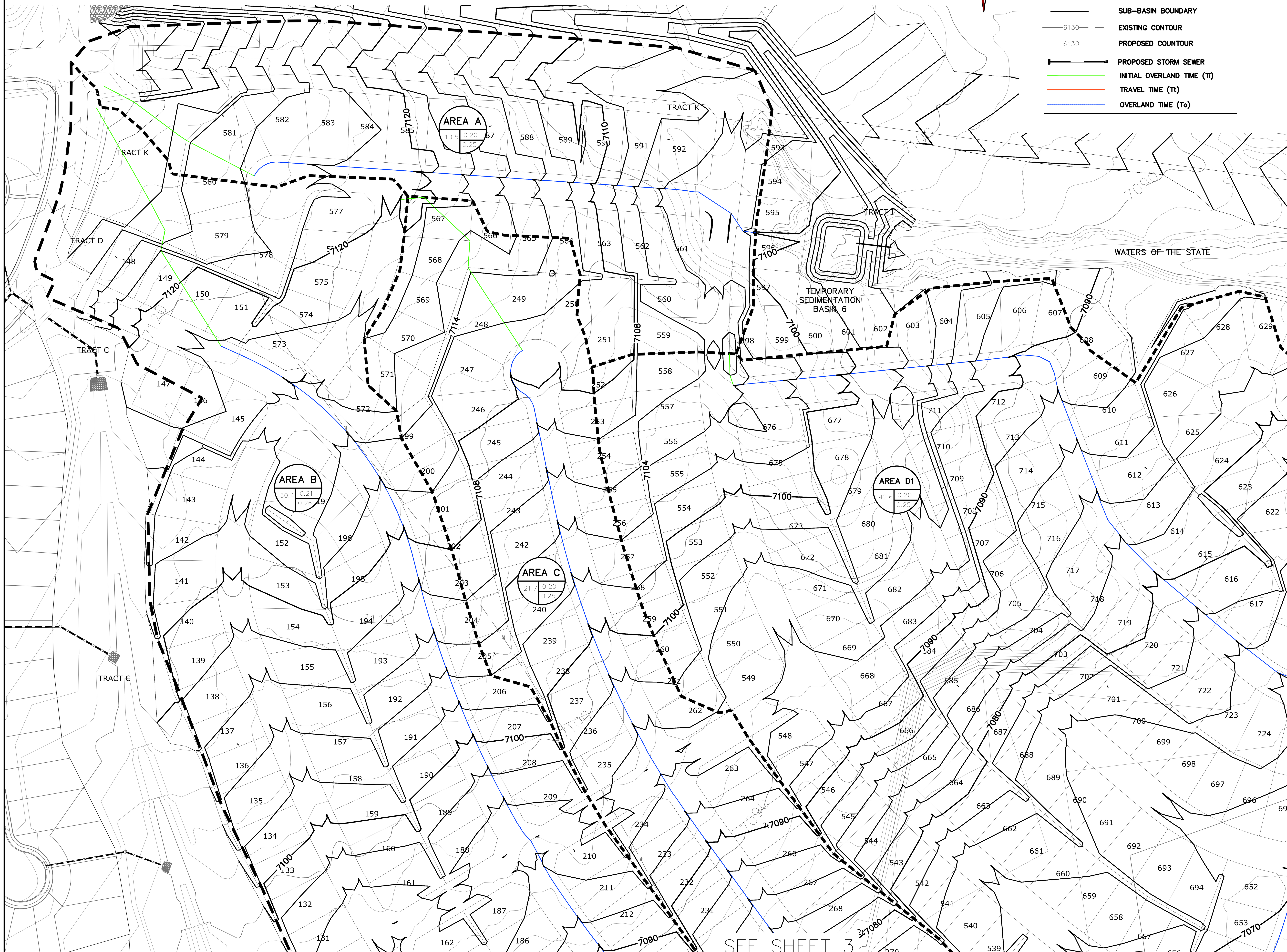
1 inch = 100 ft.

G01 — BASIN DESIGNATION
SUB-WATERSHED DESIGNATION
MINOR/MAJOR STORM COEFFICIENT
BASIN AREA IN ACRES
61 — DESIGN POINT DESIGNATION
MAJOR BASIN BOUNDARY
SUB-BASIN BOUNDARY
6130 — EXISTING CONTOUR
6130 — PROPOSED COUNTOUR
PROPOSED STORM SEWER
INITIAL OVERLAND TIME (Ti)
TRAVEL TIME (Tt)
OVERLAND TIME (To)



INDEX MAP

N.T.S.



DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)
CB4	OS1	4.4	0.9	5.9
SED6	AREA A	10.5	5.2	11
SED1	AREA B	30.4	11	23
SUMP	AREA C	21.7	8.0	17
SUMP	AREA D1	42.6	18	37
SED2	AREA D2	25.0	11	22
LAMBERT	AREA E	63.0	27	66

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					
-					

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
ROLLING HILLS RANCH GRADING

Drawn by TAK
Checked by -
Date MAR 2020

Scale 1" = 100'

1 of 4

NOTE:

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BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

