

## STORMWATER MAINTENANCE AGREEMENT

Massillon CSD – East Side Elementary School

City of Massillon, Stark County, Ohio

This Inspection and Maintenance Agreement, made this \_\_\_\_ day of \_\_\_\_\_ 20\_\_, by and between the **Massillon City School District** (hereafter referred to as the Owner) and the **City of Massillon** hereafter referred to as the Community, provides as follows:

**WHEREAS**, the Owner is responsible for certain real estate shown as Tax Map No. **10016936** that is to be developed as **East Side Elementary School** and referred to as the Property; and,

**WHEREAS**, the Owner is providing a stormwater management system consisting of the following stormwater control measures (SCMs): **cast iron stormwater grates, and frames, catch basins, storm sewers, 100 Year flow paths, stormwater management basin and features as set forth in the approved plans** as shown and described on the attached Comprehensive Stormwater Management Plan in Exhibit A and Storm Water Quality Volume Calculations in Exhibit B; and,

**WHEREAS**, to comply with Section **920.10** of the Codified Ordinances of the **City of Massillon** Comprehensive Stormwater Management, pertaining to this project, the Owner has agreed to inspect, maintain, and repair the SCMs in accordance with the terms and conditions hereinafter set forth.

**NOW, THEREFORE**, for and in consideration of the mutual covenants and undertaking of the parties, the parties hereby agree as follows:

### A. FINAL INSPECTION APPROVAL

The Owner shall certify in writing to the **City of Massillon** within 30 days of completion of the SCMs that the SCMs are constructed in accordance with the approved plans and specifications and per the approved Comprehensive Stormwater Management Plan. The Owner shall further provide an As-Built Certification, including As-Built Survey and Inspection, as described in **920.10**, a copy of this complete Inspection and Maintenance Agreement, and the approved Inspection and Maintenance Plan.

### B. MAINTENANCE PLANS FOR STORMWATER CONTROL MEASURES

1. The Owner agrees to maintain in perpetuity the SCMs in accordance with approved Maintenance Plans described in #2 below and in a manner that will permit the SCMs to perform the purposes for which they were designed and constructed, and in accordance with the standards by which they were designed and constructed, all as shown and described in the approved Comprehensive Stormwater Management Plan. This includes all pipes and channels built to convey stormwater to the SCMs, as well as structures, improvements, and vegetation provided to control the quantity and quality of the stormwater.
2. The Owner shall provide a Maintenance Plan for each SCM. The Maintenance Plans shall include the following:

- i. The location of each SCM and identification of the drainage areas served by each SCM.
- ii. Photographs of each SCM, including all inlets and outlets upon completion of construction.
- iii. A schedule of inspection.
- iv. A schedule for regular maintenance for each aspect of the SCM and description of routine and non-routine maintenance tasks to ensure continued performance of the SCM as is detailed in the approved Comprehensive Stormwater Management Plan. The Owner shall also provide a maintenance inspection checklist written so the average person can understand it shall be incorporated. The maintenance plan will include a detailed drawing of each SCM and outlet structures with the parts of the outlet structure labeled. This schedule may include additional standards, as required by the **City of Massillon** engineer, to ensure continued performance of SCMs permitted to be located in, or within 50 feet of, water resources.
- v. Location and documentation of all access and maintenance easements on the Property.

Alteration or termination of these stipulations is prohibited. The Owner must provide a draft Inspection and Maintenance Plan as part of the Comprehensive Stormwater Management Plan submittal. Once a draft is approved, a recorded copy of the Plan must be submitted to the **City of Massillon** to receive final inspection approval of the site, as noted above in Section A.

***Note: Inspection and Maintenance Plans for all SCMs shall be drawn up to comply with the latest edition of the Ohio Department of Natural Resources Division of Soil and Water Conservation "Rainwater and Land Development Manual."***

3. The Owner shall maintain, update, and store the maintenance records for the SCMs.
4. The Owner shall perform all maintenance in accordance with the Inspection and Maintenance Plan and shall complete all repairs identified through regular inspections, and any additional repairs as requested in writing by the **City of Massillon**.

#### **C. INSPECTION, MAINTENANCE AND REPAIR OF SCMs**

1. The Owner shall inspect all SCMs listed in this Agreement, every three (3) months and after major storm events for the first year of operation.
2. The Owner shall inspect all SCMs listed in this Agreement at least once every year thereafter.
3. The Owner shall submit Inspection Reports in writing to the **City of Massillon** engineer within 30 days after each inspection. The reports shall include the following:

Date of inspection: \_\_\_\_\_

Name of inspector: \_\_\_\_\_

The condition and/or presence of:

