STORMWATER MANAGEMENT AND EROSION CONTROL PLAN
for
SANDPOINT RV PARK
PONDERAY, IDAHO

Applicant: Dempsey and Associates

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INTRODUCTION

Dempsey and Associates is proposing to construct a 2-acre RV park south of Days Inn near Bonner Mall Wat in Ponderay. As a result, approximately 600 sf of additional roof area and 29,550 sf of pavement will be added to the overall site layout. Access and RV spaces will be constructed in two phases. 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 basins and landscaped areas prior to regaining predevelopment flow patterns.

EXISTING SITE CONDITIONS

The current, developed 2-acre site includes approximately 2,920 of roof top, 16,330 sf of gravel roadway, and 63,000 sf of undeveloped, native grass area. Runoff from impervious surfaces currently sheet flows unmanaged in all directions.

SOILS

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

A summary of the typical properties of each 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

Gravel Surface (C = 0.5)	= 16,330 sf
Undeveloped/Landscaped Area (C = 0.25)	= 63,000 sf
Roof (C = 0.9)	= 2,920 sf
Total all surface types	= 82,270 sf
Total pre-construction impervious	= 19,250 sf
Composite Runoff Coefficient (C)	= 0.3

POST-CONSTRUCTION LAND COVER – TOTAL SITE

Pavement (C = 0.9)	= 29,550 sf
Undeveloped/Landscaped Area (C = 0.25)	= 49,200 sf
Roof (C = 0.9)	= 3,520 sf
Total all surface types	= 82,270 sf

Total post-construction impervious	= 33,070 sf
Composite Runoff Coefficient (C)	= 0.5

STORMWATER MANAGEMENT

Based on the given 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 facilities have been sized retain and treat the first ½" of roadway impervious surfaces from new development only, and also detain the difference between pre-development and post-development runoff based on a 25-year storm event, 24-hour period. Stormwater will be released to an existing municipal storm drain system at less than pre-development rates by controlling infiltration through sandy loam topsoil and drain rock before being collected in a subsurface perforated sock pipe.

The site has been divided into three drainage areas. Drainage area "A" includes phase-1 development of access roads and RV spaces. Drainage areas "B1" and B2" include development during phase-2.

Calculation Summary

Drainage Area "A" Pre Development
Impervious Surface = 0.43 acres
Time of Concentration = 10 min.
Runoff Coefficient = 0.3
Pre Developed Peak Flow = 0.28 cfs

Drainage Area "A" Post Development
Impervious Surface = 0.43 acres
Time of Concentration = 5 min.
Runoff Coefficient = 0.9 (pavement)
Post Developed Peak Flow = 1.1 cfs

Resulting Grassy Infiltration Swale Size Required
First ½-inch of Runoff = 785 cf
24-hour, 25-year Storm = 2,023 cf (Bowstring Method)
Swale Volume Provided = 2,369 cf
(see Bowstring Method calculation in Appendix B for detail)

Drainage Area "B1" Pre Development
Impervious Surface = 0.07 acres
Time of Concentration = 10 min.
Runoff Coefficient = 0.3

Pre Developed Peak Flow = 0.04 cfs

Drainage Area "B1" Post Development
Impervious Surface = 0.07 acres
Time of Concentration = 5 min.
Runoff Coefficient = 0.9 (pavement)
Post Developed Peak Flow = 0.19 cfs

Resulting Grassy Infiltration Swale Volume Required
First ½-inch of Runoff = 133 cf
24-hour, 25-year Storm = 344 cf (Bowstring Method)
Swale Volume Provided = 435 cf
(see Bowstring Method calculation in Appendix B for detail)

Drainage Area "B2" Pre Development
Impervious Surface = 0.17 acres
Time of Concentration = 10 min.
Runoff Coefficient = 0.3
Pre Developed Peak Flow = 0.09 cfs

Drainage Area "B2" Post Development
Impervious Surface = 0.17 acres
Time of Concentration = 5 min.
Runoff Coefficient = 0.9 (pavement)
Post Developed Peak Flow = 0.43 cfs

