STORMWATER MANAGEMENT AND EROSION CONTROL METHODOLOGY AND CALCULATIONS
for
BAHIA DEL SOL, 1ST ADDITION
BONNER COUNTY, IDAHO

Applicant: Darwin Brown

Prepared by: James A. Sewell & Associates, LLC
1319 North Division
Sandpoint, Idaho 83864

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PROFESSIONAL ENGINEER REGISTERED 8607 STATE OF IDAHO B. SCOTT BROWN
7/18/2024

INTRODUCTION

Darwin Brown is proposing to subdivide Lot 3 of Bahia Del Sol and an adjoining 10-acre parcel of land (Parcel “B”) into 30 residential lots. Total upland area is about 16-acres. The property is located about ¼-mile east of Highway 95 on along Bottle Bay Rd. and along the shoreline of Fry Creek (aka Sagle Slough). As a result, approximately 1,830 lf of paved roadway and new single-family residences will be constructed.

The purpose of this report is to recommend facilities to control storm water and prevent erosion and sediment transport, and to describe the analysis used in the selection and design of those facilities. The design and selection of storm water facilities are based on and limited to known topography of the site and soils information obtained from the "Soil Survey of Bonner County Area, Idaho".

During frequent storm events, runoff will be detained onsite in shallow grass lined infiltration swales and wet ponds prior to regaining predevelopment flow patterns.

EXISTING SITE CONDITIONS

The site is currently developed with two single family residences, a shop with an accessory dwelling unit above it, and associated gravel driveways. Landcover consists of sparse trees and hay fields which are harvested on an annual basis. The property slopes in north and west directions toward Bottle Bay Rd. and the shoreline. There is an existing drainage area located in the northwest corner of Parcel “B”.

Runoff from the south side of Bottle Bay Rd. traverses the northwest corner of Parcel “B” and is intercepted by an existing 24-inch CMP culvert that extends beneath an offsite garage and discharges to Sagle Slough. Based on general topography of the surroundings, the existing drainage area that the culvert serves includes about 1,070-lineal feet of Bottle Bay Rd. and 4-acres of residential development along the south side of the county road.

SOILS

The NRCS Soil survey shows on site soils consisting of Mission Silt Loam. Mission Silt Loam soil has a low infiltration rate and depth to water table is generally 6-inches to 18-inches below the surface. NRCS classifies the Mission soil as Hydrologic Group D.

A summary of typical properties of the soil type found on the site is included in Appendix A, and is taken from the NCRS Soil survey of *Bonner County Area, Idaho, Parts of Bonner and Boundary Counties (Version 14, September 13, 2018).*

PRE-CONSTRUCTION LAND COVER – TOTAL SITE

Open Space, Group D (C = 0.65)	= 15.7 ac
Total Impervious Surface (C = 0.7)	= 1.0 ac
Composite Runoff Coefficient (C = 0.25)	= 0.65

POST-CONSTRUCTION LAND COVER – TOTAL SITE

Undeveloped/Landscaped Area (C = 0.65)	= 15.7 ac
Paved Roadways (C = 0.9)	= 1.2 ac
Gravel Roadway Shoulders (C = 0.5)	= 0.1 ac
Residential Development (C = 0.7)	= 2.0 ac
Green Space (C = 0.65)	= 12.4 ac
Composite Runoff Coefficient (C)	= 0.67

STORMWATER MANAGEMENT

Based on site topography and soil characteristics, surface dispersion of storm water and shallow detainment areas are recommended for flow management and treatment. It is further recommended that site disturbance be minimal and existing, well vegetated areas be retained and protected as much as possible.

The proposed infiltration and wet pond facilities have been sized to retain and treat the first ½" of runoff from new roadways and impervious surface from single family residences which slope toward roadside ditches. The facilities are also designed to detain the difference between pre-development and post-development runoff flow based on a 25-year storm event, 24-hour period. Post development flows will be detained and released at pre-development rates by either infiltration through imported sandy loam top soil, or through a properly sized orifices located in drainage structures.

The site has been divided into three drainage areas based on low points in the road profiles and grassy infiltration area and wet pond locations.

Calculation Summary – Storm Water Management Facilities

Drainage Area No. 1 (Vicinity of Road STA 20+17 to 25+43 and Block 2, Lots 2,4):

Predevelopment Conditions
Undeveloped Area = 61,560 sf
Time of Concentration = 10 min.
Composite Runoff Coefficient = 0.65
Predeveloped Peak Flow = 2 cfs

Post Development Conditions
New Pavement = 13,584 sf
Gravel Shoulders = 1,132 sf
Residential Lots = 6,000 sf
Total Impervious Area = 23,716 sf
Green Space = 37,844 sf
Time of Concentration = 5 min.
Composite Runoff Coefficient = 0.69
Post Developed Peak Flow = 2.7 cfs