- (i) Stormwater management pond
- (ii) Outlet structure

4. The Owner grants permission to the **City of Massillon** to enter the Property with prior notification to the Owner to inspect all aspects of the SCMs and related drainage whenever the **City of Massillon** deems necessary to verify that the SCMs are being maintained and operated in accordance with the terms and conditions hereinafter set forth. The **City of Massillon** shall maintain public records of the results of site inspections and shall provide the Owner copies of the inspection findings and shall indicate in writing any corrective actions and repairs to bring the SCMs into proper working condition if necessary.
5. The Owner shall complete all corrective actions and repairs within five (5) working days of their discovery through Owner inspections or through a request from the **City of Massillon**. If repairs will not occur within this five (5) day period, the Owner must receive written approval from the **City of Massillon** engineer for a repair schedule.
6. In the event of any default or failure by the Owner in the performance of any of the covenants and warranties pertaining to the maintenance of the SCMs, or the Owner fails to maintain the SCMs in accordance with the approved design standards and Inspection and Maintenance Plan, or, in the event of an emergency as determined by the **City of Massillon**, it is the sole discretion of the **City of Massillon**, after providing reasonable notice to the Owner, to enter the property and take whatever steps necessary to correct deficiencies and to charge the cost of such repairs to the Owner. The Owner shall reimburse the **City of Massillon** upon demand, within ten (10) days of receipt thereof for all actual cost incurred by the **City of Massillon**, or more with written approval from the **City of Massillon** engineer. All costs expended by the **City of Massillon** in performing such necessary maintenance or repairs shall constitute a lien against the properties of the Owner. Nothing herein shall obligate the **City of Massillon** to maintain the SCMs.

#### **D. FUNDING**

The Owner shall specify the method of funding for the perpetual inspection, operation, and maintenance of the SCMs listed in this Inspection and Maintenance Agreement. A description of the funding mechanism shall be submitted to the **City of Massillon** and approved by the **City of Massillon**.

#### **E. INDEMNIFICATION**

1. The Owner hereby agrees that it shall save, hold harmless, and indemnify the **City of Massillon** and its employees and officers from and against all liability, losses, claims, demands, costs and expenses arising from, or out of, default or failure by the Owner to maintain the SCMs, in accordance with the terms and conditions set forth herein, or from acts of the Owner arising from, or out of, the construction, operation, repair or maintenance of the SCMs.
2. The Owner hereby releases the **City of Massillon** from all damages, accidents, casualties, occurrences, or claims that might arise or be asserted against the **City of Massillon** from the presence, existence, or maintenance of the SCMs.

3. The parties hereto expressly do not intend by execution of this Inspection and Maintenance Agreement to create in the public, or any member thereof, any rights as a third party beneficiary or to authorize anyone not a party hereof to maintain a suit for any damages pursuant to the terms of this Inspection and Maintenance Agreement.
4. This Inspection and Maintenance Agreement shall be a covenant that runs with the land and shall inure to the benefit of and shall be binding upon the parties hereto, their respective successors and assigns, and all subsequent owners of the property.
5. The current Owner shall promptly notify the **City of Massillon** when the Owner legally transfers any of the Owners responsibilities for the SCMs. The Owner shall supply the **City of Massillon** with a copy of any document of transfer, executed by both parties.
6. Upon execution of this Inspection and Maintenance Agreement, it shall be recorded in the Recorder's Office of **Stark County**, Ohio, at the Owner's expense.

IN WITNESS WHEREOF, the Owner has caused this Inspection and Maintenance Agreement to be signed in its names by a duly authorized person.

\_\_\_\_\_  
Owner (signature)

\_\_\_\_\_  
Owner (please print)

By: \_\_\_\_\_  
**Appropriate Community Official**

## Exhibit A

# **LONG TERM MAINTENANCE PLAN FOR POST CONSTRUCTION STORMWATER QUALITY BEST MANAGEMENT PRACTICES EAST SIDE ELEMENTARY SCHOOL 1 PAUL BROWN DRIVE**

## **STORMWATER MANAGEMENT MEASURES**

### **CITY OF MASSILLON, OHIO**



Massillon City School District  
930 17<sup>th</sup> Street NE  
Massillon, Ohio 44646  
Contact: Mark Fortner  
[mfortner@massillonschools.org](mailto:mfortner@massillonschools.org)  
(330) 830 - 3900 ext. 50125

## **Project Description**

The Massillon East Side Elementary School (hereinafter referred to as development) is a new elementary school building on the existing Intermediate & Junior High School site, located at 1 Paul Brown Drive, within the City of Massillon.

There is one proposed extended wet detention storm water management structure in the development. The proposed pond will be located south of the proposed school, and shall provide water quality treatment through extended wet extended detention (24-hour draw down) in accordance with the Ohio EPA General Construction Permit OHC000005. The owner will be responsible for the general maintenance of these systems as directed in this document.

# **OPERATIONS AND MAINTENANCE MANUAL EAST SIDE ELEMENTARY SCHOOL STORMWATER MANAGEMENT MEASURES**

## **Contact Information**

1. Name: Massillon City School District  
c/o Mark Fortner
2. Address: 930 17<sup>TH</sup> Street NE  
Massillon, Ohio 44646
3. Phone: 330-830-3900 Ext. 50125
4. E-mail: mfortner@massillonschools.org

## **Statement of Responsibility**

1. The responsible party as named above, and/or any subsequent owner(s) of the property, is responsible for all maintenance and costs associated with the storm water management system.

## **Maintenance**

1. Sediment Removal Procedure

### Detention Basin Outlet Structure and Catch Basins

- a. Remove lid.
- b. Remove sediment from catch basin using shovel and other hand measures, or other mechanical measures as necessary.
- c. Clean sediment from outlet riser and unclog orifices.
- e. Replace the manhole lid.
- g. Sediment and pollutants removed from the insert shall be hauled off site and disposed of in accordance with local, state, and federal regulations.

