

Lake and Storm Water Management Plan
for
Bradley (Little) Lake
City of Sturgeon Bay
Door County, Wisconsin

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1. INTRODUCTION

This report was produced as an accompaniment to the Lake and Storm Water Management Plan for Bradley (Little) Lake plans. The purpose of the Lake and Storm Water Management Plan is to improve the water quality, habitat and esthetics of the lake and to insure future management. This is the second part of a multi-stage project to improve the water quality, habitat and ecosystem function of the lake. Along with water quality and habitat improvements, aesthetic value and recreational uses should also improve. The purpose and benefits of the management plan elements are discussed herein. The elements of the engineered plans have been designed with sustainability, ecosystem function, and esthetic appeal in mind.

Bradley (Little) Lake is a 20-acre lake located on the north end of Sunset Park, one of Sturgeon Bay's most prestigious parks. The lake is a popular spot for bird watching, picture taking, winter activities, to take children fishing, and relaxation. Little Lake is eutrophic, with excessive aquatic vegetation in the summer. The generally poor water quality, characterized by high nutrient levels and low winter dissolved oxygen levels, is reflected in low trophic indices and floristic quality indices. Historical data show that the lake is severely affected by storm water runoff from a high density urban setting. Waterfowl are also a problem.

The first part of this multi-stage project included an inventory of water quality, sediments and aquatic plants that were collected during 2007 and 2008 to determine the trophic status of the lake and evaluate the aquatic plant community. The data indicates that the lake is in a highly eutrophic state and is heavily influenced by the storm water inputs from the surrounding urban area. Shallow water depth, high nutrient loading, low dissolved oxygen and invasive vegetation impair the aquatic ecosystem of the lake. The parameters observed show either stochastic or widely swinging ranges of measurements, which indicate the influence of the urban areas on the lake. A deep layer of sediments on the lake bottom, which are brought into the lake by storm water runoff, harbor high nutrient loads. Aquatic vegetation is abundant in the lake, with the aquatic plant community dominated by invasive species.

The data from the inventory along with public input was used to draft this comprehensive management plan for the lake and engineering plans to address storm water issues. The public input gathered about the desired outcome for the lake and its use and function, and the data collected was used to assess management needs and possible solutions. This plan addresses the improvement of water quality, habitat, ecosystem function, aesthetic value and recreational uses of Little Lake.

2. PUBLIC MEETING INPUT SUMMARY

An integral part of this project was to include the dissemination of information on the project to the public as well as obtaining input from the public on the project. To this end, a citizens advisory group was formed shortly after the start of the project. This group was composed of concerned citizens, but allowed for broad participation. This

group operated independently of the main part of the project, but did have one member participate in all meetings of the technical advisory group. The technical advisory group consisted of City, County, local citizens, and consultants and was organized to synthesize important information and gain input before larger public meetings and as the project proceeded. There were four meetings of the technical group during the project. In addition to these groups there were four public meetings held throughout the project which had between 48 and 74 members of the public present. These meetings were very productive and allowed for all comments, suggestions, and ideas to be shared. The technical committee members were also present at these meetings. Based on comments from these meetings, ideas for the rejuvenation of Little Lake was formulated. The overall sense from these meetings was that ALL present were in support of the rejuvenation and clean-up of Little Lake. While ideas varied, all were very supportive of the project and what the City was moving forward with. To illustrate this point, at the end of the final plan presentation the entire crowd at the public meeting gave the City and consultants a round of applause on the plans and the project to date. This was a critical component in our assessment of this project as a success.

3. LAKE MANAGEMENT ACTIVITIES AND IMPROVEMENTS

3.1. Sediment Dredging

As outlined in the *Water Quality Monitoring and Aquatic Plant Inventory* the nutrient content of the sediments of Little Lake are very high. They likely constitute a source of nutrients to the lake, which can lead to excessive plant and algal growth. The inventory and previous work by the City of Sturgeon Bay also indicate that there is significant loading of sediments into the lake, with some areas of more than 7 feet of soft sediments found. The lake is very shallow, with an average depth of about 5 feet. This shallow depth also leads to excessive plant growth, as light penetrates to the bottom of the lake, allowing plants to grow throughout the lake. The shallow depth is also not conducive to a productive fishery. In winter months, ice cover, shallow depth, and excessive nutrients lead to dissolved oxygen lethal or near-lethal levels for fish. As a solution to these various issues, sediments will be dredged from the lake to remove the nutrient laden sediments and provide a deeper, more naturally functioning basin. The removal of the sediments will create deeper portions of the lake which improve habitat for fish and assist with the aquatic plant issues in the lake. The sediment removal will not occur in the area of the former hatchery berms, as these rocky areas are not causing problems and create a more diverse habitat.