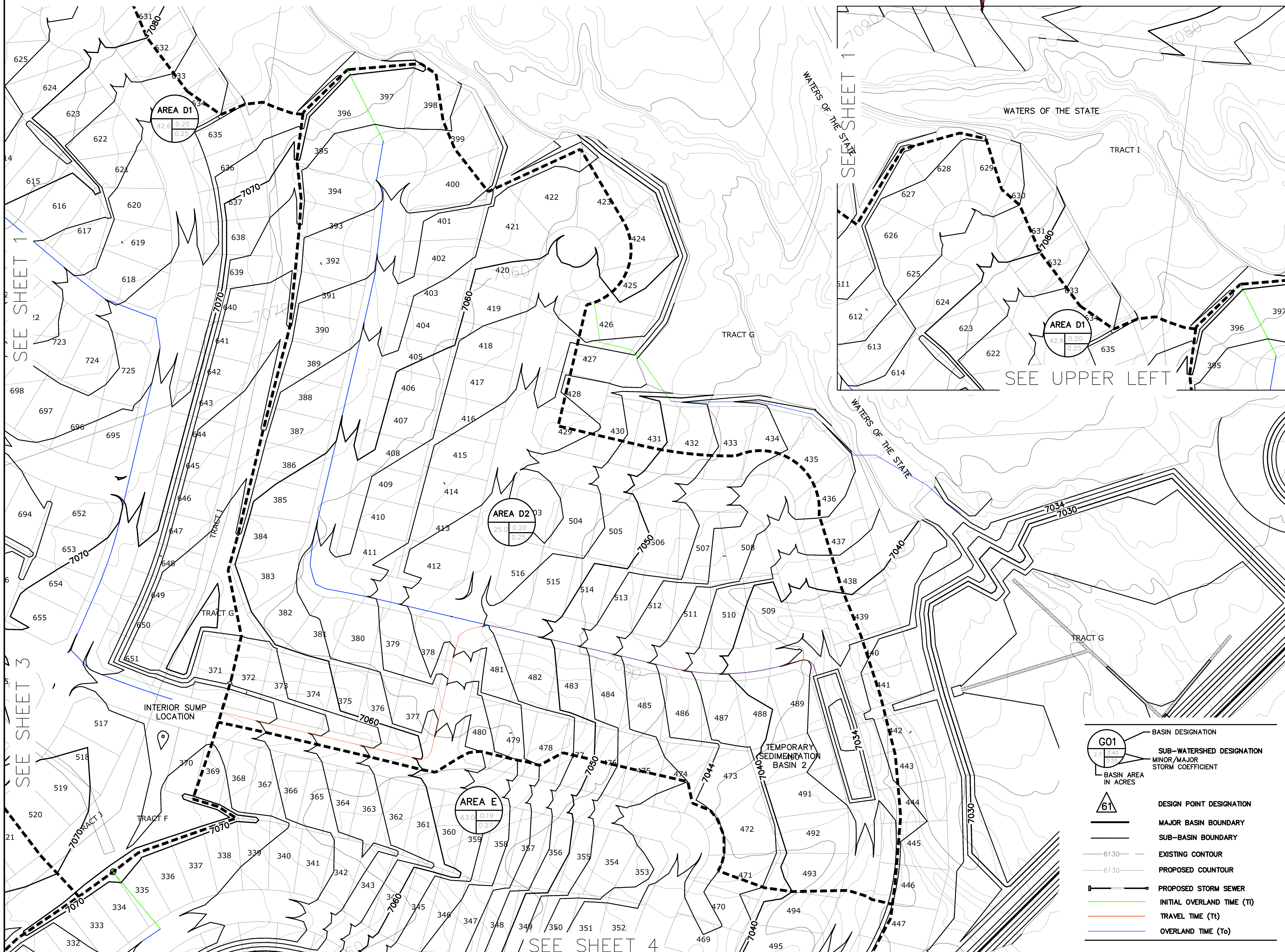
ELEVATION = 6874.00

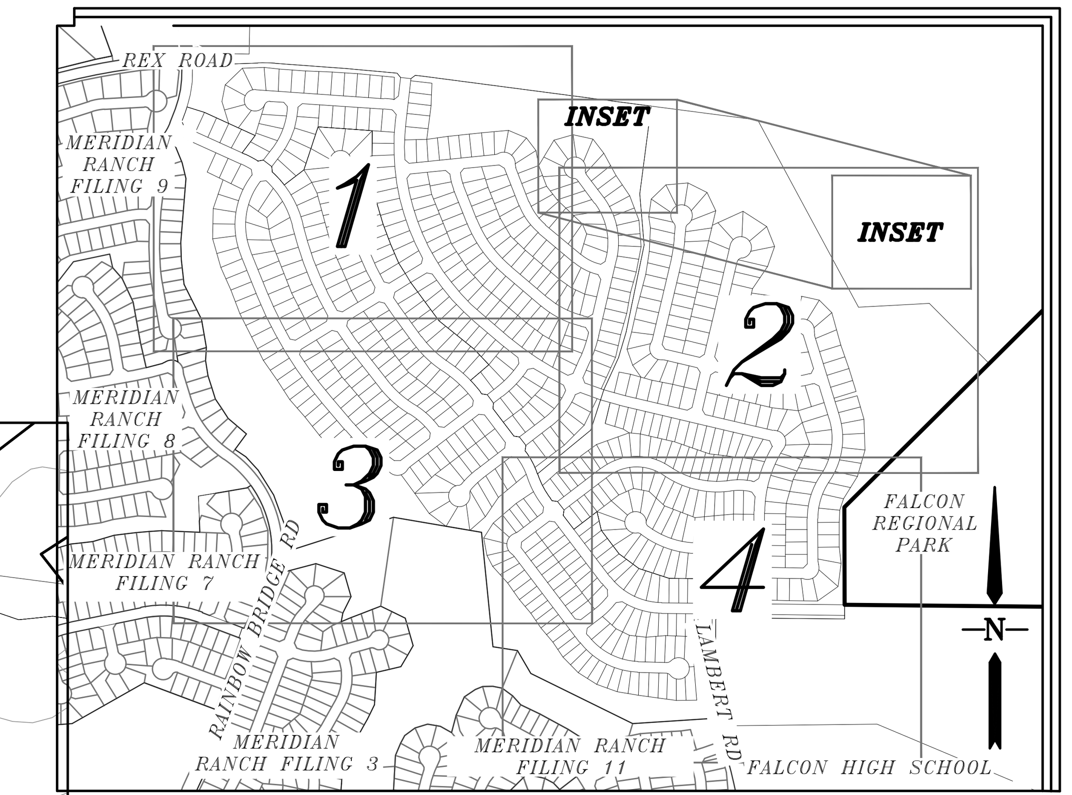
GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.





INDEX MAP

N.T.S.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)
CB4	OS1	4.4	0.9	5.9
SED6	AREA A	10.5	5.2	11
SED1	AREA B	30.4	11	23
SUMP	AREA C	21.7	8.0	17
SUMP	AREA D1	42.6	18	37
SED2	AREA D2	25.0	11	22
LAMBERT	AREA E	63.0	27	66

G01 — BASIN DESIGNATION

SUB-WATERSHED DESIGNATION

MINOR/MAJOR STORM COEFFICIENT

BASIN AREA IN ACRES

61 — DESIGN POINT DESIGNATION

MAJOR BASIN BOUNDARY

SUB-BASIN BOUNDARY

6130 — EXISTING CONTOUR

6130 — PROPOSED COUNTOUR

PROPOSED STORM SEWER

INITIAL OVERLAND TIME (Ti)

TRAVEL TIME (Tt)

OVERLAND TIME (To)

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					
-					

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MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
ROLLING HILLS RANCH GRADING

