City of Freeport Stormwater Management Plan

Prepared for

Sauk River Watershed District

July 2011

City of Freeport Stormwater Management Plan

Wenck File #0019-84

Prepared for:

SAUK RIVER WATERSHED DISTRICT
524 Fourth Street South
Sauk Centre, Minnesota 56378

Prepared by:

WENCK ASSOCIATES, INC.
1800 Pioneer Creek Center
P.O. Box 249
Maple Plain, Minnesota 55359-0249
(763) 479-4200

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1.0 Introduction

This stormwater management plan has been prepared to address urban stormwater concerns within the Sauk River Watershed District (SRWD). The SRWD contracted Wenck Associates, Inc. (Wenck) to conduct an assessment of the City of Freeport's stormwater management practices and to identify potential improvements.

1.1 PURPOSE

The purpose of the plan was to create a stormwater management tool for the City of Freeport which addresses flooding and water quality issues. The plan identifies five potential opportunities for implementing Best Management Practices (BMPs) to improve stormwater management including total phosphorus (TP) and total suspended solids (TSS) reduction. The plan has been completed on behalf of the SRWD and provides the necessary information needed to help leverage grant and cost share dollars available in the State of Minnesota for implementing these improvements.

1.2 SCOPE

The scope of work in preparing this plan was to:

- Define subwatersheds within the City.
- Complete a site visit with a city representative and SRWD staff to identify and evaluate stormwater issues (existing and future growth).
- Identify potential solutions and BMPs.
- Provide conceptual design parameters.
- Create budgetary cost estimates.
- Prepare a report with the findings.

2.0 Site Information

2.1 SUBWATERSHED DELINEATION

The subwatersheds in the vicinity of Freeport were delineated using the two-foot topographical Light Detection and Ranging (LIDAR) data provided by Stearns County, information obtained from the City, and lakeshed information from the Department of Natural Resources (DNR). The subwatershed areas identified provide an approximate surface area flowing through or out of Freeport.

The study area contains ten subwatersheds, as shown on Figure 1. All of the subwatershed boundaries extend beyond the City limits, but were identified to help understand the extent of contributing areas. The land use in the City consists of agricultural, wetlands, open space, and urban (developed).

2.2 SITE VISIT

A site visit was conducted on May 2, 2011 with the following people in attendance:

- Lynn Nelson, SRWD
- Vickie Holthaus, City of Freeport
- Chris Meehan, Wenck

During the site visit, the subwatershed boundaries were reviewed, existing problem areas were identified, and potential solutions were discussed.

2.3 EXISTING PROBLEM AREAS & POTENTIAL SOLUTIONS

Five areas were identified by the District and City for further analysis. A plan view of the potential improvement areas is shown on Figure 2, and the potential improvements are discussed further below. Each solution includes a conceptual design and cost estimate.

2.3.1 Sediment Forebay East of Existing Wetland

An existing wetland (Freeport Lake) in the northeast corner of the City, east of County Road 11 (CR-11), receives stormwater runoff from surrounding fields and CR-11. A high volume of sediment runoff from the adjacent fields and impervious surfaces is deposited in the wetland which ultimately contributes to sediment loadings in the Sauk River. The construction of a sediment forebay on the east side of the wetland would help capture some of the influent sediment prior to entering the wetland, and therefore improve the quality of the wetland and the Sauk River. Sediment forebays are typically shallow depressions that allow the sediment to be collected prior to the stormwater flowing into the wetland.

At minimum, the sediment forebay would be sized to contain a 1-inch runoff event from an approximately 16-acre tributary area. It would be two feet deep and would be constructed with 4H:1V sideslopes. The primary outlet from the forebay to the stormwater pond would be a below-grade draintile surrounded by pea rock and granular. A secondary outlet consisting of a riprap overflow would be installed for high volume storm events and to act as an emergency overflow. A standard detail of a sediment forebay from the Metropolitan Council is included in Appendix A.

The estimated conceptual cost for construction a sediment forebay adjacent to the existing stormwater pond is $47,500. A detailed breakdown of the estimate is included in Table 1.

2.3.2 Rainwater Harvesting at the Fire Department

The City Fire Department property, at the intersection of North Avenue and 1st Avenue N, is mainly impervious in nature. Impervious surfaces, such as concrete or bituminous pavement

or building rooftops, prohibit stormwater from being infiltrated into the ground. This creates more runoff that can be high in TP and TSS as well as other nutrients. The fire department also uses a large volume of potable water for their operations such as filling fire trucks for responding to emergencies or for training purposes.