3.2. Invasive Aquatic Plant Management

As found by the *Water Quality Monitoring and Aquatic Plant Inventory*, the macrophyte community of Little Lake is dominated by invasive species. Eurasian Water Milfoil and Curly-leaf Pondweed are two invasive submergent species that have invaded the lake, taking over vast areas of the lake. In order to improve the habitat of the lake, and to reduce the effect that the photosynthetic activity of these

plants are having on dissolved oxygen levels, removal of these species is desirable. Herbicide treatment of these species is preferred as mechanical removal can spread the infestation of Eurasian Water Milfoil. This plant can root from dislodged plants and fragments, which are created by mechanical removal. A permit from WDNR will be necessary to complete any Aquatic Management activities.

Due to the recommended dredging activities, specific recommendations on Aquatic Plant Management are not being made at this point, as removal of the sediments will also result in removal of aquatic macrophytes. This will in turn change the aquatic plant community, plant density, and distribution. It is likely that less aquatic plant management activities will be needed, if dredging occurs. However, it is possible for the invasive plants to re-colonize the newly dredged bottom, so aquatic plant management should be addressed shortly after dredging occurs. Targeted spot treatments are likely to be a good option for invasive species removal at that point.

3.3. Re-Stock Fishery

One of the foremost recreational use desires of the lake is fishery re-establishment. The community desires to create a sustainable urban fishery in Little Lake. This element of the management plan should also be addressed after dredging activities, as dredging activities will temporarily impair fisheries. Also it would be best to establish the desired game fish populations after habitat improvements have been made, to increase the survivability of the fishes. Fishery restoration should be coordinated with the local DNR Fisheries Biologist.

3.4. Remove Hatchery Berms Near Shore

In order to increase water circulation and fish passage and to discourage people from traversing the submerged former hatchery berms, the near shore portions of the berms will be removed. This can be accomplished before or at the same time dredging occurs. There is higher quality habitat on and around the hatchery berms and it is desirable to protect this area from human impact.

4. SHORELINE RESTORATION AND MANAGEMENT

4.1. Shoreline Restoration

Native vegetation will be established in along the shoreline areas. A variety of suitable native species have been chosen for this area. These plants are adapted to living in the shoreline environment and naturally stabilize the riparian area and provide beneficial habitat. The purpose of the vegetation is to: provide shoreline habitat, stabilize the shoreline area and prevent erosion, slow surface runoff, remove or break down some pollutants in the storm water and maintain a barrier that will discourage geese from loafing on shoreline areas.

All plant species chosen are native to Door County. All plantings must conform to the list of recommended plants as shown on the construction drawings. All vegetation for this and other project elements should be obtained from a reputable supplier. When choosing the plant stock a local or Great Lakes ecotype should be used. Protective fencing will be placed around the planted areas to protect the vegetation during establishment. These temporary fences are utilized to discourage human and goose movement through planted areas. Protecting the plantings during this critical establishment period will result in less vegetation failure and erosion. Compaction of soil should be avoided during construction and at all other times to maintain permeability of the underlying soil.

Native vegetation is incorporated into many of the lake and storm water management plan elements. Native vegetation increases infiltration of water. The root systems of most native plants are very deep and help rainfall to soak into the ground, thereby increasing water recharge and reducing surface runoff into the lake at the same time. These root systems also hold soil in place, reducing erosion of the shoreline and riparian areas. Overall, native vegetation improves water quality. Native vegetation has many benefits when compared to traditional landscape plants. Native species are inherently low maintenance and in turn save time, money and energy. They are adapted to local conditions and local pests, which makes them vigorous and resistant to most pests and diseases. Once these plants are established they require no irrigation, herbicides, insecticides, fungicides, mulching, raking, or continuous mowing.

