

The intent of this narrative is to supplement the full-size drawings showing the proposed site stormwater management system for the Schaap Center for the Performing Arts (abbreviated as “SC”). Please read the narrative in conjunction with site drawings CS100 (Site Layout and Materials Plan), CG100 (Site Grading Plan), and CU100 (Site Utility Plan).

General Site Description

The site has property in the City of Grosse Pointe Park (GPP) and in the City of Detroit (COD). The design shows the proposed building entirely within the City of Grosse Pointe Park. The site components in the City of Detroit are related to parking and landscape screening and do not include any portion of the building footprint.

The design uses catch basins, manholes, and pipes as the means of collecting and conveying storm water runoff. A bioswale is proposed on the east side of the site between the site parking and Maryland Street.

The total site property contains approximately 2 acres on the GPP side and 0.5 acres on the COD side.

Some fringe areas of the site have landscaped areas that currently drain offsite. Some small, landscaped areas will continue to drain offsite in the proposed condition. Similarly, some offsite drainage currently drains onto the site and will continue to drain onto the site in the proposed condition. Refer to storm drainage area maps at the end of the narrative.

Accumulated runoff from the GPP side of the site will be directed to an ultimate connection point at the southeast corner of the site near the intersection of Jefferson and Maryland. The connection point will be a public sewer at this location which is being designed by the City of Grosse Pointe Park. The public sewer will be a separate/dedicated storm sewer, as opposed to the current public sewer in the vicinity which carries a combination of sanitary and storm sewage.

The ultimate connection point for the site’s City of Detroit runoff is an 18” diameter DWSD sewer located beneath Jefferson Ave. This existing sewer flows west.

Stormwater Detention

Based on the 2/8/22 discussion with City of Grosse Pointe Park representatives, the GPP parking lot that is proposed to have frontage on Jefferson Ave. (east of the SC site and east of GPP municipal buildings) will be designed to provide regional storm water detention. The regional detention will be able to serve the Schaap Center detention needs that are not covered by the on-site bioswale proposed for the SC site. Additional information on the bioswale will be provided later in this narrative.

The City of Detroit BSEED and DWSD departments have conducted reviews of the Detroit portions of the project. The impervious surface areas proposed for the City of Detroit side total 0.42 acres. This falls below the 0.5-acre impervious threshold set by DWSD for rules of the Post-Construction Stormwater Management Ordinance (PCSMO) to be required. No detention is proposed for the COD side of the project.

Stormwater Conveyance

Pipe sizing for stormwater conveyance for the GPP side of the project is based on the rational method and uses the intensity formula noted in the Wayne County Storm Water Management Standards manual as follows:

$i=151.8/(tc+19.9)$, where tc =time of concentration in minutes. A minimum time of concentration of 15 minutes was used. This intensity represents the 10-year storm intensity.

Runoff coefficients of 0.95 and 0.35 were used for roofs/paving and landscape respectively. Composite runoff coefficients were used where a combination of impervious and pervious surfaces occurs within an individual contributing area.

Please refer to the attached spreadsheets and area maps for conveyance pipe sizing.

Pipe sizing on the COD side of the project is based on the same parameters as noted for the GPP side except for the stormwater intensity formula. The intensity formula below was used for COD pipe sizing (based on the DWSD PCSMO):

$$i = \frac{38.4164T^{0.2082}}{(12.3258 + D)^{0.8405}}$$

where i = design rainfall intensity, in/hr.
 T = return period, yr.
 D = duration, min

A minimum time of concentration of 10 minutes was used for the COD pipe sizing.

Stormwater Quality

Stormwater quality objectives for the site are intended to be met using a manufactured stormwater quality device which will hydrodynamically separate sediment and pollutants from the storm water prior to it discharging from the site.

The proprietary water quality device that will be used is an Aquaswirl. This manufacturer has been accepted for use in Wayne County. The device can treat 2 acres to a removal efficiency of 87% of total suspended solids. Less than 2 acres is being directed through the Aquaswirl, so removal efficiency increases to approximately 90%. When combined with the bioswale treatment, the total site will be treated to a removal efficiency of 80%.

90% removal x 1.62 Acres treated through the Aquaswirl divided by 1.83 total acres of collected runoff from GPP side = 80%

The above calculation does not include the bioswale. The bioswale treats 0.21 acres, improving the overall site removal efficiency above and beyond what the Aquaswirl achieves.