A rainwater harvesting tank is proposed to be installed on the property to collect runoff from the building and surrounding paved area. The water would be available for use by the fire department for emergency response or training purposes. This solution would help reduce runoff impacts to the Sauk River while reducing the amount of potable water consumed by the fire department.

The rainwater harvesting tank at the City Fire Department would be sized to collect and store a 1.25-inch runoff event from the approximately 0.6-acre tributary area. This would require a 20,000-gallon tank which would be installed below grade. Installation of the tank would include piping and a pump and would require restoration of the surface (pavement assumed) where it is installed. When the tank is full, overflow would bypass the tank and be discharged offsite as is currently done. A standard detail of a typical system from Darco Inc. is included in Appendix A.

The estimated conceptual cost for rainwater harvesting at the City Fire Department is $62,100. A detailed breakdown of the estimate is included in Table 2.

2.3.3 Storm Sewer Structure Revisions

The City of Freeport has several storm sewer catch basins and manholes throughout the City which receive runoff from the streets and boulevards. The existing storm sewer system conveys stormwater away from the City and the discharged runoff ultimately flows to the Sauk River. Phosphorous and sediment in the runoff is currently collected and discharged with the stormwater. However, the installation of sumps in some of the storm sewer structures would allow for some of the nutrients and sediment to be captured prior to discharge and would, therefore, provide TP and TSS treatment.

The sumps would be installed in multiple structures along 1st Avenue N, 3rd Street NE, and Main Street. The sumps would be installed by cutting out a section of the structure base, excavating approximately 2.5 feet of soil by hand, and forming concrete walls and a bottom to create an impermeable sediment trap. A bypass system, such as a pump system, would have to be implemented during construction and while the concrete cures. The sumps would also require maintenance annually to remove the sediment collected.

Assuming ten structures would be revised, the estimated conceptual cost for the storm sewer structure revisions is $24,300. A detailed breakdown of the estimate is included in Table 3.

2.3.4 Stormwater Diversion and Infiltration Basin

There is property between Main Street and Interstate 94 (I-94) which is currently open space and has limited acreage for development. A large portion of stormwater from Main Street and the area between Main Street and I-94 is routed through this property in the process of being conveyed away from the City. The construction of an infiltration basin would provide runoff control and would provide TP and TSS treatment for a large area with a high volume of impervious surfaces.

Stormwater diversion ditches would be constructed adjacent to the basin to route storm sewer discharge through the basin. The infiltration basin would be sized to collect and store a 1-inch runoff event from a 48-acre tributary area. The basin would be four feet deep with 4H:1V sideslopes. A typical basin cross-section would include topsoil, granular filter material, and pea rock with a draintile under-drain that daylights to the existing discharge point. This design would allow runoff to filter through the fill materials prior to being discharged or infiltrated in the subsurface. A detail of a typical filtration basin is included in Appendix A.

The estimated conceptual cost for the stormwater diversion and infiltration basin is $89,200. A detailed breakdown of the estimate is included in Table 4.

2.3.5 Rain Garden Initiative

Rain gardens are shallow depressions, typically constructed adjacent to streets or parking areas, which are planted with native plants that maximize water uptake and reduce runoff. The City could start a program to raise awareness regarding the benefits of rain gardens and work with residences or businesses to construct rain gardens on their property. By constructing multiple rain gardens within the City, the phosphorous and sedimentation impacts to the Sauk River would be reduced.

With community involvement, the rain gardens would be installed adjacent to the street or parking lots. The rain gardens would receive stormwater runoff directly from the impervious surfaces and would each be approximately 100 square feet in size or larger depending on land availability. A standard conceptual detail and an artist's rendering of a typical rain garden are included in Appendix A.

Assuming 10 participants construct 100 square foot rain gardens, the estimated conceptual cost for the rain garden initiative is $27,000. However, this is largely dependent on the number of participants. A detailed breakdown of the estimate is included in Table 5.

3.0 Summary

There are currently very few stormwater quality treatment practices implemented throughout the City. With consideration to past studies conducted by SRWD of the Sauk River for TP and TSS, multiple BMPs should be implemented in the City of Freeport to improve the overall quality of the Sauk River. Ideally, all improvements discussed in Section 2.3 would be implemented. However, cost, maximizing effectiveness, and anticipated community participation should be considered. With these factors in mind, it is recommended that the City of Freeport initially pursue the Stormwater Diversion and Infiltration Basin project.