Drawn by TAK
Checked by -
Date MAR 2020
Scale 1" = 100'
2 of 4

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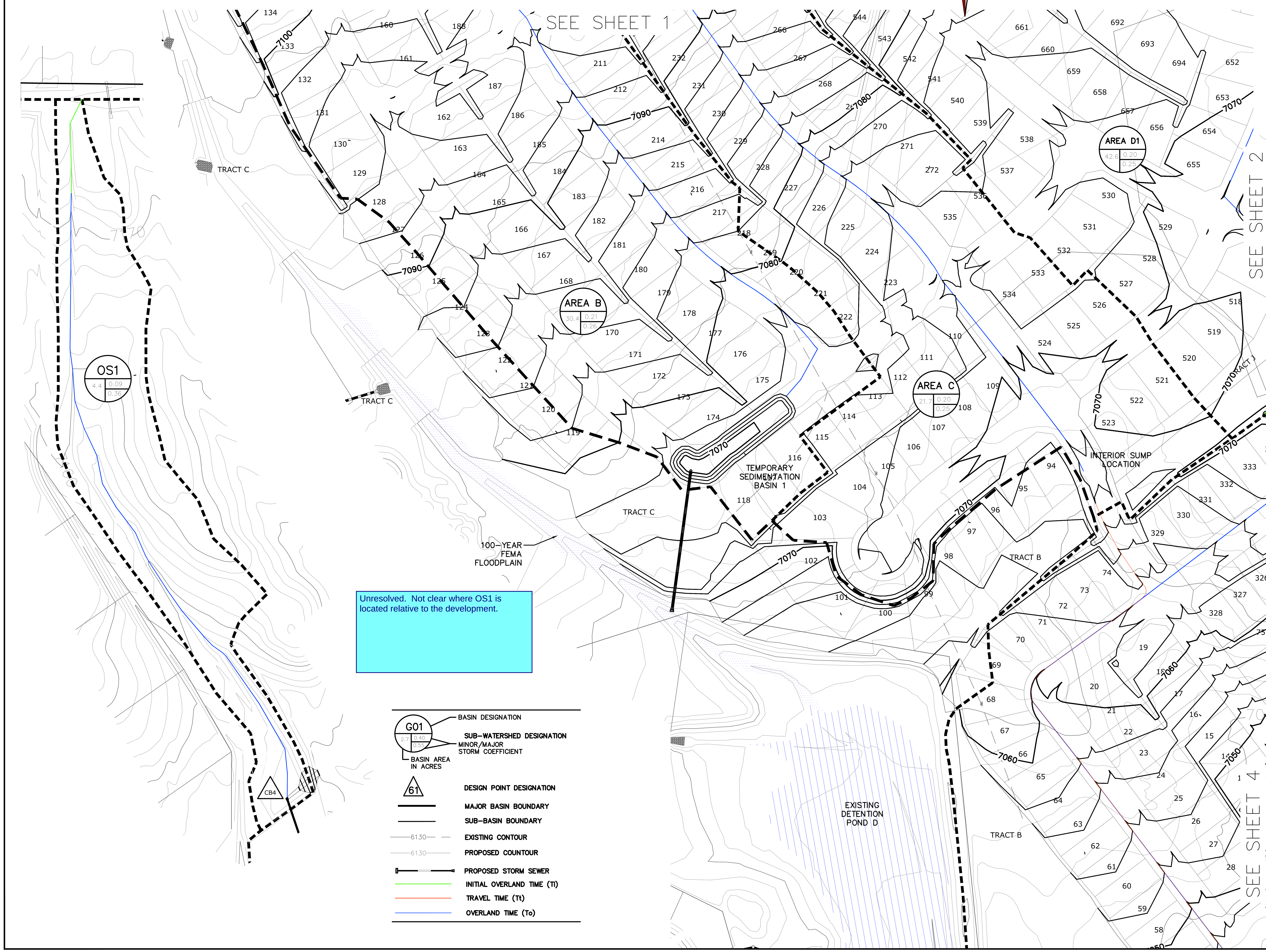
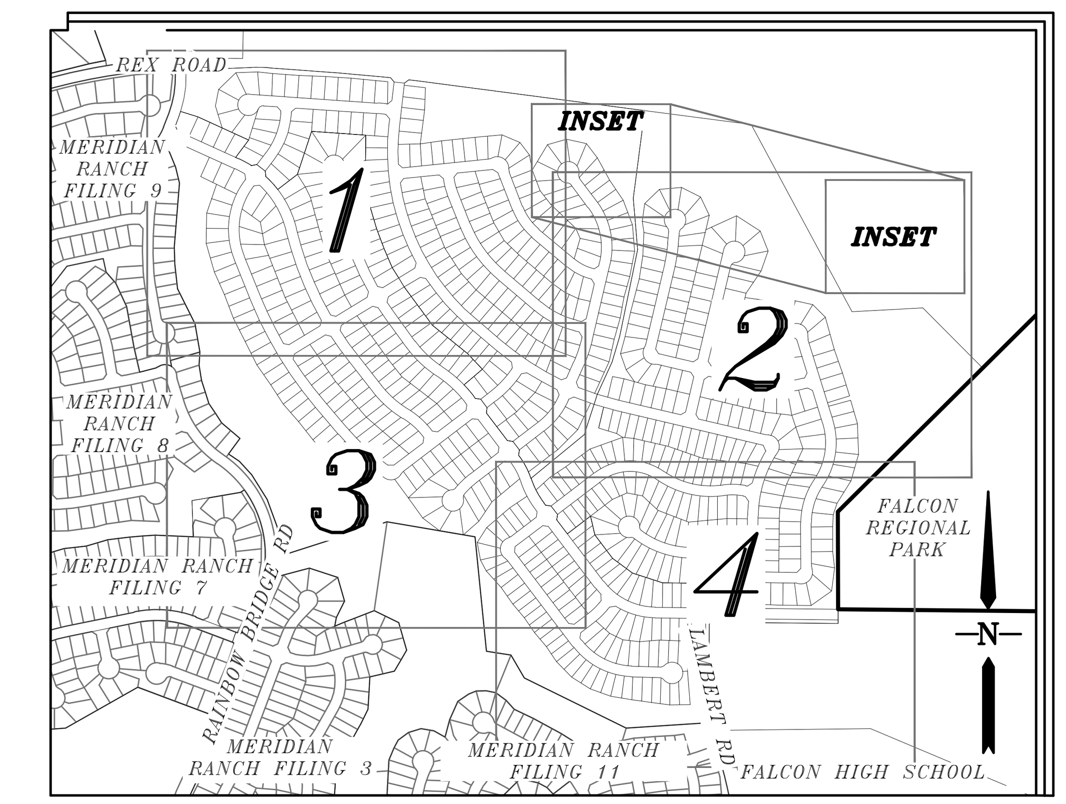
(IN FEET)
1 inch = 100 ft.





INDEX MAP
N.T.S.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)
CB4	OS1	4.4	0.9	5.9
SED6	AREA A	10.5	5.2	11
SED1	AREA B	30.4	11	23
SUMP	AREA C	21.7	8.0	17
SUMP	AREA D1	42.6	18	37
SED2	AREA D2	25.0	11	22
LAMBERT	AREA E	63.0	27	66

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
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MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
ROLLING HILLS RANCH GRADING