Bioswale

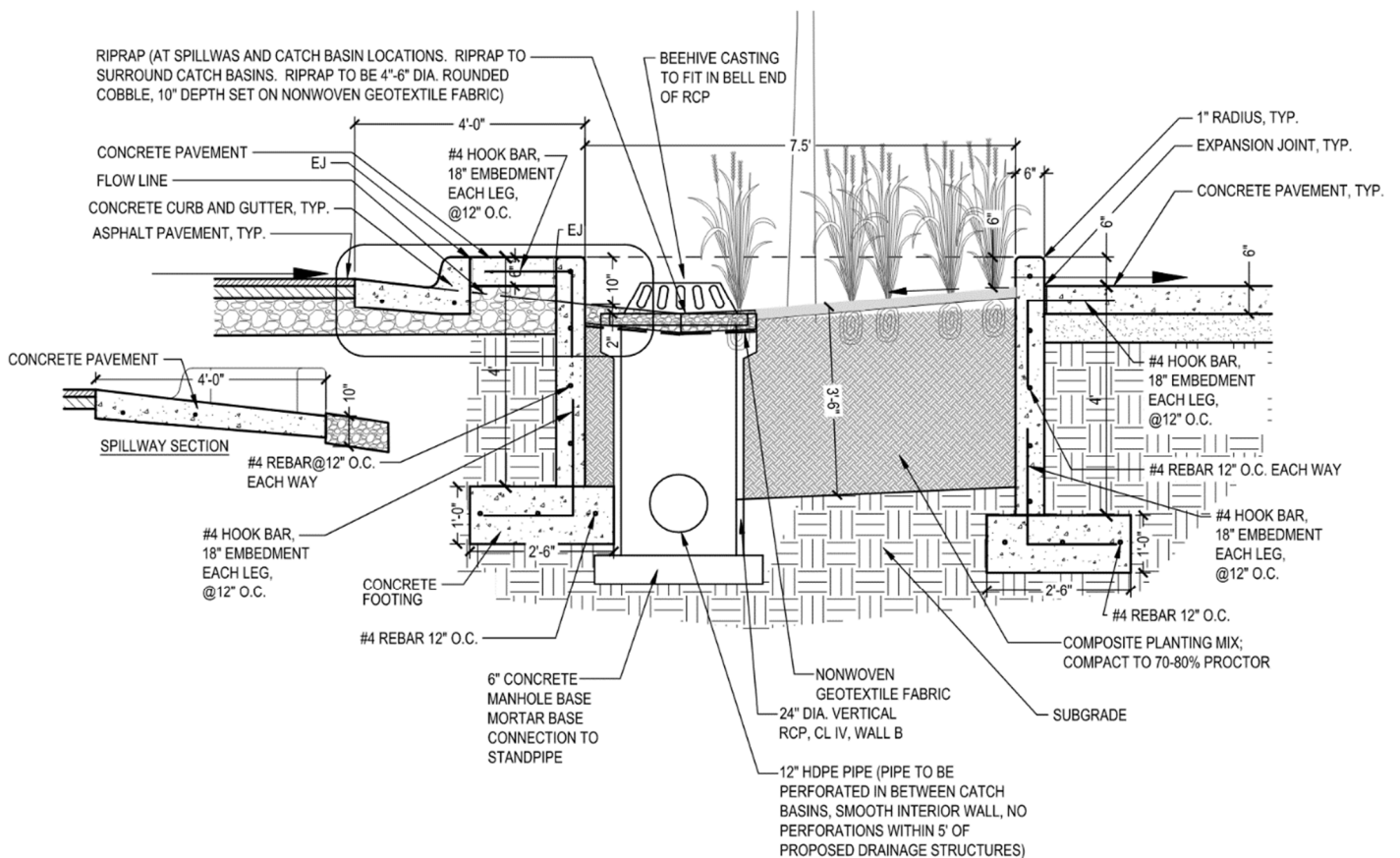
The bioswale has a void volume of approximately 960 cubic feet. This is based on a bioswale length of 183', a width of 7.5', and voids of 20% within the soil in the bioswale.

The total area directed to the bioswale is 0.21 acres. This includes the area of the bioswale itself.

1" of runoff over this 0.21-acre area equates to 762 cubic feet of runoff (assuming full runoff, without a reduction due to runoff coefficient). The bioswale void volume exceeds the first inch of runoff over the contributing area.