The Stormwater Diversion and Infiltration Basin project should be a high priority due to the large influent area with a high volume of impervious surfaces and the ability to treat TP and TSS for a large portion of the City. This project is the most expensive of the four improvement considerations, but would also be the most effective.

3.1 FUNDING

The SRWD is able to provide 50% cost share for these stormwater management projects as long as they are not associated with new construction or development. The 50% cost share option would be drawn from an undetermined pool of grant money received by the SRWD. This grant money will be distributed for various projects throughout the watershed district based on regional prioritization and projected effectiveness related to improving water quality in the Sauk River. If the City plans to develop or redevelop sections of the City, cost share funds will only be available to address the current conditions. Cost share funds may become available if proposed future construction includes implementation of stormwater abatement efforts that exceed permit requirements.

The remaining amount not funded by the cost share option would need to be funded by the City or through other means such as in-kind services/materials. Funding could also be offset by community volunteering.

3.2 PROJECTS

The following table is a summary of the potential stormwater management solutions in the City of Freeport:

Project	Reason	Estimated Cost[1]	Treatment		Priority
			TP[2] lbs/yr	TSS[2] tons/yr	
Sediment Forebay	Reduce Sediment Discharge	$47,500	59.0	38.9	Med
Rainwater Harvesting at the Fire Department	Runoff Re-use	$62,100	8.3	1.4	Low
Storm Sewer Structure Revisions	Sediment Collection	$24,300	NA	13.7	Med
Stormwater Diversion and Infiltration Basin	Improve Quality	$89,200	442.8	72.9	High
Rain Garden Initiative	Improve Quality	$27,000	10.1	1.7	Med

[1] Detailed cost estimates are attached. See Tables 1-5.

[2] Estimated treatment quantities based on assumed runoff concentrations of 8.2 lbs/ac-ft for TP and 2700 lbs/ac-ft for TSS.

Tables

City of Freeport

Stormwater Management Plan

Sauk River Watershed District

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July 2011

Table 1. Sediment Forebay Conceptual Cost Estimate

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization & Demobilization	LS	1	$15,000.00	$15,000.00
6" Topsoil Strip & Respread	CY	550	$5.00	$2,750.00
Common Excavation (2' Depth)	CY	2,200	$4.00	$8,800.00
Riprap Overflow	CY	5	$60.00	$300.00
Geotextile Fabric & Filter Material	SY	10	$5.00	$50.00
6" Draintile w/Pea Rock	LF	50	$30.00	$1,500.00
Site Restoration	AC	1.0	$1,000.00	$1,000.00
Silt Fence	LF	800	$3.00	$2,400.00
Erosion Control Blanket	SY	600	$4.00	$2,400.00
Rock Construction Entrance	LS	1	$1,000.00	$1,000.00
			Estimated Subtotal	**$35,200**
Total Cost				
Engineering & Construction Oversight (15% of Subtotal)				**$5,280**
Contingency (20% of Subtotal)				**$7,040**
			Estimated Total (Rounded)	**$47,500**

Note: Estimate based on storage capacity of 1.3 ac-ft for containing 1" runoff event from 16-acre area.

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Table 2. Rainwater Harvesting at the Fire Dept. Conceptual Cost Estimate

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization & Demobilization	LS	1	$5,000.00	$5,000.00
Fiberglass Tank (20,000 Gallons)	EA	1	$23,000.00	$23,000.00
Piping	LS	1	$5,000.00	$5,000.00
Pump & Electrical	EA	1	$3,000.00	$3,000.00
Site Restoration (Pavement)	SY	100	$100.00	$10,000.00
			Estimated Subtotal	**$46,000**
Total Cost				
Engineering & Construction Oversight (15% of Subtotal)				**$6,900**
Contingency (20% of Subtotal)				**$9,200**
			Estimated Total (Rounded)	**$62,100**

Note: Estimate based on storage capacity for containing 1.25" runoff event from 0.6-acre tributary area.