Storm Water Management Facility - Grassy Infiltration Area #1 (BMP #38b)
Volume Required to Retain the First ½-inch of Runoff = 863 cf
Volume Required to Detain a 24-hour, 25-year Storm = 365 cf
Swale Volume Provided = 875 cf

Drainage Area No. 2 (Vicinity of Road Cul-De-Sac):

Predevelopment Conditions
Undeveloped Area = 11,304 sf
Time of Concentration = 10 min.
Composite Runoff Coefficient = 0.65
Predeveloped Peak Flow = 0.4 cfs

Post Development Conditions
New Pavement = 7,850 sf
Gravel Shoulders = 641 sf
Residential Lots = 0 sf
Total Impervious Area = 8,491 sf
Green Space = 2,813 sf
Time of Concentration = 5 min.
Composite Runoff Coefficient = 0.82
Post Developed Peak Flow = 0.6 cfs

Storm Water Management Facility - Grassy Infiltration Area #2 (BMP #38b)
Volume Required to Retain the First ½-inch of Runoff = 354 cf
Volume Required to Detain a 24-hour, 25-year Storm = 329 cf
Swale Volume Provided = 367 cf

Drainage Area No. 3 (Vicinity of Road STA 1+00 to 13+00, Block 1, Lots 1 and 2-18, and Block 2, Lots 3, 5, and 6):

Predevelopment Conditions
Undeveloped Area = 262,000 sf
Time of Concentration = 10 min.
Composite Runoff Coefficient = 0.65
Predeveloped Peak Flow = 7.8 cfs

Post Development Conditions
New Pavement = 28,800 sf
Gravel Shoulders = 2,400 sf
Residential Lots = 57,000 sf
Total Impervious Area = 88,200 sf
Green Space = 173,800 sf
Time of Concentration = 5 min.

Composite Runoff Coefficient = 0.73
Post Developed Peak Flow = 12.3 cfs

Storm Water Management Facility - Wet Pond (BMP #45)
Volume to Retain the First ½-inch of Runoff = 3,675 cf
Permanent Pool Volume Required = 8,098 cf <=*Governs*
Permanent Pool Volume Provided = 8,112 cf
Extended Storage Volume Required = 2,275 cf (Based on max. 2-cfs outflow)
Extended Storage Volume Provided = 2,522 cf
Maximum Flow Rate Allowed = 8.5 cfs (predevelopment rate)
Maximum Design Flow Rate = 2 cfs (based on orifice outflow control and extended storage volume provided)

Offsite Conveyance System
Existing 24-inch Diameter Culvert Capacity = 12+ cfs (based on 1-ft or higher headwater depth)
Existing Capacity Utilized = 6.5 cfs (based on 4.2-acre drainage area)
Proposed Additional Capacity = 0.1 cfs (based on 2" dia. orifice control with 0.8' of head)

(See Bowstring Method calculations in Appendix B for detail)

EROSION CONTROL PLAN

Temporary erosion control shall be maintained through the use of existing vegetation and a stabilized construction entrance. Permanent facilities that will also serve to control erosion during construction include the grass infiltration basins, grass ditches, vegetated buffer, and reseeding of disturbed areas. Use the BMP's described in *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (Idaho BMP Manual). Silt fence shall be placed downslope of construction areas as shown in the stormwater management plan. Areas where construction activities temporarily cease for more than 21 days shall be stabilized with seeding or straw mulching. All erosion control measures shall be maintained in good working order. The contractor shall be responsible for maintenance of erosion control measures until such time that final stabilization of the site is complete. Once final stabilization is complete, the owner shall be responsible for maintenance of permanent erosion control measures.

Site Re-seeding Recommendation:
Existing areas disturbed and filled during construction shall be reseeded with natural grasses, lawn grasses, or sod as soon as possible after finish grading. Seed mixture recommendations may be obtained from the U.S.D.A. Natural Resource Conservation Service, a licensed landscape architect or a commercially marketed grass mixture may be applied.

Fertilization

It is recommended that a soil analysis be performed prior to fertilization and seeding. The fertilization guidelines should be determined by the soil analysis. The fertilizer type and rate of application should follow the recommendation of the U.S.D.A. Natural Resource Conservation Service or a landscape architect.

OPERATION AND MAINTENANCE PLAN

During Construction

During construction the contractor shall walk the site and inspect storm water and erosion control measures at least once every 7 days and following any storm event of 0.5 inches or greater. Items the contractor shall inspect are:

- Reseeding / Straw Mulching
  - Re-seed add straw mulch to bare spots and washouts, and verify healthy growth

- Grass ditches
  - Periodically inspect ditches and remove any sediment deeper than 6 inches
  - Re-establish vegetation that is damaged during high runoff events.

- Grass filtration basins
  - Periodically inspect basins and remove any sediment deeper than 6 inches
  - Re-establish vegetation that is damaged during high runoff events.

If maintenance of any temporary or final BMP is found to be necessary, the contractor shall begin repairs within 24 hours.