### Detention Basins

- a. Install silt fence around outlet structure.
- b. Remove vegetative brush, saplings, and trees.
- c. Remove sediment build-up using mechanical measures as necessary.
- d. Re-grade water quality basin according to the detention basin plan found in the construction documents.
- e. Seed, fertilize, and mulch all disturbed areas.
- f. Remove silt fence from around outlet structure once vegetation in basin is established.
- g. Sediment and pollutants removed from the basin shall be hauled off site and



disposed of in accordance with local, state, and federal regulations

2. Maintenance Schedule

- a. Storm Water Management Measures Inspection – The storm water management measures should be inspected monthly for the first year and quarterly throughout the year after that and after major storm events.
- b. Detention Basin Outlet Structure Sediment Removal – The sediment and pollutants captured in the outlet structure shall be removed when the depth of sediment reaches to within 4” of the bottom of the water quality orifice and/or a minimum of once a year.

Water Quality Maintenance Schedule		
Water Quality Measure	Maintenance Activity	Schedule
Detention Basin Outlet Structure	Inspection of Detention Basin Outlet Structure	- Monthly for the first year - Quarterly after first year - After each rain event of greater than 0.5”
	Clean out Sediment and Pollutants	- When sediment depth has reached the bottom of the water quality orifice - Minimum of once a year
Catch Basin & Manhole Sumps	An inspection of catch basin sumps	- Every 2 months for the first 6 months, yearly after first year.
	Clean and remove debris and sediment	- as needed

3. Performance of Maintenance

- a. The inspection and maintenance of the storm water quality measures should be performed by a company with prior experience in similar work, and who owns equipment capable of performing the required procedures. The owner shall execute a contract with a company to perform such duties, as necessary, and shall provide them with a copy of the operations and maintenance manual.

**Notes**

1. The owner and any contractors hired to perform maintenance duties are responsible for meeting all federal, state, and local laws and regulations during the maintenance and cleanout operations of the storm water management measures.
2. The owner and any contractors hired to perform maintenance duties are responsible for complying with all federal, state, and local regulations when disposing of material collected from the storm water management measures. Water and sediment from cleanout procedures should not be dumped into sanitary sewer.
3. All inspection reports shall be submitted to the City of Massillon Engineer’s Office and Stark County Soil & Water Conservation District for their records.

# **LONG TERM MAINTENANCE PLAN FOR POST CONSTRUCTION STORM WATER QUALITY BEST MANAGEMENT PRACTICES (BMP'S)**

**Project Name:** Massillon East Side Elementary School

**Project Location:** 1 Paul Brown Drive, Massillon, Ohio 44646

**Jurisdiction of Water Quality Practice Discharge point:** (who's MS4 system does the WQ practice discharge into): City of Massillon storm sewer

Massillon CSD c/o Mark Fortner shall be responsible for the long-term maintenance of the water quality practice(s) listed below.

They shall follow this plan and any other requirements of the Stark County Post Construction Storm Water Quality Ordinance, the City of Massillon Ordinances & OEPA to the maximum extent practicable. All inspection reports will be kept by current owners and submitted annually to the City of Massillon Engineer's Office and Stark County Soil & Water Conservation District. Inspection reports must also be submitted upon request from either to the City of Massillon Engineer's Office or Stark County Soil & Water Conservation District.

**Water Quality Practice(s) on this site:**

1. Extended Wet Detention Basin

**Primary contact information for responsible person/entity:**

Name of Post Construction Maintenance Contact: Mark Fortner

Contact Phone Number: 330-830-3900 Ext. 50125

*I verify that I have read and understand the long term maintenance responsibilities as listed in this report.*

**Owner/Responsible Party signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

## Inspections

# Sample Storm-Water Management Inspection/Maintenance Report

# Storm-Water Management Inspection/Maintenance Report

Project Name: Massillon East Side Elementary School  
Project Location: Latitude: 40°47'36.1"N , Longitude: 81°29'51.7"W  
Address: 1 Paul Brown Drive  
City/Municipality: Massillon

Contact Name: Mark Fortner  
Address 930 17th Street NE, Massillon, Ohio 44646  
Phone 330-830-3900 Ext. 50125  
E-mail mfortner@massillonschools.org

