STORM WATER MANAGEMENT FACILITIES REPORT

FOR

Storage Facility

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I. INTRODUCTION

INTRODUCTION

Project Description

This Storm Water Management Facilities Report is being prepared for proposed storage facility. The site is 4.29 acres and is currently an open field. It was previously zoned C-2 and has been rezoned as C-3. The existing lot is proposed to be subdivided. The storage facility will be lot A, 2.39 acres on the western part of the site. The eastern lot B will be 1.90 acres.

A nested bioretention basin is proposed for water quality, channel protection and flood volume for lot A. A detention basin is proposed for flood volume on lot B, assuming a future development that is 95% impervious.

Existing Site Information

The existing site consists of a grass field. There is no existing detention or water quality BMP on site.

The site is in the Dardenne Creek Watershed. Most of the site drains towards the southwest into existing storm sewers.

Proposed Site Information

The proposed disturbed area for this project is 2.72 acres The tributary area to the proposed bioretention basins is 1.84 acres, which include the roofs, parking lots and most of the drives. The untreated disturbed area consists of a portion of the entrance, grass slopes around the perimeter of the site and the proposed detention basin for lot B, so this is the maximum extent practicable.

Detention Basin Routing Information

The proposed detention basins and bypass areas were routed utilizing the Haestaed Pondpack software for the 2-year, 15-year, 25-year and 100-year storms, based on the calculated runoffs using the Rational Method. The release rates for each basin are compared to the existing (undeveloped) runoffs:

BASIN RELEASE RATES

	To Basin	Exisitng (Allowable)	From Basin	Difference
Basin A	(c.f.s.)	(c.f.s.)	(c.f.s.)	(c.f.s.)
2 yr	3.94	2.12	0	-2.12
15 yr	5.83	3.13	0	-3.13
25 yr	6.34	3.4	0	-3.4
100 yr	7.86	4.21	0	-4.21
Basin B	(c.f.s.)	(c.f.s.)	(c.f.s.)	(c.f.s.)
2 yr	4.42	2.19	1.51	-0.68
15 yr	6.54	3.23	1.72	-1.51
25 yr	7.12	3.52	1.79	-1.73
100 yr	8.82	4.35	1.94	-2.41

BASIN PONDING ELEVATIONS

		High Water Elevation (ft.)	Ponding Height (ft.)	Berm Height (ft.)	Freeboard (ft.)
	WQv	567.50	1	570.75	3.25
	Cpv	568.75	2.25	570.75	2
	2 yr	567.34	0.84	570.75	3.41
	15 yr	568.05	1.55	570.75	2.70
	25 yr	568.22	1.72	570.75	2.53
Basin A	100 yr	568.72	2.22	570.75	2.03
	2 yr	565.52	3.02	570.25	4.73
	15 yr	566.48	3.98	570.25	3.77
	25 yr	566.70	4.20	570.25	3.55
	100 yr	567.31	4.81	570.25	2.94
Basin B	100 yr LFB	568.15	5.65	570.25	2.10

Basin Routing with Low Flow Blocked

Basin B was also routed with the Haestaed Pondpack software, for the 100-year storm, assuming the low flow orifice was blocked and water ponded in the basin to the elevation of the inlet sill. This calculation verifies the capacity of the design system to still handle the volume of storm water runoff, assuming debris has blocked the low flow orifice which regulates the discharge. Basin A does not have a low flow orifice, since the smaller storms go through the bioretention soil media and the only opening is the area inlet sill.

Water Quality Measures

Water quality treatment is provided in the nested bioretention basin for lot A.

II. WATER QUALITY CALCULATIONS

Storage Facility

WATER QUALITY CALCULATIONS

BMP 1 Bioretention Basin 1

Water Quality Volume (WQv)

Tributary Area = = 1.84 ac.
Impervious Area = = 1.47 ac.
Pervious Area = = 0.37 ac.
% Impervious (I) = 1.47 ac. / 1.84 ac. x100 = 79.9 %

WQv = {(P)(Rv)(A)} / 12 where: P = 1.14 in.
Rv = 0.05 + 0.009(I) = 0.77
A = 1.84 ac.

WQv = 1.14 x 0.77 x 1.84 / 12

WQv = 0.13 ac.*ft. x 43,560 s.f./ac.
WQv = **5,856 c.f.**

Bioretention Calculations

Filter Bed Area (Af)

Af = WQv x df / k x (hf + df) x tf

Af = Surface area of filter bed (s.f.)
WQv = Water Quality Volume (c.f.)
df = Filter Bed Depth (ft.)
k = coefficient of permeability of filter media (ft./day)
hf = average height of water above filter bed (ft.)
tf = design filter bed drain time (days)
* 1.67 days recommended for sand filters
2.0 days for bioretention

WQv = 5,856 c.f.
df = 2.5 ft.
k = 2 ft./day
hf = 0.75 ft.
tf = 2 days

Required:

Af = 5,856 x 2.5 / 2 x (0.75 + 2.5) x 2

Af = 1,126 s.f.

Provided:

Af = 2,415 s.f. at 566.5 > 1,126 s.f.

Required:

75% of WQv prior to filtration = 4392

Bioretention Basin				
Elevation	Area	0.40 * Area	ncremental Volume	Volume Sum
	(s.f.)	(s.f.)	(c.f.)	(c.f.)
Bio-Soil Media Storage				
564.00	2,415	966	0	0
565.00	2,415	966	966	966
566.00	2,415	966	966	1,932
566.50	2,415	966	483	2,415
Basin Storage Volume				
Elevation	Area	A1+A2+sqr(A1xA2)	ncremental Volume	Volume Sum
	(s.f.)	(s.f.)	(c.f.)	(c.f.)
566.50	2,415	0	0	0
567.00	2,720	7,698	1,283	1,283
567.50	3,040	8,636	1,439	2,722
			Total Volume	5,137

WQv provided	**5,137**	>	**4,392**	**c.f.**

III. CHANNEL PROTECTION CALCULATIONS

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CHANNEL PROTECTION VOLUME CALCULATIONS

CP_v: Area 1

Channel Protection Volume

Tributary Area = 1.84 ac.

Impervious Area = 1.47 ac.

Pervious Area = 0.37 ac.

T_c (Time of Concentration) = 5.0 min. 0.08

P (rainfall depth for 1 yr., 24 hr. storm) = 2.50 in.

% Impervious (I) = $\frac{1.47 \text{ ac.}}{1.8 \text{ ac.}}$ x100 = 79.9 %

S= (1000/CN) - 10 = 0.53

Qa = $\frac{(P - Ia)^2}{(P - Ia) + S}$ = 1.96 in.

CN Value = 95

Ia (initial abstraction) = 200/CN-2

= 200/ 95 -2

= 0.11

Ia/P = 0.042

1 Year Post Developed Peak Discharge (from Figure D.11.1)

$q_i = q_u A Q_a$ where: q_u = unit peak factor (fig. D.11.1)

= 1,000 csm/in.

A = drainage area in square miles

= 1.84 ac.

= 0.003 sq. mi.

Q_a = 1 yr. post developed runoff

= 1.96 in.

q_i = 1,000 * 0.003 * = 1.96

q_i = 5.6444 c.f.s.

q_o/q_i = 0.020 (from Figure D.11.2; T=24 hrs.)

q_o = peak outflow discharge

$q_o = (q_o/q_i)(q_i)$

q_o = 0.020 * 5.644351588

q_o = **0.113 cfs** (CP_v Release Rate)

Ratio of Storage to Runoff Volume

V_s/V_r (Extended Detention Storage Volume)

$V_s/V_r = 0.683 - 1.43 (q_o/q_i) + 1.64 (q_o/q_i)^2 - 0.804 (q_o/q_i)^3$

V_s/V_r = 0.655

Extended Detention Storage Volume (V_s)

$V_s = (V_s/V_r)(V_r)$ $V_r = Q_a$

V_s = 0.655 * 1.96

V_s = 1.286 in.

Convert to ac.*ft.

$V_s = V_s/12*A$

$V_s = \frac{1.286}{12} * 1.84$

V_s = 0.197 ac.*ft.

V_s = **8,590 c.f.**

Bioretention Basin				
Elevation	Area	0.40 * Area	Incremental Volume	Volume Sum
	(s.f.)	(s.f.)	(c.f.)	(c.f.)
Bio-Soil Media Storage				
564.00	2,415	966	0	0
565.00	2,415	966	966	966
566.00	2,415	966	966	1,932
566.50	2,415	966	483	2,415
Basin Storage Volume				
Elevation	Area	A1+A2+sqr(A1xA2)	Incremental Volume	Volume Sum
	(s.f.)	(s.f.)	(c.f.)	(c.f.)
566.50	2,415	0	0	0
567.00	2,720	7,698	1,283	1,283
568.00	3,370	9,118	3,039	4,322
568.75	3,900	10,895	2,724	7,045
			Total Volume	9,460

CPv provided	**9,460**	>	**8,590 c.f.**

IV. HYDRAULIC CALCS

15 YR

HYDRAULIC CALCULATION SHEET (SEE DRAINAGE AREA PLAN FOR P.I. AND Q (inflow) FOR EACH STRUCTURE)

Project name:	***Storage Facility***	**Calculated By:**	***AMG***
Project number:	***1919***	**Checked By:**	***BAH***
Project Location:	***O'Fallon, MO***	**Date:**	***9/10/19***

Bend Coefficients :

5° = 0.06	20° = 0.24	35° = 0.40	50° = 0.50	65° = 0.57	80° = 0.65
10° = 0.11	25° = 0.30	40° = 0.43	55° = 0.52	70° = 0.60	85° = 0.67
15° = 0.18	30° = 0.35	45° = 0.47	60° = 0.55	75° = 0.62	90° = 0.70

	LINE		FLOW LINE ELEVATIONS												HEAD LOSS				Hydraulic Elevations					
Structure Number	Upper structure	Lower structure	Upper structure	Lower Structure	Length (ft)	Flowline Grade ft/ft	Pipe Size (in.)	Full Flow Cap. (cfs)	Total (Q) (cfs)	Mean Full Flow Vel.(V) (ft/s)	Bend Coef.	Velocity Head (V_h) (ft	QV_h (ft^4/s)	Pipe Coef. (n)	H_f (ft)	Junction (ft)	Bend (ft)	Total H_{mt}	Upper F.I + Dia.	Lower H.E. +H_f	Lower H.E.	Structure Upper H.E. + H_{mt}	TOP or SILL Structure Elevation	Free Board	Structure Number
12	12	11	568.50	567.50	102.7	0.0097	12	3.52	0.21	0.27	0.00	0.00	0.00	0.013	0.00	0.00	0.00	0.00	569.50	569.66	569.66	569.66	571.50	1.84	12
11	11	10	567.50	567.15	142.2	0.0025	12	1.77	1.01	1.29	0.47	0.03	0.03	0.013	0.11	0.03	0.01	0.05	568.50	569.61	569.50	569.66	570.50	0.84	11
10	10	9	567.15	566.85	61.5	0.0049	12	2.50	1.26	1.60	0.06	0.04	0.05	0.013	0.08	0.03	0.00	0.03	568.15	569.47	569.39	569.50	571.50	2.00	10
9	9	2	566.85	566.65	66.6	0.0030	12	1.96	1.40	1.78	0.52	0.05	0.07	0.013	0.10	0.02	0.03	0.04	567.85	569.35	569.25	569.39	570.75	1.36	9
2	2		566.65												Starting HGL = HGL AT 2										
8	8	7	568.50	568.35	60.7	0.0025	12	1.78	0.21	0.27	0.00	0.00	0.00	0.013	0.00	0.00	0.00	0.00	569.50	570.35	570.34	570.35	571.50	1.15	8
7	7	6	568.35	568.20	79.2	0.0019	12	1.55	0.42	0.53	0.70	0.00	0.00	0.013	0.01	0.01	0.00	0.01	569.35	570.34	570.32	570.34	571.50	1.16	7
6	6	5	568.20	567.80	79.2	0.0051	12	2.54	1.41	1.80	0.00	0.05	0.07	0.013	0.12	0.06	0.00	0.06	569.20	570.26	570.14	570.32	571.50	1.18	6
5	5	4	567.80	567.40	79.2	0.0051	15	4.60	2.76	2.25	0.00	0.08	0.22	0.013	0.14	0.07	0.00	0.07	569.05	570.07	569.92	570.14	571.50	1.36	5
4	4	3	567.40	567.00	79.2	0.0051	15	4.60	3.61	2.94	0.00	0.13	0.49	0.013	0.25	0.10	0.00	0.10	568.65	569.82	569.58	569.92	571.50	1.58	4
3	3	2	567.00	566.65	62.2	0.0056	15	4.86	3.75	3.06	0.67	0.14	0.54	0.013	0.21	0.02	0.10	0.12	568.25	569.46	569.25	569.58	571.50	1.92	3
2	2	1	566.65	566.50	16.5	0.0091	15	6.18	5.29	4.31	0.65	0.29	1.53	0.013	0.11	0.23	0.19	0.42	567.90	568.83	568.72	569.25	570.75	1.50	2
1	1		566.50												Starting HGL = 100 YR EL										
14	14	13	564.00	563.70	60.0	0.0050	18	7.45	5.83	3.30	0.00	0.17	0.99	0.013	0.18	0.22	0.00	0.22	565.50	565.38	565.20	565.72	568.75	3.03	14
13	13		563.70												Starting HGL = Top of pipe at 13										
16	16	15	562.35	562.00	68.0	0.0051	18	7.56	6.54	3.70	0.00	0.21	1.39	0.013	0.26	0.28	0.00	0.28	563.85	563.76	563.50	564.13	567.75	3.62	16
15	15		562.00												Starting HGL = Top of pipe at 15										

MEAN FULL FLOW VELOCI $V = Q_{ACT.}/A_{PIPE}$

FRICTION LOSS (H_f) : $Hf = 2.87\ n^2\ (LV^2/d^{1.33})$

VELOCITY HEAD : $V_h = V^2/2g$

JUNCTION LOSSES (JUNC.) = $[\ Q_{out}Vh_{out} - Sum\ (Q_{in}V_{in})]x1.33/Q_{out}$

BEND LOSSES (BEND) = $(V^2_{in}/2g)$ * ANGLE COEFFICIENT

Note:

1. IF MORE THAN ONE INCOMING LINE, CALCULATE EACH BEND LOSS AND ADD TOGETHER.
2. NO STRUCTURE LOSSES TO BE CALCULATED AT A DROP.
3. IF $QV_{h(in)} > QV_{h(out)}$, NO JUNCTION LOSSES TO BE CALCULATED.