After Final Stabilization

Upon completion of construction and final stabilization, the owners shall take responsibility for operation and maintenance of the stormwater management and erosion control system as well as the funding for the continued maintenance of this system. After final stabilization, the stormwater management and erosion control system shall be inspected at least every six months. The items that shall be inspected are:

- Grass infiltration swales
  - Remove all sediment from the basin and dispose off-site at the end of construction, and during each inspection.
- Grass ditches
  - Remove all sediment from the ditches and dispose off-site at the end of construction, and during each inspection.
- Sloped areas
  - Re-establish grass or vegetation in bare spots found on all sloped areas, or stabilize with another best management practice.

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IMPLEMENTATION SCHEDULE

The proposed construction schedule is as follows:

Spring 2025
- Install temporary erosion control
- Perform fill and excavation work for new roadway

Spring/Summer 2025
- Complete construction
- Check re-vegetated areas for bare spots, washouts, etc.

Late Summer 2025
- Repair and reseed as necessary
- Final stabilization complete

SUMMARY

With the proper implementation of the best management practices listed above, the subject property is capable of supporting the proposed site development without substantial risk of soil erosion or sedimentation of surface waters. The site is capable of treating and conveying stormwater runoff from the proposed pavement using the best management practices described in this report.

APPENDIX A

NRCS Soils Classification, IDF Curve Area Classification Map, Rainfall Intensity Diagram, Runoff Coefficients

Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

32—Mission silt loam, 2 to 12 percent slopes

Map Unit Setting

National map unit symbol: 5463
Elevation: 2,000 to 2,800 feet
Mean annual precipitation: 25 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Farmland of statewide importance, if drained

Map Unit Composition

Mission and similar soils: 70 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mission

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and loess over silty glaciolacustrine deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
Bw - 3 to 12 inches: silt loam
2Btx - 12 to 21 inches: silt loam
2E - 21 to 33 inches: silt
2Bt - 33 to 48 inches: silt loam
3C - 48 to 67 inches: fine sand

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 10 to 20 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: F043AY527WA - Warm-Frigid, Udic, Loamy Foothills/Valleys, high water table (western redcedar, moist herb) Thuja plicata / Clintonia uniflora
Other vegetative classification: western redcedar/queencup beadlily (CN530)
Hydric soil rating: No

Minor Components

Wrencoe
Percent of map unit: 5 percent
Landform: Flood plains
Microfeatures of landform position: Shorelines
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R043AY512ID - Warm-Frigid Aquic-Udic Loamy Flood Plains (Wet) (DECA/CAREX)
Hydric soil rating: Yes

Hoodoo
Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties
Survey Area Data: Version 19, Aug 31, 2023