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Table 3. Storm Sewer Structure Revisions Conceptual Cost Estimate

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization & Demobilization	LS	1	$5,000.00	$5,000.00
Cut & Remove Concrete Base (2' x 2' x 6")	EA	10	$400.00	$4,000.00
Excavate & Install Concrete Sump	EA	10	$600.00	$6,000.00
Stormwater Bypass (Pump, etc.)	EA	10	$200.00	$2,000.00
Site Restoration (Includes Street Sweeping)	LS	1	$1,000.00	$1,000.00
			Estimated Subtotal	**$18,000**
Total Cost				
Engineering & Construction Oversight (15% of Subtotal)				**$2,700**
Contingency (20% of Subtotal)				**$3,600**
			Estimated Total (Rounded)	**$24,300**

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Table 4. Stormwater Diversion & Infiltration Basins Conceptual Cost Estimate

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization & Demobilization	LS	1	$15,000.00	$15,000.00
6" Topsoil Strip & Respread	CY	400	$5.00	$2,000.00
Stormwater Diversion Grading	LS	1	$2,000.00	$2,000.00
Common Excavation (4' Depth)	CY	3,300	$4.00	$13,200.00
Pea Rock (1' Depth)	CY	800	$15.00	$12,000.00
Granular Filter Material (1' Depth)	CY	800	$7.00	$5,600.00
Filter Blanket	SY	2,500	$3.00	$7,500.00
6" Draintile	LF	200	$15.00	$3,000.00
Site Restoration	AC	1.0	$1,000.00	$1,000.00
Silt Fence	LF	600	$3.00	$1,800.00
Erosion Control Blanket	SY	500	$4.00	$2,000.00
Rock Construction Entrance	LS	1	$1,000.00	$1,000.00
			Estimated Subtotal	**$66,100**
Total Cost				
Engineering & Construction Oversight (15% of Subtotal)				**$9,915**
Contingency (20% of Subtotal)				**$13,220**
			Estimated Total (Rounded)	**$89,200**

Note: Estimate based on storage capacity of 2.0 ac-ft for containing 0.5" runoff event from 48-acre area.

Table 5. Raingarden Infiltration Initiative Conceptual Cost Estimate

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization & Demobilization	LS	1	$5,000.00	$5,000.00
Raingarden	EA	10	$1,000.00	$10,000.00
Site Restoration	LS	1	$5,000.00	$5,000.00
			Estimated Subtotal	**$20,000**
Total Cost				
Engineering & Construction Oversight (15% of Subtotal)				**$3,000**
Contingency (20% of Subtotal)				**$4,000**
			Estimated Total (Rounded)	**$27,000**

Note: Estimate based on 100 square foot raingardens and $10/sf for total construction.

Figures

SAUK RIVER WATERSHED DISTRICT

City of Freeport Subwatershed Map

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

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Figure 1

Legend

- Municipal Boundary
- Constructed Wetlands
- Regional Ponding
- Rainwater Harvesting
- Sediment Forbay
- Infrastructure Improvements
- Rain Garden Initiative Areas
- Rain Garden and Stormwater Pond Improvements
- Infiltration Basin
- Plantings

Construct Sediment Forbay East of Existing Wetland

Rainwater Harvesting for Fire Department

Storm Sewer Structure Improvements (Add Sumps)

Stormwater Diversion and Infiltration Basin Between I-94 and CR-157

2010 Aerial Photograph (Source: Mn GEO)

600 300 0 600 Feet

N

Path: L:\0019\0019-84\mxd\Freeport SW Improv.mxd
Date: 6/23/2011 Time: 11:14:04 AM User: shujc0243