V. DETENTION BASIN ROUTING (PondPack V8i)

A. Proposed and Allowable Runoff Rates
B. 2 Year 20 Minute
C. 15 Year 20 Minute
D. 25 Year 20 Minute
E. 100 Year 20 Minute

Lot A
Peak Runoff
(Rational Method)
CEDC 1919

2 year, 20 minute storm

Impervious		1.47	AC @	2.39	3.51
Pervious		0.37	AC @	1.15	0.43
	Total	**1.84**			**3.94**

15 year, 20 minute storm

Impervious		1.47	AC @	3.54	5.20
Pervious		0.37	AC @	1.70	0.63
	Total	**1.84**			**5.83**

25 year, 20 minute storm

Impervious		1.47	AC @	3.85	5.66
Pervious		0.37	AC @	1.85	0.68
	Total	**1.84**			**6.34**

100 year, 20 minute storm

Impervious		1.47	AC @	4.77	7.01
Pervious		0.37	AC @	2.29	0.85
	Total	**1.84**			**7.86**

Lot A
Allowable Release Rate
(Rational Method)
CEDC 1919

2 year, 20 minute storm

Pervious		1.84	AC @	1.15	2.12
	Total	**1.84**			**2.12**

15 year, 20 minute storm

Pervious		1.84	AC @	1.70	3.13
	Total	**1.84**			**3.13**

25 year, 20 minute storm

Pervious		1.84	AC @	1.85	3.40
	Total	**1.84**			**3.40**

100 year, 20 minute storm

Pervious		1.84	AC @	2.29	4.21
	Total	**1.84**			**4.21**

Storage Facility

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
To Basin	Watershed - 15	0	0.161	0.083	5.83
To Basin	Watershed - 2	0	0.109	0.083	3.94
To Basin	Watershed - 25	0	0.175	0.083	6.34
To Basin	Watershed - 100	0	0.217	0.083	7.86

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Basin Out	Watershed - 15	0	0.000	0.000	0.00
Basin Out	Watershed - 2	0	0.000	0.000	0.00
Basin Out	Watershed - 25	0	0.000	0.000	0.00
Basin Out	Watershed - 100	0	0.000	0.000	0.00

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Basin (IN)	Watershed - 15	0	0.159	0.100	5.83	(N/A)	(N/A)
Basin (OUT)	Watershed - 15	0	0.000	0.000	0.00	568.05	0.159
Basin (IN)	Watershed - 2	0	0.107	0.100	3.94	(N/A)	(N/A)
Basin (OUT)	Watershed - 2	0	0.000	0.000	0.00	567.34	0.107
Basin (IN)	Watershed - 25	0	0.173	0.100	6.34	(N/A)	(N/A)
Basin (OUT)	Watershed - 25	0	0.000	0.000	0.00	568.22	0.172
Basin (IN)	Watershed - 100	0	0.214	0.100	7.86	(N/A)	(N/A)
Basin (OUT)	Watershed - 100	0	0.000	0.000	0.00	568.72	0.214

Storage Facility

Subsection: Elevation-Area Volume Curve
Return Event: 2 years
Label: Basin
Storm Event:

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr(A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
564.00	0.0	965.0	0.0	0.000	0.000
565.00	0.0	965.0	2,895.0	0.022	0.022
566.49	0.0	965.0	2,895.0	0.033	0.055
566.50	0.0	2,415.0	4,906.6	0.000	0.056
567.00	0.0	2,720.0	7,698.0	0.029	0.085
568.00	0.0	3,370.0	9,117.6	0.070	0.155
569.00	0.0	4,080.0	11,158.0	0.085	0.240
570.00	0.0	4,845.0	13,371.1	0.102	0.342

Storage Facility

Subsection: Outlet Input Data
Label: Outlet 1

Return Event: 2 years
Storm Event:

Requested Pond Water Surface Elevations	
Minimum (Headwater)	564.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	570.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Area Inlet Weir568.75	Forward	Outfall Pipe	568.75	570.00
Culvert-Circular	Outfall Pipe	Forward	TW	564.00	570.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Storage Facility

Subsection: Outlet Input Data
Label: Outlet 1

Return Event: 2 years
Storm Event:

Structure ID: Area Inlet Weir568.75 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	568.75 ft
Weir Length	11.67 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Outfall Pipe Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	18.0 in
Length	59.96 ft
Length (Computed Barrel)	59.96 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.018
Kr	0.200
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.092
T2 ratio (HW/D)	1.195
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	565.64 ft	T1 Flow	7.58 ft³/s
T2 Elevation	565.79 ft	T2 Flow	8.66 ft³/s

Storage Facility

Subsection: Outlet Input Data
Label: Outlet 1

Return Event: 2 years
Storm Event:

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.100 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Storage Facility

Subsection: Elevation-Volume-Flow Table (Pond) Return Event: 2 years

Label: Basin Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
564.00	0.00	0.000	965.0	0.00	0.00	0.00
564.50	0.00	0.011	965.0	0.00	0.00	5.36
565.00	0.00	0.022	965.0	0.00	0.00	10.72
565.50	0.00	0.033	965.0	0.00	0.00	16.08
566.00	0.00	0.044	965.0	0.00	0.00	21.44
566.50	0.00	0.056	2,415.0	0.00	0.00	26.88
567.00	0.00	0.085	2,720.0	0.00	0.00	41.14
567.50	0.00	0.118	3,036.3	0.00	0.00	57.12
568.00	0.00	0.155	3,370.0	0.00	0.00	74.90
568.50	0.00	0.195	3,716.5	0.00	0.00	94.58
568.75	0.00	0.217	3,896.1	0.00	0.00	105.15
569.00	4.39	0.240	4,080.0	0.00	4.39	120.62
569.50	18.66	0.289	4,454.3	0.00	18.66	158.59
570.00	20.33	0.342	4,845.0	0.00	20.33	186.08

Storage Facility

Subsection: Elevation-Volume-Flow Table (Pond)
Label: Basin

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
564.00	0.00	0.000	965.0	0.00	0.00	0.00
564.50	0.00	0.011	965.0	0.00	0.00	5.36
565.00	0.00	0.022	965.0	0.00	0.00	10.72
565.50	0.00	0.033	965.0	0.00	0.00	16.08
566.00	0.00	0.044	965.0	0.00	0.00	21.44
566.50	0.00	0.056	2,415.0	0.00	0.00	26.88
567.00	0.00	0.085	2,720.0	0.00	0.00	41.14
567.50	0.00	0.118	3,036.3	0.00	0.00	57.12
568.00	0.00	0.155	3,370.0	0.00	0.00	74.90
568.50	0.00	0.195	3,716.5	0.00	0.00	94.58
568.75	0.00	0.217	3,896.1	0.00	0.00	105.15
569.00	4.39	0.240	4,080.0	0.00	4.39	120.62
569.50	18.66	0.289	4,454.3	0.00	18.66	158.59
570.00	20.33	0.342	4,845.0	0.00	20.33	186.08

Storage Facility

Subsection: Elevation-Volume-Flow Table (Pond) Return Event: 25 years

Label: Basin Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
564.00	0.00	0.000	965.0	0.00	0.00	0.00
564.50	0.00	0.011	965.0	0.00	0.00	5.36
565.00	0.00	0.022	965.0	0.00	0.00	10.72
565.50	0.00	0.033	965.0	0.00	0.00	16.08
566.00	0.00	0.044	965.0	0.00	0.00	21.44
566.50	0.00	0.056	2,415.0	0.00	0.00	26.88
567.00	0.00	0.085	2,720.0	0.00	0.00	41.14
567.50	0.00	0.118	3,036.3	0.00	0.00	57.12
568.00	0.00	0.155	3,370.0	0.00	0.00	74.90
568.50	0.00	0.195	3,716.5	0.00	0.00	94.58
568.75	0.00	0.217	3,896.1	0.00	0.00	105.15
569.00	4.39	0.240	4,080.0	0.00	4.39	120.62
569.50	18.66	0.289	4,454.3	0.00	18.66	158.59
570.00	20.33	0.342	4,845.0	0.00	20.33	186.08

Storage Facility

Subsection: Elevation-Volume-Flow Table (Pond) Return Event: 100 years

Label: Basin Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
564.00	0.00	0.000	965.0	0.00	0.00	0.00
564.50	0.00	0.011	965.0	0.00	0.00	5.36
565.00	0.00	0.022	965.0	0.00	0.00	10.72
565.50	0.00	0.033	965.0	0.00	0.00	16.08
566.00	0.00	0.044	965.0	0.00	0.00	21.44
566.50	0.00	0.056	2,415.0	0.00	0.00	26.88
567.00	0.00	0.085	2,720.0	0.00	0.00	41.14
567.50	0.00	0.118	3,036.3	0.00	0.00	57.12
568.00	0.00	0.155	3,370.0	0.00	0.00	74.90
568.50	0.00	0.195	3,716.5	0.00	0.00	94.58
568.75	0.00	0.217	3,896.1	0.00	0.00	105.15
569.00	4.39	0.240	4,080.0	0.00	4.39	120.62
569.50	18.66	0.289	4,454.3	0.00	18.66	158.59
570.00	20.33	0.342	4,845.0	0.00	20.33	186.08

Storage Facility

Subsection: Level Pool Pond Routing Summary
Return Event: 2 years
Label: Basin (IN)
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	3.94 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	567.34 ft
Volume (Peak)	0.107 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.107 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.000 ac-ft
Volume (Retained)	0.107 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.4 %

Storage Facility

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	5.83 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	568.05 ft
Volume (Peak)	0.159 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.159 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.000 ac-ft
Volume (Retained)	0.159 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Storage Facility

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Return Event: 25 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	6.34 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	568.22 ft
Volume (Peak)	0.172 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.173 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.000 ac-ft
Volume (Retained)	0.172 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.3 %

Storage Facility

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Return Event: 100 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	564.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	7.86 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	568.72 ft
Volume (Peak)	0.214 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.214 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.000 ac-ft
Volume (Retained)	0.214 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Storage Facility

Subsection: Pond Routed Hydrograph (total out) Return Event: 2 years
Label: Basin (OUT) Storm Event:

Peak Discharge	0.00 ft³/s
Time to Peak	11.650 hours
Hydrograph Volume	0.000 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Storage Facility

Subsection: Pond Routed Hydrograph (total out)
Label: Basin (OUT)

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Storage Facility

Subsection: Pond Routed Hydrograph (total out) Return Event: 25 years

Label: Basin (OUT) Storm Event:

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Storage Facility

Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years

Label: Basin (OUT) Storm Event:

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Lot B
Peak Runoff
(Rational Method)
CEDC 1919

2 year, 20 minute storm

Impervious		1.80	AC @	2.39	4.30
Pervious		0.10	AC @	1.15	0.12
	Total	**1.90**			**4.42**

15 year, 20 minute storm

Impervious		1.80	AC @	3.54	6.37
Pervious		0.10	AC @	1.70	0.17
	Total	**1.90**			**6.54**

25 year, 20 minute storm

Impervious		1.80	AC @	3.85	6.93
Pervious		0.10	AC @	1.85	0.19
	Total	**1.90**			**7.12**

100 year, 20 minute storm

Impervious		1.80	AC @	4.77	8.59
Pervious		0.10	AC @	2.29	0.23
	Total	**1.90**			**8.82**

Lot B
Allowable Release Rate
(Rational Method)
CEDC 1919

2 year, 20 minute storm

Pervious		1.90	AC @	1.15	2.19
	Total	**1.90**			**2.19**

15 year, 20 minute storm

Pervious		1.90	AC @	1.70	3.23
	Total	**1.90**			**3.23**

25 year, 20 minute storm

Pervious		1.90	AC @	1.85	3.52
	Total	**1.90**			**3.52**

100 year, 20 minute storm

Pervious		1.90	AC @	2.29	4.35
	Total	**1.90**			**4.35**

Storage Facility Lot B

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
To Basin	Watershed - 100	0	10,584.000	0.083	8.82
To Basin	Watershed - 2	0	5,304.000	0.083	4.42
To Basin	Watershed - 25	0	8,544.000	0.083	7.12
To Basin	Watershed - 15	0	7,848.000	0.083	6.54

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
Basin Out	Watershed - 100	0	10,478.000	0.400	1.94
Basin Out	Watershed - 2	0	5,251.000	0.400	1.51
Basin Out	Watershed - 25	0	8,459.000	0.400	1.79
Basin Out	Watershed - 15	0	7,770.000	0.400	1.72

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin (IN)	Watershed - 100	0	10,478.000	0.100	8.82	(N/A)	(N/A)
Basin (OUT)	Watershed - 100	0	10,478.000	0.400	1.94	567.31	8,300.000
Basin (IN)	Watershed - 2	0	5,251.000	0.100	4.42	(N/A)	(N/A)
Basin (OUT)	Watershed - 2	0	5,251.000	0.400	1.51	565.52	3,633.000
Basin (IN)	Watershed - 25	0	8,459.000	0.100	7.12	(N/A)	(N/A)
Basin (OUT)	Watershed - 25	0	8,459.000	0.400	1.79	566.70	6,469.000
Basin (IN)	Watershed - 15	0	7,770.000	0.100	6.54	(N/A)	(N/A)
Basin (OUT)	Watershed - 15	0	7,770.000	0.400	1.72	566.48	5,866.000

Storage Facility Lot B

Subsection: Elevation-Area Volume Curve
Return Event: 100 years
Label: Basin
Storm Event:

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr(A1*A2) (ft²)	Volume (ft³)	Volume (Total) (ft³)
562.50	0.0	100.0	0.0	0.000	0.000
563.00	0.0	790.0	1,171.1	195.000	195.000
564.00	0.0	1,220.0	2,991.7	997.000	1,192.000
565.00	0.0	1,730.0	4,402.8	1,468.000	2,660.000
566.00	0.0	2,320.0	6,053.4	2,018.000	4,678.000
567.00	0.0	2,990.0	7,943.8	2,648.000	7,326.000
568.00	0.0	3,690.0	10,001.6	3,334.000	10,660.000
569.00	0.0	4,445.0	12,184.9	4,062.000	14,721.000
570.00	0.0	5,260.0	14,540.4	4,847.000	19,568.000

Storage Facility Lot B

Subsection: Outlet Input Data
Label: Outlet 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	562.50 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	570.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 1	Forward	Outfall Pipe	562.50	570.00
Rectangular Weir	Area Inlet Weir	Forward	Outfall Pipe	567.75	570.00
Culvert-Circular	Outfall Pipe	Forward	TW	562.35	570.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Storage Facility Lot B

Subsection: Outlet Input Data
Label: Outlet 1

Structure ID: Area Inlet Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	567.75 ft
Weir Length	11.67 ft
Weir Coefficient	3.00 (ft^0.5)/s

Storage Facility Lot B

Subsection: Outlet Input Data
Label: Outlet 1

Structure ID: Outfall Pipe Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	18.0 in
Length	68.01 ft
Length (Computed Barrel)	68.01 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.018
Kr	0.200
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.092
T2 ratio (HW/D)	1.195
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	563.99 ft	T1 Flow	7.58 ft³/s
T2 Elevation	564.14 ft	T2 Flow	8.66 ft³/s

Storage Facility Lot B

Subsection: Outlet Input Data
Label: Outlet 1

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	562.50 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.100 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Storage Facility Lot B

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Return Event: 2 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	562.50 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	4.42 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	1.51 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	565.52 ft
Volume (Peak)	3,633.232 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	5,251.000 ft³
Volume (Total Infiltration)	0.000 ft³
Volume (Total Outlet Outflow)	5,251.000 ft³
Volume (Retained)	0.000 ft³
Volume (Unrouted)	0.000 ft³
Error (Mass Balance)	0.0 %

Storage Facility Lot B

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	562.50 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	6.54 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	1.72 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	566.48 ft
Volume (Peak)	5,865.959 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	7,770.000 ft³
Volume (Total Infiltration)	0.000 ft³
Volume (Total Outlet Outflow)	7,770.000 ft³
Volume (Retained)	0.000 ft³
Volume (Unrouted)	0.000 ft³
Error (Mass Balance)	0.0 %

Storage Facility Lot B

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Return Event: 25 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	562.50 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	7.12 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	1.79 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	566.70 ft
Volume (Peak)	6,469.469 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	8,459.000 ft³
Volume (Total Infiltration)	0.000 ft³
Volume (Total Outlet Outflow)	8,459.000 ft³
Volume (Retained)	0.000 ft³
Volume (Unrouted)	0.000 ft³
Error (Mass Balance)	0.0 %

Storage Facility Lot B

Subsection: Level Pool Pond Routing Summary
Return Event: 100 years
Label: Basin (IN)
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	562.50 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	8.82 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	1.94 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	567.31 ft
Volume (Peak)	8,299.817 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	10,478.000 ft³
Volume (Total Infiltration)	0.000 ft³
Volume (Total Outlet Outflow)	10,478.000 ft³
Volume (Retained)	0.000 ft³
Volume (Unrouted)	0.000 ft³
Error (Mass Balance)	0.0 %

Storage Facility Lot B

Subsection: Pond Routed Hydrograph (total out) Return Event: 2 years

Label: Basin (OUT) Storm Event:

Peak Discharge	1.51 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	5,250.683 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.48	0.89	1.01	1.15
0.250	1.32	1.43	1.50	1.51	1.49
0.500	1.45	1.41	1.37	1.30	1.23
0.750	1.17	1.11	1.07	1.02	0.98
1.000	0.95	0.92	0.89	0.81	0.69
1.250	0.58	0.50	0.34	0.22	0.14
1.500	0.09	0.06	0.04	0.02	0.02
1.750	0.01	0.01	0.00	0.00	0.00
2.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Storage Facility Lot B

Subsection: Pond Routed Hydrograph (total out)
Label: Basin (OUT)

Peak Discharge	1.72 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	7,769.143 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.57	0.96	1.20	1.42
0.250	1.55	1.64	1.70	1.72	1.71
0.500	1.68	1.66	1.64	1.61	1.58
0.750	1.54	1.51	1.48	1.44	1.40
1.000	1.35	1.28	1.22	1.15	1.10
1.250	1.05	1.01	0.97	0.94	0.91
1.500	0.88	0.77	0.66	0.56	0.47
1.750	0.30	0.19	0.12	0.08	0.05
2.000	0.03	0.02	0.01	0.01	0.01
2.250	0.00	0.00	0.00	0.00	(N/A)

Storage Facility Lot B

Subsection: Pond Routed Hydrograph (total out) Return Event: 25 years

Label: Basin (OUT) Storm Event:

Peak Discharge	1.79 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	8,458.185 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.60	0.98	1.26	1.47
0.250	1.59	1.68	1.75	1.79	1.77
0.500	1.73	1.71	1.68	1.66	1.64
0.750	1.61	1.58	1.54	1.51	1.47
1.000	1.44	1.40	1.35	1.28	1.22
1.250	1.15	1.10	1.05	1.01	0.97
1.500	0.94	0.91	0.88	0.77	0.65
1.750	0.56	0.47	0.30	0.19	0.12
2.000	0.08	0.05	0.03	0.02	0.01
2.250	0.01	0.01	0.00	0.00	0.00
2.500	0.00	(N/A)	(N/A)	(N/A)	(N/A)

Storage Facility Lot B

Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years
Label: Basin (OUT) Storm Event:

Peak Discharge	1.94 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	10,477.858 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.67	1.05	1.40	1.58
0.250	1.69	1.82	1.91	1.94	1.93
0.500	1.91	1.88	1.85	1.82	1.78
0.750	1.75	1.72	1.69	1.67	1.65
1.000	1.62	1.59	1.56	1.53	1.49
1.250	1.45	1.42	1.38	1.32	1.25
1.500	1.18	1.12	1.08	1.03	0.99
1.750	0.95	0.92	0.90	0.83	0.71
2.000	0.60	0.51	0.38	0.24	0.15
2.250	0.10	0.06	0.04	0.03	0.02
2.500	0.01	0.01	0.00	0.00	0.00
2.750	0.00	0.00	(N/A)	(N/A)	(N/A)

Storage Facility Lot B- LFB

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
To Basin	Watershed - 100	0	10,584.000	0.083	8.82

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
Basin Out	Watershed - 100	0	10,478.000	0.300	8.82

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin (IN)	Watershed - 100	0	10,478.000	0.100	8.82	(N/A)	(N/A)
Basin (OUT)	Watershed - 100	0	10,478.000	0.300	8.82	568.15	11,207.000

Storage Facility Lot B- LFB

Subsection: Outlet Input Data
Label: Outlet 1

Return Event: 100 years
Storm Event:

Requested Pond Water Surface Elevations	
Minimum (Headwater)	562.50 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	570.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Area Inlet Weir	Forward	Outfall Pipe	567.75	570.00
Culvert-Circular	Outfall Pipe	Forward	TW	562.35	570.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Storage Facility Lot B- LFB

Subsection: Outlet Input Data
Label: Outlet 1

Return Event: 100 years
Storm Event:

Structure ID: Area Inlet Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	567.75 ft
Weir Length	11.67 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Outfall Pipe Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	18.0 in
Length	68.01 ft
Length (Computed Barrel)	68.01 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.018
Kr	0.200
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.092
T2 ratio (HW/D)	1.195
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	563.99 ft	T1 Flow	7.58 ft³/s
T2 Elevation	564.14 ft	T2 Flow	8.66 ft³/s

Storage Facility Lot B- LFB

Subsection: Outlet Input Data
Label: Outlet 1

Return Event: 100 years
Storm Event:

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.100 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Storage Facility Lot B- LFB

Subsection: Elevation-Volume-Flow Table (Pond) Return Event: 100 years

Label: Basin Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	567.75 ft
Volume (Initial)	9,760.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ft³)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
562.50	0.00	0.000	100.0	0.00	0.00	0.00
563.00	0.00	195.178	790.0	0.00	0.00	2.17
563.50	0.00	640.050	993.4	0.00	0.00	7.11
564.00	0.00	1,192.423	1,220.0	0.00	0.00	13.25
564.50	0.00	1,862.471	1,463.9	0.00	0.00	20.69
565.00	0.00	2,660.019	1,730.0	0.00	0.00	29.56
565.50	0.00	3,595.169	2,014.2	0.00	0.00	39.95
566.00	0.00	4,677.818	2,320.0	0.00	0.00	51.98
566.50	0.00	5,918.032	2,644.4	0.00	0.00	65.76
567.00	0.00	7,325.745	2,990.0	0.00	0.00	81.40
567.50	0.00	8,905.180	3,330.8	0.00	0.00	98.95
567.75	0.00	9,759.948	3,508.1	0.00	0.00	108.44
568.00	4.39	10,659.616	3,690.0	0.00	4.39	122.83
568.50	19.53	12,596.065	4,058.7	0.00	19.53	159.48
569.00	21.10	14,721.264	4,445.0	0.00	21.10	184.67
569.50	22.16	17,042.782	4,843.9	0.00	22.16	211.52
570.00	23.11	19,568.050	5,260.0	0.00	23.11	240.53

Storage Facility Lot B- LFB

Subsection: Level Pool Pond Routing Summary
Label: Basin (IN)

Return Event: 100 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	567.75 ft
Volume (Initial)	9,760.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	8.82 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	8.82 ft³/s	Time to Peak (Flow, Outlet)	0.300 hours

Elevation (Water Surface, Peak)	568.15 ft
Volume (Peak)	11,207.118 ft³

Mass Balance (ft³)	
Volume (Initial)	9,760.000 ft³
Volume (Total Inflow)	10,478.000 ft³
Volume (Total Infiltration)	0.000 ft³
Volume (Total Outlet Outflow)	10,478.000 ft³
Volume (Retained)	9,760.000 ft³
Volume (Unrouted)	0.000 ft³
Error (Mass Balance)	0.0 %

Storage Facility Lot B- LFB

Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years

Label: Basin (OUT) Storm Event:

Peak Discharge	8.82 ft³/s
Time to Peak	0.300 hours
Hydrograph Volume	10,478.060 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.61	5.13	8.18	8.71
0.250	8.80	8.82	8.09	5.05	2.33
0.500	0.91	0.35	0.14	0.05	0.02
0.750	0.01	0.00	0.00	0.00	(N/A)

VI. MAINTENANCE AND OPERATION PLAN

E. Maintenance and Operation Plan

F. Stormwater Management Facility Maintenance Inspection Checklist

1. Bioretention Basin Checklist

The responsible party will maintain all private stormwater facilities in good working order. Minimum maintenance of the private facilities shall include routine inspection, maintenance and removal of sediment, debris, oil and foreign material from the storm sewers, inlets and manholes, and routine inspection, maintenance and cleaning of the bioretention basin so that the operation and capacity of the stormwater facilities continues to function properly. The party responsible for maintenance must evaluate the plan for effectiveness at least annually and revise as necessary.

1. **BIORETENTION BASINS**

   A bioretention area, sometimes referred to as a 'rain garden', exists on this property for the purpose of improving water quality of flooding problems that result from stormwater runoff. Responsibility for maintaining this bioretention area lies with the property owner. This maintenance plan explains the basic tasks that are needed to be sure the bioretention area works properly.

   At a minimum, the property owner should inspect the bioretention area in May and October of each year. An inspection checklist/report is provided. A city inspector may also periodically inspect the bioretention area.

   a. The bioretention area may pond water after a rain shower, this is normal. Do not fill in the bioretention area. The bioretention area is intended to temporarily store stormwater and then let it slowly soak into the ground. If standing water remains for longer than 3 days, the top of the planting bed has likely clogged. Clogging can be repaired by raking the surface, soil aeration (poking holes in the top layer of soil), or replacing the top 2-3 inches of planting soil and mulch.

   b. The plant species in the bioretention area were specially selected. These plants typically will not require watering or fertilizing beyond their first year. Watering during drought periods will help plant appearance.

   c. Plants may be trimmed as needed to provide a desirable 'shape'. Between November and March, plants should be cut near the ground surface. It is encouraged to leave the seed heads through the winter for bird watching.

   d. Weeds may be pulled and spot use of herbicides is fine, but blanket herbicide application is not recommended. The insects and birds living around a healthy bioretention area keep mosquito populations in check.

   e. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible.

   f. The area must be inspected for unwanted underbrush and tree growth at least once a year.

   g. Rainwater flowing into the basin may carry trash and debris. Inlet pipes and pop-ups should be checked and cleaned as needed. Trash, debris, leaf litter and sediment should be regularly removed to ensure that the bioretention area is not

clogged and does not fill in. Trash, debris and sediment collected in the bioretention area can normally be disposed with other household waste. Material suspected to be polluted by oil, old paint chips (lead) or other chemicals that could potentially be hazardous should be properly tested and disposed in accordance with state and federal hazardous waste regulations.

2. DETENTION BASIN

A detention basin exists on this property for the purpose of reducing the rate of runoff to match pre-development conditions and reduce the potential of flooding problems that result from stormwater runoff. Responsibility for maintaining this detention area lies with the property owner. This maintenance plan explains the basic tasks that are needed to be sure the detention basin works properly.

At a minimum, the property owner should inspect the detention area in May and October of each year. An inspection checklist/report is provided. The owner of this property must submit a copy of the inspection checklist to MSD. The annual BMP inspection report should be submitted to MSD before March 31st of each year. A MSD inspector will also periodically inspect the detention area.

a. The detention basin area will pond water after a rain shower, this is normal. The runoff is designed to be released slowly over approximately a 24-hour period. Do not fill in the detention basin area.

b. The lawn area within the basin should be periodically mowed and maintained to prevent overgrowth of vegetation.

c. The area must be inspected for unwanted underbrush and tree growth at least once a year.

d. Rainwater flowing into the basin may carry trash and debris. Inlet pipes and low flow pipe should be checked and cleaned as needed. Trash, debris, leaf litter and sediment should be regularly removed to ensure that the basin area and outlets are not clogged and do not fill in. Trash, debris and sediment collected in the basin area can normally be disposed with other household waste.