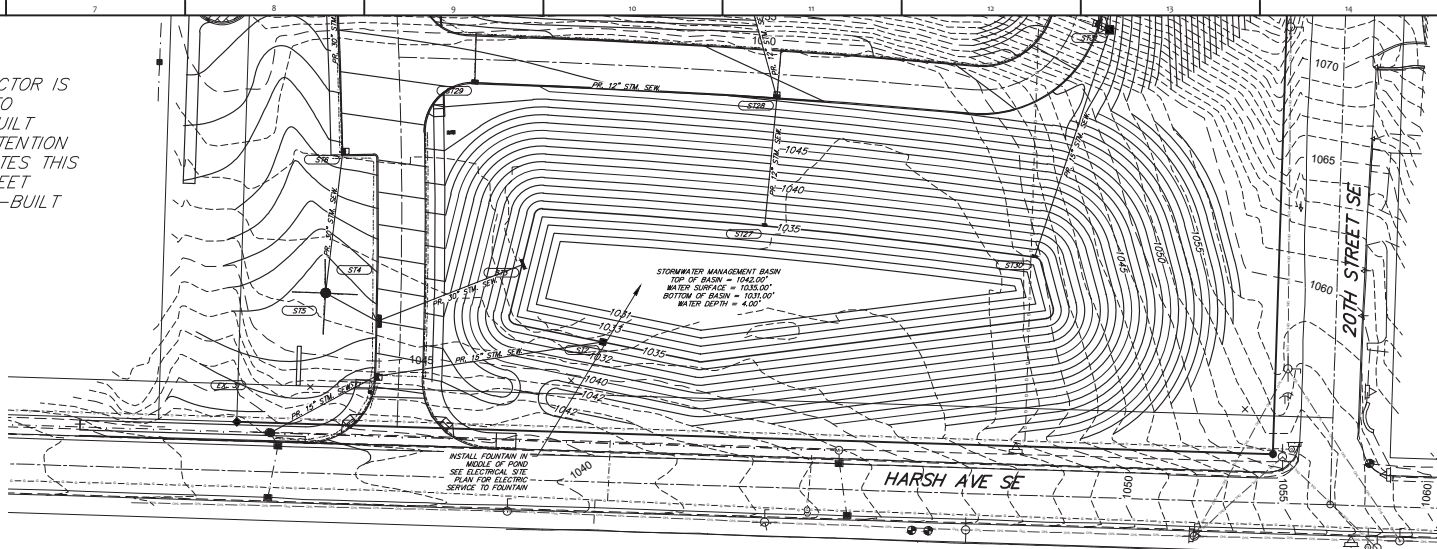
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## Exhibit B



OUTLET PROFILE  
SCALE: HORIZ. 1"=30', VERT. 1"=5'

NOTE: CONTRACTOR IS RESPONSIBLE TO PROVIDE AS-BUILT SURVEY OF DETENTION BASIN. SEE NOTES THIS SHEET AND SHEET C-401 FOR AS-BUILT REQUIREMENTS



STORMWATER MANAGEMENT PLAN  
SCALE: 1"=30'