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					
-					

Scale 1" = 100'
Drawn by TAK
Checked by -
Date MAR 2020

NOTE:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

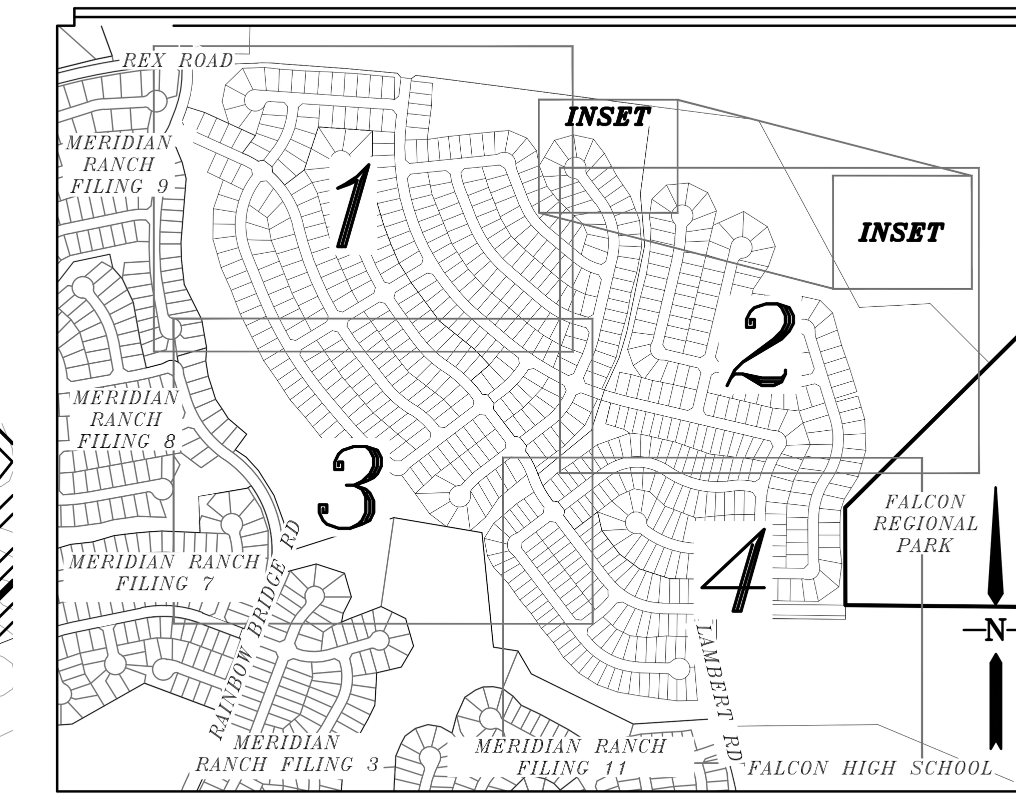
ELEVATION = 6874.00

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

N



INDEX MAP
N.T.S.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)
CB4	OS1	4.4	0.9	5.9
SED6	AREA A	10.5	5.2	11
SED1	AREA B	30.4	11	23
SUMP	AREA C	21.7	8.0	17
SUMP	AREA D1	42.6	18	37
SED2	AREA D2	25.0	11	22
LAMBERT	AREA E	63.0	27	66

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					
-					

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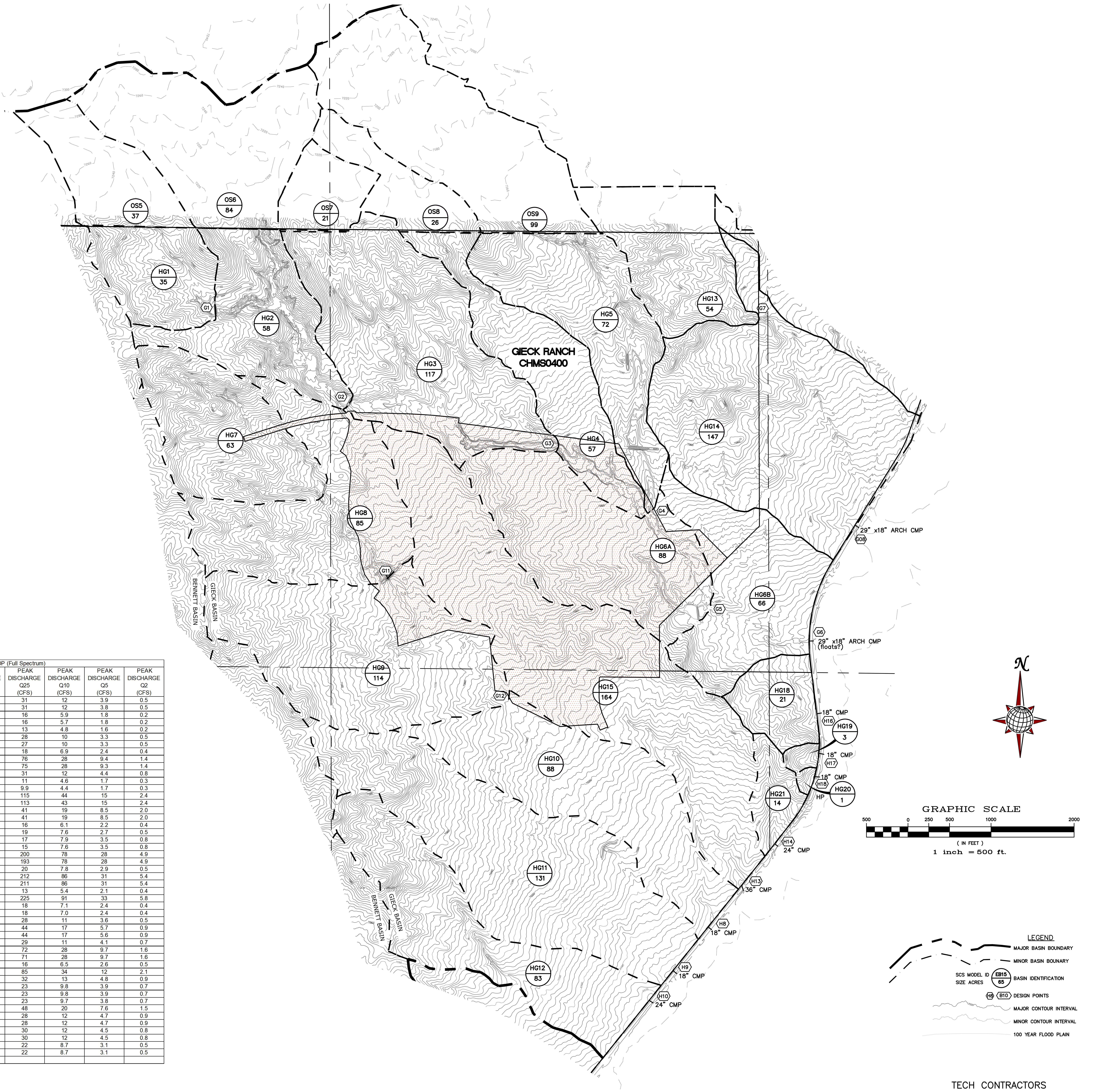
MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
ROLLING HILLS RANCH GRADING

Drawn by TAK
Checked by -
Date MAR 2020

Scale 1" = 100'