Resulting Grassy Infiltration Swale Volume Required
First ½-inch of Runoff = 313 cf
24-hour, 25-year Storm = 837 cf (Bowstring Method)
Swale Volume Provided = 987 cf
(see Bowstring Method calculation in Appendix B for detail)

EROSION CONTROL PLAN

Temporary erosion control shall be maintained through the use of existing vegetation and an existing stabilized construction entrance (gravel access road). 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 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 infiltration 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 basins

    - 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.
    -

IMPLEMENTATION SCHEDULE

The proposed construction schedule is as follows:

Spring 2021
- Install temporary erosion control
- Perform fill and excavation work for building pad, utilities and drive surfaces

Spring/Summer 2021
- Complete construction
- Check re-vegetated areas for bare spots, washouts, etc.

Late Summer 2021
- 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 driveway using the best management practices described in this report.

APPENDIX A

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

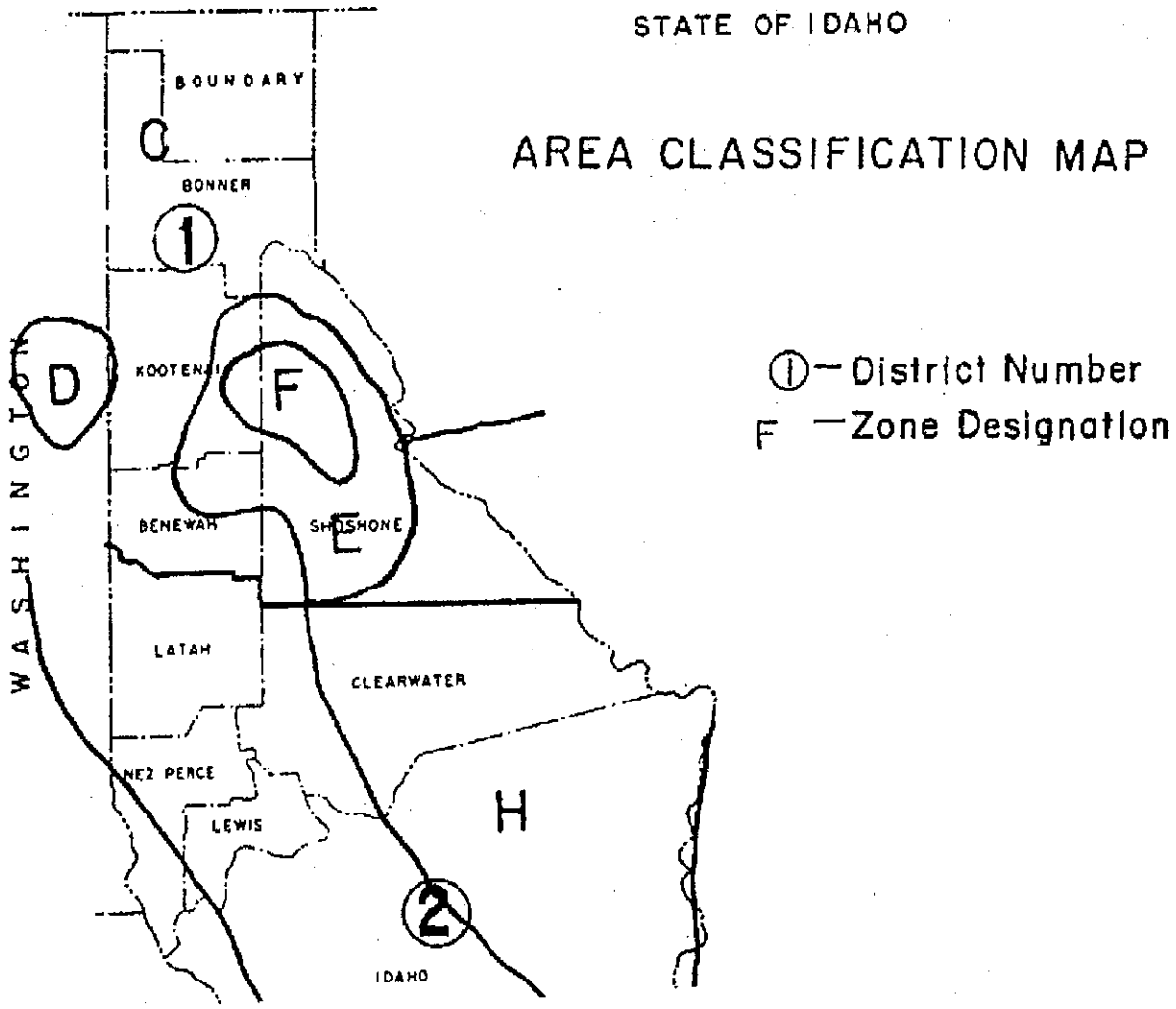

FIGURE 6-3 AREA CLASSIFICATION MAP FOR IDF CURVES - IDAHO
(IDAHO TRANSPORTATION DEPARTMENT)