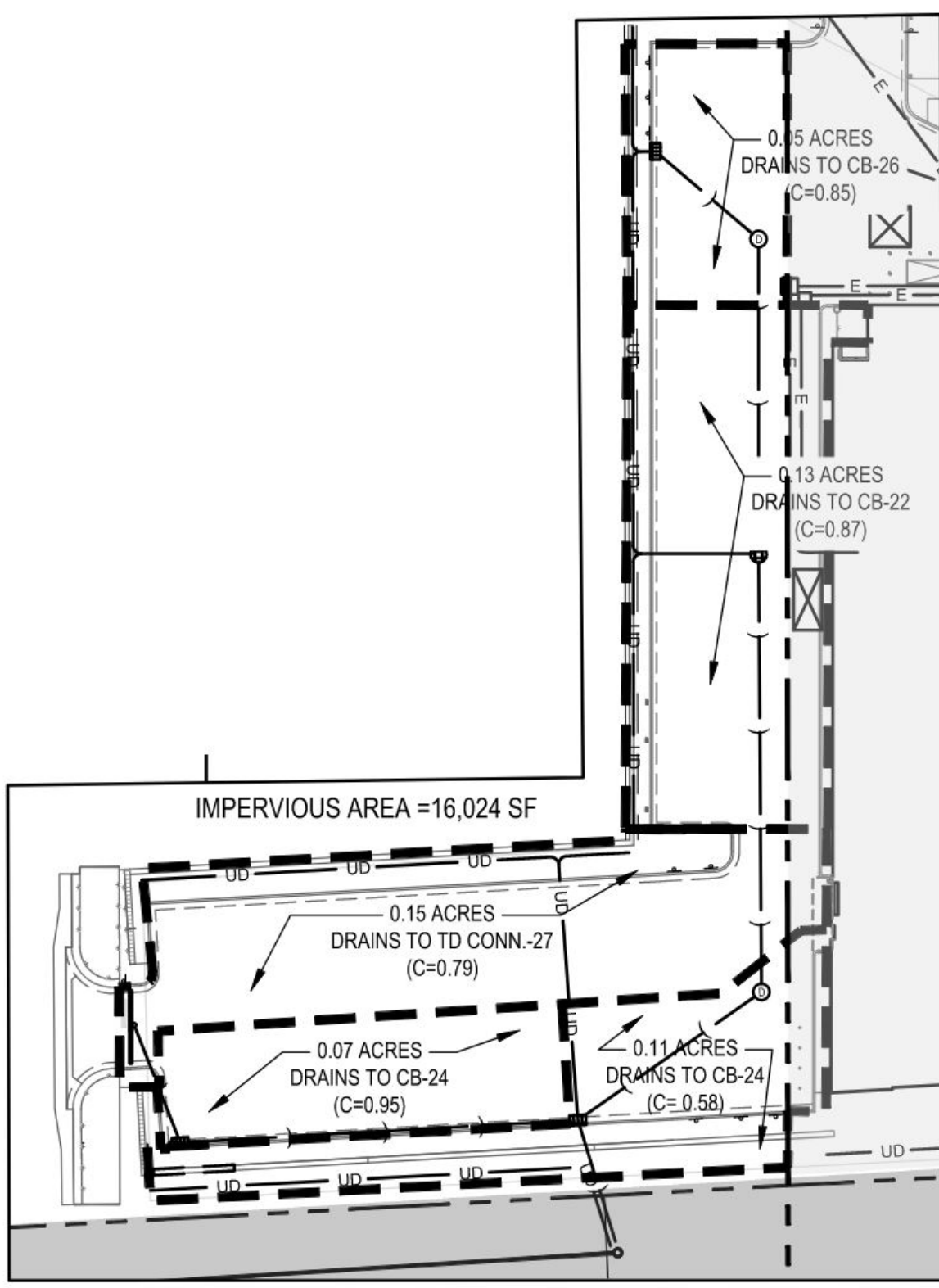
Because the bioswale is immediately adjacent to parking and a backup of water into the lot is not desired, a restrictor will not be placed on the outflow from the bioswale.