STORMWATER MANAGEMENT BASIN NOTES

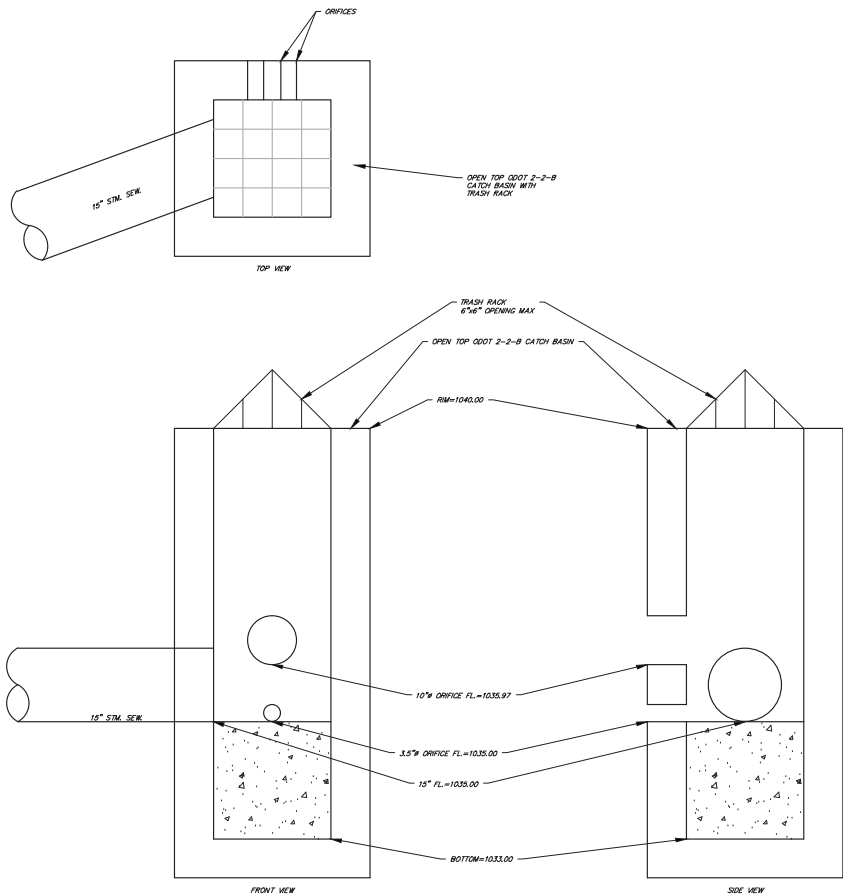
- 1) THE FINAL STORMWATER MANAGEMENT BASIN SHALL NOT BE INSTALLED UNTIL THE END OF THE PROJECT. SEE SHEET C-700 FOR DIRECTION ON USING THE STORMWATER MANAGEMENT BASIN AS A SEDIMENT BASIN WHILE THE SITE IS UNDER CONSTRUCTION.
- 2) THE CONTRACTOR SHALL INSTALL THE STORMWATER MANAGEMENT BASIN AS SHOWN ON THIS PLAN AT THE END OF THE PROJECT.
- 3) THE CONTRACTOR SHALL COMPLETELY Dewater THE SEDIMENT BASIN PRIOR TO BEGINNING ANY REGRADING ANY PARTS OF THE SEDIMENT BASIN TO ACHIEVE THE FINAL PLAN ELEVATIONS OF THE STORMWATER MANAGEMENT BASIN.
- 4) THE CONTRACTOR IS RESPONSIBLE FOR ALL EXPENSES TO CONVEY THE SEDIMENT BASIN TO THE FINAL STORMWATER MANAGEMENT BASIN, AS SHOWN ON THIS PLAN, INCLUDING BUT NOT LIMITED TO, REGRADING OF THE STORMWATER MANAGEMENT BASIN, MODIFICATION OF THE OUTLET STRUCTURE, CLEANING OF THE OUTLET STRUCTURE AND SITE STORM SEWERS.
- 5) AFTER THE CONSTRUCTION OF THE STORMWATER MANAGEMENT BASIN AND CONVERSION OF THE OUTLET STRUCTURE, THE CONTRACTOR SHALL PROVIDE AN AS-BUILT SURVEY STAMPED BY AN Ohio REGISTERED PROFESSIONAL SURVEYOR, IN BOTH HATCH COPY AND ELECTRONIC AUTOCAD FILE TO THE PROJECT ENGINEER OF THE ENTIRE SITE, INCLUDING STORMWATER MANAGEMENT BASIN AREA AND OUTLET STRUCTURE FOR REVIEW AND ACCEPTANCE OF WORK.
- 6) DEVIATION FROM THE DESIGN ELEVATIONS AND LOCATIONS OF MORE THAN 1/8" VERTICALLY OR 1" HORIZONTALLY FOR THE OUTLET STRUCTURE, INCLUDING FINAL FLOWLINE'S, DRIVE AND OVERFLOW MENS, WILL NOT BE ACCEPTED.
- 7) DEVIATION OF 1% OR GREATER FROM THE DESIGN STORAGE VOLUME AT EACH CONTOUR ELEVATION WILL NOT BE ACCEPTED.
- 8) THE WATER QUALITY VOLUME MUST BE MET IN ITS ENTIRETY IN ACCORDANCE WITH THE Ohio EPA GENERAL CONSTRUCTION PERMIT 040300006.
- 9) THE STORMWATER MANAGEMENT BASIN SHALL NOT AT ANY TIME DISCHARGE STORM WATER AT A HIGHER RATE THAN ANY ALLOWABLE DISCHARGE RATE FOR EACH STORM EVENT.
- 10) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL EXPENSES TO HIRE A PROFESSIONAL SURVEYOR TO PERFORM AN AS-BUILT SURVEY, AS WELL AS REGRADE THE BASIN TO THE DESIGN ELEVATIONS AND LOCATIONS AND ADJUST OR REPLACE THE OUTLET STRUCTURE UNTIL SAID AS-BUILT DRAWINGS DEMONSTRATE THAT THE WORK IS COMPLETE AND ACCEPTABLE TO THE PROJECT ENGINEER.
- 11) AT THE END OF THE PROJECT, AFTER FINAL SITE STABILIZATION IS COMPLETE (70%+ VEGETATIVE COVER ESTABLISHED), THE CONTRACTOR SHALL SUBMIT VIDEO EVIDENCE OF ALL STORM SEWERS TO PROVE THE STORM SEWERS ARE CLEAR OF ANY SEDIMENT, TRASH OR DEBRIS. EACH STORM RUN SHALL BE INSPECTED, IN ACCORDANCE WITH ODOT 811.12 REQUIREMENTS AND A PERFORMANCE REPORT SHALL BE SUBMITTED ALONG WITH THE VIDEO FILES FOR REVIEW IN ACCORDANCE WITH ODOT 811.04 D. IF ANY SEDIMENT, TRASH OR DEBRIS IS PRESENT, THE CONTRACTOR SHALL CLEAN THE STORM SEWERS USING THE AT-140 PROCESS RECOMMENDED BY THE MANUFACTURER AND RESUBMIT NEW VIDEO EVIDENCE AND PERFORMANCE REPORT OF THE STORM SEWERS, AT TO ADDITIONAL COST TO THE PROJECT.
- 12) IN THE EVENT THE CONTRACTOR FAILS TO PROVIDE ADEQUATE CLOSE OUT DOCUMENTS INCLUDING AS-BUILT AND VIDEO EVIDENCE, THE DESIGN TEAM RESERVES THE RIGHT TO PERFORM AND/OR SUBCONTRACT THE REQUIRED SERVICES REQUIRED TO PRODUCE THE REQUIRED AS-BUILT DOCUMENTS AND VIDEO INSPECTIONS. THE CONTRACTOR WILL THEN BE BIDD CHARGED FOR THE COST PLUS TEN PERCENT (10%) THE FEES ASSOCIATED WITH ACQUIRING THE REQUIRED DOCUMENTS.