SAUK RIVER WATERSHED DISTRICT

City of Freeport Stormwater Improvement Considerations

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

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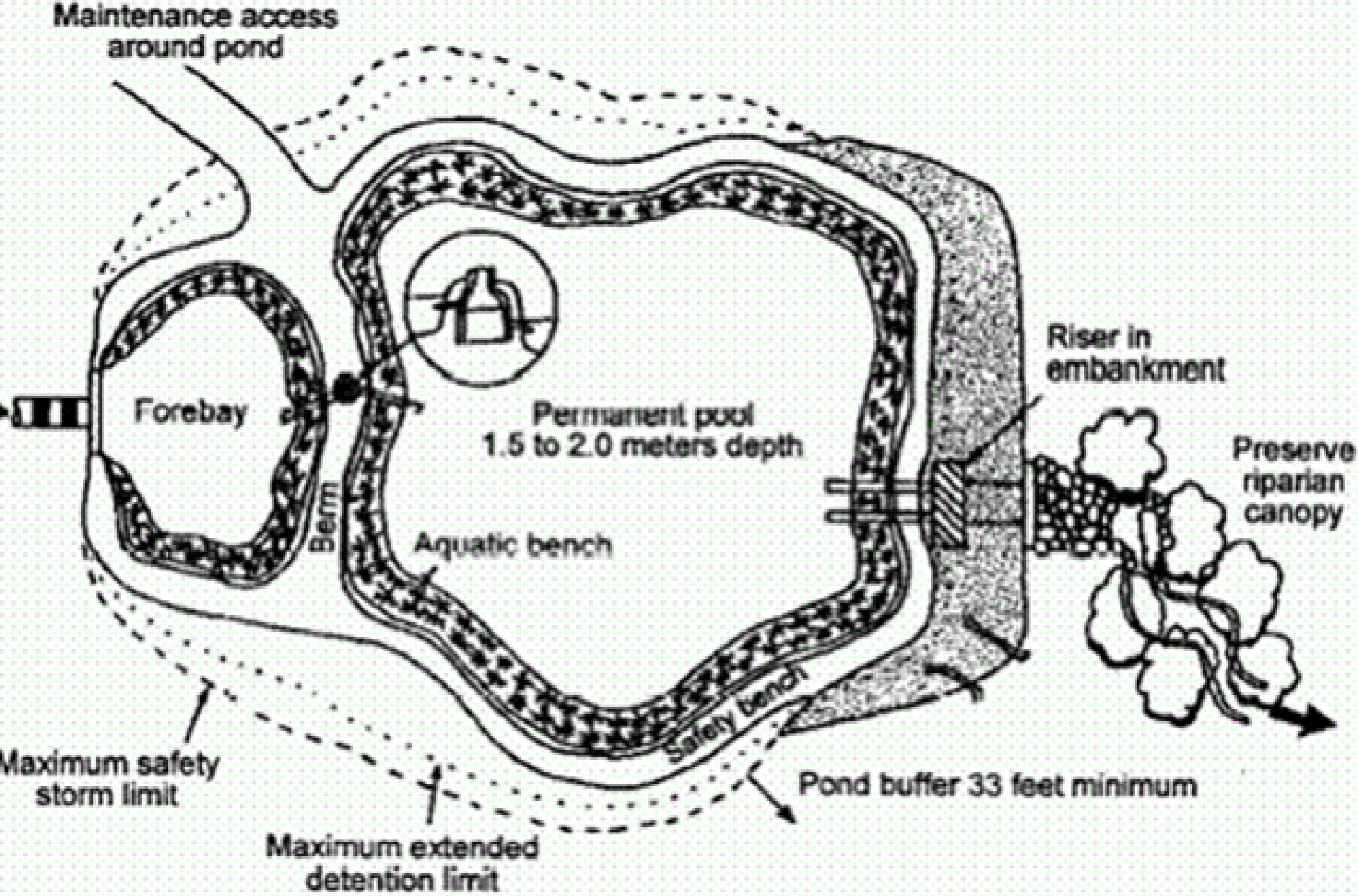
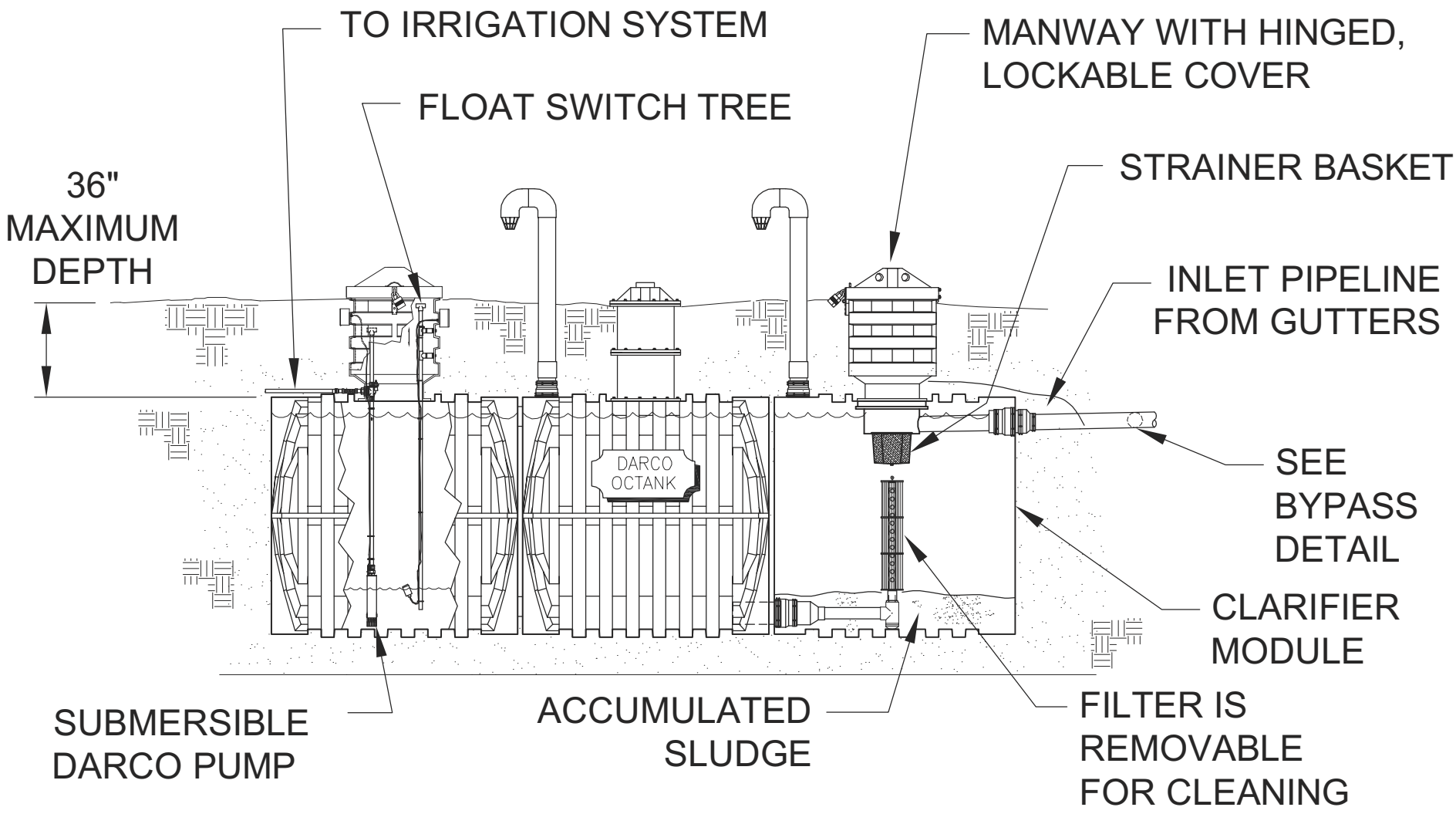
Figure 2