4.2. Shoreline Management and Invasive Species Removal

The shoreline should be managed in the future with the goal of maintaining a native plant community, free from invasive species. Species along the shoreline should be those found in the various planting plans along with any other native species that may establish and existing native trees and shrubs. Invasive plants should be removed. This removal can be done as outlined by the plan specifications (during establishment) and the maintenance plan. Invasive species management may require a permit from WDNR.

The shoreline should also be managed so that vegetation forms a barrier to geese and other nuisance waterfowl. Vegetation should not be mowed or cut down to the waters edge, which would provide an avenue of access. An exception to this would be vegetation removal in the non-motorized boat launch area.

4.3. Removal of Bridge, Culverts and Fence

Historic uses of the lake have left behind unused and possibly unsafe infrastructure. The removal of these items is outlined in the plan specifications. The goal of these actions is to create a natural shoreline, free of structures and hazards. The former bridge that traversed the canal to the Bay was partially abandoned with the canal and then later the overflow pipes. The remaining above ground portions of this

structure will be removed and any pipes abandoned. The area will be graded and planted the same way as the rest of the shoreline. Out of use culverts along the shoreline will also be partially removed and abandoned. These areas will also be planted with shoreline species. The fence around the former hatchery area will be removed to create access to the lakeshore. This wooded area will also be part of the invasive species management as outlined on the plans.

5. STORM WATER MANGEMENT

The elements of the storm water management plan provide several layers of protection to the lake. Some elements are meant to reduce the amount of contamination that the storm water runoff picks up and others are designed to intercept and treat storm water before it reaches the lake. Infiltration and bioremediation are important mechanisms to decrease storm water quantity and to improve storm water quality. Plants absorb nutrients and break down contaminants from storm water while at the same time increasing evapotranspiration. As storm water infiltrates, it is filtered, removing particles and contaminants such as oils, heavy metals, chemicals, sediments, debris and bacteria. Infiltration also recharges groundwater. In this case, infiltration will be used to reduce non-point source pollution entering the lake through a sustainable, naturalized approach.

Compaction of soil in the storm water management areas (biofiltration basin, wetland, buffer, etc.) should be avoided during construction and at all other times, as it will significantly impact the performance of these areas. Low ground pressure equipment should be utilized in these areas and heavy equipment usage in the outlying areas should be limited to maintain permeability of the underlying soil. All vegetation for project elements should be obtained from a reputable supplier. It is preferable to have a local ecotype of the species used.

5.1. Decrease Width of Alabama Street

The width of Alabama Street, which runs along the north side of the lake, will be decreased in some areas. Portions of the existing asphalt pavement will be removed to decrease the impervious surface near the lake there by reducing surface runoff to the lake and increase area available for the buffer. This will further protect the lake from contamination. Access will be maintained as Alabama Street is a city street with residences on the north side. As the roadway deteriorates and replacement becomes necessary, porous or permeable pavements should be considered, as these elements will also offer an increase in infiltration.

5.2. Buffer

A continuous buffer of native vegetation will be installed around the lake, between the water and any impervious surfaces. The buffer will vary in width, depending on available area and usage. The goal of the buffers is to provide a naturalized setting around the lake, provide habitat and improve water quality. Buffers have many

benefits to lakes including: reducing sedimentation, removing nutrients and contaminants from surface runoff, stabilizing riparian areas and reducing erosion. These all result in better aquatic habitat. Buffers also offer benefits to wildlife and park users such as: providing nesting sites and travel paths, providing food sources to insects, birds and other organisms and providing beautiful naturalized scenery.

All plant species chosen are native to Door County. All plantings must conform to the list of recommended plants in the plan specifications. All vegetation for this and other project elements should be obtained from a reputable supplier. When choosing the plant stock a local or Great Lakes ecotype should be used. Protective fencing will be placed around the planted areas to protect the vegetation during establishment. These temporary fences are utilized to discourage human and goose movement through planted areas. Protecting the plantings during this critical establishment period will result in less vegetation failure and erosion. Compaction of soil should be avoided during construction and at all other times to maintain permeability of the underlying soil.

5.3. Biofiltration Basin

A biofiltration basin will be installed northeast of the lake. The purpose of the biofiltration basin is to intercept and treat storm water runoff before it reaches the lake, thereby eliminating a possible source of contamination. The biofiltration basin will capture surface water flow from the area and the storm water pipe that currently discharges into the lake here. Contaminants in the water are filtered out by the engineered soil mix and vegetation as it soaks through the filtration berm and into the ground. The biofiltration basin also provides temporary storm water storage through the use of the engineered soils and the construction of a shallow depression. Native species planted in the rain garden will slow water flow, assist in infiltration and phytoremediation and improve aesthetics.