Please see the proposed bioswale cross section below:



Bioswale Cross Section

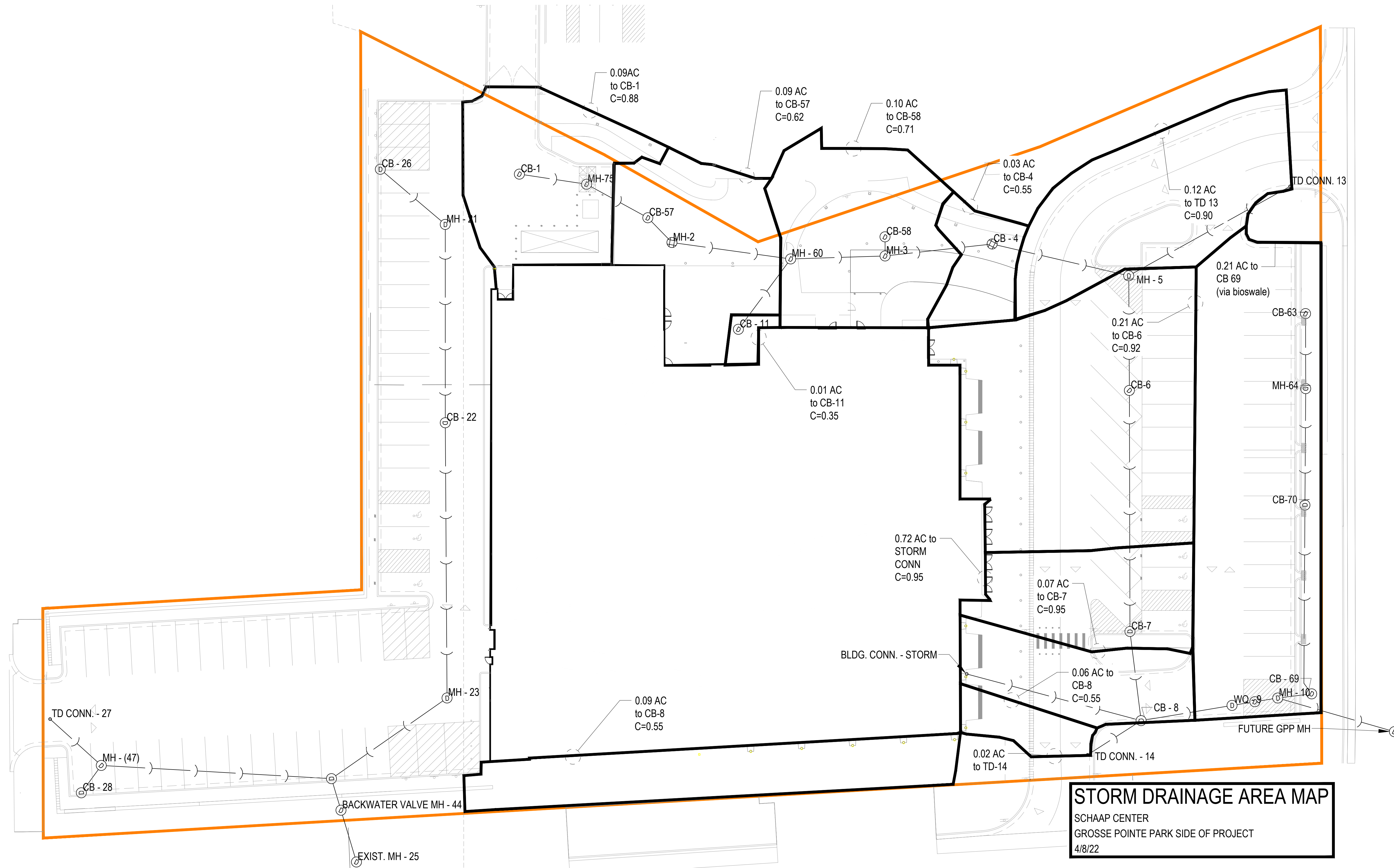
Site stormwater conveyance calculations and drainage area maps are included below.



① DRAINAGE AREA MAP (CITY OF DETROIT JURISDICTION)