INSPECTION OF FACILITIES

The property owner will maintain all private stormwater facilities in good working order. The stormwater facilities will have an annual inspection, maintenance, and reporting schedule, every 3 months or as actually needed, whichever is most restrictive.

Inspection of Bioretention Basins:

The raingardens shall be inspected at least 4 times annually. Four times annually means every three months. For this facility, it is recommended that the property owner utilize a checklist to assure that required maintenance and inspections are being performed. A copy of this checklist is provided in the following section. The property owner shall keep a record of the inspection logs detailing the results of the inspection, and any maintenance or corrective action required. Minimum maintenance of the private facilities shall include the routine removal of sediment, debris, oil and foreign material from the storm and sanitary sewers and areas of porous pavement so that the operation and capacity of the facilities continues to function properly.

Inspection Frequency

In the first year of operation, inspections shall take place at least once each quarter during the spring, summer and early fall. Bi-monthly inspections should also be conducted from November through March to determine how leaf litter will impact the flow capacity of the structures. After the first year of operation inspections shall take place at a minimum every 3 months.

Routine (every 3 months) inspections of stormwater facilities shall consist of the following:

1. Inspect each manhole and inlet structure for any silt or debris build-up.

2. Check to see that all sewer structure grates and lids are in place, seated properly and no damage has occurred to the grates or lid.

3. Inspection of the raingardens will consist of the following:
   a. Inspect for sediment and debris at the bottom of the raingarden area. Sediment shall be cleaned out when it reaches a maximum depth of 6".
   b. Check the perforated pipe in the raingardens for blockages. An indication of an improperly functioning perforated pipe is the ponding of water over the filter (if water fails to infiltrate within 48 hours).
   c. Clean or remove debris from obstructing the openings within the overflow catch basins.

In the event that any of the filter media in the stormwater treatment basin needs to be replaced the following are the requirements for filter media replacement.

Upper Gravel Layer:

The washed gravel layer at the top of the perforated pipe must be 6 inches thick and meet ASTM C-33 size No. 8.

Geotextile Fabric:

The geotextile fabric shall be MSD Type 4, or approved equivalent. Geotextile fabric must meet ASTM D-4833 (puncture strength 125 lb.) and ASTM D-4632 (tensile strength 300 lb.) Filter fabric must not be used in these facilities.

Sand Filter Layer:

Washed ASTM C33 Fine Aggregate Concrete Sand is utilized for applications in St. Louis County. Manufactured sand or stone dust is not acceptable.

Gravel Bed Around Underdrain Pipe(s)
The washed gravel layer surrounding the underdrain pipe(s) must meet ASTM C-33 (No. 6 OR 67). See plan for additional information.

Underdrain Pipe
The underdrain pipe consists of 6-inch diameter SDR-35 or stronger perforated PVC pipes at 0.00% slope. Perforations must be 3/8 inch in diameter and must be spaced on 1 foot centers, placed on two sides of the pipe with holes facing down.

Inspection of Detention Basin:

The detention basin shall be inspected at least 4 times annually. Four times annually means every three months. For this facility, it is recommended that the property owner utilize a checklist to assure that required maintenance and inspections are being performed. A copy of this checklist is provided in the following section. The property owner shall keep a record of the inspection logs detailing the results of the inspection, and any maintenance or corrective action required.

Inspection Frequency
In the first year of operation, inspections shall take place at least once each quarter during the spring, summer and early fall. Bi-monthly inspections should also be conducted from November through March to determine how leaf litter will impact the flow capacity of the structures. After the first year of operation inspections shall take place at a minimum every 3 months.
Routine (every 3 months) inspections of stormwater facilities shall consist of the following:

1. Inspect each manhole and inlet structure for any silt or debris build-up.

2. Check to see that all sewer structure grates and lids are in place, seated properly and no damage has occurred to the grates or lid.

3. Inspection of the basin will consist of the following:
   a. Inspect for sediment, trash and leaf litter at the bottom of the basin and the potential for blocking the low-flow orifice and the outfall structure
   b. Check the low-flow orifice for blockages. An indication of an improperly functioning low-flow orifice is the ponding of water longer than 2-days following a rain event
   c. Clean or remove debris from obstructing the openings within the overflow catch basins.

CLEANING OF FACILITIES

The stormwater facility shall be cleaned shortly after the project is completed and erosion control has been removed and vegetation has been established. All silt and debris should be removed from the storm sewer structures and storm sewer lines before reaching the raingarden. All sediment and debris should be diverted away from the bioretention basin.

All sediment removed from the site shall be disposed of according to current erosion and sediment control regulations. When cleaning a BMP, standing “clear, unpolluted water” can

be decanted and discharged to the storm system. Water that has become turbid during cleaning should be either:

1.) Pumped and hauled to an acceptable wastewater disposal facility or
2.) Treated by filtration, such as pumped through a bag filter and discharged to the sanitary sewer system.

The following definitions shall be used as a reference:

Clear water: Water that has settled its solids for 24 hours and can be pumped out of the BMP without re-suspending the solids.

Unpolluted water: Defined by MSD Ordinance 12559 as meaning "any water that may be discharged under NPDES regulations into waters of the State without having to be authorized by a NPDES permit and which will not cause any violations of State or Federal water quality standards."

A special discharge permit is not required for discharging to the sanitary system if the total volume is less than 10,000 gallons. The flow rate pumped into the sanitary system shall not exceed 50 gpm.

The owner is responsible for determining whether the filter media and debris are classified as special waste and for properly handling and disposal of the material. Records of the same must be kept and be made available for inspection by appropriate authorities. Use of a qualified, even possibly license and bonded, disposal service is highly recommended, and should be contacted for assistance and direction. The following general guidance is based on the federal regulations, 40 CFR 262.11- Special Waste Determination. (Note- Regulations are subject to change in the future and this is offered only as general information available at this time.) The generator of the waste should determine if the waste is a special waste using the following method:

1. Determine if the waste is excluded from being a hazardous waste per 10 CSR 25-4.261(2)(A) and 40 CFR 261.4; then
2. Determine if the waste is listed as a hazardous waste per 10 CSR 25-4.261 (2) (D) and 40 CFR 261 subpart D; then
3. Determine if the waste is a characteristic hazardous waste (i.e. ignitable, corrosive, reactive, or toxic). Consider the materials used or the process used to generate the waste.

   Based on this knowledge, determine the appropriate testing and analysis in accordance with 10 CSR 25-4.261(2)(C) and 40 CFR 261 subpart C.

Testing for hazardous waste characteristics requires sampling at the point of generation. If the analyze detects any property characteristic of hazardous waste, you must manage the waste as a hazardous waste. It is very important to understand that hazardous wastes remain hazardous waste when diluted or stabilized, unless it is specifically excluded from the definition of hazardous waste after the process (40 CFR 261.3). You may not dilute hazardous waste solely for the purpose of rendering it non-hazardous, unless dilution is warranted in an emergency response situation or where the dilution is part of a hazardous waste treatment

process regulated or exempted under 10 CSR 25-7 or 10 CSR 25-9. You may not dispose of regulated hazardous waste treatment process regulated or exempted under 10 CSR 25-7 or 10 CSR 25-9. You may not dispose of regulated special wastes in any sanitary, demolition, utility waste landfill in Missouri.

The following table lists typical properties of characteristic hazardous waste:
(This is not a complete listing, but only a guideline to determine if a waste may be a characteristic hazardous waste)

Ignitability
Catches fire easily through friction absorption of moisture or spontaneous chemical changes

Corrosivity
pH<2.0 or pH>12.5
Reactivity
Wastes that are normally unstable, react violently with water, can explode or release poisonous gases.

Toxicity
TCLP, EPS Method 1311, any contaminants listed in Table 1 of 40 CFR 261.24 equal to or greater than the listed concentration.

Once the waste is determined to be non-hazardous and contain no free liquids, you must request approval from the owner/operator of the disposal facility to dispose of the special waste at the landfill by filling out and signing the generator's portion of the Special Waste Disposal Request Form.

You must also identify health and hazards associated with the materials, as well as any special shipping, handling or safety requirements. For example, note whether the material should be transported in covered containers or whether it is a respiratory hazard. The completed Special Waste Disposal Request Form, along with appropriate test results and other pertinent information, are then sent to the receiving landfill for the landfill owner or operator's review and signature prior to acceptance and disposal of the waste. Until a landfill accepts the waste for disposal, it is the owner's responsibility to manage the waste in an environmentally sound manner.

Free liquids must have pollutant components removed to or below regulatory thresholds before the free liquid may be discharged to the environment, or pretreatment or treatment facility, as and where allowable by the local authority or jurisdiction. Do not discharge the liquids or liquid slurry, captured by the cleaning and maintenance process, into any storm or sanitary structures.

NOTE: This checklist is not mandated for use by MSD and does not exempt BMP owners from design and maintenance requirements specified in the SWMFR.

STORMWATER MANAGEMENT FACILITY MAINTENANCE INSPECTION CHECKLIST

BIOR/BIOS: BIORETENTION/RAIN GARDEN

Location: _____ P Job Number: _____

Owner Change since last inspection? Yes No Inspector: _____

Owner Name:_____ Date of Inspection: _____

Owner Address: _____ Owner Phone Number: _____

Site Conditions: _____

INSPECTION RATING SYSTEM
0 = Good condition. Well maintained, no action required. Satisfactory Performance.
1 = Moderate condition. Should monitor. Satisfactory Performance.
2 = Degraded condition. Routine maintenance and repair needed. Unsatisfactory Performance.
3 = Serious condition. Immediate need for repair or replacement. Unsatisfactory Performance.

NOTE TO INSPECTOR: All personnel entering any confined spaces must take appropriate safety measures and follow applicable OSHA regulations.

INSPECTION ITEMS	RATING	COMMENTS
Overall Drainage Area Conditions:		
A. INLETS (If not piped, identify as overland flow)		
Provide stable conveyance into facility?	0 1 2 3 N/A	
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Evidence of erosion?	0 1 2 3 N/A	
B. PRETREATMENT (if applicable)		
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Evidence of standing water? (Ponding, Noticeable Odors, Water Stains, Algae)	0 1 2 3 N/A	
Evidence of clogging?	0 1 2 3 N/A	
Dead vegetation/exposed soil?	0 1 2 3 N/A	
Evidence of erosion?	0 1 2 3 N/A	
C. TREATMENT AREA AND VEGETATION		
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Signs of erosion or movement of mulch (or pea gravel)?	0 1 2 3 N/A	
Evidence of oil/chemical accumulation?	0 1 2 3 N/A	
Evidence of standing water? (Ponding, Noticeable Odors, Water Stains, Algae)	0 1 2 3 N/A	
Underdrain system (if equipped) broken/clogged?	0 1 2 3 N/A	
Adequate plant covering present?	0 1 2 3 N/A	
Is vegetation overgrown? Invasive, overgrown weeds, woody vegetation?	0 1 2 3 N/A	
Dead vegetation/exposed soil?	0 1 2 3 N/A	
Signs of mulch layer thinning (or pea gravel)?	0 1 2 3 N/A	
D. OVERFLOW/OUTLET STRUCTURE		
Stable conveyance out of facility provided?	0 1 2 3 N/A	
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Evidence of erosion at/around?	0 1 2 3 N/A	
E. HAZARDS		
Complaints from local residents? (describe if any)	0 1 2 3 N/A	
Any public hazards observed? (describe if any)	0 1 2 3 N/A	

F. CORRECTIVE ACTIONS*

*If any 2-3 ratings are given in Sections A-E of this checklist, list corrective actions recommended or completed during inspection.

CORRECTIVE ACTIONS	RECOMMENDED TO OWNER	COMPLETED AT TIME OF INSPECTION

G. PHOTOGRAPHS

Please attach photographs, with descriptions, showing current condition of the system and any defeciencies noted in this inspection.

NOTE: This checklist is not mandated for use by MSD and does not exempt BMP owners from design and maintenance requirements specified in the SWMFR.

STORMWATER MANAGEMENT FACILITY MAINTENANCE INSPECTION CHECKLIST

STORMWATER PONDS

Circle Type: P-1: Micropool ED Pond P-2: Wet Pond P-3: Wet ED Pond P-4: Multiple Pond System P-5: Pocket Pond DET: Detention

Location: _____ P Job Number: _____

Owner Change since last inspection? Yes No Inspector: _____

Owner Name:_____ Date of Inspection: _____

Owner Address: _____ Owner Phone Number: _____

Site Conditions: _____

INSPECTION RATING SYSTEM

0 = Good condition. Well maintained, no action required. Satisfactory Performance.
1 = Moderate condition. Should monitor. Satisfactory Performance.
2 = Degraded condition. Routine maintenance and repair needed. Unsatisfactory Performance.
3 = Serious condition. Immediate need for repair or replacement. Unsatisfactory Performance.

NOTE TO INSPECTOR: All personnel entering any confined spaces must take appropriate safety measures and follow applicable OSHA regulations.

INSPECTION ITEMS	RATING	COMMENTS
Overall Drainage Area Conditions:		
A. INLETS (If not piped, identify as overland flow)		
Provide stable conveyance into facility?	0 1 2 3 N/A	
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Evidence of erosion?	0 1 2 3 N/A	
B. PRETREATMENT (if applicable)		
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Excessive Sediment ? If >50% of volume is excessive.	0 1 2 3 N/A	
Evidence of clogging?	0 1 2 3 N/A	
Dead vegetation/exposed soil?	0 1 2 3 N/A	
Evidence of erosion?	0 1 2 3 N/A	
C. FACILITY		
Maintenance access to facility?	0 1 2 3 N/A	
Evidence of animal droppings around basin? (geese/duck/dog, etc)	0 1 2 3 N/A	
Condition of structural components?	0 1 2 3 N/A	
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Excessive Sediment ? If >50% of volume is excessive.	0 1 2 3 N/A	
Low orifice trash/debris accumulation causing blockage?	0 1 2 3 N/A	
Berms/Embankments, overall condition?	0 1 2 3 N/A	
Cattails removed?	0 1 2 3 N/A	
Check all issues observed:	Evidence of erosion ☐ Cracking, bulging or sloughing ☐ Presence of woody vegetation ☐ Evidence of animal burrows ☐	
D. OVERFLOW/OUTLET STRUCTURE		
Outlets provide stable conveyance out of facility?	0 1 2 3 N/A	
Excessive trash/debris/sediment accumulation?	0 1 2 3 N/A	
Evidence of erosion at/around?	0 1 2 3 N/A	
E. HAZARDS		
Complaints from local residents? (describe if any)	0 1 2 3 N/A	
Any public hazards observed? (describe if any)	0 1 2 3 N/A	

F. CORRECTIVE ACTIONS*

*If any 2-3 ratings are given in Sections A-E of this checklist, list corrective actions recommended or completed during inspection.

