



**STORMWATER MANAGEMENT and EROSION CONTROL PLAN**  
**for**  
**NORTHWEST AUTOBODY STORAGE YARD**  
**PONDERAY, IDAHO**

Project: The applicant is proposing to construct a gravel surfaced storage yard.

Landowner: Northwest Autobody  
1202 Triangle Dr.  
Ponderay, ID 83852

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Sandpoint, Idaho 83864



## **INTRODUCTION**

Northwest Autobody is proposing to construct a gravel surface storage yard on an undeveloped 1-acre parcel of land located adjacent to Schweitzer Plaza Drive in Ponderay, ID. As a result, approximately 39,873 sf of impervious surface will be installed. The purpose of this report is to recommend facilities to control storm water runoff from the described impervious surfaces and prevent erosion and sediment transport. The design and selection of storm water facilities are based on soil information obtained from the "NRCS Web Soil Survey, Bonner County Area, Idaho" and limited to topography and apparent site conditions at the time analysis was performed.

During frequent storm events, runoff will be detained onsite in shallow grass lined filtration swales and landscaped areas prior to regaining predevelopment flow patterns.

## **EXISTING SITE CONDITIONS**

The site is currently undeveloped and slopes gently in all directions. Land cover consists of open pasture with native grass.

## **SOILS**

The NRCS classifies native soil in the area as 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 *NRCS Soil Survey of Bonner County Area, Idaho, Parts of Bonner and Boundary Counties (Version 14, September 13, 2018)*.

## **PRE-CONSTRUCTION LAND COVER – TOTAL SITE**

Total Undeveloped Area (C = 0.3)	=	1.06 ac
Composite Runoff Coefficient (C)	=	0.30

## **POST-CONSTRUCTION LAND COVER – TOTAL SITE**

Total Area	=	1.06 ac
Compacted Gravel (C= 0.5)	=	0.92 ac
Green Space (C= 0.3)	=	0.15 ac
Composite Runoff Coefficient (C)	=	0.47

## **STORMWATER MANAGEMENT**

Based on the given site, topography and soil characteristics, surface dispersion of storm water and shallow detention 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 filtration facilities have been sized to retain and treat the first ½" of runoff

from impervious surfaces and detain the difference between pre-development and post-development flow rates based on a 25-year storm event, 24-hour period. Post development flows will be detained and released at pre-development rates by transmissivity through geotextile fabric.

The site has been divided into two drainage areas, including the west portion of the site (0.48-acres) and the east drainage area (0.58-acres). Filtration swales have been designed for each drainage area and presented in the calculations and on the plans as either GFA 1a and 1b servicing the west side of the site, or 2a and 2b serving the east portion. The calculations also include an analysis of the site considering a combine grassy swale area to verify the overall detention rate.

### **Calculation Summary – Grassy Filtration Area Detention Design**

#### Total Site – Predevelopment Conditions

Undeveloped Area = 1.06 ac  
Time of Concentration = 10 min.  
Runoff Coefficient = 0.3  
Predeveloped Peak Flow = 0.69 cfs

#### Total Site – Post Development Conditions

Developed Area = 1.06 ac  
Impervious Surface = 0.92 ac  
Green Space = 0.15 ac  
Time of Concentration = 5 min.  
Composite Runoff Coefficient = 0.47  
Post Developed Peak Flow = 1.4 cfs

#### Total Site - Resulting Filtration Volume Required

First ½-inch of Runoff = 1661 cf  
24-hour, 25-year Storm = 1197 cf (Bowstring Method)  
Swale Volume Provided = 1980 cf  
(see Bowstring Method calculation in Appendix B for details)

#### Area 1a – Predevelopment Conditions

Undeveloped Area = 0.3 ac  
Time of Concentration = 10 min.  
Runoff Coefficient = 0.3  
Predeveloped Peak Flow = 0.2 cfs

#### Area 1a – Post Development Conditions

Developed Area = 0.3 ac  
Impervious Surface = 0.26 ac  
Green Space = 0.04 ac

Time of Concentration = 5 min.  
Composite Runoff Coefficient = 0.47  
Post Developed Peak Flow = 0.4 cfs

Area 1a - Resulting Filtration Volume Required

First ½-inch of Runoff = 467 cf  
24-hour, 25-year Storm = 351 cf (Bowstring Method)  
Swale Volume Provided = 597 cf

Area 1b – Predevelopment Conditions

Undeveloped Area = 0.18 ac  
Time of Concentration = 10 min.  
Runoff Coefficient = 0.3  
Predeveloped Peak Flow = 0.12 cfs

Area 1b – Post Development Conditions

Developed Area = 0.18 ac  
Impervious Surface = 0.16 ac  
Green Space = 0.02 ac  
Time of Concentration = 5 min.  
Composite Runoff Coefficient = 0.48  
Post Developed Peak Flow = 0.24 cfs