Job Name : GPPAC		Min. Time of Concentration, t_c :		10	Minutes		Pipe Material :		RCP						
Job Number : 12345.00		D		10	$i = 38.4164T^{0.2082}/(12.325+D)^{0.8405}$		Manning n :		0.013						
Analysis Description : Storm Sewer Analysis							Minimum Velocity :		2.5 ft/sec						
							Maximum Velocity :		10.0 ft/sec						
Upstream Structure No.	Downstream Structure No.	Watershed Characteristics							Pipe Characteristics						Time to Next Structure, Tf min
		Drainage Area, A acres	Runoff Coefficient, C	Equivalent Area, (AxC) acres	Cumulative Equiv. Area acres	Time of Concentration T_c , min	Design Rainfall Intensity, i in/hr	Runoff Rate, Q cfs	Pipe Diameter, D inches	Pipe Length, L ft	Pipe Slope, S %	Pipe Flow Capacity, * Qfull, cfs	Pipe Flow Velocity, Vfull, fps	Pipe Flow Q/Qfull	
CB- 26	MH- 21	0.05	0.85	0.041	0.041	10.00	4.56	0.19	12	33	0.50	2.52	3.21	0.07	10.17
MH 21	CB- 22	0.00	0.00	0.000	0.041	10.17	4.56	0.19	12	78	0.50	2.52	3.21	0.07	10.58
CB- 22	MH- 23	0.13	0.87	0.109	0.150	10.58	4.56	0.68	12	108	0.50	2.52	3.21	0.27	11.14
MH 23	CB- 24	0.00	0.00	0.000	0.150	11.14	4.56	0.68	12	54	0.50	2.52	3.21	0.27	11.42
CB- 24	MH- 25	0.11	0.58	0.064	0.398	11.42	4.56	1.82	12	35	0.99	3.54	4.51	0.51	11.55
CB 27	CB 28	0.15	0.79	0.119	0.119	10.00	4.56	0.54	12	29	0.50	2.52	3.21	0.21	10.15
CB- 28	CB 24	0.07	0.95	0.067	0.185	10.15	4.56	0.84	12	100	0.50	2.52	3.21	0.34	10.67

Schaap Center for the Performing Arts
 City of Detroit Side of Project
 Drainage Conveyance Calculations



STORM DRAINAGE AREA MAP
SCHAAP CENTER
GROSSE POINTE PARK SIDE OF PROJECT
4/8/22

Job Name : **Schaap Center**
 Description : **GPP Side of Project**
 Analysis Description : **Storm Sewer Analysis**

Min. Time of Concentration, t_c : **15** Minutes

Pipe Material : **RCP**
 Manning n : **0.013**

$i = 151.8/(t_c+19.9)$

Upstream Structure No.	Downstream Structure No.	Watershed Characteristics							Pipe Characteristics						
		Drainage Area, A acres	Runoff Coefficient, C	Equivalent Area, (AxC) acres	Cumulative Equiv. Area acres	Time of Concentration Tc, min	Design Rainfall Intensity, i in/hr	Runoff Rate, Q cfs	Pipe Diameter, D inches	Pipe Length, L ft	Pipe Slope, S %	Pipe Flow Capacity,* Qfull, cfs	Pipe Flow Velocity, Vfull, fps	Q/Qfull	Time to Next Structure, Tf min
CB 1	MH 75	0.09	0.88	0.079	0.079	15.00	4.35	0.34	12	27	0.60	2.76	3.51	0.12	15.13
MH 75	CB 57	0.00	0.00	0.000	0.079	15.13	4.33	0.34	12	27	0.52	2.57	3.27	0.13	15.27
CB 57	MH 2	0.09	0.62	0.056	0.135	15.27	4.32	0.58	12	14	0.50	2.52	3.21	0.23	15.34
MH 2	MH 60	0.00	0.00	0.000	0.135	15.34	4.31	0.58	15	47	0.27	3.36	2.73	0.17	15.62
MH 60	MH 3	0.00	0.00	0.000	0.139	15.62	4.27	0.59	15	37	0.32	3.65	2.98	0.16	15.83
MH 3	CB 4	0.00	0.00	0.000	0.210	15.83	4.25	0.89	15	42	0.96	6.33	5.16	0.14	15.97
CB 4	MH 5	0.03	0.55	0.017	0.226	15.97	4.23	0.96	15	55	0.60	5.00	4.08	0.19	16.19
MH 5	CB 6	0.00	0.00	0.000	0.343	16.19	4.21	1.44	15	45	0.60	5.00	4.08	0.29	16.38
CB 6	CB 7	0.21	0.92	0.193	0.536	16.38	4.18	2.24	15	95	0.60	5.00	4.08	0.45	16.77
CB 7	CB 8	0.07	0.95	0.067	0.603	16.77	4.14	2.50	15	35	0.60	5.00	4.08	0.50	16.91
CB 8	WQ 9	0.15	0.55	0.083	1.388	16.91	4.12	5.73	18	35	1.52	12.95	7.33	0.44	16.99
WQ 9	MH 59	0.00	0.00	0.000	1.388	16.99	4.12	5.73	18	9	0.72	8.91	5.04	0.64	17.02
MH 59	MH 10	0.00	0.00	0.000	1.388	17.02	4.11	5.73	18	9	0.72	8.91	5.04	0.64	17.05
MH 10	GPP	0.00	0.00	0.000	1.569	17.05	4.11	6.45	18	48	0.50	7.43	4.20	0.87	17.24
CB 69	MH 10	0.21	0.86	0.181	0.181	30.00	3.04	0.55	12	13	0.50	2.52	3.21	0.22	30.07
CB 11	MH 60	0.01	0.35	0.004	0.004	15.00	4.35	0.02	18	48	0.50	7.43	4.20	0.00	15.19
BC ST	CB 8	0.72	0.95	0.684	0.684	15.00	4.35	2.98	15	71	0.60	5.00	4.08	0.59	15.29
CB 58	MH 3	0.10	0.71	0.071	0.071	15.00	4.35	0.31	12	8	2.00	5.04	6.41	0.06	15.02
TD 13	MH 5	0.13	0.90	0.117	0.117	15.00	4.35	0.51	15	72	0.60	5.00	4.08	0.10	15.29
TD 14	CB 8	0.02	0.95	0.019	0.019	15.00	4.35	0.08	15	25	0.60	5.00	4.08	0.02	15.10