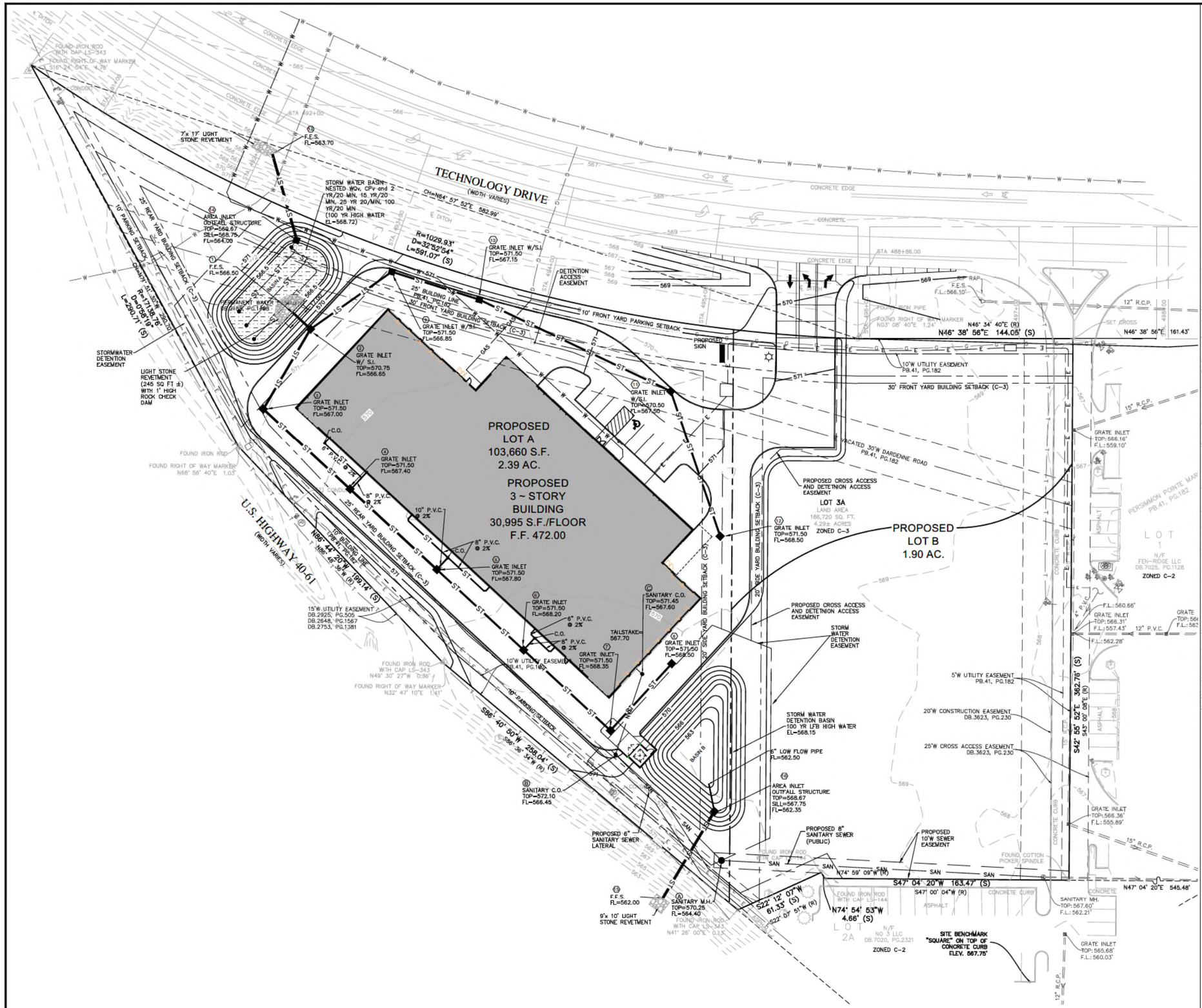
CORRECTIVE ACTIONS	RECOMMENDED TO OWNER	COMPLETED AT TIME OF INSPECTION

G. PHOTOGRAPHS

Please attach photographs, with descriptions, showing current condition of the system and any defeciencies noted in this inspection.

VII. REFERENCE INFORMATION

A. Site and Grading Plans
B. Existing and Proposed Drainage Area Plan
C. BMP Plan
D. BMP details



GRAPHIC SCALE

(IN FEET)
1 inch = 30 ft.

BASIS OF BEARING:

GRID NORTH MISSOURI COORDINATE SYSTEM OF 1983, EAST ZONE

- O – DENOTES FOUND 1/2" IRON PIPE
- o – DENOTES FOUND IRON ROD
- △ – DENOTES FOUND RIGHT OF WAY MARKER
- ✳ – DENOTES FOUND COTTON PICKER SPINDLE

GENERAL NOTES

1.) ALL UTILITIES SHOWN HAVE BEEN LOCATED FROM AVAILABLE RECORDS. THEIR LOCATION SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR HAS THE RESPONSIBILITY TO NOTIFY ALL UTILITY COMPANIES, PRIOR TO CONSTRUCTION, TO HAVE EXISTING UTILITIES FIELD LOCATED. THE CONTRACTOR SHALL BE ON RECORD WITH THE MISSOURI ONE CALL SYSTEM. ALL PROPOSED UTILITIES SHALL BE UNDERGROUND.

2.) BOUNDARY AND TOPOGRAPHIC SURVEY BY MARLER SURVEYING COMPANY.

3.) ALL ON-SITE MATERIALS AND METHODS OF CONSTRUCTION TO MEET THE CURRENT STANDARDS AND SPECIFICATIONS OF THE CITY OF O'FALLON.

4.) ALL GRADED AREAS SHALL BE PROTECTED FROM EROSION BY EROSION CONTROL DEVICES AND/OR SEEDING AND MULCHING AS REQUIRED BY THE CITY OF O'FALLON.

5.) PROPOSED CONTOURS SHOWN ARE FINISHED ELEVATIONS ON PAVED AREAS.

6.) ALL GRADING AND DRAINAGE TO BE IN CONFORMANCE WITH THE CITY OF O'FALLON.

7.) ADEQUATE TEMPORARY OFF-STREET PARKING FOR CONSTRUCTION EMPLOYEES SHALL BE PROVIDED. PARKING ON NON-SURFACED AREAS SHALL BE PROHIBITED IN ORDER TO ELIMINATE THE CONDITION WHEREBY MUD FROM CONSTRUCTION AND EMPLOYEES' VEHICLES IS TRACKED ONTO THE PAVEMENT CAUSING HAZARDOUS ROADWAY AND DRIVEWAY CONDITIONS.

8.) ALL SEWER CONSTRUCTION AND MATERIALS TO BE IN ACCORDANCE WITH THE CITY OF O'FALLON AND DUCKETT CREEK SEWER DISTRICT STANDARD CONSTRUCTION SPECIFICATIONS FOR SEWER AND DRAINAGE FACILITIES.

9.) THE CONTRACTOR SHALL BE REQUIRED TO VERIFY ALL EXISTING CONDITIONS AT THE SITE PRIOR TO SUBMITTING BID OR STARTING WORK. THE CONTRACTOR SHALL REPORT ANY DISCREPANCIES THAT MAY EXIST BETWEEN THE CONTRACT DOCUMENTS AND REQUEST CLARIFICATION IN WRITING PRIOR TO THE BID.

10.) THE CONTRACTOR SHALL COORDINATE CONSTRUCTION PARKING WITH THE OWNER AND/OR THE CITY OF O'FALLON.

11.) CONTRACTOR SHALL VERIFY EXISTING UTILITY SERVICES ARE CAPPED OR REMOVED AND/OR ABANDONED AS REQUIRED PER THE SPECIFICATIONS OF THE APPROPRIATE GOVERNING AGENCY.

12.) PROVIDE PROTECTIONS NECESSARY TO PREVENT DAMAGE TO EXISTING IMPROVEMENTS AND UTILITIES INDICATED TO REMAIN IN PLACE.

13.) LANDSCAPING IRRIGATION SYSTEMS TO BE CAPPED AND REMOVED IN AREAS OF CONSTRUCTION WITH SERVICE LINES AND CAPS FLAGGED OR PROPERLY MARKED FOR FUTURE TIE-INS, IF APPLICABLE.

14.) THE CONTRACTOR SHALL BE RESPONSIBLE FOR TRAFFIC CONTROL PER THE CITY OF O'FALLON STANDARDS TO MINIMIZE TRAFFIC DISRUPTION WITHIN RIGHT-OF-WAY OF ADJACENT ROADS.

15.) ALL DEBRIS RESULTING FROM THE DEMOLITION OF PAVEMENTS, CURBING, STRUCTURES, FOUNDATION AND FOOTINGS SHALL BE REMOVED FROM THE SITE AND LEGALLY DISPOSED OF UNLESS NOTED OTHERWISE IN THE PROJECT SPECIFICATIONS.

16.) PUBLIC UTILITY FACILITIES SUCH AS MANHOLES, METER AND VALVE BOXES OF GAS, ELECTRIC AND TELEPHONE WILL BE ADJUSTED OR RELOCATED BY THE VARIOUS UTILITY COMPANIES. ADJUSTMENT OF UTILITY AND SEWER FACILITIES NOT PROVIDED BY THE UTILITY COMPANIES WILL BE PROVIDED BY THE CONTRACTOR AS NECESSARY.

17.) DESIGN OF SHORING FOR UTILITY AND SEWER TRENCHES IS THE RESPONSIBILITY OF THE CONTRACTOR.

18.) NO BURNING OF TREES, OVERGROWTH, DEBRIS, BRUSH, OR ANY MATERIAL ALLOWED ON SITE.

19.) ANY ABANDONED SEWERS SHALL BE REMOVED OR COMPLETELY GROUT FILLED.

20.) ALL WALKS AND ADA ACCESSIBLE ROUTES SHALL NOT HAVE A CROSS SLOPE THAT EXCEEDS 2% AND A RUNNING SLOPE THAT EXCEEDS 5%.

21.) ALL SIGNAGE SHALL REQUIRE APPROVAL THROUGH A SEPARATE PROCESS.

22.) "NO DUMPING-DRAINS TO WATERWAY" MARKING REQUIRED ON ALL GRATED INLETS.

DCSD NOTES

1. EXISTING SANITARY SEWER SERVICE SHALL NOT BE INTERRUPTED.

BRANDON A. HARP, P.E. E-28650
PROFESSIONAL ENGINEER
CEDC LICENSE NO.: 2003004674

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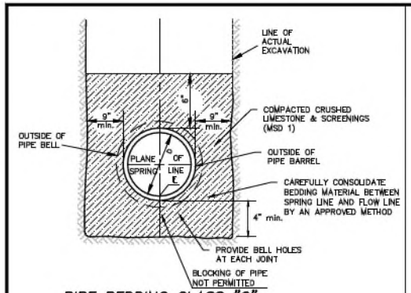
Site Improvement Plan for a
STORAGE FACILITY
1160 Technology Drive
O'Fallon, Missouri 63368

Proj. # 1919		
No.	Description	Date
	to City	7/29/19
	Coordination set	8/23/19
	Coordination set	9/11/19

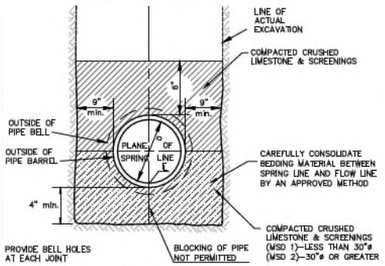
SITE AND GRADING PLAN

C04



PIPE BEDDING CLASS "C"

(FOR ALL PIPE EXCEPT REINFORCED CONCRETE PIPE)

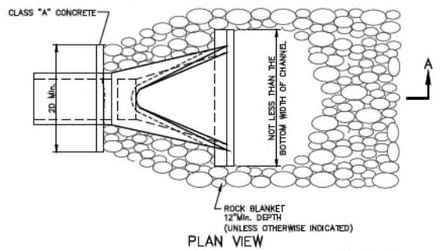


PIPE BEDDING CLASS "C"

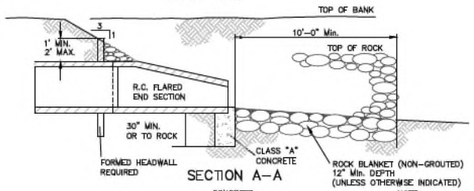
(MODIFIED FOR REINFORCED CONCRETE PIPE)

PIPE BEDDING DETAILS

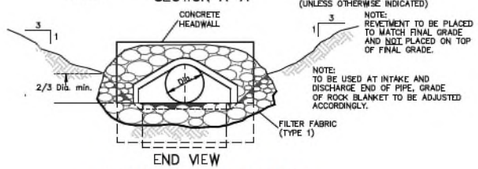
(PRIVATE STORM SEWER)



PLAN VIEW



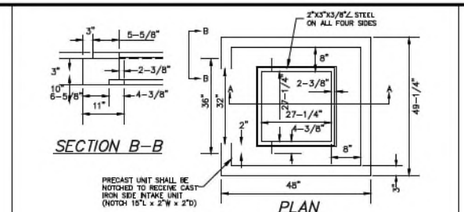
SECTION A–A



END VIEW

FLARED END SECTION

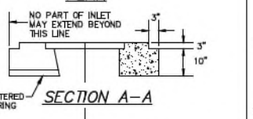
(FOR ONSITE USE ONLY)