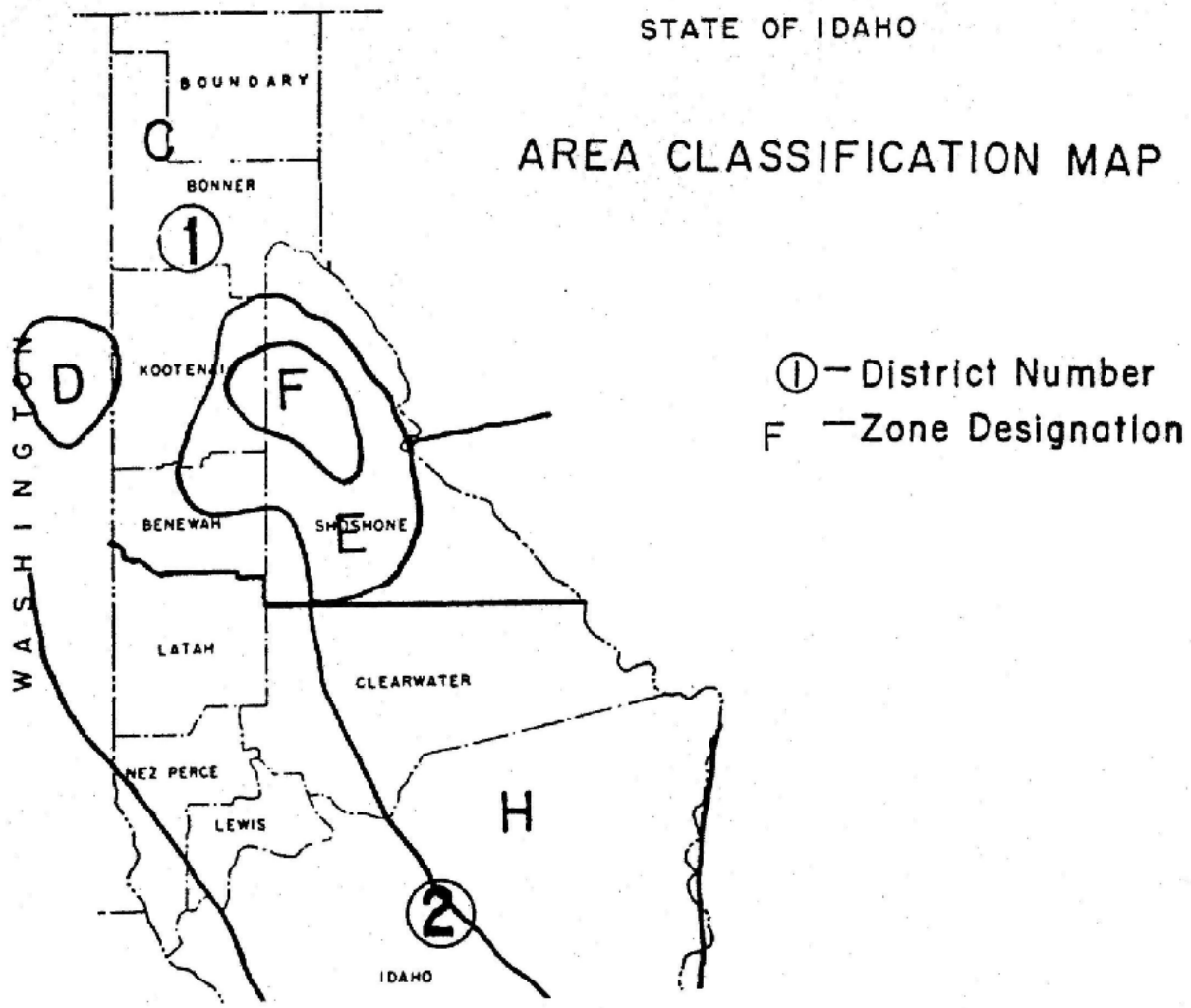

FIGURE 6-3 AREA CLASSIFICATION MAP FOR IDF CURVES - IDAHO
(IDAHO TRANSPORTATION DEPARTMENT)

FIGURE 6-4 ZONE C, INTENSITY-DURATION-FREQUENCY CURVE
(IDAHO TRANSPORTATION DEPARTMENT)