Area 1b - Resulting Filtration Volume Required

First ½-inch of Runoff = 296 cf  
24-hour, 25-year Storm = 180 cf (Bowstring Method)  
Swale Volume Provided = 297 cf

Area 2a – Predevelopment Conditions

Undeveloped Area = 0.28 ac  
Time of Concentration = 10 min.  
Runoff Coefficient = 0.3  
Predeveloped Peak Flow = 0.18 cfs

Area 2a – Post Development Conditions

Developed Area = 0.28 ac  
Impervious Surface = 0.24 ac  
Green Space = 0.04 ac  
Time of Concentration = 5 min.  
Composite Runoff Coefficient = 0.47  
Post Developed Peak Flow = 0.37 cfs

Area 2a - Resulting Filtration Volume Required

First ½-inch of Runoff = 434 cf

24-hour, 25-year Storm = 318 cf (Bowstring Method)  
Swale Volume Provided = 539 cf

Area 2b – Predevelopment Conditions

Undeveloped Area = 0.3 ac  
Time of Concentration = 10 min.  
Runoff Coefficient = 0.3  
Predeveloped Peak Flow = 0.19 cfs

Area 2b – Post Development Conditions

Developed Area = 0.3 ac  
Impervious Surface = 0.26 ac  
Green Space = 0.04 ac  
Time of Concentration = 5 min.  
Composite Runoff Coefficient = 0.47  
Post Developed Peak Flow = 0.39 cfs

Area 2b - Resulting Filtration Volume Required

First ½-inch of Runoff = 465 cf  
24-hour, 25-year Storm = 348 cf (Bowstring Method)  
Swale Volume Provided = 487 cf

**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 which include grass infiltration basins, grass or rock-lined ditches, existing vegetated buffers, and reseeded 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 and/or Rock-Lined channels
  - Periodically inspect ditches or and/or channels and remove any sediment deeper than 6 inches
  - Re-establish vegetation that is damaged during high runoff events.
  - Add additional rock as necessary to prevent erosion of channel sides and bottom
- 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 filtration swales
  - Remove all sediment from the basin and dispose off-site at the end of construction, and during each inspection.
- Grass ditches and/or Rock-Lined Channels
  - Remove all sediment from the ditches and/or channels 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 2022

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

#### Summer 2022

- Complete construction
- Check re-vegetated areas for bare spots, washouts, etc.

#### Late Summer/Fall 2022

- 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

### 31—Mission silt loam, 0 to 2 percent slopes

#### Map Unit Setting

*National map unit symbol:* 5462  
*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:* Prime farmland if drained

#### Map Unit Composition

*Mission and similar soils:* 75 percent  
*Minor components:* 5 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:* Concave  
*Across-slope shape:* Linear  
*Parent material:* Volcanic ash and loess over silty glaciolacustrine  
deposits

##### Typical profile

*O<sub>i</sub> - 0 to 1 inches:* slightly decomposed plant material  
*A - 1 to 3 inches:* silt loam  
*B<sub>w</sub> - 3 to 12 inches:* silt loam  
*2B<sub>tx</sub> - 12 to 21 inches:* silt loam  
*2E - 21 to 33 inches:* silt  
*2B<sub>t</sub> - 33 to 48 inches:* silt loam  
*3C - 48 to 67 inches:* fine sand

##### Properties and qualities

*Slope:* 0 to 2 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 (K<sub>sat</sub>):* 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 capacity:* 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**

#### **Hoodoo**

*Percent of map unit:* 3 percent  
*Landform:* Flood plains, drainageways  
*Down-slope shape:* Concave  
*Across-slope shape:* Linear  
*Hydric soil rating:* Yes

#### **Odenson**

*Percent of map unit:* 2 percent  
*Landform:* Depressions  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary  
Counties