All plant species chosen are native to Door County. The use of this native vegetation is especially important along the Lake Michigan shoreline, a valuable ecological resource. Native plants are part of a balanced community. They rarely become invasive and take over natural communities. Native vegetation also improves the local habitat by providing food and shelter for songbirds, butterflies and other desirable wildlife. Native vegetation also allows people to get closer to nature, who otherwise would not have the opportunity. Children can learn about and connect with the environment and wildlife. Using native species also demonstrates a community's commitment to environmental stewardship. Native species can, as they are in this plan, be used to improve public health by reducing runoff, pesticides and the use of energy. By reducing the pollution of water bodies, they not only improve water quality but other natural environments as well.

All plantings must conform to the list of recommended plants as shown on the construction drawings. All vegetation for this and other project elements should be obtained from a reputable supplier. When choosing the plant stock a local or Great

Lakes ecotype should be used. Protective fencing will be placed around the planted areas to protect the vegetation during establishment. These temporary fences are utilized to discourage human and goose movement through planted areas. Protecting the plantings during this critical establishment period will result in less vegetation failure and erosion. Compaction of soil should be avoided during construction and at all other times to maintain permeability of the underlying soil.

5.4. Storm Water Retention Forebay

A portion of the southeast corner of the lake will be converted into a storm water retention forebay. This solution was chosen because storm water currently outlets directly into the lake, contributing in large part to the degradation of the lake habitat and water quality. While an optimum solution would divert water into a storm water management facility before ever entering the lake, due to the placement of the storm sewer and outlets that was not possible. So as an alternative, a portion of the lake will be separated from the main lake to form a forebay. This forebay will act as a storm water retention basin, capturing sediments and other contaminants from storm water and allowing them to settle out. The forebay also has a small underwater preliminary forebay, the purpose of which is to capture as much of the contaminants in a small, easily cleaned area. The forebay will confine the storm sewer discharge, no longer allowing it to flow directly into the lake and provide some treatment of the storm water. The forebay will outlet into a treatment wetland, where additional treatment of the storm water will take place. Once established the forebay will require periodic inspection and maintenance, which is outlined in the *Maintenance Plan* (see Appendix C).

5.5. Storm Water Treatment Wetland

The storm water treatment wetland will be installed along the southern end of the lake. The wetland will receive water from the forebay. Also the existing storm sewer discharge at the southwestern edge of the lake will be removed and rerouted into the wetland. The purpose of the wetland is to provide treatment to storm water before it reaches the lake, significantly reducing a source of contamination to the lake. Storm water will be treated through filtration and bioremediation in the wetland, removing and breaking down nutrients and other contaminants. Water from the forebay and park storm sewer will overflow into the wetland, where it will be treated, and then overflow out of the wetland into the lake. The results will be greater treatment of storm water and the removal of the direct discharge at the lake, which is directly contributing to water quality issues.

It is best to let the vegetation in the wetland become established before bringing the system "online". If this is not possible, more rigorous maintenance will need to be performed for the establishment of the vegetation and erosion control. When completed and established the wetland will require periodic inspection and maintenance (see the accompanying *Appendix C - Maintenance Plan* for details).

All plant species chosen are native to Door County. All plantings must conform to the list of recommended plants as shown on the construction drawings. All vegetation for this and other project elements should be obtained from a reputable supplier. When choosing the plant stock a local or Great Lakes ecotype should be used. Protective fencing will be placed around the planted areas to protect the vegetation during establishment. These temporary fences are utilized to discourage human and goose movement through planted areas. Protecting the plantings during this critical establishment period will result in less vegetation failure and erosion. Compaction of soil should be avoided during construction and at all other times to maintain permeability of the underlying soil.