Schaap Center for the Performing Arts
 City of Grosse Pointe Park Side of Project
 Drainage Conveyance Calculations



Sizing Report

2733 Kanasita Drive • Suite 111 • Chattanooga, TN 37343 • Phone: (423) 870-8888 • Fax: (423) 826-2112 • www.aquashieldinc.com

Site Information

Project Name: Performing Arts Center Site Area (acres): 2.02
 Unit Label: _____ Runoff Coefficient : 0.86
 Unit Location: Grosse Point Park Target Removal Efficiency(%): 80% based on OK-110

Product Recommendation

Aqua-Swirl™ Model	Net Annual TSS Removal Efficiency	Chamber Diameter	Maximum Stub-Out Pipe Outer Diameter		Oil/Debris Storage Capacity	Sediment Storage Capacity
AS-3	86.85 %	3.5 ft.	Offline	BYP ⁵	110 gal	20 ft ³
			10 in.	21 in.		

Rainfall Information

NCDC Station¹: DETROIT METRO AP, MI

Data Range: 6526 days (~17.88 yrs within 44 yr span)⁴

Rainfall Event Range (in./hr)	Rainfall Interval Point (in./hr)	Operating Rate (cfs)	Total Rainfall (%)	Removal Efficiency (%) ²	Relative Efficiency (%)
0.08 - 0.10	0.090	0.18	35.03	94.25	33.02
0.10 - 0.12	0.110	0.22	13.58	93.13	12.65
0.12 - 0.14	0.130	0.26	10.03	91.92	9.22
0.14 - 0.16	0.150	0.30	8.11	90.60	7.35
0.16 - 0.18	0.170	0.34	5.57	89.19	4.97
0.18 - 0.20	0.190	0.38	4.58	87.69	4.02
0.20 - 0.25	0.225	0.45	6.95	84.80	5.89
0.25 - 0.35	0.300	0.60	8.11	77.64	6.30
0.35 - 0.45	0.400	0.80	3.33	65.94	2.20
0.45 - 0.55	0.500	1.01	1.59	51.81	0.82
0.55 - 0.65	0.600	1.21	0.90	35.22	0.32
0.65 - 0.75	0.700	1.41	0.58	16.20	0.09
Total Cumulative Rainfall %:			98.36³	Net Annual %:	86.85

Sales Agent Information

Agent Name: Joe OBrien Phone: (734) 657-3839
 Company Name: Entel Service and Technology Fax: (734) 944-7754
 Address: 5782 Katz Farm Court E-mail: jobrien@entel-group.com
 City, State Zip: Saline, MI 48176

Footnotes

- Recorded as hourly precipitation rainfall data (inches), National Climatic Data Center (NCDC)
- Based on Tennessee Tech University laboratory testing of the AquaSwirl™ Model AS-3 for OK-110 silica particles 50-125 microns(Neary, 2002)
- 90% Rainfall Event, calculated as a cumulative percentile of individual events, www.stormwatercenter.net, sizing criteria (Center for Watershed Protection)
- NCDC data may not be consecutive, skipping days, months and/or years in the range of dates.
- The Aqua-Swirl™ Internal Bypass (BYP) provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.
- The performance curve slope can be adjusted via Pecllet Scaling to provide various estimated sizing per specific particle sizes (eg. 50, 125-microns, etc.).