Survey Area Data: Version 16, Jun 4, 2020

STATE OF IDAHO

AREA CLASSIFICATION MAP

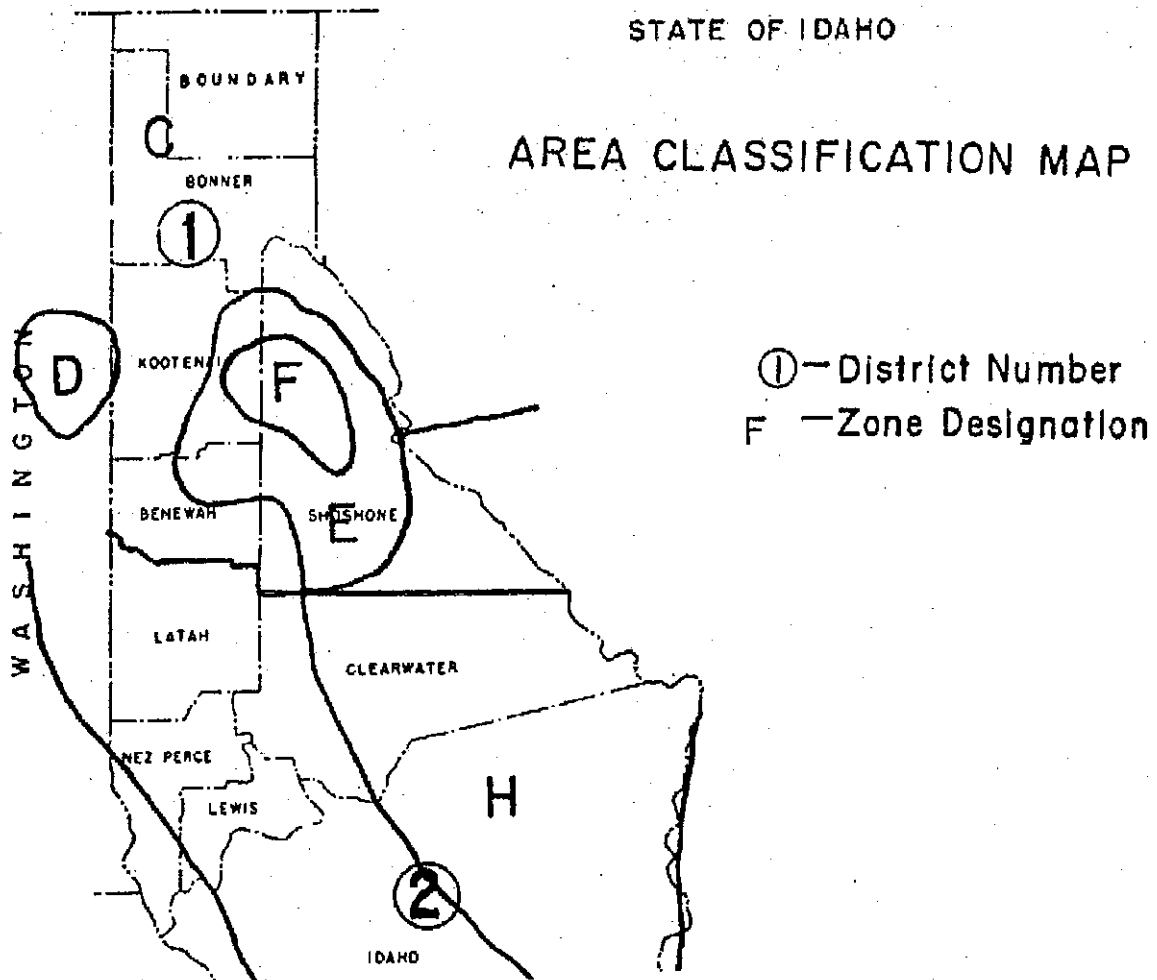
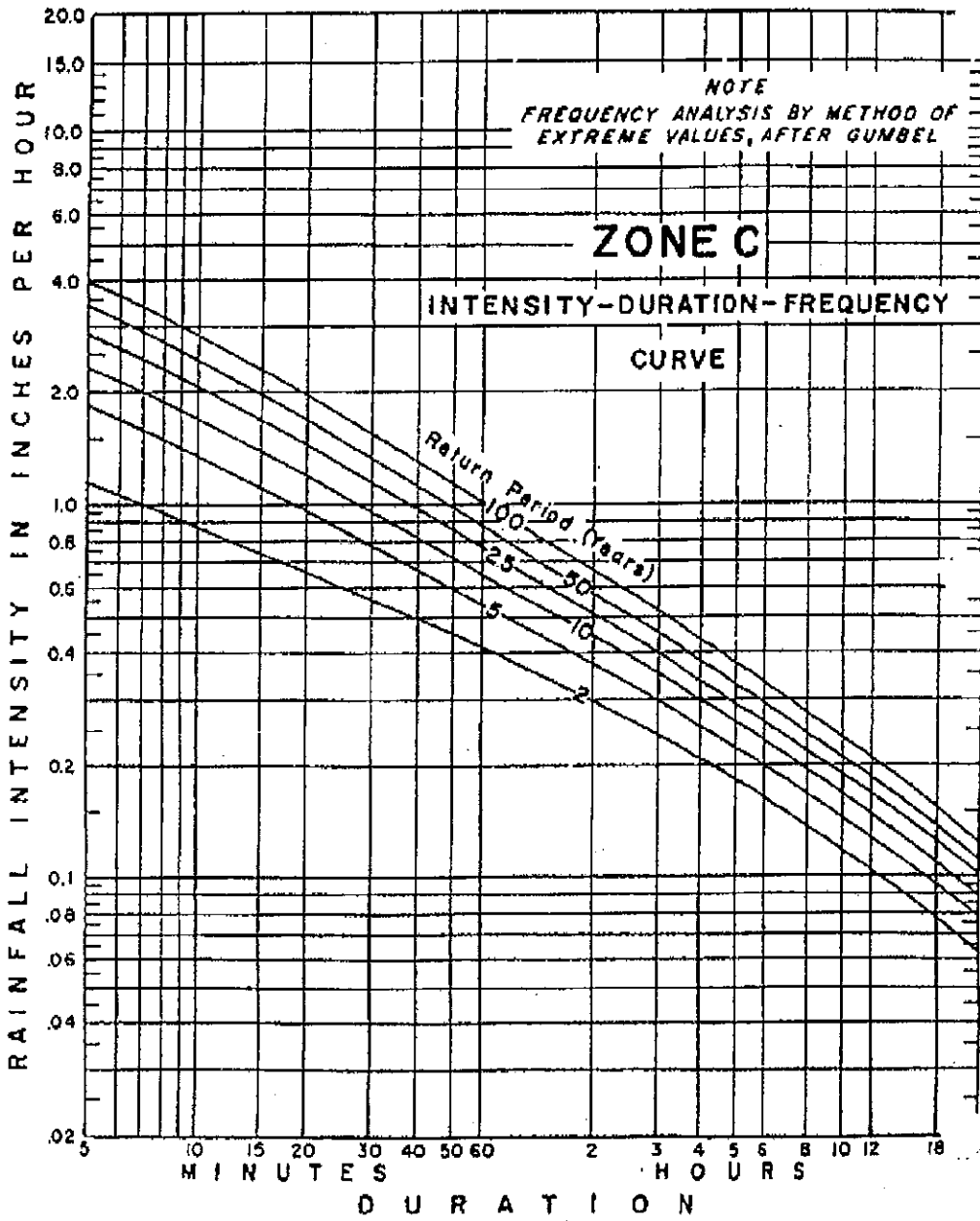