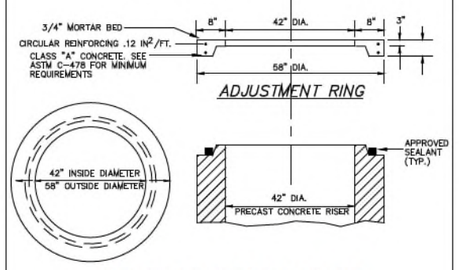
SECTION B–B

PLAN

NOTE: TOP ELEVATION IS TOP OF GRATE FLUSH WITH PAVEMENT

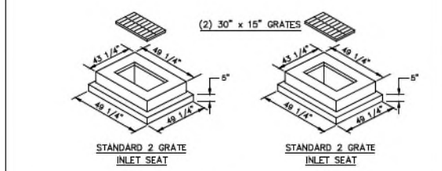


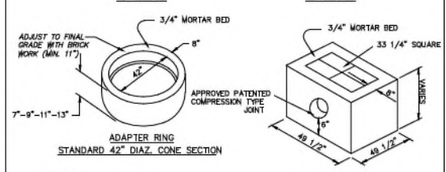
SECTION A–A

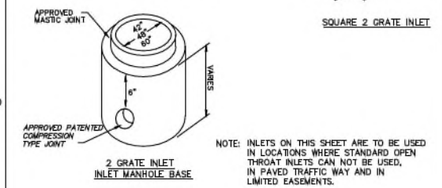


ADJUSTMENT RING

GRATE SEAT FOR 2-GRATE INLET WITH SIDE INTAKE

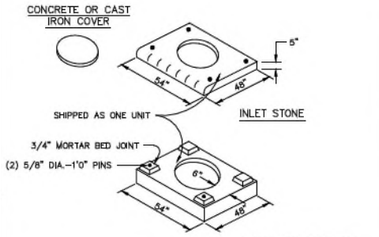






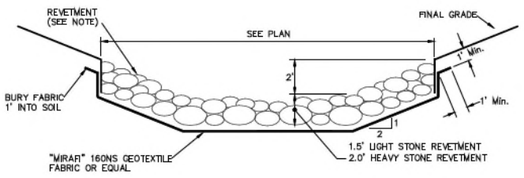
NOTE: INLETS ON THIS SHEET ARE TO BE USED IN LOCATIONS WHERE STANDARD OPEN THROAT INLETS CAN NOT BE USED, IN PAVED TRAFFIC WAY AND IN LIMITED EASEMENTS.

2 GRATE INLET



PRECAST AREA INLET

DETAIL OF SEWER CLEANOUT

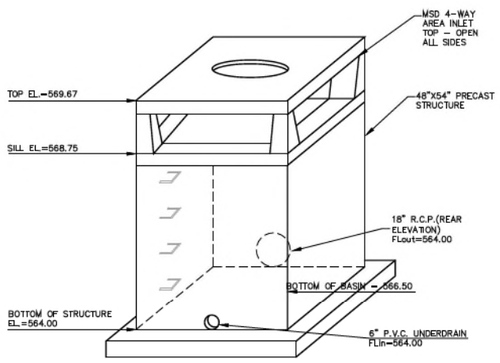


ROCK BLANKET NOTES:

1. STONE FOR LIGHT STONE REVETMENT SHALL BE AT LEAST 6 INCH TO 8 INCH DIAMETER.
2. STONE FOR HEAVY STONE REVETMENT SHALL BE AT LEAST 12 INCH DIAMETER.
3. TOP OF REVETMENT TO BE PLACED TO MATCH PROPOSED GRADE AND NOT PLACED ON TOP OF PROPOSED GRADE.

ROCK BLANKET DETAIL

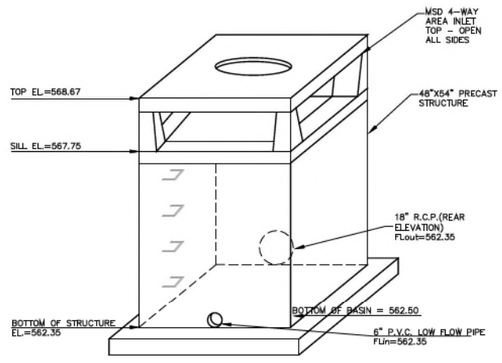
(FOR LOCATIONS SEE PLANS)



FRONT ELEVATION OF STRUCTURE

AREA INLET #14

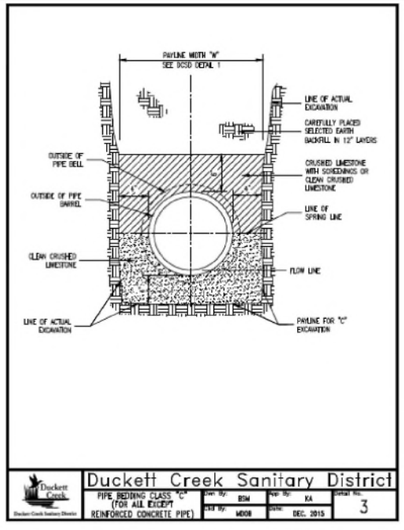
(NOT TO SCALE)



FRONT ELEVATION OF STRUCTURE

AREA INLET #16

(NOT TO SCALE)

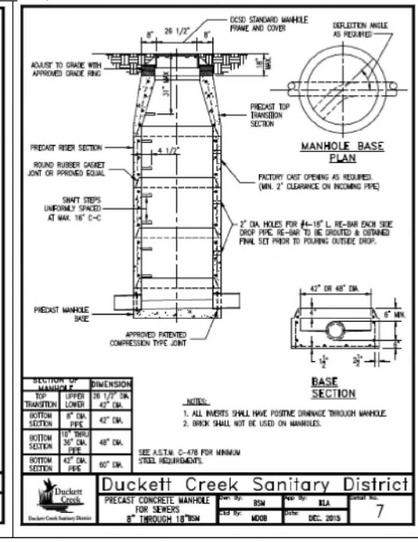


Duckett Creek Sanitary District

PIPE BEDDING CLASS "C" (FOR ALL EXCEPT REINFORCED CONCRETE PIPE)

Dwn. By: BSM | Rev. By: KA | Detail No. 3

Job By: MDOB | Date: DEC. 2015



SECTION OF MANHOLE		DIMENSION
TOP TRANSITION	UPPER	26 1/2" DIA.
	LOWER	42" DIA.
BOTTOM SECTION	8" DIA. PIPE	42" DIA.
BOTTOM SECTION	18" THRU 36" DIA. PIPE	48" DIA.
BOTTOM SECTION	42" DIA. PIPE	60" DIA.

NOTES:
1. ALL INVERTS SHALL HAVE POSITIVE DRAINAGE THROUGH MANHOLE.
2. BRICK SHALL NOT BE USED ON MANHOLES.

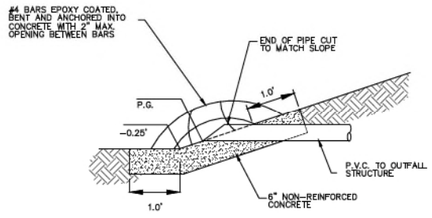
SEE A.S.T.M. C-478 FOR MINIMUM STEEL REQUIREMENTS.

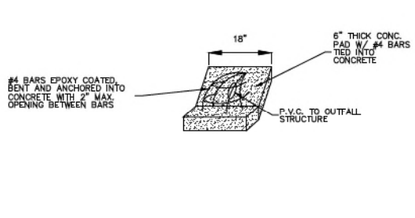
Duckett Creek Sanitary District

PRECAST CONCRETE MANHOLE FOR SEWERS 8" THROUGH 18"RSM

Dwn. By: BSM | Rev. By: BLA | Detail No. 7

Job By: MDOB | Date: DEC. 2015





CONCRETE PAD FOR LOW FLOW

STATE OF MISSOURI
BRANDON A. HARP
NUMBER 2008020
PROFESSIONAL ENGINEER

BRANDON A. HARP, P.E. E-28650
PROFESSIONAL ENGINEER
CEDC LICENSE NO.: 2003004674

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DESIGN CONSULTANTS

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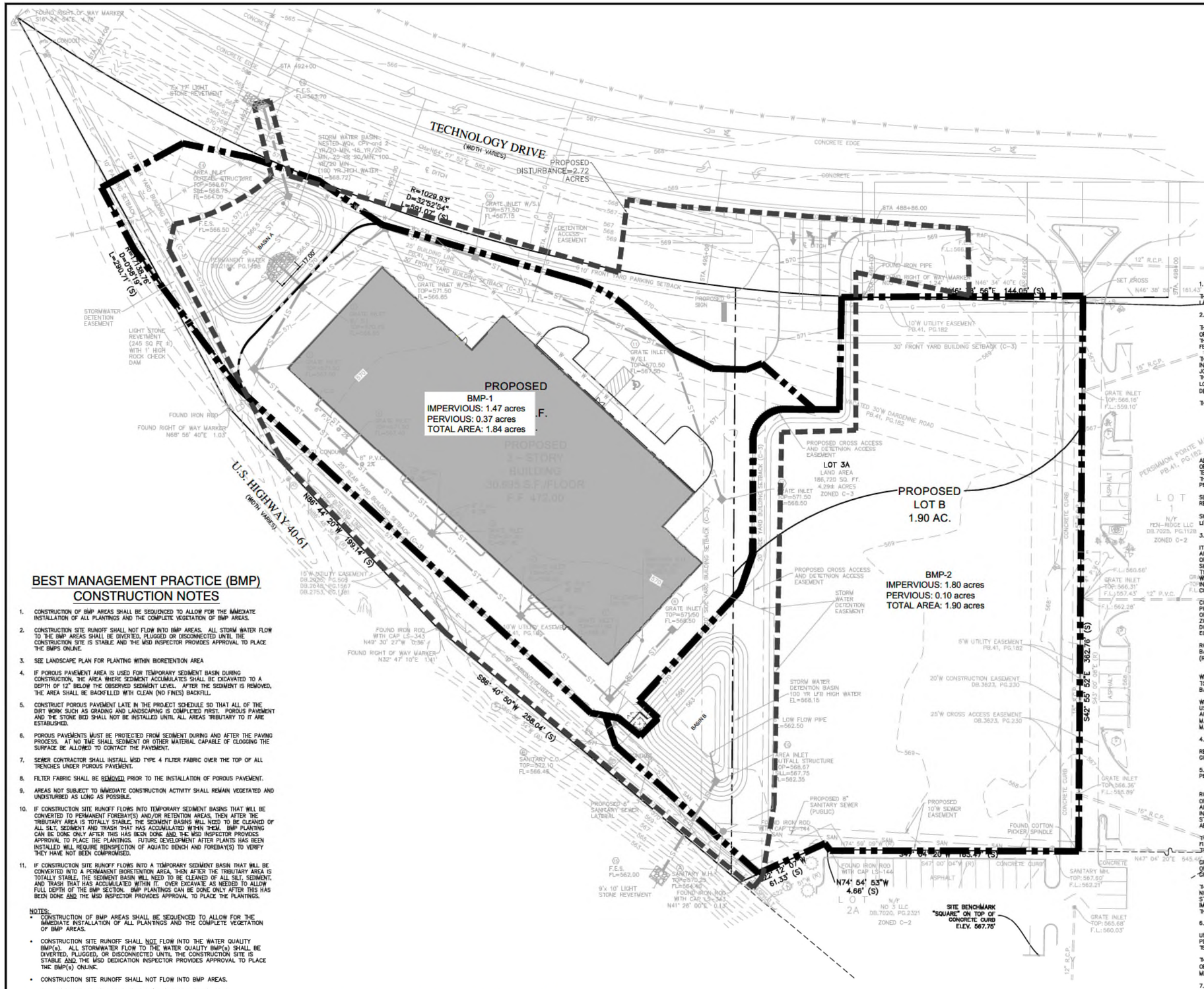
Site Improvement Plan for a
STORAGE FACILITY
1160 Technology Drive
O'Fallon, Missouri 63368

Proj. # 1919

No.	Description	Date
	to City	7/29/19
	Coordination set	8/23/19
	Coordination set	9/11/19

SEWER DETAILS

C07



GRAPHIC SCALE

30 0 15 30 60

(IN FEET)
1 inch = 30 ft.

BASIS OF BEARING:
GRID NORTH MISSOURI COORDINATE SYSTEM OF 1983, EAST ZONE

- O – DENOTES FOUND 1/2" IRON PIPE
- o – DENOTES FOUND IRON ROD
- △ – DENOTES FOUND RIGHT OF WAY MARKER
- ✳ – DENOTES FOUND COTTON PICKER SPINDLE

BIORETENTION NOTES

1. MATERIAL SPECIFICATIONS

THE ALLOWABLE MATERIALS TO BE USED IN BIORETENTION AREA ARE DETAILED IN THE MSD LANDSCAPE GUIDE FOR STORMWATER BEST MANAGEMENT PRACTICES.

2. PLANTING SOIL

THE PLANTING SOIL SHOULD BE SANDY LOAM OR LOAMY SAND (SHOULD CONTAIN A MINIMUM OF 60 PERCENT SAND, BY VOLUME). THE CLAY CONTENT FOR THESE SOILS SHOULD BE LESS THAN 10 PERCENT BY VOLUME. A SATURATED HYDRAULIC CONDUCTIVITY OF AT LEAST 2.0 FEET PER DAY IS REQUIRED.

THE SOIL SHOULD BE FREE OF STONES, STUMPS, ROOTS OR OTHER WOODY MATERIAL OVER 1 INCH IN DIAMETER. FOR BEST RESULTS, BRUSH OR SEEDS FROM NOXIOUS WEEDS SUCH AS JOHNSON GRASS, MUGWORT, NUTSEDGE AND CANADIAN THISTLE SHOULD NOT BE PRESENT IN THE SOILS. PLACEMENT OF THE PLANTING SOIL SHOULD BE IN LIFTS OF 12 TO 18 INCHES, LOOSELY COMPACTED (RUBBER WHEELED HEAVY EQUIPMENT AND MECHANICAL TAMPING DEVICES ARE NOT RECOMMENDED FOR COMPACTION).