5.6. Best Management Practices

The purpose of the Best Management Practices (BMPs) is to remove or reduce possible sources that contribute to the contamination of the lake. These include storm water, nuisance waterfowl, debris accumulated along the lake and pets. Using BMPs to eliminate or reduce possible sources of contamination is a low cost technique that will reduce on lake contamination. BMPs can also increase public awareness of the problem and engage the community in the solution. It is an easy way for citizens to contribute and do their part to improve water quality and environmental sustainability. Information on and a list of BMPs for citizens was provided at the public input meetings. This information is available through the City of Sturgeon Bay Parks Department. BMPs should also be established in the park and if possible in the community. These BMPs will minimize the pollutants that enter the lake area and in turn minimize what reaches the lake. Implementation of the BMPs will require a combination of local government cooperation and coordination. It will require little capital investment. The BMPs are as follows:

- The parking lot, driveway, roads and other hard surfaces near the lake should be cleaned quarterly (after snow melt, after spring rains/before lake opens, beginning of July, beginning of September). This can be accomplished by using a street sweeper or equivalent equipment.
- Remove accumulated debris and trash from the park and provide waste receptacles.
- Implement storm water ordinances for future development and/or existing development.
- Install signs in the park and around the lake area reading:
 - “Don’t Feed the Birds”
 - “No Pets Allowed”
 - “Pick Up Trash”

6. RECREATION

As a part of the public input and planning process recreation was a key feature for future lake use and management. As such, recreational facilities were incorporated into the lake plans to provide for recreational activities most desired by the public. One emphasis of this desire was to maintain the atmosphere of the park and residential area, which included no powered watercraft and maximize opportunities for passive or quiet recreation.

6.1. Fishing Pier

A fishing pier was incorporated into the retention forebay berm to allow for access to the lake for fishermen of all ages and abilities. With the desire to have Little Lake become an urban fishery this facility will certainly add to the enjoyment of the lake and the resource.

6.2. Canoe/Kayak/Paddleboat Launch

Keeping in line with the desire for use of the lake, but to not allow motorized watercraft, a canoe/kayak/paddleboat launch will be placed conveniently near the parking area. This access will allow for easy access and launching of all varieties of non-motorized watercraft into the lake.

6.3. Paths and Boardwalks

Paths and boardwalks will be strategically placed around the lake. These will be an extension of the existing paths throughout the park. The paths will be accessible at several points, from the park and sidewalks in the surrounding neighborhood. They will also traverse across the forebay berm (connecting to the fishing pier), through the wetland area, the wooded area, along the shoreline and through the buffer. These paths will provide: ease of access around the lake, controlled access through the vegetation and protection of wetlands, woodlands and other natural areas from damage caused by foot traffic. The path and boardwalk materials utilized should allow for infiltration of storm water. The crushed limestone paths will provide a durable surface for the foot traffic and bicycles.

Engineer's Estimate of Probable Construction Costs
Little Lake (Bradley Lake)
Sturgeon Bay, Wisconsin

Miller Engineers & Scientists Project No. 07-1-17612

NOT FOR CONSTRUCTION

Description of Item	Quantity	Unit Cost	Total
1) Mobilization/Demobilization (per phase)	L.S.	--	\$5,000
2) Environmental Permitting	L.S.	--	\$25,000
3) Crushed Limestone Path	715 tons	\$15 /ton	\$10,725
4) Biofiltration Berm			
a) biofiltration soil mix	240 c.y.	\$10 /c.y.	\$2,400
d) drainage aggregate	200 tons	\$15 /ton	\$3,000
5) Boardwalk Berm			
a) granular material	6965 c.y.	\$15 /ton	\$6,980
b) breaker or shot run	650 tons	\$20 /ton	\$13,000
c) topsoil	310 c.y.	\$20 c.y.	\$6,200
6) Forebay Berm			
a) breaker or shot run	1050 tons	\$20 /ton	\$21,000
7) Boardwalk	830 l.f.	\$70 l/f/	\$58,100
8) Site Grading	7000 c.y.	\$3.50 /c.y.	\$24,500
9) Topsoil Stripping	4.25 ac	\$2,000 /ac	\$8,500
10) Bridge Demolition (<i>Allowance</i>)	L.S.	--	\$25,000
11) Road Realignment			
a) Base Course	170 tons	\$12 /ton	\$2,040
b) Asphalt binder	56 tons	\$60 /ton	\$3,360
c) surface course	33 tons	\$70 /ton	\$2,310
12) Small Boat Launch	L.S.	--	\$750
13) Flooding Piers (<i>Allowance</i>)	L.S.	--	\$50,000
	Subtotal for Items 1-13		\$267,865
	Contingency (Approx. 20%)		\$53,573
	Total (Excluding Dredging)		\$321,438
14) Dredging	44,000 c.y.	\$15 /c.y.	\$660,000
(Requires determination of adjacent site for dewatering of sediments)			
	Project Total without Plantings		\$981,438