STORMWATER MANAGEMENT BASIN SUMMARY					
STORM EVENT (YEAR)	PRE-DEVELOPED RUN-OFF RATES (CFS)	POST-DEVELOPED RUN-OFF RATES (CFS)	ALLOWABLE RUN-OFF RATES (CFS)	DEFENTION BASIN DISCHARGE RATES (CFS)	PEAK STORAGE ELEVATION (FT.)
1	13.57	17.69	13.57	1.32	1036.58
2	18.96	23.31	13.57	2.96	1036.95
5	27.50	31.92	13.57	3.64	1037.58
10	35.16	38.49	35.16	4.37	1038.14
25	42.00	50.79	42.00	5.20	1038.85
50	57.37	60.51	57.37	5.74	1039.61
100	68.73	71.07	68.73	6.18	1040.23

THE CRITICAL STORM WAS CALCULATED TO BE THE 5-YEAR STORM  
NOV REQUIRED BELOW PERMANENT WATER SURFACE = 16,711.53 CUBIC FEET  
(INCLUDES 20% FOR SEDIMENT STORAGE)  
NOV PROVIDED BELOW PERMANENT WATER SURFACE = 45,449 CUBIC FEET  
NOV REQUIRED ABOVE PERMANENT WATER SURFACE = 16,014.01 CUBIC FEET  
NOV PROVIDED ABOVE PERMANENT WATER SURFACE = 16,108.53 CUBIC FEET

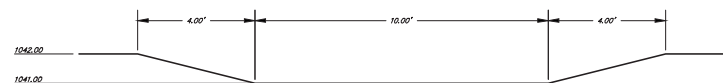
STORMWATER MANAGEMENT BASIN STORAGE (ABOVE PERMANENT POOL)	
ELEVATION (FEET)	VOLUME (CUBIC FEET)
1035	0
1036	16,607
1037	35,807
1038	57,761
1039	85,509
1040	110,172
1041	140,849
1042	174,643
STORMWATER MANAGEMENT BASIN STORAGE (PERMANENT POOL)	
ELEVATION (FEET)	VOLUME (CUBIC FEET)
1031	0
1032	7,231
1033	16,648
1034	26,315
1035	42,408



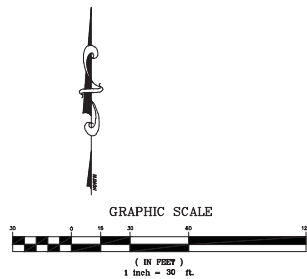
OUTLET STRUCTURE "ST2" DETAIL  
SCALE: HORIZ. 1"=1', VERT. 1"=1'

NOTE:  
CONTRACTOR SHALL INSTALL FLOATING FOUNTAIN SYSTEM IN MIDDLE OF BASIN FOR WATER QUALITY CONTROL. SEE ELECTRICAL PLANS FOR POWER TO FOUNTAIN.  
FOUNTAIN SHALL BE OUTDOOR WATER SOLUTIONS ECO LINE 1/2 HP 175V FLOATING POND FOUNTAIN, OR APPROVED EQUAL.  
CONTRACTOR SHALL PROVIDE ALL ITEMS, INCLUDING ANCHOR, INSTALLED.  
FOUNTAIN SPRAY SHALL PROVIDE GREATER THAN 50% SURFACE AREA OF THE POND. CONTRACTOR SHALL UPGRADE FOUNTAIN, OR PROVIDE MULTIPLE FOUNTAINS TO MEET INTENDED COVERAGE.

NOTE: THIS STORMWATER MANAGEMENT BASIN IS A WET EXTENDED DETENTION BASIN



EMERGENCY OVERFLOW WEIR  
SCALE: HORIZ. 1"=2', VERT. 1"=2'



## Exhibit C

The water quality volume for this site is calculated in accordance with the Ohio EPA General Construction Permit OHC000006 dated April 23, 2023. Since this site is a redevelopment site, water quality is calculated using Equation 3 on Page 23 of 60.

Calculate the run-off coefficient “ $R_{V1}$ ” (Existing Conditions):

$$R_{V1} = 0.05 + 0.9i$$

$R_{V1}$  = Coefficient

$$i = \text{Imperviousness ratio} = \text{imperviousness acreage} / \text{total acreage} = 2.70 / 12.94 = 0.209$$

$$R_{V1} = 0.05 + 0.9(0.209) = 0.2381$$

Calculate the run-off coefficient “ $R_{V2}$ ” (Proposed Conditions):

$$R_{V2} = 0.05 + 0.9i$$

$R_{V2}$  = Coefficient

$$i = \text{Imperviousness ratio} = \text{imperviousness acreage} / \text{total acreage} = 7.85 / 12.94 = 0.607$$

$$R_{V2} = 0.05 + 0.9(0.607) = 0.5963$$

Calculate the required “Water Quality Pond Volume” (WQV) (Equation 3):

$$WQV = P \times A \times [(R_{V1} \times 0.2) + (R_{V2} - R_{V1})] / 12$$

WQV = Volume in Acre-Feet

$$R_{V1} = \text{Existing Conditions Run-Off Coefficient} = 0.2381$$

$$R_{V2} = \text{Proposed Conditions Run-Off Coefficient} = 0.5963$$

$$P = \text{Precipitation Depth} = 0.9 \text{ Inches}$$

$$A = \text{Drainage Area} = 12.94 \text{ Acres}$$

$$WQV = 0.9 \times 12.94 \times [(0.2381 \times 0.2) + (0.5963 - 0.2381)] / 12$$

$$WQV = 0.36764481 \text{ Acre-Feet}$$

$$WQV = 16,014.61 \text{ Cubic Feet}$$

Required volume below the water surface (elevation 1035.00).

$$(16,014.61 \times 1.00) + (16,014.61 \times 0.20) = 19,217.53 \text{ Cubic Feet}$$

The pond volume table states the permanent water pool volume is approximately 42,408 Cubic Feet.