THE PLANTING SOIL SHALL BE TESTED AND SHALL MEET THE FOLLOWING CRITERIA:

PHRANGE	5.2–8.0
ORGANIC MATTER	1.5 – 5 PERCENT (BY WEIGHT)
MAGNESIUM	35 LB./AC
PHOSPHORUS (PHOSPHATE – P205	75 LB./AC
POTASSIUM (POTASH – K2O)	85 IB./AC
SOLUBLE SALTS	NOT TO EXCEED 500 PPM

ALL BIORETENTION AREAS SHALL HAVE A MINIMUM OF ONE TEST. EACH TEST SHALL CONSIST OF BOTH THE STANDARD SOIL TEST FOR PH, PHOSPHORUS, AND POTASSIUM AND ADDITIONAL TESTS OF ORGANIC MATTER, AND SOLUBLE SALTS. A TEXTURAL ANALYSIS IS REQUIRED FROM THE SITE STOCKPILED TOPSOIL. IF TOPSOIL IS IMPORTED, THEN A TEXTURE ANALYSIS SHALL BE PERFORMED FOR EACH LOCATION WHERE THE TOP SOIL WAS EXCAVATED.

SINCE DIFFERENT LABS CALIBRATE THEIR TESTING EQUIPMENT DIFFERENTLY, ALL TESTING RESULTS SHALL COME FROM THE SAME TESTING FACILITY.

SHOULD THE PH FALL OUT OF THE ACCEPTABLE RANGE, IT MAY BE MODIFIED (HIGHER) WITH LIME OR (LOWER) WITH IRON SULFATE PLUS SULFUR.

3. COMPACTION

IT IS VERY IMPORTANT TO MINIMIZE COMPACTION OF BOTH THE BASE OF THE BIORETENTION AREA AND THE REQUIRED BACKFILL. WHEN POSSIBLE, USE EXCAVATION HOES TO REMOVE ORIGINAL SOIL IF BIORETENTION AREAS ARE EXCAVATED USING A LOADER, THE CONTRACTOR SHOULD USE WIDE TRACK OR MARSH TRACK EQUIPMENT, OR LIGHT EQUIPMENT WITH TURF TYPE TIRES. USE OF EQUIPMENT WITH NARROW TRACKS OR NARROW TIRES, RUBBER TIRES WITH LARGE LUGS, OR HIGH PRESSURE TIRES WILL CAUSE EXCESSIVE COMPACTION RESULTING IN REDUCED INFILTRATION RATES AND IS NOT ACCEPTABLE. COMPACTION WILL SIGNIFICANTLY CONTRIBUTE TO DESIGN FAILURE.

COMPACTION CAN BE ALLEVIATED AT THE BASE OF THE BIORETENTION FACILITY BY USING A PRIMARY TILLING OPERATION SUCH AS A CHISEL PLOW, RIPPER, OR SUBSOILER. THESE TILLING OPERATIONS ARE TO REFRACTURE THE SOIL PROFILE THROUGH THE 12 INCH COMPACTION ZONE. SUBSTITUTE METHODS MUST BE APPROVED BY THE ENGINEER. ROTOTILLERS TYPICALLY DO NOT TILL DEEP ENOUGH TO REDUCE THE EFFECTS OF COMPACTION FROM HEAVY EQUIPMENT.

ROTOTILL 2 TO 3 INCHES OF SAND INTO THE BASE OF THE BIORETENTION FACILITY BEFORE BACKFILLING THE OPTIONAL SAND LAYER. PUMP ANY PONDED WATER BEFORE PREPARING (ROTOTILLING) BASE.

WHEN BACKFILLING THE TOPSOIL OVER THE SAND LAYER, FIRST PLACE 3 TO 4 INCHES OF TOPSOIL OVER THE SAND, THEN ROTOTILL THE SAND/TOPSOIL TO CREATE A GRADATION ZONE. BACKFILL THE REMAINDER OF THE TOPSOIL TO FINAL GRADE.

WHEN BACKFILLING THE BIORETENTION FACILITY, PLACE SOIL IN LIFTS 12 IN. TO 18 IN. DO NOT USE HEAVY EQUIPMENT WITHIN THE BIORETENTION BASIN. HEAVY EQUIPMENT CAN BE USED AROUND THE PERIMETER OF THE BASIN TO SUPPLY SOILS AND SAND. GRADE BIORETENTION MATERIALS WITH LIGHT EQUIPMENT SUCH AS A COMPACT LOADER OR A DOZER/LOADER WITH MARSH TRACKS.

4. PLANT MATERIAL

RECOMMENDED PLANT MATERIAL FOR BIORETENTION AREAS CAN BE FOUND IN MSD LANDSCAPE GUIDE FOR STORMWATER BEST MANAGEMENT PRACTICES.

5. PLANT INSTALLATION
PEA GRAVEL SHOULD BE PLACED TO A UNIFORM THICKNESS OF 2 IN. – 3 IN.

ROOT STOCK OF THE PLANT MATERIAL SHALL BE KEPT MOIST DURING TRANSPORT AND ON–SITE STORAGE. THE PLANT ROOT BALL SHOULD BE PLANTED SO 1/8TH OF THE BALL IS ABOVE FINAL GRADE SURFACE. THE DIAMETER OF THE PLANTING PIT SHALL BE AT LEAST SIX INCHES LARGER THAN THE DIAMETER OF THE PLANTING BALL. SET AND MAINTAIN THE PLANT STRAIGHT DURING THE ENTIRE PLANTING PROCESS. THOROUGHLY WATER GROUND BED COVER AFTER INSTALLATION.

TREES SHALL BE BRACED USING 2 IN. BY 2 IN. STAKES ONLY AS NECESSARY AND FOR THE FIRST GROWING SEASON ONLY. STAKES ARE TO BE EQUALLY SPACED ON THE OUTSIDE OF THE TREE BALL.

GRASSES AND LEGUME SEED SHOULD BE DRILLED INTO THE SOIL TO A DEPTH OF AT LEAST ONE INCH. GRASS AND LEGUME PLUGS SHALL BE PLANTED FOLLOWING THE NON–GRASS GROUND COVER PLANTING SPECIFICATIONS.

THE TOPSOIL SPECIFICATIONS PROVIDE ENOUGH ORGANIC MATERIAL TO ADEQUATELY SUPPLY NUTRIENTS FROM NATURAL CYCLING. THE PRIMARY FUNCTION OF THE BIORETENTION STRUCTURE IS TO IMPROVE WATER QUALITY. ADDING FERTILIZERS DEFEATS, OR AT A MINIMUM, IMPEDES THIS GOAL. ONLY ADD FERTILIZER IF WOOD CHIPS OR MULCH ARE USED TO AMEND THE SOIL. ROTOTILL UREA FERTILIZER AT A RATE OF 2 POUNDS PER 1000 SQUARE FEET.

6. UNDERDRAINS

UNDERDRAINS ARE TO BE PLACED ON A 3 FT. WIDE SECTION OF FILTER CLOTH. PIPE IS PLACED NEXT, FOLLOWED BY THE GRAVEL BEDDING. THE ENDS OF UNDERDRAIN PIPES NOT TERMINATING IN AN OBSERVATION WELL SHALL BE CAPPED.

THE MAIN COLLECTOR PIPE FOR UNDERDRAIN SYSTEMS SHALL BE CONSTRUCTED AT A SLOPE OF 0 PERCENT. OBSERVATION WELLS AND/OR CLEAN–OUT PIPES MUST BE PROVIDED (ONE MINIMUM PER EVERY 1000 SQUARE FEET OF SURFACE AREA).

7. MISCELLANEOUS

THE BIORETENTION FACILITY MAY NOT BE CONSTRUCTED UNTIL ALL CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED.

BEST MANAGEMENT PRACTICE (BMP) CONSTRUCTION NOTES

1. CONSTRUCTION OF BMP AREAS SHALL BE SEQUENCED TO ALLOW FOR THE IMMEDIATE INSTALLATION OF ALL PLANTINGS AND THE COMPLETE VEGETATION OF BMP AREAS.
2. CONSTRUCTION SITE RUNOFF SHALL NOT FLOW INTO BMP AREAS. ALL STORM WATER FLOW TO THE BMP AREAS SHALL BE DIVERTED, PLUGGED OR DISCONNECTED UNTIL THE CONSTRUCTION SITE IS STABLE AND THE MSD INSPECTOR PROVIDES APPROVAL TO PLACE THE BMPS ONLINE.
3. SEE LANDSCAPE PLAN FOR PLANTING WITHIN BIORETENTION AREA
4. IF POROUS PAVEMENT AREA IS USED FOR TEMPORARY SEDIMENT BASIN DURING CONSTRUCTION, THE AREA WHERE SEDIMENT ACCUMULATES SHALL BE EXCAVATED TO A DEPTH OF 12" BELOW THE OBSERVED SEDIMENT LEVEL. AFTER THE SEDIMENT IS REMOVED, THE AREA SHALL BE BACKFILLED WITH CLEAN (NO FINES) BACKFILL
5. CONSTRUCT POROUS PAVEMENT LATE IN THE PROJECT SCHEDULE SO THAT ALL OF THE DIRT WORK SUCH AS GRADING AND LANDSCAPING IS COMPLETED FIRST. POROUS PAVEMENT AND THE STONE BED SHALL NOT BE INSTALLED UNTIL ALL AREAS TRIBUTARY TO IT ARE ESTABLISHED.
6. POROUS PAVEMENTS MUST BE PROTECTED FROM SEDIMENT DURING AND AFTER THE PAVING PROCESS. AT NO TIME SHALL SEDIMENT OR OTHER MATERIAL CAPABLE OF CLOGGING THE SURFACE BE ALLOWED TO CONTACT THE PAVEMENT.
7. SEWER CONTRACTOR SHALL INSTALL MSD TYPE 4 FILTER FABRIC OVER THE TOP OF ALL TRENCHES UNDER POROUS PAVEMENT.
8. FILTER FABRIC SHALL BE REMOVED PRIOR TO THE INSTALLATION OF POROUS PAVEMENT.
9. AREAS NOT SUBJECT TO IMMEDIATE CONSTRUCTION ACTIVITY SHALL REMAIN VEGETATED AND UNDISTURBED AS LONG AS POSSIBLE.
10. IF CONSTRUCTION SITE RUNOFF FLOWS INTO TEMPORARY SEDIMENT BASINS THAT WILL BE CONVERTED TO PERMANENT FOREBAY(S) AND/OR RETENTION AREAS, THEN AFTER THE TRIBUTARY AREA IS TOTALLY STABLE, THE SEDIMENT BASINS WILL NEED TO BE CLEANED OF ALL SILT, SEDIMENT AND TRASH THAT HAS ACCUMULATED WITHIN THEM. BMP PLANTING CAN BE DONE ONLY AFTER THIS HAS BEEN DONE AND THE MSD INSPECTOR PROVIDES APPROVAL TO PLACE THE PLANTINGS. FUTURE DEVELOPMENT AFTER PLANTS HAS BEEN INSTALLED WILL REQUIRE REINSPECTION OF AQUATIC BENCH AND FOREBAY(S) TO VERIFY THEY HAVE NOT BEEN COMPROMISED.
11. IF CONSTRUCTION SITE RUNOFF FLOWS INTO A TEMPORARY SEDIMENT BASIN THAT WILL BE CONVERTED INTO A PERMANENT BIORETENTION AREA, THEN AFTER THE TRIBUTARY AREA IS TOTALLY STABLE, THE SEDIMENT BASIN WILL NEED TO BE CLEANED OF ALL SILT, SEDIMENT, AND TRASH THAT HAS ACCUMULATED WITHIN IT. OVER EXCAVATE AS NEEDED TO ALLOW FULL DEPTH OF THE BMP SECTION. BMP PLANTINGS CAN BE DONE ONLY AFTER THIS HAS BEEN DONE AND THE MSD INSPECTOR PROVIDES APPROVAL TO PLACE THE PLANTINGS.

NOTES:
- CONSTRUCTION OF BMP AREAS SHALL BE SEQUENCED TO ALLOW FOR THE IMMEDIATE INSTALLATION OF ALL PLANTINGS AND THE COMPLETE VEGETATION OF BMP AREAS.
- CONSTRUCTION SITE RUNOFF SHALL NOT FLOW INTO THE WATER QUALITY BMP(s). ALL STORMWATER FLOW TO THE WATER QUALITY BMP(s) SHALL BE DIVERTED, PLUGGED, OR DISCONNECTED UNTIL THE CONSTRUCTION SITE IS STABLE AND THE MSD DEDICATION INSPECTOR PROVIDES APPROVAL TO PLACE THE BMP(s) ONLINE.
- CONSTRUCTION SITE RUNOFF SHALL NOT FLOW INTO BMP AREAS.
- SEE LANDSCAPE PLAN FOR PLANTING WITHIN BIORETENTION AREA.
- AREAS NOT SUBJECT TO IMMEDIATE CONSTRUCTION ACTIVITY SHALL REMAIN VEGETATED AND UNDISTURBED AS LONG AS POSSIBLE.
- THE CONTRACTOR SHALL STAY WITHIN THE LIMITS OF DISTURBANCE AS SHOWN ON THE PLANS AND MINIMIZE DISTURBANCE WITHIN THE WORK AREA WHEREVER POSSIBLE.

CONSTRUCTION SITE RUNOFF NOTE

CONSTRUCTION SITE RUNOFF SHALL NOT FLOW INTO BMP AREAS. ALL STORMWATER FLOW TO BMP AREAS SHALL BE DIVERTED, PLUGGED, OR DISCONNECTED UNTIL THE CONSTRUCTION SITE IS STABLE AND THE MSD INSPECTOR PROVIDES APPROVAL TO PLACE THE BMP ON–LINE.