Appendix A

Standard Details


Maintenance access around pond
Forebay
Berm
Permanent pool 1.5 to 2.0 meters depth
Aquatic bench
Riser in embankment
Preserve riparian canopy
Safety bench
Maximum safety storm limit
Maximum extended detention limit
Pond buffer 33 feet minimum

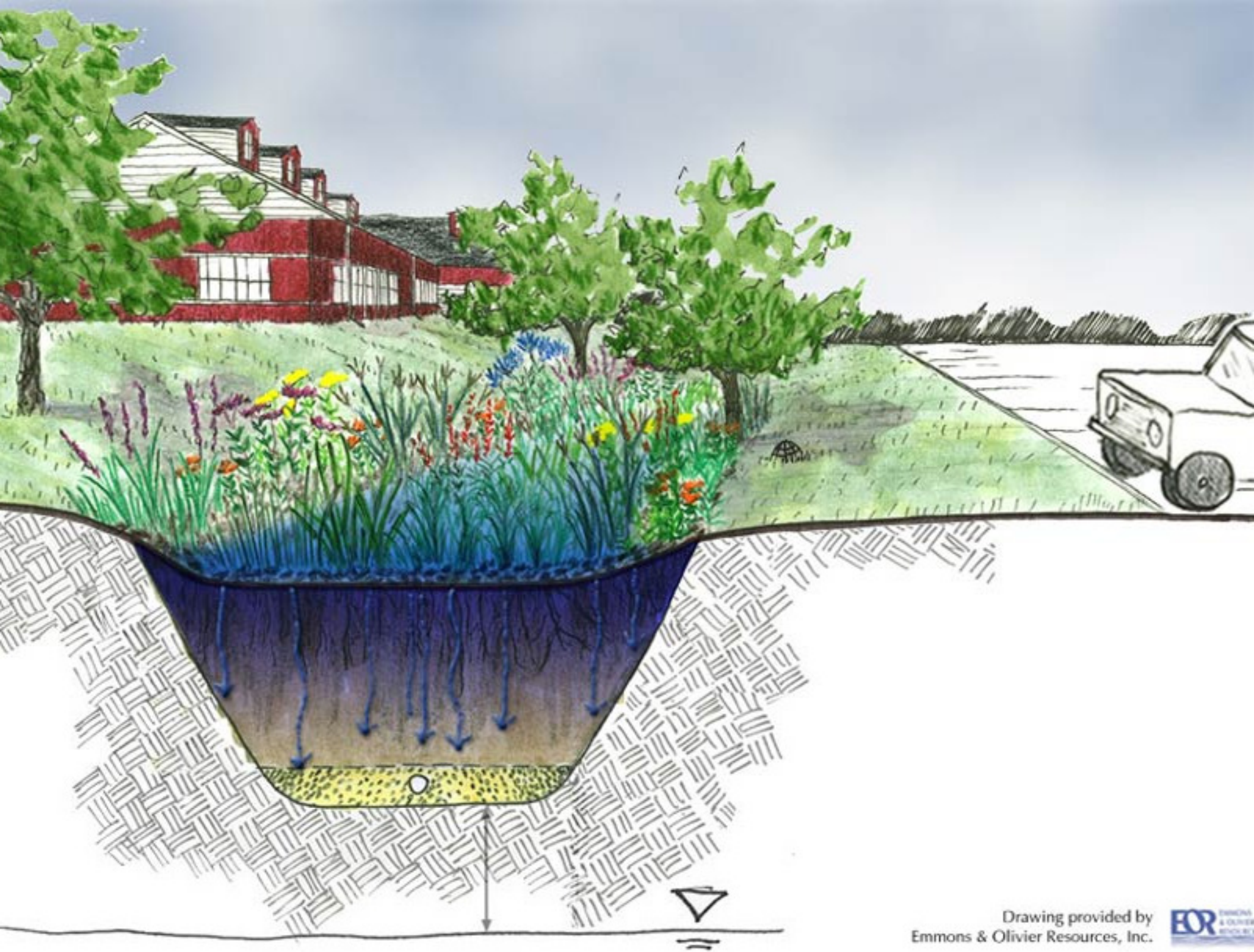
RAIN HARVESTING