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

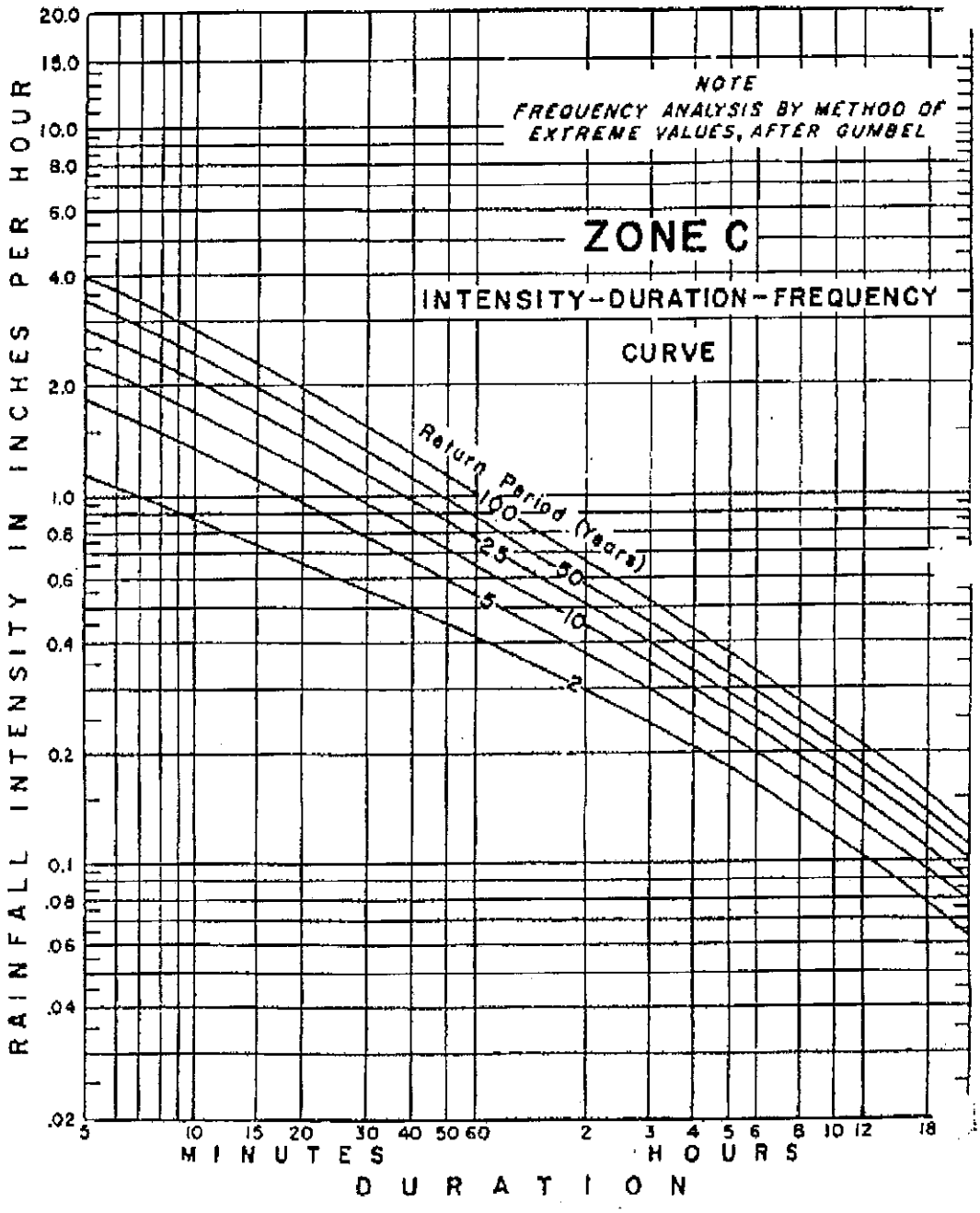

Table 4B.2. Values of Runoff Coefficient (C) for Rational Formula

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

Drainage Area A

BOWSTRING METHOD

DATE: 12/7/2020

Design Storm Return Period	25	yr	**Infiltration (max. 2 in/hr)**	
			Infiltration Rate	
Drywell Outflow	0.00	cfs	(in/hr)=	1.0
Bed of GIA Outflow	0.01	cfs	GIA Bed Area (sf) =	224
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)**	
Impervious Area	0.43	acres	First 1/2-Inch Runoff =	785
Composite Runoff Coefficient	0.90			
AxC=	0.39		**Drywell Capacities**	
Time of Concentration	5.00	min	Single Barell (cfs) =	0.30
Pre-Developed:			Double Barell (cfs) =	1.00
Sub Basin Area	0.43	acres		
Composite Runoff Coefficient	0.30			
AxC=	0.13			
Time of Concentration	10	min		
Pre-Developed Flow Rate (cfs)	0.28	*(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	1.09	438	0.36	146	291
10	600	2.17	0.85	593	0.28	198	392
15	900	1.83	0.71	714	0.24	238	471
20	1200	1.65	0.64	837	0.21	279	552
25	1500	1.45	0.56	905	0.19	302	595
30	1800	1.27	0.49	941	0.16	314	618
35	2100	1.19	0.46	1,021	0.15	340	669
40	2400	1.11	0.43	1,082	0.14	361	709
45	2700	1.04	0.41	1,135	0.14	378	743