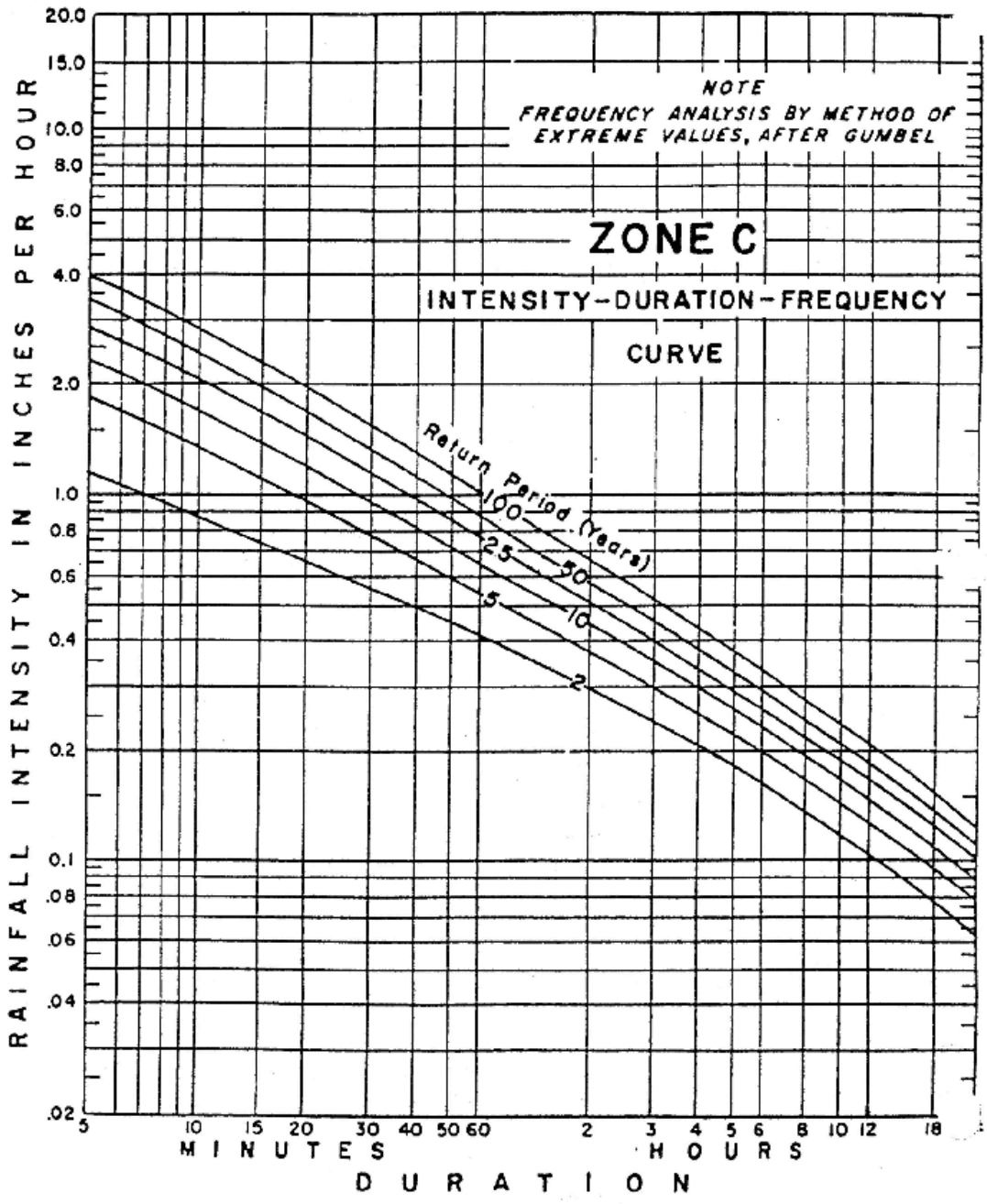

Table 4B.2. Values of Runoff Coefficient (C) for Rational Formula

Land Use	Description	Hydrologic Soils Group			
		A	B	C	D
Cultivated Land	Without conservation treatment	0.49	0.67	0.81	0.88
	With conservation treatment	0.27	0.43	0.67	0.67
Pasture or Range Land	Poor condition	0.38	0.63	0.78	0.84
	Good condition	---	0.25	0.51	0.65
Meadow	Good condition	---	---	0.41	0.61
Wood or Forest Land	Thin stand, poor cover, no mulch	---	0.34	0.59	0.70
	Good cover	---	---	0.45	0.59
Open Space, Lawn, Park, Golf Course, or Cemetery	Good condition (grass cover on 75% or more)	---	0.25	0.51	0.65
	Fair condition (grass cover on 50% to 75%)	---	0.45	0.63	0.74
Commercial and Business Area	85% impervious	0.84	0.90	0.93	0.96
Industrial District	72% impervious	0.67	0.81	0.88	0.92
Residential Lot Average lot size (acres): 1/8 1/4 1/3 1/2 1.0	Average % of lot impervious: 65 38 30 25 20	 0.59 0.29 --- --- ---	 0.76 0.55 0.49 0.45 0.41	 0.86 0.70 0.67 0.65 0.63	 0.90 0.80 0.78 0.76 0.74
Paved Area	Parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Street or Road	Paved with curbs and storm sewers	0.99 0.57	0.99 0.76	0.99 0.84	0.99 0.88
	Gravel	0.49	0.69	0.80	0.84

Note: The designer must use judgment to select the appropriate C value within the range. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have the lowest C values. Smaller areas with dense soils, moderate to steep slopes, and sparse vegetation should assigned the highest C values.

SOURCE: Panhandle Stormwater Erosion Control and Education Program Training Manual (2007)

APPENDIX B

Storm Water Management Calculations

Vegetated Infiltration Area No. 1 (Roadway STA 20+17 to 25+43, Blk 2 Lots 2,4)

IMPERVIOUS SURFACE CALCULATIONS Date: 6/13/23

Basin Description	Area (sf)	Area (ac)	C	Remarks
Associated Sub Drainage Area	61,560	1.41		60' ROW and 10k SF Lots
ACP Culdesac	13,584	0.31	0.90	ACP Width 24'
Gravel Shoulders	1,132	0.03	0.50	Shoulder Width 12"
Residential (2-Lots)	6,000	0.14	0.50	3,000 SF Impervious Area per Lot
Total Impervious Area	20,716	0.48		
Green Space	40,844	0.94	0.65	Assumed Open Space Group D Soil
Composite Runoff Coeff.			0.69	

BOWSTRING CALCULATIONS

Design Storm Return Period	25	yr	**Infiltration (max. 2 in/hr)**		
Drywell Outflow	0.00	cfs	Infiltration Rate (in/hr)=	2.00	
Bed of GIA Outflow	0.00	cfs	Infiltration Area (sf) =	40	
Check Dam Outflow (Geotex + Drain Rock)	0.000	cfs	**Fabric Transmissivity**		
Wier Outflow	0.00	cfs	Trans. Rate (cfs/sf)=	0.000	
Orifice Outflow	0.00	cfs	Outlet Area (sf) =	0.00	
Post Developed			**Treatment Storage (cf)**		
Area	1.41	acres	First 1/2-Inch Runoff =	863	
Composite Runoff Coefficient	0.69				
AxC=	0.97		**Drywell Capacities**		
Time of Concentration	5.00	min	Single Barell (cfs) =	0.30	
Pre-Developed:			Double Barell (cfs) =	1.00	
Sub Basin Area	1.41	acres			
Composite Runoff Coefficient	0.65	Assumed Pasture Group D Soil			
AxC=	0.92				
Time of Concentration	10	min			
Pre-Developed Flow Rate (cfs)	1.99	*(flow rate based on 10-min time of concentration)*			

Time (min)	Time (sec)	25-Year Storm Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	Operating Storage (cf)
5	300	2.8	2.72	1,094	2.57	1,034	60
10	600	2.17	2.11	1,481	1.99	1,399	80
15	900	1.83	1.78	1,782	1.68	1,684	96
20	1200	1.65	1.60	2,088	1.52	1,973	113