FIGURE 6-3 AREA CLASSIFICATION MAP FOR IDF CURVES - IDAHO  
(IDAHO TRANSPORTATION DEPARTMENT)

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):	Average % of lot impervious:				
1/8	65	0.59	0.76	0.86	0.90
1/4	38	0.29	0.55	0.70	0.80
1/3	30	---	0.49	0.67	0.78
1/2	25	---	0.45	0.65	0.76
1.0	20	---	0.41	0.63	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	0.99	0.99	0.99
		0.57	0.76	0.84	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

## Combined Grassy Filtration Area - Total Project Area

### BOWSTRING METHOD

DATE: 5/4/2021

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

GIA Bed Area (sf) = 0

Check Dam Outflow (Geotex + Drain Rock)

0.007 cfs

**Fabric Transmissivity**

Wier Outflow

0.00 cfs

Trans. Rate (cfs/sf)= 0.004

Orifice Outflow

0.00 cfs

Outlet Area (sf) = 2.00

### **Post Developed**

Area

1.06 acres

**Treatment Storage (cf)**

First 1/2-Inch Runoff = 1,661

Composite Runoff Coefficient

0.47

AxC=

0.50

**Drywell Capacities**

Time of Concentration

5.00 min

Single Barel (cfs) = 0.30

### **Pre-Developed:**

Sub Basin Area

1.06 acres

Double Barel (cfs) = 1.00

Composite Runoff Coefficient

0.30

AxC=

0.32

Time of Concentration

10 min

Pre-Developed Flow Rate (cfs)

0.69 (flow rate based on 10-min time of concentration)

Time (min)	Time (sec)	25-Year Storm		Operating			Storage (cf)
		Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	
5	300	2.8	1.40	564	0.89	358	204
10	600	2.17	1.09	764	0.69	485	275
15	900	1.83	0.92	919	0.58	583	329
20	1200	1.65	0.83	1,077	0.53	684	385
25	1500	1.45	0.73	1,164	0.46	739	414
30	1800	1.27	0.64	1,211	0.40	769	429
35	2100	1.19	0.60	1,313	0.38	834	465
40	2400	1.11	0.56	1,392	0.35	884	491
45	2700	1.04	0.52	1,461	0.33	927	514
50	3000	0.96	0.48	1,493	0.31	948	524
55	3300	0.88	0.44	1,501	0.28	953	524
60	3600	0.8	0.40	1,485	0.25	942	516
65	3900	0.78	0.39	1,565	0.25	993	543
70	4200	0.75	0.38	1,617	0.24	1,027	560
75	4500	0.72	0.36	1,661	0.23	1,054	574
80	4800	0.7	0.35	1,720	0.22	1,092	594
85	5100	0.67	0.34	1,747	0.21	1,109	601
90	5400	0.65	0.33	1,793	0.21	1,138	616
95	5700	0.63	0.32	1,832	0.20	1,163	628
100	6000	0.61	0.31	1,866	0.19	1,184	638