50	3000	0.96	0.37	1,160	0.12	387	758
55	3300	0.88	0.34	1,166	0.11	389	760
60	3600	0.8	0.31	1,153	0.10	384	750
65	3900	0.78	0.30	1,216	0.10	405	790
70	4200	0.75	0.29	1,257	0.10	419	816
75	4500	0.72	0.28	1,290	0.09	430	837
80	4800	0.7	0.27	1,336	0.09	445	866
85	5100	0.67	0.26	1,357	0.09	452	878
90	5400	0.65	0.25	1,393	0.08	464	901
95	5700	0.63	0.25	1,424	0.08	475	920

100	6000	0.61	0.24	1,450	0.08	483	935
105	6300	0.59	0.23	1,471	0.08	490	948
110	6600	0.57	0.22	1,488	0.07	496	958
115	6900	0.55	0.21	1,500	0.07	500	964
120	7200	0.53	0.21	1,507	0.07	502	967
125	7500	0.51	0.20	1,510	0.07	503	968
130	7800	0.49	0.19	1,508	0.06	503	965
135	8100	0.47	0.18	1,501	0.06	500	959
150	9000	0.43	0.17	1,524	0.06	508	970
165	9900	0.4	0.16	1,558	0.05	519	987
180	10800	0.38	0.15	1,613	0.05	538	1,020
195	11700	0.37	0.14	1,701	0.05	567	1,073
210	12600	0.36	0.14	1,781	0.05	594	1,122
225	13500	0.34	0.13	1,801	0.04	600	1,131
240	14400	0.33	0.13	1,864	0.04	621	1,168
300	18000	0.29	0.11	2,045	0.04	682	1,270
360	21600	0.25	0.10	2,113	0.03	704	1,297
365	21900	0.25	0.10	2,142	0.03	714	1,315
370	22200	0.25	0.10	2,171	0.03	724	1,333
1080	64800	0.14	0.05	3,539	0.02	1,180	2,023
1440	86400	0.11	0.04	3,706	0.01	1,235	2,023