25	1500	1.45	1.41	2,258	1.33	2,134	121
30	1800	1.27	1.23	2,348	1.17	2,219	126
35	2100	1.19	1.16	2,547	1.09	2,407	136
40	2400	1.11	1.08	2,699	1.02	2,551	144
45	2700	1.04	1.01	2,832	0.96	2,677	151
50	3000	0.96	0.93	2,895	0.88	2,736	153
55	3300	0.88	0.86	2,910	0.81	2,750	154
60	3600	0.8	0.78	2,879	0.73	2,721	151
65	3900	0.78	0.76	3,034	0.72	2,867	159
70	4200	0.75	0.73	3,136	0.69	2,964	165
75	4500	0.72	0.70	3,221	0.66	3,044	169
80	4800	0.7	0.68	3,335	0.64	3,152	174
85	5100	0.67	0.65	3,388	0.62	3,202	177
90	5400	0.65	0.63	3,476	0.60	3,285	181
95	5700	0.63	0.61	3,553	0.58	3,358	185
100	6000	0.61	0.59	3,618	0.56	3,419	188
105	6300	0.59	0.57	3,671	0.54	3,470	190
110	6600	0.57	0.55	3,713	0.52	3,509	192
115	6900	0.55	0.53	3,743	0.51	3,538	193
120	7200	0.53	0.52	3,762	0.49	3,555	193
125	7500	0.51	0.50	3,768	0.47	3,561	193
130	7800	0.49	0.48	3,764	0.45	3,557	192
135	8100	0.47	0.46	3,747	0.43	3,541	191
150	9000	0.43	0.42	3,804	0.39	3,595	192
165	9900	0.4	0.39	3,889	0.37	3,675	195
180	10800	0.38	0.37	4,027	0.35	3,806	201
195	11700	0.37	0.36	4,244	0.34	4,011	212
210	12600	0.36	0.35	4,445	0.33	4,200	221
225	13500	0.34	0.33	4,495	0.31	4,248	222
240	14400	0.33	0.32	4,652	0.30	4,396	229
300	18000	0.29	0.28	5,103	0.27	4,822	247
360	21600	0.25	0.24	5,274	0.23	4,984	250
365	21900	0.25	0.24	5,346	0.23	5,053	253
370	22200	0.25	0.24	5,419	0.23	5,122	257
1080	64800	0.14	0.14	8,832	0.13	8,347	365
1440	86400	0.11	0.11	9,249	0.10	8,741	348

GIA Design Dimensions

GIA Bed Variables:

Length =	80.00	ft
Width =	14.00	ft
Depth =	8.00	in
Side Slopes =	3	:1
Free Board =	2.00	in

Required Treatment Volume:

863 cf

Subdrain Media Area:

Width =	1.00	ft
Length =	40	ft
Area =	40	sf

Resulting Dimensions at Operating Level:

84.00	ft	Bed Area	**1,120**	sf
18.00	ft	Top Area	1,512	sf

Resulting Top Dimensions (including free board):

85.00	ft	Height	10.00	in
19.00	ft	Top Area	1,615	sf

Resulting Volume:

875 cf

Vegetated Infiltration Area No. 2 (Roadway Culdesac)

IMPERVIOUS SURFACE CALCULATIONS Date: 6/13/23

Basin Description	Area (sf)	Area (ac)	C	Remarks
Associated Sub Drainage Area	11,304	0.26		Based on 60' ROW
ACP Culdesac	7,850	0.18	0.90	ACP Radius 50'
Gravel Shoulders	641	0.01	0.50	Shoulder Width 12"
Residential	0	0.00	0.50	
Other	0	0.00	0.90	
Total Impervious Area	8,491	0.19		
Green Space	2,813	0.06	0.65	Assumed Open Space Group D Soil
Composite Runoff Coeff.			0.82	

BOWSTRING CALCULATIONS

Design Storm Return Period	25	yr	**Infiltration (max. 2 in/hr)**		
Drywell Outflow	0.00	cfs	Infiltration Rate (in/hr)=	2.00	
Bed of GIA Outflow	0.00	cfs	Infiltration Area (sf) =	20	
Check Dam Outflow (Geotex + Drain Rock)	0.000	cfs	**Fabric Transmissivity**		
Wier Outflow	0.00	cfs	Trans. Rate (cfs/sf)=	0.000	
Orifice Outflow	0.00	cfs	Outlet Area (sf) =	0.00	
Post Developed			**Treatment Storage (cf)**		
Area	0.26	acres	First 1/2-Inch Runoff =	354	
Composite Runoff Coefficient	0.82				
AxC=	0.21		**Drywell Capacities**		
Time of Concentration	5.00	min	Single Barell (cfs) =	0.30	
Pre-Developed:			Double Barell (cfs) =	1.00	
Sub Basin Area	0.26	acres			
Composite Runoff Coefficient	0.65	Assumed Pasture Group D Soil			
AxC=	0.17				
Time of Concentration	10	min			
Pre-Developed Flow Rate (cfs)	0.37	*(flow rate based on 10-min time of concentration)*			