105	6300	0.59	0.30	1,893	0.19	1,202	646
110	6600	0.57	0.29	1,915	0.18	1,215	652
115	6900	0.55	0.28	1,930	0.18	1,225	655
120	7200	0.53	0.27	1,940	0.17	1,231	657
125	7500	0.51	0.26	1,943	0.16	1,234	656
130	7800	0.49	0.25	1,941	0.16	1,232	653
135	8100	0.47	0.24	1,932	0.15	1,227	647
150	9000	0.43	0.22	1,962	0.14	1,245	652
165	9900	0.4	0.20	2,005	0.13	1,273	661
180	10800	0.38	0.19	2,077	0.12	1,318	681
195	11700	0.37	0.19	2,189	0.12	1,389	715
210	12600	0.36	0.18	2,292	0.11	1,455	746
225	13500	0.34	0.17	2,318	0.11	1,471	749
240	14400	0.33	0.17	2,399	0.11	1,523	772
300	18000	0.29	0.15	2,631	0.09	1,670	831
360	21600	0.25	0.13	2,720	0.08	1,726	838
365	21900	0.25	0.13	2,757	0.08	1,750	849
370	22200	0.25	0.13	2,795	0.08	1,774	861
1080	64800	0.14	0.07	4,555	0.04	2,891	1,197
1440	86400	0.11	0.06	4,770	0.04	3,028	1,120

**GFA Design Dimensions**

GFA Bed Variables:

Length =	321.00	ft
Avg Width =	10.78	ft
Depth =	6.00	in
Side Slopes =	3	:1
Free Board =	2.00	in

Required Treatment Volume:

1,661 cf

Resulting Dimensions at Operating Level:

324.00	ft	Bed Area	3,460	sf
13.78	ft	Top Area	4,465	sf

Resulting Top Dimensions (including free board):

325.00	ft	Height	8.00	in
14.78	ft	Top Area	4,804	sf

Resulting Volume:

1,980	cf	Trench L	0
14,812	gal	Trench W	0
		Trench A	0.00



## Grassy Filtration Area 1a

### BOWSTRING METHOD

DATE: 5/4/2021

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

GIA Bed Area (sf) =

0

Check Dam Outflow (Geotex + Drain Rock)

0.002 cfs

### Fabric Transmissivity

Wier Outflow

0.00 cfs

Trans. Rate (cfs/sf)=

0.004

Orifice Outflow

0.00 cfs

Outlet Area (sf) =

0.50

### Treatment Storage

(cf)

### Post Developed

Area

0.30 acres

First 1/2-Inch Runoff =

467

Composite Runoff Coefficient

0.47

AxC=

0.14

### Drywell Capacities

Time of Concentration

5.00 min

Single Barel (cfs) =

0.30

### Pre-Developed:

Double Barel (cfs) =

1.00

Sub Basin Area

0.30 acres

Composite Runoff Coefficient

0.30

AxC=

0.09

Time of Concentration

10 min

Pre-Developed Flow Rate (cfs)

0.20 (flow rate based on 10-min time of concentration)

Time (min)	Time (sec)	25-Year Storm		Operating			
		Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	Storage (cf)
5	300	2.8	0.40	159	0.25	101	57
10	600	2.17	0.31	216	0.20	137	77
15	900	1.83	0.26	259	0.16	165	93
20	1200	1.65	0.23	304	0.15	193	108
25	1500	1.45	0.21	329	0.13	209	117
30	1800	1.27	0.18	342	0.11	218	121
35	2100	1.19	0.17	371	0.11	236	131
40	2400	1.11	0.16	393	0.10	250	138
45	2700	1.04	0.15	412	0.09	262	145
50	3000	0.96	0.14	421	0.09	268	148
55	3300	0.88	0.12	424	0.08	270	148
60	3600	0.8	0.11	419	0.07	267	146
65	3900	0.78	0.11	442	0.07	281	154
70	4200	0.75	0.11	456	0.07	291	158
75	4500	0.72	0.10	469	0.06	298	162
80	4800	0.7	0.10	485	0.06	309	168
85	5100	0.67	0.09	493	0.06	314	170
90	5400	0.65	0.09	506	0.06	322	174
95	5700	0.63	0.09	517	0.06	329	178
100	6000	0.61	0.09	527	0.05	335	181