ROLLING HILLS RANCH
STANDALONE GRADING



HISTORIC MDDP (Full Spectrum)							
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	81	53	31	12	3.9	0.5
OS06-G02	0.1313	79	52	31	12	3.8	0.5
OS05	0.0578	40	26	16	5.9	1.8	0.2
OS05-G01	0.0578	38	26	16	5.7	1.8	0.2
HG01	0.0547	33	21	13	4.8	1.6	0.2
G01	0.1125	71	47	28	10	3.3	0.5
G01-G02	0.1125	70	47	27	10	3.3	0.5
HG02	0.0906	46	30	18	6.9	2.4	0.4
G02	0.3344	194	129	76	28	9.4	1.4
G02-G03	0.3344	192	127	75	28	9.3	1.4
HG03	0.1828	79	51	31	12	4.4	0.8
OS07	0.0328	25	17	11	4.6	1.7	0.3
OS07-G03	0.0328	24	17	9.9	4.4	1.7	0.3
G03	0.55	295	195	115	44	15	2.4
G03-G04	0.55	286	192	113	43	15	2.4
OS09	0.1547	92	64	41	19	8.5	2.0
OS09-G04	0.1547	91	63	41	19	8.5	2.0
HG04	0.0891	40	27	16	6.1	2.2	0.4
HG05	0.1125	50	33	19	7.6	2.7	0.5
OS08	0.0406	36	25	17	7.9	3.5	0.8
OS08-G04	0.0406	34	24	15	7.6	3.5	0.8
G04	0.9469	502	336	200	78	28	4.9
G04-G05	0.9469	496	322	193	78	28	4.9
HG06A	0.1375	50	33	20	7.8	2.9	0.5
G05	1.0844	544	355	212	86	31	5.4
G05-G06	1.0844	530	353	211	86	31	5.4
HG06B	0.1031	34	22	13	5.4	2.1	0.4
G06	1.1875	561	375	225	91	33	5.8
HG07	0.0984	47	31	18	7.1	2.4	0.4
HG07-G11	0.0984	47	31	18	7.0	2.4	0.4
HG08	0.1328	73	48	28	11	3.6	0.5
G11	0.2312	115	75	44	17	5.7	0.9
G11-G12	0.2312	114	75	44	17	5.6	0.9
HG09	0.1781	73	48	29	11	4.1	0.7
G12	0.4093	187	122	72	28	9.7	1.6
G12-H08	0.4093	183	121	71	28	9.7	1.6
HG10	0.1375	39	26	16	6.5	2.6	0.5
H08	0.5468	216	142	85	34	12	2.1
HG14	0.2297	81	53	32	13	4.8	0.9
HG13	0.0844	55	37	23	9.8	3.9	0.7
G07	0.0844	55	37	23	9.8	3.9	0.7
G07-G08	0.0844	54	37	23	9.7	3.8	0.7
G08	0.3141	119	78	48	20	7.6	1.5
HG15	0.2563	70	46	28	12	4.7	0.9
H13	0.2563	70	46	28	12	4.7	0.9
HG11	0.2047	77	51	30	12	4.5	0.8
H09	0.2047	77	51	30	12	4.5	0.8
HG12	0.1297	57	38	22	8.7	3.1	0.5
H10	0.1297	57	38	22	8.7	3.1	0.5

TECH CONTRACTORS
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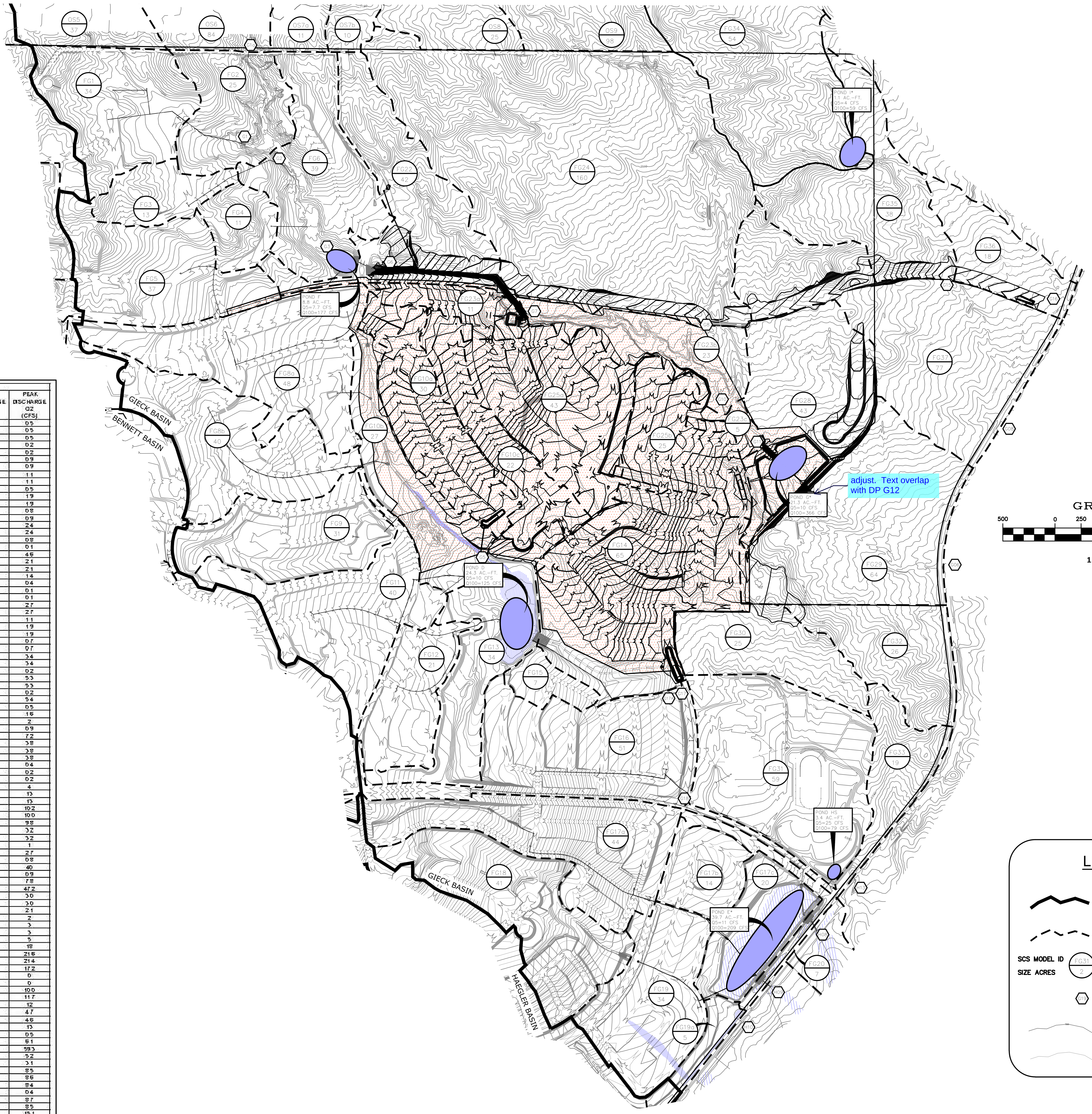
HISTORIC CONDITIONS - SCS MAP

MAR 2020

FIGURE 4

ROLLING HILLS RANCH
STANDALONE GRADING



N

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)
1 inch = 500 ft.