Time (min)	Time (sec)	25-Year Storm Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	Operating Storage (cf)
5	300	2.8	0.59	238	0.47	190	48
10	600	2.17	0.46	322	0.37	257	65
15	900	1.83	0.39	388	0.31	309	78
20	1200	1.65	0.35	454	0.28	362	91

25	1500	1.45	0.31	491	0.24	392	98
30	1800	1.27	0.27	511	0.21	407	102
35	2100	1.19	0.25	554	0.20	442	110
40	2400	1.11	0.23	587	0.19	468	117
45	2700	1.04	0.22	616	0.18	492	122
50	3000	0.96	0.20	630	0.16	502	125
55	3300	0.88	0.19	633	0.15	505	125
60	3600	0.8	0.17	626	0.13	500	124
65	3900	0.78	0.16	660	0.13	527	130
70	4200	0.75	0.16	682	0.13	544	134
75	4500	0.72	0.15	701	0.12	559	138
80	4800	0.7	0.15	726	0.12	579	143
85	5100	0.67	0.14	737	0.11	588	145
90	5400	0.65	0.14	756	0.11	603	148
95	5700	0.63	0.13	773	0.11	617	151
100	6000	0.61	0.13	787	0.10	628	154
105	6300	0.59	0.12	799	0.10	637	156
110	6600	0.57	0.12	808	0.10	644	158
115	6900	0.55	0.12	815	0.09	650	159
120	7200	0.53	0.11	819	0.09	653	159
125	7500	0.51	0.11	820	0.09	654	159
130	7800	0.49	0.10	819	0.08	653	159
135	8100	0.47	0.10	815	0.08	650	158
150	9000	0.43	0.09	828	0.07	660	159
165	9900	0.4	0.08	846	0.07	675	162
180	10800	0.38	0.08	876	0.06	699	168
195	11700	0.37	0.08	924	0.06	737	176
210	12600	0.36	0.08	967	0.06	771	184
225	13500	0.34	0.07	978	0.06	780	186
240	14400	0.33	0.07	1,012	0.06	807	192
300	18000	0.29	0.06	1,110	0.05	885	208
360	21600	0.25	0.05	1,148	0.04	915	212
365	21900	0.25	0.05	1,163	0.04	928	215
370	22200	0.25	0.05	1,179	0.04	940	218
1080	64800	0.14	0.03	1,922	0.02	1,533	329
1440	86400	0.11	0.02	2,013	0.02	1,605	328

GIA Design Dimensions

GIA Bed Variables:

Length =	23.00	ft
Width =	20.00	ft
Depth =	8.00	in
Side Slopes =	3	:1
Free Board =	2.00	in

Required Treatment Volume:

354 cf

Subdrain Media Area:

Width =	1.00	ft
Length =	20	ft
Area =	20	sf

Resulting Dimensions at Operating Level:

27.00	ft	Bed Area	**460**	sf
24.00	ft	Top Area	648	sf

Resulting Top Dimensions (including free board):

28.00	ft	Height	10.00	in
25.00	ft	Top Area	700	sf

Resulting Volume:

367 cf

Wet Pond (Roadway STA 1+00 to 13+00, Blk 1 Lots 1, 2, 4-18, Blk 2 Lots 3,5,6)

IMPERVIOUS SURFACE CALCULATIONS Date: 3/4/24

Basin Description	Area (sf)	Area (ac)	C	Remarks
Sub Drainage Area 1	262,000	6.01		Based on 60' ROW and 10k SF Lots
ACP Roadway	28,800	0.66	0.90	ACP Width 24'
Gravel Shoulders	2,400	0.06	0.50	Shoulder Width 12"
Residential (19-Lots)	57,000	1.31	0.90	3,000 SF Impervious Area per Lot
Other	0	0.00	0.90	
Total Impervious Area	88,200	2.02		
Green Space	173,800	3.99	0.65	Assumed Open Space Group D Soil
Composite Runoff Coeff.			0.73	

BOWSTRING CALCULATIONS

Design Storm Return Period	25	yr	**Infiltration (max. 2 in/hr)**	
Drywell Outflow	0.00	cfs	Infiltration Rate (in/hr)=	0.00
Bed of GIA Outflow	0.00	cfs	Infiltration Area (sf) =	1,849
Check Dam Outflow (Geotex + Drain Rock)	0.000	cfs	**Fabric Transmissivity**	
Wier Outflow	0.00	cfs	Trans. Rate (cfs/sf)=	0.000
Orifice Outflow	**0.11**	cfs	Outlet Area (sf) =	0.00
Post Developed			**Treatment Storage (cf)**	
Area	6.01	acres	First 1/2-Inch Runoff =	3,675
Composite Runoff Coefficient	0.73			
AxC=	4.39		**Permanent Pool Volume Required:**	
Time of Concentration	5.00	min	2-yr, 24-hr Flow (cfs)	0.28
Pre-Developed:			2-yr, 24-hr Vol. (cf)	24,295
Sub Basin Area	6.01	acres	1/3 of the Vol. (cf)	8,098
Predevelopment Runoff Coefficient	0.60	Adjusted to lower discharge rate to 2.2 cfs		
AxC=	3.61			
Time of Concentration	10	min		
Pre-Developed Flow Rate (cfs)	7.83	*(flow rate based on 10-min time of concentration)*		