GFA Design Dimensions

GFA Bed Variables:

Length =	96.40	ft
Width =	96.30	ft
Depth =	3.00	in
Side Slopes =	4	:1
Free Board =	2.00	in

Required Treatment Volume:

785 cf

Resulting Dimensions at Operating Level:

98.40	ft	Bed Area	9,283	sf
98.30	ft	Top Area	9,673	sf

Resulting Top Dimensions (including free board):

99.73	ft	Height	5.00	in
99.63	ft	Top Area	9,937	sf

Resulting Volume:

2,369 cf

Drainage Area B1

BOWSTRING METHOD

DATE: 12/7/2020

Design Storm Return Period	25	yr	**Infiltration (max. 2 in/hr)**	
			Infiltration Rate	
Drywell Outflow	0.00	cfs	(in/hr)=	1.0
Bed of GIA Outflow	0.00	cfs	GIA Bed Area (sf) =	60
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)**	
Impervious Area	0.07	acres	First 1/2-Inch Runoff =	133
Composite Runoff Coefficient	0.90			
AxC=	0.07		**Drywell Capacities**	
Time of Concentration	5.00	min	Single Barell (cfs) =	0.30
Pre-Developed:			Double Barell (cfs) =	1.00
Sub Basin Area	0.07	acres		
Composite Runoff Coefficient	0.25			
AxC=	0.02			
Time of Concentration	10	min		
Pre-Developed Flow Rate (cfs)	0.04	*(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	0.19	74	0.05	21	53
10	600	2.17	0.14	101	0.04	28	72
15	900	1.83	0.12	121	0.03	34	86
20	1200	1.65	0.11	142	0.03	39	101
25	1500	1.45	0.10	154	0.03	43	109
30	1800	1.27	0.08	160	0.02	44	113
35	2100	1.19	0.08	173	0.02	48	122
40	2400	1.11	0.07	184	0.02	51	129
45	2700	1.04	0.07	193	0.02	54	135
50	3000	0.96	0.06	197	0.02	55	138
55	3300	0.88	0.06	198	0.02	55	138
60	3600	0.8	0.05	196	0.01	54	136
65	3900	0.78	0.05	206	0.01	57	144
70	4200	0.75	0.05	213	0.01	59	148
75	4500	0.72	0.05	219	0.01	61	152
80	4800	0.7	0.05	227	0.01	63	157
85	5100	0.67	0.04	230	0.01	64	159
90	5400	0.65	0.04	236	0.01	66	163
95	5700	0.63	0.04	242	0.01	67	167

100	6000	0.61	0.04	246	0.01	68	169
105	6300	0.59	0.04	250	0.01	69	172
110	6600	0.57	0.04	253	0.01	70	173
115	6900	0.55	0.04	255	0.01	71	174
120	7200	0.53	0.04	256	0.01	71	175
125	7500	0.51	0.03	256	0.01	71	175
130	7800	0.49	0.03	256	0.01	71	174
135	8100	0.47	0.03	255	0.01	71	173
150	9000	0.43	0.03	259	0.01	72	174
165	9900	0.4	0.03	265	0.01	73	177
180	10800	0.38	0.03	274	0.01	76	183
195	11700	0.37	0.02	289	0.01	80	192
210	12600	0.36	0.02	302	0.01	84	201
225	13500	0.34	0.02	306	0.01	85	202
240	14400	0.33	0.02	316	0.01	88	209
300	18000	0.29	0.02	347	0.01	96	226
360	21600	0.25	0.02	359	0.00	100	229
365	21900	0.25	0.02	364	0.00	101	232
370	22200	0.25	0.02	369	0.00	102	235
1080	64800	0.14	0.01	601	0.00	167	344
1440	86400	0.11	0.01	629	0.00	175	334

GFA Design Dimensions

GFA Bed Variables:

Length =	40.70	ft
Width =	40.70	ft
Depth =	3.00	in
Side Slopes =	4	:1
Free Board =	2.00	in

Required Treatment Volume:

133 cf

Resulting Dimensions at Operating Level:

42.70	ft	Bed Area	1,656	sf
42.70	ft	Top Area	1,823	sf

Resulting Top Dimensions (including free board):

44.03	ft	Height	5.00	in
44.03	ft	Top Area	1,939	sf

Resulting Volume:

435 cf

Drainage Area B2

BOWSTRING METHOD

DATE: 12/7/2020

Design Storm Return Period	25	yr	**Infiltration (max. 2 in/hr)**	
			Infiltration Rate	
Drywell Outflow	0.00	cfs	(in/hr)=	1.0
Bed of GIA Outflow	0.00	cfs	GIA Bed Area (sf) =	120
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)**	
Impervious Area	0.17	acres	First 1/2-Inch Runoff =	313
Composite Runoff Coefficient	0.90			
AxC=	0.15		**Drywell Capacities**	
Time of Concentration	5.00	min	Single Barell (cfs) =	0.30
Pre-Developed:			Double Barell (cfs) =	1.00
Sub Basin Area	0.17	acres		
Composite Runoff Coefficient	0.25			
AxC=	0.04			
Time of Concentration	10	min		
Pre-Developed Flow Rate (cfs)	0.09	*(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	0.43	174	0.12	48	125
10	600	2.17	0.34	236	0.09	66	169
15	900	1.83	0.28	284	0.08	79	203
20	1200	1.65	0.26	333	0.07	92	237
25	1500	1.45	0.22	360	0.06	100	256
30	1800	1.27	0.20	374	0.05	104	265
35	2100	1.19	0.18	406	0.05	113	287
40	2400	1.11	0.17	430	0.05	120	304
45	2700	1.04	0.16	452	0.04	125	319
50	3000	0.96	0.15	461	0.04	128	325
55	3300	0.88	0.14	464	0.04	129	326
60	3600	0.8	0.12	459	0.03	127	321
65	3900	0.78	0.12	484	0.03	134	339
70	4200	0.75	0.12	500	0.03	139	349
75	4500	0.72	0.11	513	0.03	143	358
80	4800	0.7	0.11	532	0.03	148	371
85	5100	0.67	0.10	540	0.03	150	376

90	5400	0.65	0.10	554	0.03	154	385
95	5700	0.63	0.10	566	0.03	157	393
100	6000	0.61	0.09	577	0.03	160	400
105	6300	0.59	0.09	585	0.03	163	405
110	6600	0.57	0.09	592	0.02	164	409
115	6900	0.55	0.09	597	0.02	166	412
120	7200	0.53	0.08	600	0.02	167	413
125	7500	0.51	0.08	601	0.02	167	413
130	7800	0.49	0.08	600	0.02	167	412
135	8100	0.47	0.07	597	0.02	166	409
150	9000	0.43	0.07	606	0.02	168	413
165	9900	0.4	0.06	620	0.02	172	420
180	10800	0.38	0.06	642	0.02	178	434
195	11700	0.37	0.06	677	0.02	188	456
210	12600	0.36	0.06	709	0.02	197	477
225	13500	0.34	0.05	717	0.01	199	480
240	14400	0.33	0.05	742	0.01	206	496
300	18000	0.29	0.04	813	0.01	226	538
360	21600	0.25	0.04	841	0.01	234	547
365	21900	0.25	0.04	852	0.01	237	555
370	22200	0.25	0.04	864	0.01	240	562
1080	64800	0.14	0.02	1,408	0.01	391	837
1440	86400	0.11	0.02	1,474	0.00	410	825

GFA Design Dimensions

GFA Bed Variables:

Length =	47.00	ft
Width =	47.00	ft
Depth =	5.00	in
Side Slopes =	4	:1
Free Board =	2.00	in

Required Treatment Volume:

313 cf

Resulting Dimensions at Operating Level:

50.33	ft	Bed Area	2,209	sf
50.33	ft	Top Area	2,533	sf

Resulting Top Dimensions (including free board):

51.67	ft	Height	7.00	in
51.67	ft	Top Area	2,669	sf

Resulting Volume:

987 cf