Required volume above the water surface.

$$16,014.61 \times 1.00 = 16,014.61 \text{ Cubic Feet}$$

Apply the storage volume (16,014.611 c.f.) to the pond. The resulting water elevation is 1035.97. Interpolating from the provided Elevation vs. Area table, you will determine that at elevation 1035.97, the pond storage volume is approximately 16,108.33 c.f. which is above the required volume.

Using the Drain Time Calculator in Pond Pack software to demonstrate that it takes at least 24 hours to drain the pond from elevation 1035.97 through a 3.5" diameter orifice. 24 hours is the minimum drain time for wet extended detention. Following is a print out of the Time vs. Volume table from the Drain Time Calculator starting at elevation 1035.97 showing 2,121 c.f. of water is retained in the basin at 24 hours (1440 minutes). The table shows it will take longer than 24 hours to drain the pond from elevation 1035.97.

In addition, the minimum drain time, 50% of the above pool volume must remain in the water quality basin for the first 8 hours (480 minutes). The Time vs. Volume table from the Drain Time Calculator starting at elevation 1035.97 demonstrates that 8,222 c.f. is remaining in the basin beyond the initial 8 hours.

References:

- 1.) O.E.P.A. N.P.D.E.S. for Discharge of Storm Water from Construction Sites. (Permit OHC000005 effective April 23, 2018)
- 2.) Rainwater and Land Development Manual for Ohio. Post-Construction Storm Water Treatment Section. Water Quality Ponds.



Type.... Time vs. Volume  
Name.... MDRAIN 1        OUT

File.... F:\22-070\22-070\_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
.00	16068	15968	15870	15772	15677
25.00	15579	15484	15389	15294	15199
50.00	15106	15011	14918	14826	14731
75.00	14636	14544	14451	14359	14267
100.00	14175	14085	13993	13903	13814
125.00	13724	13634	13545	13458	13370
150.00	13281	13194	13107	13020	12933
175.00	12846	12760	12673	12588	12504
200.00	12418	12333	12249	12167	12083
225.00	12001	11917	11835	11753	11673
250.00	11592	11510	11431	11351	11270
275.00	11191	11111	11032	10953	10874
300.00	10795	10718	10641	10564	10488
325.00	10411	10336	10260	10185	10111
350.00	10037	9962	9890	9816	9744
375.00	9672	9598	9526	9454	9382
400.00	9310	9240	9169	9099	9030
425.00	8960	8890	8821	8754	8686
450.00	8619	8552	8485	8420	8352
475.00	8287	8222	8157	8092	8030
500.00	7965	7900	7837	7772	7710
525.00	7647	7585	7524	7462	7401
550.00	7341	7280	7220	7162	7101
575.00	7043	6985	6927	6870	6812
600.00	6756	6700	6644	6588	6532
625.00	6478	6422	6368	6314	6261
650.00	6207	6153	6099	6047	5994
675.00	5942	5890	5841	5789	5740
700.00	5690	5640	5591	5543	5494
725.00	5446	5399	5351	5304	5259
750.00	5213	5166	5121	5077	5032
775.00	4988	4943	4900	4857	4813
800.00	4772	4729	4688	4644	4603
825.00	4562	4523	4484	4444	4407
850.00	4368	4331	4296	4258	4223
875.00	4188	4155	4120	4087	4055
900.00	4022	3991	3960	3929	3897
925.00	3868	3837	3808	3781	3751
950.00	3724	3697	3670	3642	3617
975.00	3590	3565	3541	3516	3491
1000.00	3468	3444	3421	3398	3375
1025.00	3353	3332	3311	3289	3268
1050.00	3247	3227	3206	3187	3167

480 min.

8 hrs.