LEGEND

MAJOR BASIN BOUNDARY
MINOR BASIN BOUNDARY
SCS MODEL ID SIZE ACRES — BASIN IDENTIFICATION
DESIGN POINT
MAJOR CONTOUR INTERVAL
MINOR CONTOUR INTERVAL

GRADING MDDP (Full Spectrum)							
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	30	12	3.8	0.5
G1a	0.1313	80	52	30	12	3.8	0.5
G1a-G2	0.1313	79	52	30	11	3.6	0.5
OS05	0.0578	39	26	15	5.6	1.8	0.2
OS05-G1	0.0578	39	25	15	5.5	1.7	0.2
FG01	0.0531	31	22	14	6.9	3.3	0.9
FG01-G1	0.0531	31	22	14	6.9	3.3	0.9
G1	0.1109	61	41	25	11	4.8	1.1
G1-G2	0.1109	60	41	25	11	4.8	1.1
FG02	0.0391	32	22	14	6.2	2.6	0.5
G2	0.2813	166	112	67	27	10	1.9
G2-G3	0.2813	163	108	66	27	10	1.9
FG03	0.0203	24	17	12	5.9	0.8	0.8
FG04	0.0172	22	16	11	5.8	3.1	0.9
G3	0.3188	184	123	74	31	11	2.4
G3-POND F	0.3188	183	121	74	31	11	2.4
FG06	0.0658	46	32	20	9.1	3.9	0.8
OS07a-POND F	0.0170	13	9.0	5.7	2.4	0.9	0.1
POND F IN	0.4996	285	193	120	53	21	4.6
POND F	0.4996	177	121	80	16	7.7	2.1
POND F-G7	0.4996	176	120	80	16	7.7	2.1
FG22	0.0658	51	36	24	12	5.6	1.4
FG23a	0.0166	17	12	8.0	3.9	1.9	0.4
OS07b	0.0156	13	10	6.2	2.6	1.0	0.1
OS07b-G7	0.0156	13	9.2	5.4	2.3	0.9	0.1
G7	0.5576	211	142	71	21	10	2.7
G7-G10	0.5576	211	142	71	21	10	2.7
FG24	0.2303	110	73	43	17	6.2	1.1
OS09	0.1527	90	62	39	18	8.2	1.9
OS09-G10	0.1527	88	61	39	18	8.2	1.9
OS08	0.0397	35	24	16	7.5	3.4	0.7
OS08-G8	0.0397	34	24	15	7.2	3.3	0.7
G8	0.4427	227	154	94	41	17	3.4
G8-G10	0.4427	225	151	94	41	17	3.4
FG23b	0.0359	21	14	8.4	3.3	1.2	0.2
G10	1.0362	439	282	143	58	24	5.3
G10-G11	1.0362	437	280	142	58	24	5.3
FG23c	0.0070	5.8	4.2	2.8	1.4	0.7	0.2
G11	1.0432	440	282	143	59	24	5.4
FG28	0.0673	38	26	16	7	3	0.5
FG25A	0.0666	52	37	25	12.3	5.9	1.6
FG25A-FG25B	0.0666	52	37	24	12	6	2
FG25B	0.0391	29	21	14	7	3	0.9
POND G IN	1.2162	533	337	184	77	33	7.2
POND G	1.2162	366	211	102	29	10	3.8
G12	1.2162	366	211	102	28.6	10.2	3.8
G12-G06	1.2162	366	210	102	28.6	10.2	3.8
FG29	0.0997	60	39	23	8.7	2.8	0.4
FG32	0.0402	29	19	11	4	1	0.2
FG32-G06	0.0402	28	19	11	4	1	0.2
G06	1.3361	386	223	108	31	11	4
FG08A	0.0750	116	90	66	41	27	13
FG08A-G05	0.0750	110	86	64	41	27	13
FG08B	0.0650	86	67	49	31	20	10.2
FG08B-G05	0.0650	84	65	48	29	19	10.0
FG11	0.0625	75	59	44	28	18.6	9.8
FG09	0.0484	48	36	25	14	8.3	3.2
FG09-G05	0.0484	48	36	25	14	8.0	3.2
FG10A	0.0446	33	23	15	7	4	1
FG10B	0.0416	42	31	22	12.2	7.0	2.7
FG10C	0.0339	27	19	12	6	3	0.8
G05	0.3690	411	311	223	133	84	40
FG13	0.0334	34	24	15	7	4	0.9
FG12	0.0328	50	40	30	20	14	7.8
POND D IN	0.4552	487	368	264.0	156.4	98.4	47.2
POND D	0.4552	125	83	42.2	16.7	9.7	3.0
POND D-G17	0.4552	125	83	42	17	10	3.0
FG15	0.0103	15	12	9	6	4	2.1
FG15-G17A	0.0103	15	12	9	6	4	2
G17A	0.4655	127	85	43	17	10	3
FG14	0.1019	94	67	45	22	11	3
G17-G18	0.5674	148	98	57	29	15	5
FG16	0.0791	133	104	78	50	34	18
G18	0.6465	243	181	127	74.5	45.7	21.6
G18-POND E	0.6465	243	181	127	74.2	45.3	21.4
FG31	0.0922	116	92	69	45	31	17.2
FG30	0.0389	30	20	12	4	1	0
FG30-POND HS	0.0389	28	19	11	4	1	0
POND HS	0.1311	112	63	40	28	19	10.0
FG17a	0.0694	101	78	57	39	25	11.7
FG17a-POND E	0.0694	99	76	56	39	25	12
FG18	0.0644	56	42	30	17.6	10.6	4.7
FG18-POND E	0.0644	56	42	30	17	11	4.6
FG19	0.0527	84	66	50	33	23	13
FG17c	0.0313	31	22	14	7	3	0.5
FG17b	0.0214	39	31	24	16	11	6.1
POND E IN	1.0168	561	428	308	186	118	59.3
POND E	1.0168	209	127	61	23	11	5.2
H08	1.0168	181	114	54	18	8	3.1
FG20	0.0109	28	23	19	15	12	8.5
H08A	1.0277	183	116	54	18	12	8.6
H08-4W4-4	1.0277	183	116	54	18	12	8.4
4W-H8B	0.0344	38	27	17	8	3	0.4
4W4-4	1.0621	186	117	55	21	14	8.7
4W4-4-4W4-1	1.0621	186	117	55	21	13	8.5
4W-B	0.0806	134	102	75	47	30	15.1
FG19A	0.0077	10	8	6	3	2	1.0
H09	0.0000	27	12	7	5	3	2.1
H09-4W4-3	0.0000	27	12	7	5	3	2.1
4W4-3	0.0883	142	109	80	50	32	15.0
4W-4-3-4W4-1	0.0883	142	108	79	49	31	14.5
4W-C	0.0827	81	56	36	16	6	0.9
4W4-1	1.2331	285	210	146	81	48	22.0
4W4-1-4W4	1.2331	272	204	142	77	47	21.0
4W-D	0.0558	50	35	22	9	4	0.6
4W4	1.2889	318	236	162	87	50	21.6
FG34	0.0836	48	32	19	7	2	0.3
G14	0.0836	48	32	19	7	2	0.3
G14-G15	0.0836	48	32	18	7	2	0.3
FG35	0.0586	19	13	7	3	1	0.2
G15	0.1422	60	39	23	9	3	0.6
G15-G08	0.1422	59	39	23	9	3	0.6
FG37	0.1203	44	29	17	7	3	0.5
FG36	0.0281	16	10	6	2	1	0.1
FG36-G08	0.0281	15	10	6	2	1	0.1
G08	0.2906	114	75	44	18	6	1.1
FG33	0.0302	28	21	14	7	4	1.3