105	6300	0.59	0.08	534	0.05	340	183
110	6600	0.57	0.08	540	0.05	344	185
115	6900	0.55	0.08	545	0.05	347	186
120	7200	0.53	0.07	548	0.05	349	186
125	7500	0.51	0.07	549	0.05	349	186
130	7800	0.49	0.07	548	0.04	349	185
135	8100	0.47	0.07	545	0.04	347	184
150	9000	0.43	0.06	554	0.04	352	185
165	9900	0.4	0.06	566	0.04	360	188
180	10800	0.38	0.05	586	0.03	373	194
195	11700	0.37	0.05	618	0.03	393	203
210	12600	0.36	0.05	647	0.03	412	212
225	13500	0.34	0.05	654	0.03	416	214
240	14400	0.33	0.05	677	0.03	431	220
300	18000	0.29	0.04	743	0.03	473	238
360	21600	0.25	0.04	768	0.02	489	240
365	21900	0.25	0.04	778	0.02	495	243
370	22200	0.25	0.04	789	0.02	502	247
1080	64800	0.14	0.02	1,286	0.01	818	351
1440	86400	0.11	0.02	1,346	0.01	857	334

### GFA Design Dimensions

#### GFA Bed Variables:

Length =	264.00	ft
Avg Width =	3.00	ft
Depth =	6.00	in
Side Slopes =	3	:1
Free Board =	2.00	in

#### Required Treatment Volume:

467 cf

#### Resulting Dimensions at Operating Level:

267.00	ft	Bed Area	792	sf
6.00	ft	Top Area	1,602	sf

#### Resulting Top Dimensions (including free board):

<b>268.00</b>	ft	Height	8.00	in
<b>7.00</b>	ft	Top Area	1,876	sf

#### Resulting Volume:

597	cf	Trench L	0
4,468	gal	Trench W	0
		Trench A	0.00

## Grassy Filtration Area 1b

### BOWSTRING METHOD

DATE: 5/4/2021

Design Storm Return Period

25 yr

### Infiltration (max. 2 in/hr)

Drywell Outflow

0.00 cfs

Infiltration Rate

0.00

Bed of GIA Outflow

0.00 cfs

(in/hr)=

GIA Bed Area (sf) =

0

Check Dam Outflow (Geotex + Drain Rock)

0.002 cfs

### Fabric Transmissivity

Wier Outflow

0.00 cfs

Trans. Rate (cfs/sf)=

0.004

Orifice Outflow

0.00 cfs

Outlet Area (sf) =

0.50

### Treatment Storage

(cf)

### Post Developed

Area

0.18 acres

First 1/2-Inch Runoff =

296

Composite Runoff Coefficient

0.48

### Drywell Capacities

AxC=

0.09

Single Barell (cfs) =

0.30

Time of Concentration

5.00 min

Double Barell (cfs) =

1.00

### Pre-Developed:

Sub Basin Area

0.18 acres

Composite Runoff Coefficient

0.30

AxC=

0.05

Time of Concentration

10 min

Pre-Developed Flow Rate (cfs)

0.12 (flow rate based on 10-min time of concentration)

Time (min)	Time (sec)	25-Year Storm		Operating			Storage (cf)
		Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	
5	300	2.8	0.24	98	0.15	61	36
10	600	2.17	0.19	132	0.12	82	49
15	900	1.83	0.16	159	0.10	99	58
20	1200	1.65	0.14	186	0.09	116	68
25	1500	1.45	0.13	201	0.08	126	73
30	1800	1.27	0.11	209	0.07	131	76
35	2100	1.19	0.10	227	0.06	142	82
40	2400	1.11	0.10	241	0.06	150	86
45	2700	1.04	0.09	253	0.06	158	90
50	3000	0.96	0.08	258	0.05	161	92
55	3300	0.88	0.08	259	0.05	162	92
60	3600	0.8	0.07	257	0.04	160	90
65	3900	0.78	0.07	271	0.04	169	95
70	4200	0.75	0.06	280	0.04	174	98
75	4500	0.72	0.06	287	0.04	179	100
80	4800	0.7	0.06	297	0.04	186	103
85	5100	0.67	0.06	302	0.04	188	104
90	5400	0.65	0.06	310	0.04	193	107
95	5700	0.63	0.05	317	0.03	198	109
100	6000	0.61	0.05	323	0.03	201	111

105	6300	0.59	0.05	327	0.03	204	112
110	6600	0.57	0.05	331	0.03	207	113
115	6900	0.55	0.05	334	0.03	208	113
120	7200	0.53	0.05	335	0.03	209	113
125	7500	0.51	0.04	336	0.03	210	113
130	7800	0.49	0.04	336	0.03	209	112
135	8100	0.47	0.04	334	0.03	208	111
150	9000	0.43	0.04	339	0.02	212	111
165	9900	0.4	0.03	347	0.02	216	113
180	10800	0.38	0.03	359	0.02	224	116
195	11700	0.37	0.03	378	0.02	236	121
210	12600	0.36	0.03	396	0.02	247	126
225	13500	0.34	0.03	401	0.02	250	126
240	14400	0.33	0.03	415	0.02	259	130
300	18000	0.29	0.03	455	0.02	284	139
360	21600	0.25	0.02	470	0.01	293	138
365	21900	0.25	0.02	477	0.01	297	140
370	22200	0.25	0.02	483	0.01	301	142
1080	64800	0.14	0.01	787	0.01	491	180
1440	86400	0.11	0.01	825	0.01	514	155