Type.... Time vs. Volume  
Name.... MDRAIN 1        OUT

File.... F:\22-070\22-070\_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min				
	Time on left represents time for first value in each row.				
1075.00	3148	3129	3111	3092	3075
1100.00	3055	3038	3019	3001	2984
1125.00	2966	2949	2932	2914	2897
1150.00	2882	2864	2847	2831	2816
1175.00	2799	2783	2768	2752	2737
1200.00	2722	2706	2691	2675	2660
1225.00	2647	2631	2618	2602	2589
1250.00	2573	2560	2546	2533	2520
1275.00	2506	2493	2479	2466	2452
1300.00	2439	2427	2414	2402	2389
1325.00	2377	2364	2353	2341	2328
1350.00	2316	2305	2293	2282	2270
1375.00	2259	2247	2237	2226	2214
1400.00	2203	2193	2182	2172	2161
1425.00	2151	2140	2130	2121	2111
1450.00	2100	2090	2080	2071	2061
1475.00	2052	2042	2033	2023	2015
1500.00	2006	1996	1987	1979	1970
1525.00	1960	1952	1943	1935	1928
1550.00	1918	1910	1903	1893	1885
1575.00	1878	1870	1863	1855	1845
1600.00	1838	1830	1824	1817	1809
1625.00	1802	1794	1786	1781	1773
1650.00	1765	1758	1752	1744	1739
1675.00	1731	1725	1718	1712	1704
1700.00	1699	1693	1685	1679	1674
1725.00	1666	1660	1655	1649	1643
1750.00	1638	1632	1626	1620	1615
1775.00	1609	1603	1598	1592	1586
1800.00	1580	1575	1569	1565	1559
1825.00	1554	1548	1544	1539	1533
1850.00	1529	1523	1518	1514	1508
1875.00	1502	1499	1493	1487	1483
1900.00	1478	1474	1468	1462	1459
1925.00	1453	1449	1443	1440	1434
1950.00	1430	1424	1421	1415	1411
1975.00	1405	1402	1396	1392	1386
2000.00	1383	1377	1373	1369	1364
2025.00	1360	1354	1350	1347	1341
2050.00	1337	1331	1328	1324	1318
2075.00	1314	1310	1305	1301	1297
2100.00	1293	1288	1284	1280	1276
2125.00	1271	1267	1263	1259	1254
2150.00	1250	1246	1242	1238	1233

1440 min  
24 hrs

Type.... Time vs. Volume  
Name.... MDRAIN 1        OUT

File.... F:\22-070\22-070\_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
2175.00	1229	1225	1221	1218	1214
2200.00	1210	1204	1200	1197	1193
2225.00	1189	1185	1181	1178	1174
2250.00	1170	1164	1161	1157	1153
2275.00	1149	1145	1142	1138	1134
2300.00	1130	1127	1123	1119	1115
2325.00	1111	1108	1104	1100	1098
2350.00	1094	1091	1087	1083	1079
2375.00	1075	1072	1068	1064	1060
2400.00	1058	1055	1051	1047	1043
2425.00	1039	1036	1034	1030	1026
2450.00	1022	1019	1017	1013	1009
2475.00	1005	1002	1000	996	992
2500.00	988	986	983	979	977
2525.00	973	969	966	964	960
2550.00	956	954	950	947	945
2575.00	941	937	935	932	928
2600.00	926	922	918	916	913
2625.00	911	907	903	901	898
2650.00	896	892	888	886	882
2675.00	880	877	875	871	869
2700.00	865	862	860	856	854
2725.00	850	848	845	843	839
2750.00	837	833	831	829	826
2775.00	824	820	818	814	812
2800.00	809	807	805	801	799
2825.00	795	794	790	788	786
2850.00	782	780	778	775	773
2875.00	769	767	765	761	760
2900.00	758	754	752	750	746
2925.00	745	743	739	737	735
2950.00	733	729	728	726	722
2975.00	720	718	716	712	711
3000.00	709	707	703	701	699
3025.00	697	694	692	690	688
3050.00	684	682	680	678	677
3075.00	673	671	669	667	665
3100.00	663	660	658	656	654
3125.00	652	650	646	645	643
3150.00	641	639	637	635	631
3175.00	629	628	626	624	622
3200.00	620	618	616	614	611
3225.00	609	607	605	603	601
3250.00	599	597	596	594	592

Type.... Time vs. Volume  
Name.... MDRAIN 1        OUT

File.... F:\22-070\22-070\_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
3275.00	590	588	586	584	582
3300.00	580	579	577	575	573
3325.00	571	569	567	565	563
3350.00	562	560	558	556	554
3375.00	552	550	548	547	545
3400.00	543	541	539	537	535
3425.00	533	531	530	528	526
3450.00	524	522	520	520	518
3475.00	516	515	513	511	509
3500.00	507	505	503	501	501
3525.00	499	498	496	494	492
3550.00	490	488	488	486	484
3575.00	483	481	479	477	477
3600.00	475	473	471	469	467
3625.00	467	466	464	462	460
3650.00	460	458	456	454	452
3675.00	451	451	449	447	445
3700.00	445	443	441	439	437
3725.00	437	435	434	432	432
3750.00	430	428	426	426	424
3775.00	422	420	420	419	417
3800.00	415	415	413	411	409
3825.00	409	407	405	404	404
3850.00	402	400	400	398	396
3875.00	396	394	392	390	390
3900.00	388	387	387	385	383
3925.00	383	381	379	379	377
3950.00	375	375	373	372	372
3975.00	370	368	368	366	364
4000.00	364	362	360	360	358
4025.00	358	356	355	355	353
4050.00	351	351	349	349	347
4075.00	345	345	343	341	341
4100.00	340	340	338	336	336
4125.00	334	334	332	332	330
4150.00	328	328	326	326	325
4175.00	323	323	321	321	319
4200.00	319	317	315	315	313
4225.00	313	311	311	310	310
4250.00	308	308	306	304	304
4275.00	302	302	300	300	298
4300.00	298	296	296	294	294
4325.00	293	293	291	291	289
4350.00	287	287	285	285	283

Type.... Time vs. Volume  
Name.... MDRAIN 1        OUT

File.... F:\22-070\22-070\_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min				
	Time on left represents time for first value in each row.				
4375.00	283	281	281	279	279
4400.00	278	278	276	276	276
4425.00	274	274	272	272	270
4450.00	270	268			