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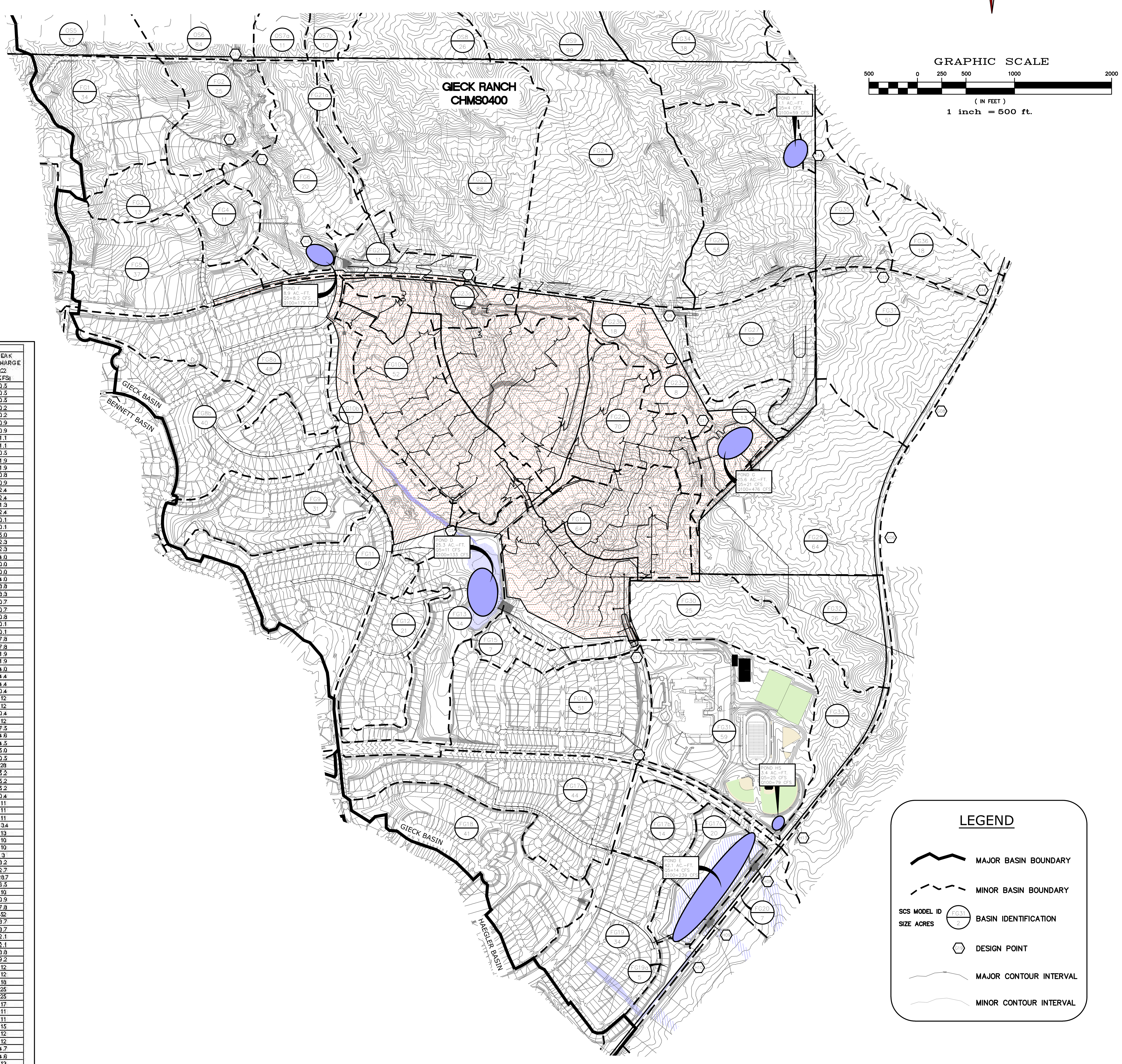
*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