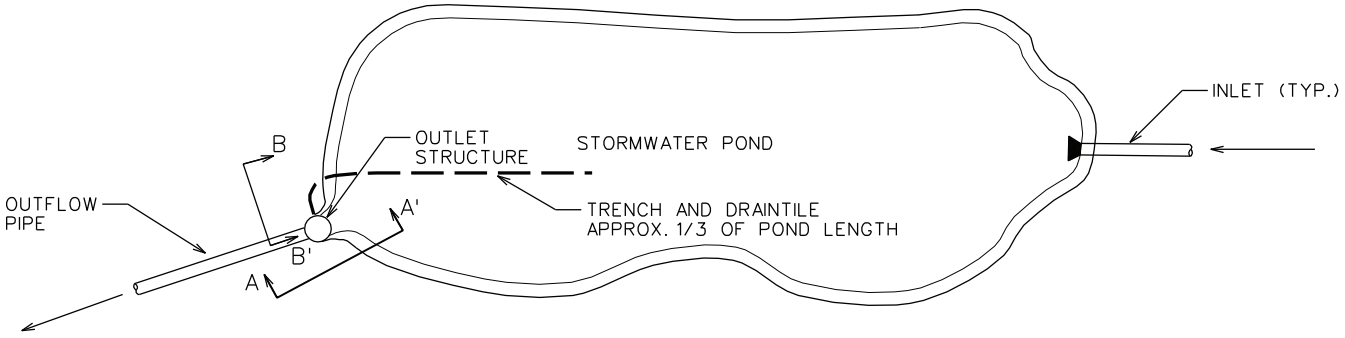
WARNING

PLUMBING AND ELECTRICAL WORK MUST MEET LOCAL CODES

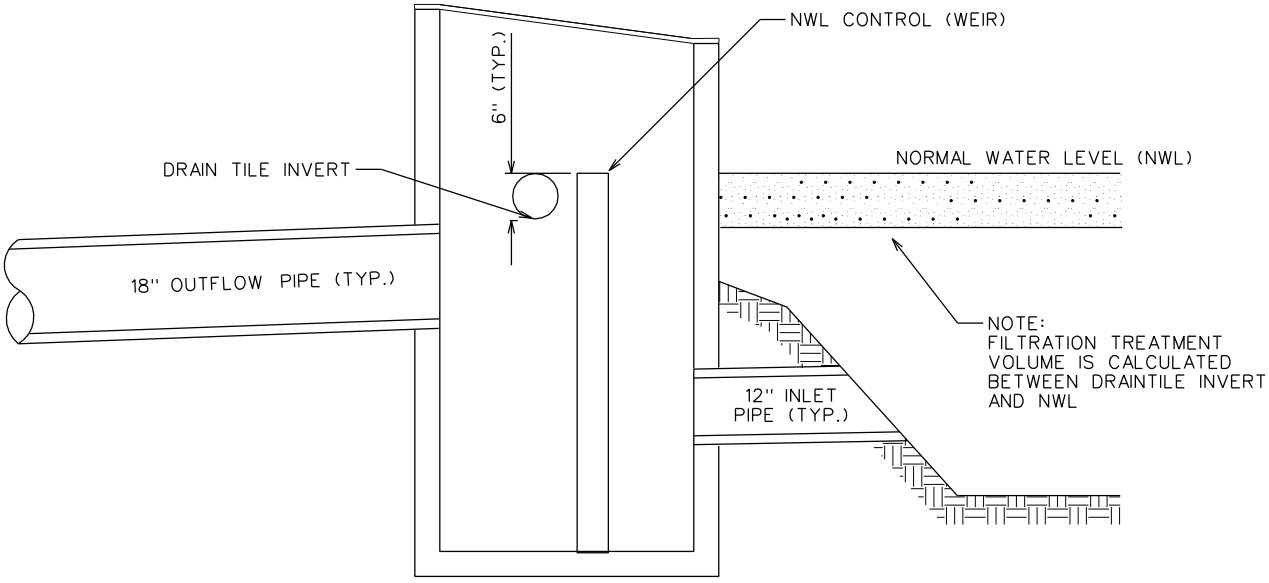
NOT TO SCALE, FOR ILLUSTRATION ONLY



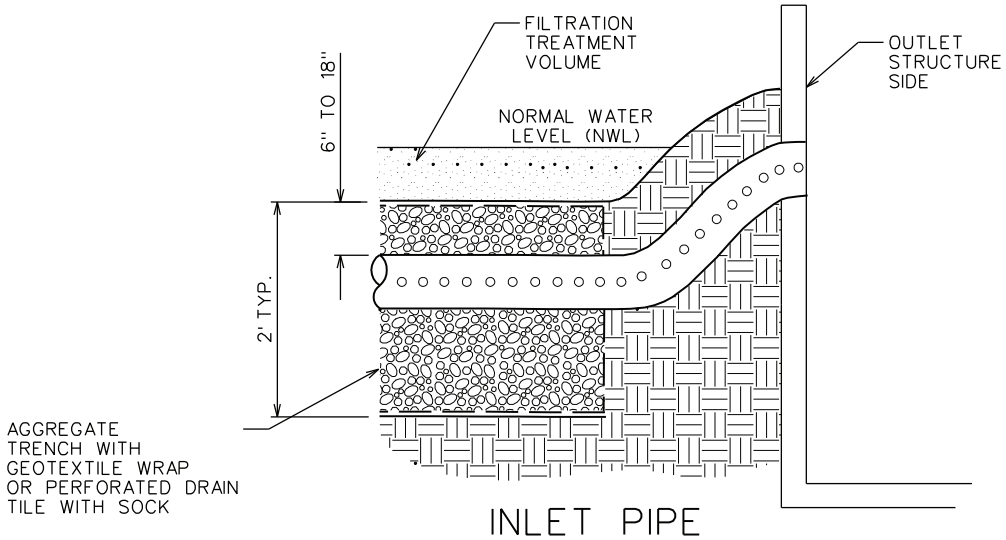
Drawing provided by
Emmons & Olivier Resources, Inc.



PLAN VIEW



OUTLET STRUCTURE
SECTION A-A'



INLET PIPE
SECTION B-B'

M:/1242/23 FIGURE5.DGN