Description of Item	Quantity	Unit Cost	Total
15) Planting Schedule (By Zone)			
a) Zone 1 - Lower Shoreline - 26,925 s.f. (0.62 acres)			
1) Seeding		\$0.15 s.f.	
2) Straw mulch		\$0.05 s.f.	
3) Fiber blanket		\$0.33 s.f.	
4) Plugs and planting		\$3.00 s.f.	
5) Preparation, herbicide, etc.		\$0.02 s.f.	
		Total - \$3.55/s.f.	\$95,584
b) Zone 2 - Upper Shoreline - 75,940 s.f. (1.74 acres)			
1) Seeding		\$0.15 s.f.	
2) Straw mulch		\$0.05 s.f.	
3) Fiber blanket		\$0.33 s.f.	
4) Plugs and planting		\$3.00 s.f.	
5) Preparation, herbicide, etc.		\$0.02 s.f.	
		Total - \$3.55/s.f.	\$132,136
c) Zone 3 - Buffer Meadow - 131,860 s.f. (3.03 acres)			
1) Seeding		\$0.15 s.f.	
2) Straw mulch		\$0.05 s.f.	
3) Preparation		\$0.02 s.f.	
		Total - \$.22/s.f.	\$29,009
d) Zone 4 - Biofiltration Basin - 41,133 s.f. (0.94 acres)			
1) Straw mulch		\$0.05 s.f.	
3) Fiber blanket		\$0.33 s.f.	
4) Plugs and planting		\$3.00 s.f.	
5) Preparation, herbicide, etc.		\$0.02 s.f.	
		Total - \$3.40/s.f.	\$139,852
e) Zone 5 - Wooded Area - 51,616 s.f. (1.18 acres)			
1) Over-seeding		\$0.25 s.f.	
		Total - \$.25/s.f.	\$12,904
f) Zone 6 - Wetland Area - 62,222 s.f. (1.43 acres)			
1) Seeding		\$0.15 s.f.	
2) Straw mulch		\$0.05 s.f.	
3) Compost		\$0.11 s.f.	
3) Fiber blanket		\$0.33 s.f.	
4) Plugs and planting		\$3.00 s.f.	
5) Preparation, herbicide, etc.		\$0.02 s.f.	
		Total - \$3.66/s.f.	\$227,732
16) Fencing - Temporary	10,005 l.f.	\$2 /l.f.	\$20,010
	Subtotal for Items 15-16		\$657,226
	GRAND TOTAL		\$1,638,664

APPENDIX B

PLAN SPECIFICATIONS

<u>Section</u>	<u>Description</u>
01410	Testing Services
02200	Earthwork
02211	Rough Grading
02222	Selective Demolition
02231	Dense Aggregate Base
02500	Dredging
02741	Hot-Mix Asphalt Paving
02800	Landscaping
02930	Lawn Repair

SECTION 01410
TESTING SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Selection and payment.
- B. Contractor submittals.
- C. Agency responsibilities.
- D. Agency reports.
- E. Limits on testing authority.
- F. Contractor responsibilities.
- G. Schedule of tests.

1.2 RELATED SECTIONS

Not Used.

1.3 REFERENCES

- A. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- B. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- C. ASTM D4561 - Practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.
- D. ASTM E329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.

1.4 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing agency or laboratory to perform specified testing.
- B. Employment of testing agency or laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.5 QUALITY ASSURANCE

- A. Laboratory: Authorized to operate in State in which Project is located.
- B. Laboratory Staff: Maintain a full time Registered Engineer on staff to review services.
- C. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.6 AGENCY RESPONSIBILITIES

- A. Test samples of mixes submitted by Contractor.
- B. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
- C. Perform specified sampling and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Owner, Engineer, and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional tests required by Engineer.
- G. Attend preconstruction meetings and progress meetings.

1.7 AGENCY REPORTS

- A. After each test, promptly submit one copy of report to Owner, Engineer and to Contractor.
- B. Include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and specifications section.
 - 6. Location in the Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.
- C. When requested by Engineer, provide interpretation of test results.