GRADED CONDITIONS - SCS MAP

MAR 2020

FIGURE 5

ROLLING HILLS RANCH
STANDALONE GRADING



	FUTURE MDDP (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q25 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	30	12	3.8	0.5
G1a	0.1313	80	52	30	12	3.8	0.5
G1a-G2	0.1313	79	52	30	11	3.6	0.5
OS05	0.0578	39	26	15	5.6	1.8	0.2
OS05-G1	0.0578	39	25	15	5.5	1.7	0.2
FG01	0.0538	31	22	14	7.0	3.4	0.9
FG01-G1	0.0538	31	22	14	7.0	3.4	0.9
G1	0.1116	61	41	25	11	4.9	1.1
G1-G2	0.1116	61	41	25	11	4.8	1.1
FG02	0.0391	32	22	14	6.4	2.7	0.5
G2	0.2820	167	112	67	27	10	1.9
G2-G3	0.2820	163	109	66	27	10	1.9
FG03	0.0203	24	17	12	5.9	0.8	0.8
FG04	0.0172	22	16	11	5.8	3.1	0.9
G3	0.3195	185	123	74	31	11	2.4
G3-POND F	0.3195	183	121	74	31	11	2.4
FG06	0.0675	56	40	26	12	5.8	1.3
FG05	0.0580	45	33	23	12	6.7	2.4
OS07a	0.0170	14	9.2	5.7	2.5	0.9	0.1
OS07a-POND F	0.0170	13	9.0	5.7	2.4	0.9	0.1
POND F IN	0.4620	293	200	123	54	22	5.0
POND F	0.4620	179	125	63	17	8.2	2.3
POND F-G7	0.4620	179	123	63	17	8.2	2.3
FG21b	0.0170	26	20	16	10.2	7.0	4.0
FG21a	0.0072	6.1	4.1	2.4	0.9	0.3	0.0
FG21a-G7	0.0072	5.8	3.4	2.2	0.8	0.3	0.0
G7	0.4862	188	129	66	18	8.9	4.0
G7-G8	0.4862	188	129	66	18	8.9	3.8
FG22	0.1380	102	73	47	24	12	3.3
OS08	0.0406	35	25	16	7.7	3.4	0.7
OS08-G8	0.0406	34	24	15	7.5	3.4	0.7
FG23a	0.0216	21	15	10	5.2	2.7	0.8
OS07b	0.0156	15	10	6.2	2.6	1.0	0.1
OS07b-G7	0.0156	14	10	6.0	2.4	0.9	0.1
G8	0.7020	296	191	96	47	25	7.8
G8-G10	0.7020	293	190	95	47	24	7.8
OS09	0.1527	90	62	39	18	8.2	1.9
OS09-G10	0.1527	88	62	39	18	8.2	1.9
FG24	0.1373	105	76	50	26	13	4.0
G9	0.2900	180	125	81	38	17	4.4
G9-G10	0.2900	178	125	79	37	17	4.4
FG23b	0.0286	23	16	10	4.6	2.0	0.4
G10	1.0206	483	311	175	80	39	12
G10-G11	1.0206	479	309	174	79	39	12
FG23c	0.0122	12	8.7	5.7	3.0	1.5	0.4
G11	1.0328	484	312	176	81	40	12
FG25	0.1086	85	64	46	27	17	7.5
FG26	0.0863	78	58	40	22	12	4.6
FG26-POND G	0.0863	77	57	39	22	12	4.5
FG27	0.0500	52	40	29	17	11	5.0
FG28	0.0245	18	13	8.5	4.1	2.0	0.5
POND G IN	1.3022	690	457	287	145	79	28
POND G	1.3022	476	328	170	54	21	5.2
G12	1.3022	476	328	170	54	21	5.2
G12-G06	1.3022	476	325	170	54	21	5.2
FG29	0.0997	60	39	23	8.7	2.8	0.4
FG32	0.0402	72	57	44	29	20	11
FG32-G06	0.0402	69	54	41	27	18	11
G06	1.4421	503	344	180	59	23	11
FG08A	0.0750	116	90	66	41	27	13.4
FG08A-G05	0.0750	110	86	64	41	27	13
FG08B	0.0630	86	67	49	31	20	10
FG08B-G05	0.0630	84	65	48	29	19	10
FG09	0.0484	48	36	25	14	8	3
FG09-G05	0.0484	48	36	25	14	8	3.2
FG10B	0.0416	42	31	22	12	7.0	2.7
G05	0.2280	282	215	156	94	58.8	28.7
FG10A	0.0806	81	61	43	25	15.0	6.5
FG11	0.0625	75	59	44	28	19	10
FG13	0.0534	34	24	15	7.5	3.6	0.9
FG12	0.0328	50	40	30	20	14	7.8
POND D IN	0.4573	509	387	280	168	107	52
POND D	0.4573	133	90	49	18	11	3.7
POND D-G17	0.4573	133	90	49	18	11	3.7
FG15	0.0103	15	12	9.0	5.8	3.9	2.1
FG15-G17A	0.0103	15	12	9.0	5.8	3.9	2.1
G17A	0.4676	136	91	50	18	11	3.8
FG14	0.1000	98	74	53	32	20	9.2
G17	0.5676	195	129	75	41	25	12
G17-G18	0.5676	194	128	74	41	25	12
FG16	0.0791	133	104	78	50	34	18
G18	0.6467	238	178	127	78	50	25
G18-POND E	0.6467	236	176	126	77	49	25
FG31	0.0922	116	92	69	45	31	17
FG30	0.0389	73	57	44	29	20	11
FG30-PONDHS	0.0389	70	56	42	27	18	11
POND HS	0.1311	153	106	53	36	26	15
FG17a	0.0694	101	78	57	35	23	12
FG17a-POND E	0.0694	99	76	56	35	23	12
FG18	0.0644	56	42	30	18	11	4.7
FG18-POND E	0.0644	56	42	30	17	11	4.6
FG19	0.0527	84	66	50	33	23	13
FG17c	0.0313	31	22	14	6.5	2.9	0.5
FG17b	0.0214	39	31	24	16	11	6.1
POND E IN	1.0170	608	432	317	196	126	64
POND E	1.0170	239	149	77	28	14	5.8
H08	1.0170	203	134	69	22	10	3.5
H09	0.0000	36	15	8.0	5.7	3.8	2.3
FG34	0.0600	34	23	13	5.5	2.0	0.3
G14	0.0600	34	23	13	5.5	2.0	0.3
G14-G15	0.0600	34	22	13	5.4	2.0	0.3
FG35	0.0344	20	13	8.3	3.5	1.5	0.3
G15	0.0944	53	36	21	8.7	3.3	0.6
G15-G08	0.0944	52	35	21	8.7	3.3	0.6
FG37	0.0797	41	27	16	6.0	2.0	0.3
FG36	0.0281	14	9.4	5.5	2.1	0.7	0.1
FG36-G08	0.0281	14	9.3	5.4	2.1	0.7	0.1
G08	0.2022	106	69	41	16	5.8	1.0

*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

FUTURE CONDITIONS - SCS MAP

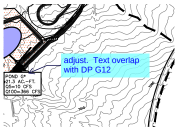
TECH CONTRACTORS
11886 STAPLETON DR.
FALCON, CO 80831
TELEPHONE: 719.495.7444

MAR 2020

FIGURE 5

FDR_V2.pdf Markup Summary

dsdlaforce (15)



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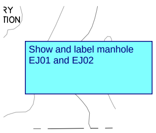
adjust. Text overlap with DP G12



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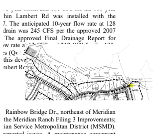
Show and label manhole EJ01 and EJ02



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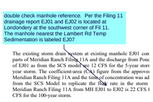

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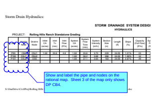
double check manhole reference. Per the Filing 11 drainage report EJ01 and EJ02 is located at Londondery at the southwest corner of Fil 11. The manhole nearest the Lambert Rd Temp Sedimentation is labeled EJ07



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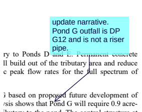
Show and label the pipe and nodes on the rational map. Sheet 3 of the map only shows DP CB4.



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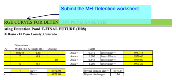
update narrative. Pond G outfall is DP G12 and is not a riser pipe.



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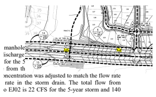
Submit the MH-Detention worksheet.



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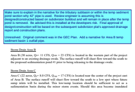

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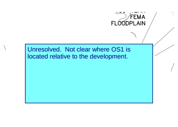
Make sure to explain in the narrative for the tributary subbasin or within the temp sediment pond section why 42" pipe is used. Review engineer is assuming this is designed/constructed based on subdivision buildout and will remain in place after the temp pond is removed. Be advised this is installed at the developers risk. Final approval of design/construction will be based on the subsequent subdivision plat's approved drainage report and construction plans.

Unresolved. Original comment was in the GEC Plan. Add a narrative for Area B temp sediment basin 1 outfall pipe.



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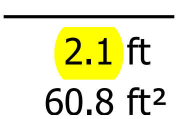
Unresolved. Not clear where OS1 is located relative to the development.



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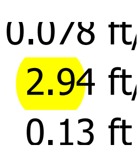
2.1



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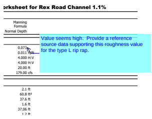
2.9



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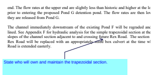
Value seems high. Provide a reference source data supporting this roughness value for the type L rip rap.



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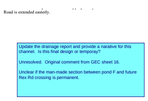
State who will own and maintain the trapezoidal section.



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Update the drainage report and provide a narative for this channel. Is this final design or temporay?

Unresolved. Original comment from GEC sheet 16.

Unclear if the man-made section between pond F and future Rex Rd crossing is permanent.