**GFA Design Dimensions**

GFA Bed Variables:

Length =	46.00	ft
Avg Width =	11.00	ft
Depth =	6.00	in
Side Slopes =	3	:1
Free Board =	2.00	in

Required Treatment Volume:

296 cf

Resulting Dimensions at Operating Level:

49.00	ft	Bed Area	506	sf
14.00	ft	Top Area	686	sf

Resulting Top Dimensions (including free board):

50.00	ft	Height	8.00	in
15.00	ft	Top Area	750	sf

Resulting Volume:

297	cf	Trench L	0
2,221	gal	Trench W	0
		Trench A	0.00

## Grassy Filtration Area 2a

### BOWSTRING METHOD

DATE: 5/4/2021

Design Storm Return Period

25 yr

### **Infiltration (max. 2 in/hr)**

Drywell Outflow

0.00 cfs

Infiltration Rate

0.00

Bed of GIA Outflow

0.00 cfs

(in/hr)=

GIA Bed Area (sf) =

0

Check Dam Outflow (Geotex + Drain Rock)

0.002 cfs

### **Fabric Transmissivity**

Wier Outflow

0.00 cfs

Trans. Rate (cfs/sf)=

0.004

Orifice Outflow

0.00 cfs

Outlet Area (sf) =

0.50

### **Treatment Storage**

(cf)

### **Post Developed**

Area

0.28 acres

First 1/2-Inch Runoff =

434

Composite Runoff Coefficient

0.47

### **Drywell Capacities**

AxC=

0.13

Single Barell (cfs) =

0.30

Time of Concentration

5.00 min

Double Barell (cfs) =

1.00

### **Pre-Developed:**

Sub Basin Area

0.28 acres

Composite Runoff Coefficient

0.30

AxC=

0.08

Time of Concentration

10 min

Pre-Developed Flow Rate (cfs)

0.18 (flow rate based on 10-min time of concentration)

Time (min)	Time (sec)	25-Year Storm			Operating		
		Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	Storage (cf)
5	300	2.8	0.37	149	0.24	95	53
10	600	2.17	0.29	202	0.18	129	72
15	900	1.83	0.24	243	0.16	155	86
20	1200	1.65	0.22	285	0.14	182	101
25	1500	1.45	0.19	308	0.12	197	108
30	1800	1.27	0.17	320	0.11	205	112
35	2100	1.19	0.16	347	0.10	222	122
40	2400	1.11	0.15	368	0.09	235	129
45	2700	1.04	0.14	386	0.09	247	135
50	3000	0.96	0.13	395	0.08	252	137
55	3300	0.88	0.12	397	0.07	254	137
60	3600	0.8	0.11	393	0.07	251	135
65	3900	0.78	0.10	414	0.07	264	142
70	4200	0.75	0.10	428	0.06	273	147
75	4500	0.72	0.10	439	0.06	281	150

80	4800	0.7	0.09	455	0.06	291	156
85	5100	0.67	0.09	462	0.06	295	158
90	5400	0.65	0.09	474	0.06	303	161
95	5700	0.63	0.08	485	0.05	310	165
100	6000	0.61	0.08	494	0.05	315	167
105	6300	0.59	0.08	501	0.05	320	169
110	6600	0.57	0.08	506	0.05	324	171
115	6900	0.55	0.07	511	0.05	326	172
120	7200	0.53	0.07	513	0.04	328	172
125	7500	0.51	0.07	514	0.04	328	172
130	7800	0.49	0.06	513	0.04	328	171
135	8100	0.47	0.06	511	0.04	327	170
150	9000	0.43	0.06	519	0.04	332	171
165	9900	0.4	0.05	530	0.03	339	174
180	10800	0.38	0.05	549	0.03	351	179
195	11700	0.37	0.05	579	0.03	370	188
210	12600	0.36	0.05	606	0.03	387	196
225	13500	0.34	0.05	613	0.03	392	197
240	14400	0.33	0.04	634	0.03	405	203
300	18000	0.29	0.04	696	0.02	445	219
360	21600	0.25	0.03	719	0.02	460	221
365	21900	0.25	0.03	729	0.02	466	224
370	22200	0.25	0.03	739	0.02	472	227
1080	64800	0.14	0.02	1,205	0.01	770	318
1440	86400	0.11	0.01	1,262	0.01	806	300

### GFA Design Dimensions

GFA Bed Variables:

Length = 238.00 ft

Avg Width = 3.00 ft

Depth = 6.00 in

Side Slopes = 3 :1

Free Board = 2.00 in

Required Treatment Volume:

434 cf

Resulting Dimensions at Operating Level:

241.00 ft Bed Area 714 sf

6.00 ft Top Area 1,446 sf

Resulting Top Dimensions (including free board):

242.00 ft Height 8.00 in

7.00 ft Top Area 1,694 sf

Resulting Volume:

539 cf Trench L 0

4,031 gal Trench W 0

Trench A 0.00

## Grassy Filtration Area 2b

### BOWSTRING METHOD

DATE: 5/4/2021

Design Storm Return Period

25 yr

### Infiltration (max. 2 in/hr)

Drywell Outflow

0.00 cfs

Infiltration Rate

0.00

Bed of GIA Outflow

0.00 cfs

(in/hr)=

GIA Bed Area (sf) =

0

Check Dam Outflow (Geotex + Drain Rock)

0.002 cfs

### Fabric Transmissivity

Wier Outflow

0.00 cfs

Trans. Rate (cfs/sf)=

0.004

Orifice Outflow

0.00 cfs

Outlet Area (sf) =

0.50

### Treatment Storage

(cf)

### Post Developed

Area

0.30 acres

First 1/2-Inch Runoff =

465

Composite Runoff Coefficient

0.47

### Drywell Capacities

AxC=

0.14

Single Barell (cfs) =

0.30

Time of Concentration

5.00 min

Double Barell (cfs) =

1.00

### Pre-Developed:

Sub Basin Area

0.30 acres

Composite Runoff Coefficient

0.30

AxC=

0.09

Time of Concentration

10 min

Pre-Developed Flow Rate (cfs)

0.19 (flow rate based on 10-min time of concentration)

Time (min)	Time (sec)	25-Year Storm		Operating			
		Intensity (in/hr)	Qpost(cfs)	Vpost (cf)	Qpre(cfs)	Vpre(cf)	Storage (cf)
5	300	2.8	0.39	158	0.25	101	57
10	600	2.17	0.30	214	0.19	136	77
15	900	1.83	0.26	258	0.16	164	92
20	1200	1.65	0.23	302	0.15	192	108
25	1500	1.45	0.20	326	0.13	208	116
30	1800	1.27	0.18	339	0.11	216	120
35	2100	1.19	0.17	368	0.11	234	130
40	2400	1.11	0.16	390	0.10	248	138
45	2700	1.04	0.15	410	0.09	260	144
50	3000	0.96	0.13	418	0.09	266	147
55	3300	0.88	0.12	421	0.08	267	147
60	3600	0.8	0.11	416	0.07	265	145
65	3900	0.78	0.11	439	0.07	279	153
70	4200	0.75	0.11	453	0.07	288	158
75	4500	0.72	0.10	466	0.06	296	161

80	4800	0.7	0.10	482	0.06	307	167
85	5100	0.67	0.09	490	0.06	311	169
90	5400	0.65	0.09	503	0.06	320	173
95	5700	0.63	0.09	514	0.06	327	177
100	6000	0.61	0.09	523	0.05	333	180
105	6300	0.59	0.08	531	0.05	337	182
110	6600	0.57	0.08	537	0.05	341	184
115	6900	0.55	0.08	541	0.05	344	185
120	7200	0.53	0.07	544	0.05	346	185
125	7500	0.51	0.07	545	0.05	346	185
130	7800	0.49	0.07	544	0.04	346	184
135	8100	0.47	0.07	542	0.04	344	183
150	9000	0.43	0.06	550	0.04	350	184
165	9900	0.4	0.06	562	0.04	357	187
180	10800	0.38	0.05	582	0.03	370	193
195	11700	0.37	0.05	614	0.03	390	202
210	12600	0.36	0.05	643	0.03	409	211
225	13500	0.34	0.05	650	0.03	413	212
240	14400	0.33	0.05	673	0.03	428	219
300	18000	0.29	0.04	738	0.03	469	236
360	21600	0.25	0.04	762	0.02	485	239
365	21900	0.25	0.04	773	0.02	491	242
370	22200	0.25	0.04	784	0.02	498	245
1080	64800	0.14	0.02	1,277	0.01	812	348
1440	86400	0.11	0.02	1,337	0.01	850	332

### GFA Design Dimensions

GFA Bed Variables:

Length = 46.00 ft

Avg Width = 19.00 ft

Depth = 6.00 in

Side Slopes = 3 :1

Free Board = 2.00 in

Required Treatment Volume:

465 cf

Resulting Dimensions at Operating Level:

49.00 ft Bed Area 874 sf

22.00 ft Top Area 1,078 sf

Resulting Top Dimensions (including free board):

50.00 ft Height 8.00 in

23.00 ft Top Area 1,150 sf

Resulting Volume:

487 cf Trench L 0

3,642 gal Trench W 0

Trench A 0.00