1.8 LIMITS ON TESTING AUTHORITY

- A. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

- B. Agency or laboratory may not approve or accept any portion of the Work.
- C. Agency or laboratory may not assume any duties of Contractor.
- D. Agency or laboratory has no authority to stop the Work.

1.9 CONTRACTOR RESPONSIBILITIES

- A. Deliver to agency or laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- B. Cooperate with testing personnel, and provide access to the Work.
- C. Provide incidental labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the site or at source of Products to be tested.
 - 3. To facilitate tests.
 - 4. To provide storage and curing of test samples.
- D. Notify Engineer and laboratory 48 hours prior to expected time for operations requiring testing services.

1.10 SCHEDULE OF TESTS

- A. Individual Specification Sections: Tests required and standards for testing.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

*** END OF SECTION ***

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Excavation and Preparation of Subgrade for paths, constructed wetland areas, and shoreline.
- B. Excavation and preparation of subgrade for park road.

1.2 RELATED SPECIFICATIONS

- A. *State of Wisconsin Standard Specifications for Highway and Structure Construction*, latest revision.
- B. *Wisconsin Construction Site Best Management Practice Handbook*.
- C. *ASTM D1557 Test Method for Moisture-Density Relations*
- D. *ASTM D2487 Classification of Soils for Engineering Purposes*
- E. *ASTM D2922 Density of Soil by Nuclear Methods*
- F. *ASTM D3017 Water Content of Soil by Nuclear Methods*

1.3 QUALITY ASSURANCE

- A. Owner shall employ and pay for a qualified independent Geotechnical Testing Laboratory to perform soil testing and observation service during earthwork operations.

1.4 EXISTING CONDITIONS

- A. Existing Utilities: Prior to commencing any earthwork activity, the Contractor shall perform a site survey, research public utility records, and verify the location of existing utility piping, structures, and associated appurtenances. The Contractor shall verify that earthwork activities may be performed with original design and reference standards. If unanticipated conditions are uncovered, the Contractor shall notify the Owner's Representative accordingly.
 - 1. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 2. If uncharted, or incorrectly charted, piping or other utilities are encountered during excavation, consult utility Owner immediately for directions and notify the Owner's Representative. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
- B. Documentation of Existing Utilities: Prior to commencing any earthwork activity, the Contractor shall have his Registered Land Surveyor accurately record all relevant information pertaining to the location of uncovered existing utilities. Relevant information shall include, but is not necessarily limited to, horizontal and vertical location, material type, size, condition, etc. The Land Surveyor shall submit this information directly to the Owner's Representative for review.

- C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
 - 1. Operate warning lights as recommended by authorities having jurisdiction.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 3. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by the Owner's Representative and then only after acceptable temporary utility services have been provided. Provide a minimum of 48 hours notice to the Owner's Representative, and receive written notice to proceed before interrupting any utility.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Excavated material, graded free of roots, rocks larger than 1-inch, subsoil, debris, and large weeds.
- B. Common Fill: On-site or off-site natural soil free from organic matter, debris, vegetation, stones larger than 6 inches and frozen material and classified as GW, GP, GM, GC, SW, SP, SM, SC, or CL in ASTM D2487.
- C. Dense Aggregate Base: Wisconsin DOT, Section 305.
 - 1. General: The aggregate shall consist of hard durable particles of stone or crushed gravel and a filler of natural sand, or other finely divided mineral matter. Materials shall be substantially free from vegetable matter, shale, and lumps or balls of clay.
- D. Limestone Screenings: Screenings shall be from limestone, free of organic matter and debris. Material shall be well graded with 100% of the material passing ¾-inch sieve and have a minimum of 15% fines.
- E. Contractor shall submit a sample of the dense aggregate base and limestone screening for a sieve analysis to the Geotechnical Testing Laboratory. The materials shall be approved at least five days prior to its intended use.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, elevations, and grades.
- B. Protect benchmarks, property corners, and grade stakes.
- C. Locate and identify utilities that are to remain and protect them from damage.
- D. Locate and retain soil materials away from edge of excavations.
- E. Remove/relocate millings where necessary for ditch/shoulder work (incidental to the ditch grading).