Time (min)	Time (sec)	25-Year Storm Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	Extended Storage (cf)
5	300	2.8	12.30	4,946	10.10	4,062	851

10	600	2.17	9.53	6,693	7.83	5,497	1,130
15	900	1.83	8.04	8,057	6.60	6,617	1,341
20	1200	1.65	7.25	9,439	5.95	7,753	1,555
25	1500	1.45	6.37	10,206	5.23	8,383	1,659
30	1800	1.27	5.58	10,613	4.58	8,717	1,699
35	2100	1.19	5.23	11,513	4.29	9,456	1,827
40	2400	1.11	4.88	12,202	4.01	10,022	1,917
45	2700	1.04	4.57	12,804	3.75	10,516	1,991
50	3000	0.96	4.22	13,084	3.46	10,747	2,009
55	3300	0.88	3.87	13,154	3.18	10,804	1,988
60	3600	0.8	3.51	13,012	2.89	10,688	1,930
65	3900	0.78	3.43	13,715	2.81	11,265	2,023
70	4200	0.75	3.30	14,176	2.71	11,644	2,072
75	4500	0.72	3.16	14,558	2.60	11,958	2,108
80	4800	0.7	3.08	15,077	2.53	12,383	2,167
85	5100	0.67	2.94	15,314	2.42	12,578	2,177
90	5400	0.65	2.86	15,713	2.35	12,906	2,215
95	5700	0.63	2.77	16,060	2.27	13,191	2,244
100	6000	0.61	2.68	16,354	2.20	13,433	2,264
105	6300	0.59	2.59	16,596	2.13	13,631	2,274
110	6600	0.57	2.50	16,785	2.06	13,786	2,275
115	6900	0.55	2.42	16,921	1.98	13,898	2,267
120	7200	0.53	2.33	17,004	1.91	13,966	2,249
125	7500	0.51	2.24	17,035	1.84	13,991	2,221
130	7800	0.49	2.15	17,012	1.77	13,973	2,185
135	8100	0.47	2.07	16,937	1.70	13,912	2,138
150	9000	0.43	1.89	17,196	1.55	14,124	2,086
165	9900	0.4	1.76	17,578	1.44	14,438	2,056
180	10800	0.38	1.67	18,202	1.37	14,950	2,068
195	11700	0.37	1.63	19,186	1.34	15,759	2,146
210	12600	0.36	1.58	20,091	1.30	16,502	2,209
225	13500	0.34	1.49	20,320	1.23	16,690	2,151
240	14400	0.33	1.45	21,027	1.19	17,271	2,179
300	18000	0.29	1.27	23,065	1.05	18,945	2,148
360	21600	0.25	1.10	23,838	0.90	19,580	1,892
365	21900	0.25	1.10	24,168	0.90	19,850	1,918
370	22200	0.25	1.10	24,497	0.90	20,121	1,944
1080	64800	0.14	0.62	39,922	0.51	32,791	32
1440	86400	0.11	0.48	41,807	0.40	34,339	-1,998

Permanent Pool:

GIA Bed Variables:			Resulting Dimensions at Operating Level:				
Length =	43.00	ft	61.00	ft	Bed Area	1,849	sf
Width =	43.00	ft	61.00	ft	Top Area	3,721	sf
Depth =	36.00	in	Resulting Top Dimensions (including free board):				
Side Slopes =	3	:1	61.00	ft	Height	36.00	in
Free Board =	0.00	in	61.00	ft	Top Area	3,721	sf
Required Treatment Volume:			Resulting Volume:				
8,098	cf		**8,112**	cf			

Extended Storage:

GIA Bed Variables:			Resulting Dimensions at Operating Level:				
Length =	64.00	ft	67.50	ft	Bed Area	4,096	sf
Width =	64.00	ft	67.50	ft	Top Area	4,556	sf
Depth =	7.00	in	Resulting Top Dimensions (including free board):				
Side Slopes =	3	:1	68.50	ft	Height	9.00	in
Free Board =	2.00	in	68.50	ft	Top Area	4,692	sf
Required Treatment Volume:			Resulting Volume:				
2,275	cf		**2,522**	cf			

Orifice Flow

D =	0.17	ft
H =	0.80	ft
Cd =	0.70	(pvc)
A =	0.02	sf
Q =	0.11	cfs