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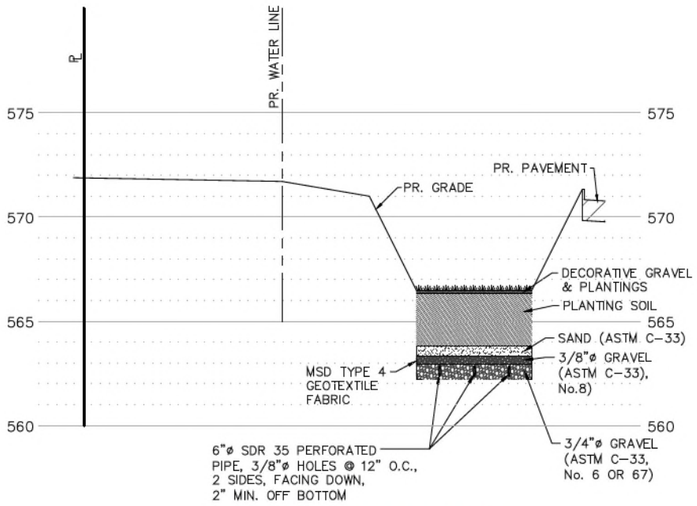
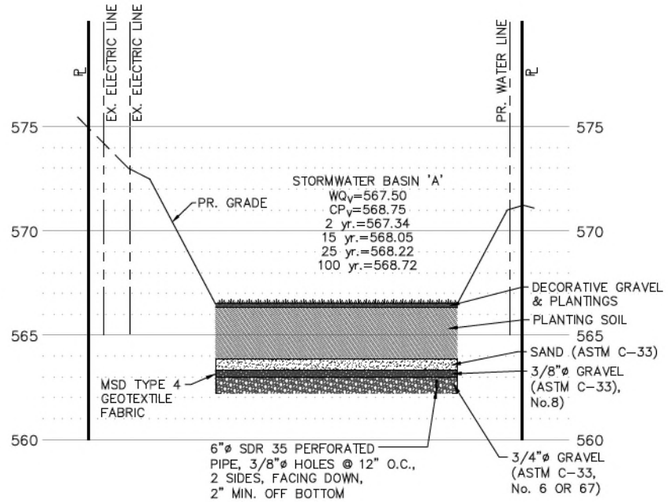
BEST MANAGEMENT PRACTICES PLAN

C09



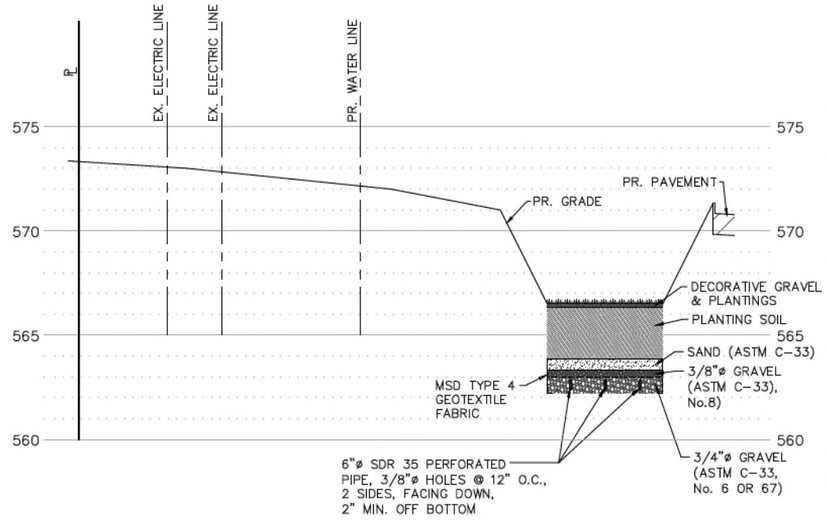
BIORETENTION BASIN 'A' SECTION A-A

SCALE:
HORIZONTAL: 1"=20'
VERTICAL: 1"=5'



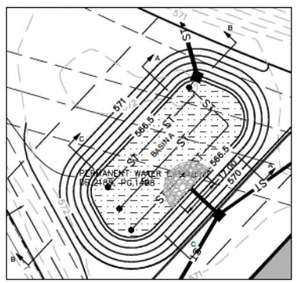
BIORETENTION BASIN 'A' SECTION B-B

SCALE:
HORIZONTAL: 1"=20'
VERTICAL: 1"=5'



BIORETENTION BASIN 'A' SECTION C-C

SCALE:
HORIZONTAL: 1"=20'
VERTICAL: 1"=5'

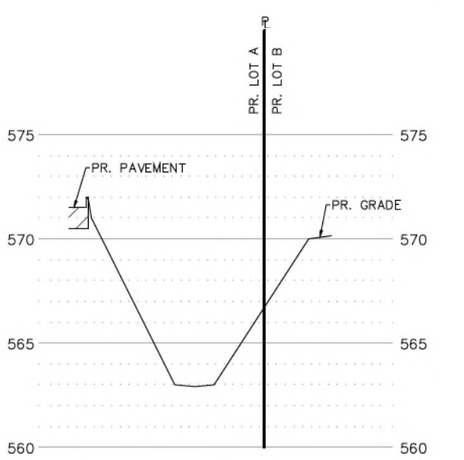


BIORETENTION BASIN A

DETENTION BASIN B

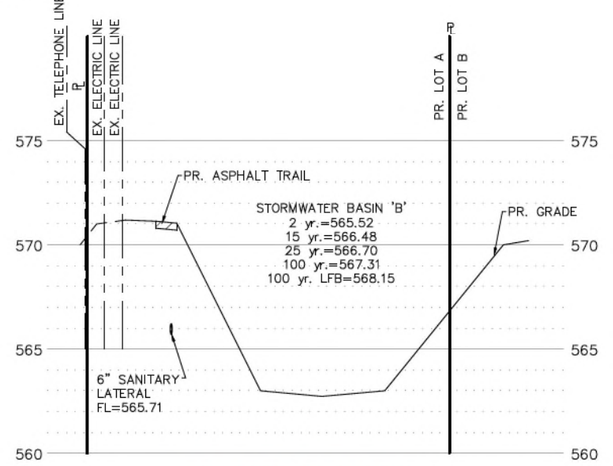
GRAPHIC SCALE

(IN FEET)
1 inch = 30 ft.



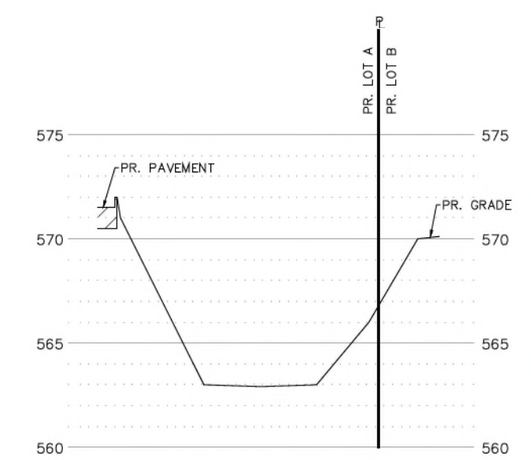
DETENTION BASIN 'B' SECTION A-A

SCALE:
HORIZONTAL: 1"=20'
VERTICAL: 1"=5'



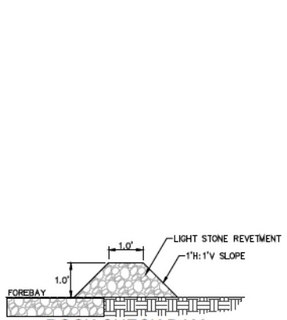
DETENTION BASIN 'B' SECTION B-B

SCALE:
HORIZONTAL: 1"=20'
VERTICAL: 1"=5'



DETENTION BASIN 'B' SECTION C-C

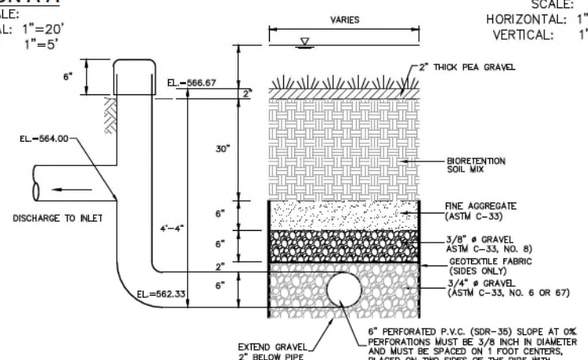
SCALE:
HORIZONTAL: 1"=20'
VERTICAL: 1"=5'



ROCK CHECK DAM

(n.t.s.)

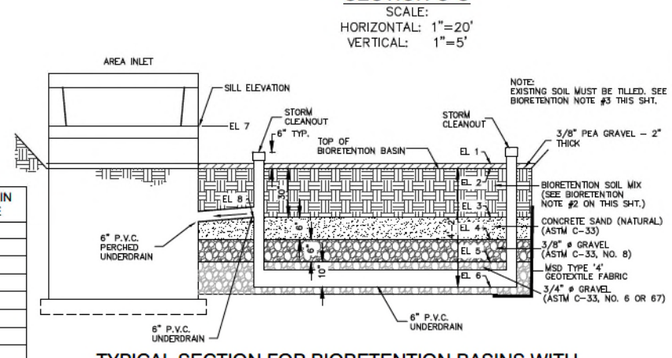
1. STONE FOR LIGHT STONE REVETMENT SHALL BE AT LEAST 6 INCH TO 8 INCH DIAMETER.
2. STONE SHOULD BE DRY STACKED ON FINISH GRADE



TYPICAL SECTION FOR A BIORETENTION BASIN

(n.t.s.)

BIORETENTION BASIN ELEVATION TABLE	
WQV	567.50
CPV	568.75
100YR	568.72
EL 1	566.67
EL 2	566.50
EL 3	564.00
EL 4	563.50
EL 5	563.00
EL 6	562.33
EL 7	568.75
EL 8	564.00



TYPICAL SECTION FOR BIORETENTION BASINS WITH PERCHED UNDERDRAIN

(n.t.s.)

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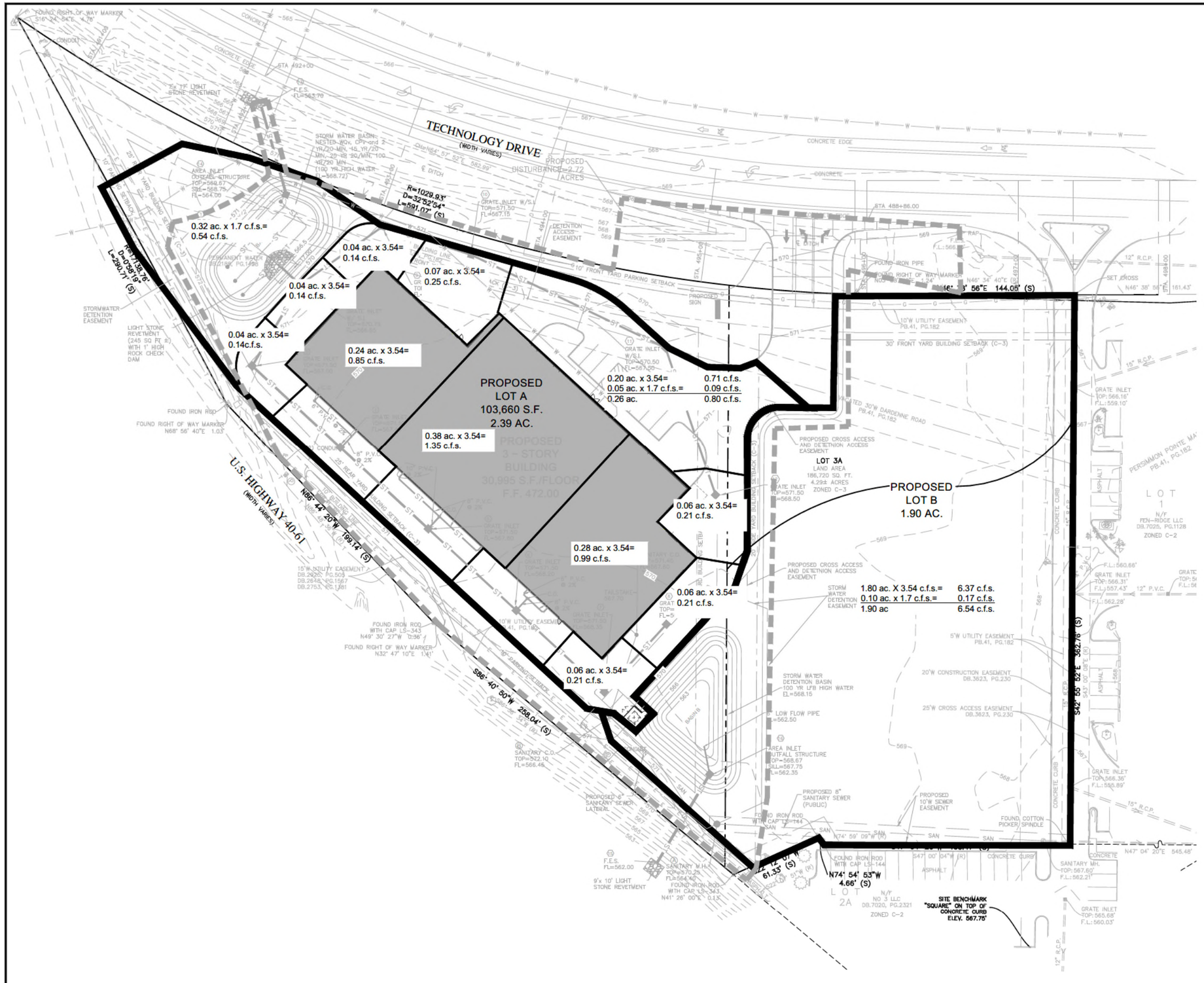
BEST MANAGEMENT PRACTICES DETAILS

C10



GRAPHIC SCALE

30 0 15 30 60

(IN FEET)
1 inch = 30 ft.

BASIS OF BEARING:
GRID NORTH MISSOURI COORDINATE SYSTEM OF 1983, EAST ZONE

- ○ – DENOTES FOUND 1/2" IRON PIPE
- o – DENOTES FOUND IRON ROD
- △ – DENOTES FOUND RIGHT OF WAY MARKER
- ✳ – DENOTES FOUND COTTON PICKER SPINDLE

STATE OF MISSOURI
BRANDON A. HARP
NUMBER 28650
NOTARIAL SEAL

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DRAINAGE AREA PLAN

C11