3.2 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. Excavation shall be performed in accordance with applicable Standard Specifications.
- B. Fill that is greater than 3 feet in thickness shall be tested at least every 2 feet (vertical) at a testing density of 1 test/1,000 sy.
- C. Fill, which is to be placed beneath the street pavement, shall be compacted to 98% of the soil's maximum density, as determined by ASTM D698. In cut areas, the subgrade beneath the pavement shall have its top 12 inches of depth compacted to 95% of its maximum density, per ASTM D698.
- D. Field density tests for determining the compaction of fill will be accomplished by the Engineer, at the request of the Owner's Representative, and paid for by the Owner. Requirements for an undue amount of attendance upon the work of the purpose of retesting Contractor's work, which is not satisfactorily performed may result in the Owner's assessment of excessive testing costs against the Contractor.
- E. Compaction beneath structures paths and paving should be 98% of Standard Proctor ASTM D698.

3.3 PLACEMENT AND COMPACTIONS

- A. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- B. Control soil and fill compaction, providing compaction to meet the specified density for each area classification indicated below. Correct improperly compacted areas or lifts as directed by the Owner's Representative if soil density tests indicate inadequate compaction.
 - 1. Percentage of Proctor Maximum Dry Density Requirement: Compact soil to not less than the following percentage of maximum density, in accordance with ASTM D698 (Standard Proctor). Contractor shall notify the Owner's Testing Laboratory at least 24 hours in advance of requiring compaction testing.
 - a. Under pavements, compact the top 12 inches of subgrade and each layer of backfill or fill material to at least 98% of the Standard Proctor maximum dry density.
 - b. Under lawn or unpaved areas and berms, compact top 6 inches of subgrade and each layer of backfill or fill material to at least 88% but not more than 94% of the Standard Proctor maximum dry density.
 - c. No compaction in wetland, stormwater infiltration areas, or shoreline areas shown on the Drawings. The use of low ground pressure equipment is required when grading in our accessing these areas.
- C. Moisture control: where soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as

necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 2. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.
- D. Proof-rolling: Proof-roll the finished subgrade within the road reconstruction area with the project engineer present with a loaded tandem-axle dump truck. The subgrade shall not rut or displace more than 1/2 inch under the weight of the loaded truck. Soft or unstable areas shall be undercut, replaced with suitable fill material, and recompacted.
- E. Use only low ground pressure equipment in wetland, stormwater areas, and shoreline areas as shown on the Drawings.

3.4 SUBGRADE GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerance, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

Finish surfaces free from irregular surface changes and as follows:

1. Unpaved Areas: Finish areas to receive biofilter mix or topsoil to within not more than 0.1-foot above or below required subgrade elevations.
 2. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2-inch above or below required subgrade elevation.
- B. Prepare the road subgrade for placement of the dense aggregate base, according to the WDOT Standard Specifications.
- C. The use of low ground pressure equipment is required when grading or accessing wetland, stormwater infiltration, or shoreline areas.

3.5 PAVEMENT SUBBASE COURSE

- A. General: Subbase course consists of placing subbase material (crushed aggregate base course), in layers of specified thickness, over subgrade surface to support a pavement base course.
- B. Grade Control: During construction, maintain lines and subgrades including crown and cross-slope of subbase course.
- C. Place and compact the subbase course material on the prepared subgrade in accordance with applicable articles of the WDOT Standard Specifications.
1. Percentage of Proctor Maximum Dry Density Requirement: Compact soil to not less than the following percentage of maximum dry density, in accordance with ASTM D698 (Standard Proctor). Contractor shall notify the Owner's Testing Laboratory at least 24 hours in advance of requiring compaction testing.

- a. The aggregate subbase course shall be compacted near optimum moisture content to achieve a minimum density of 98% of the Standard Proctor of maximum laboratory dry density.

3.6 FIELD QUALITY ASSURANCE

- A. Quality Assurance Testing During Construction: Allow the geotechnical testing laboratory to observe and test and approve each subgrade, each fill layer and the subbase before further backfill or construction work is performed.
 1. Perform Field Density Tests by the nuclear method in accordance with ASTM D 2922.
 2. Calibration checks of both density and moisture gages at beginning of work and on each different type of material encountered.
 3. Road Areas: A minimum of one density test per every 200 linear feet of road shall be performed. Additional density tests will need to be performed if initial tests fail.
 4. If in opinion of the Geotechnical Testing Laboratory, based on testing service reports and observation, subgrade or fills that have been placed are below specified density, the Owner's Representative shall direct that additional compaction and testing be performed as necessary until specified density is obtained.

3.7 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface, add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal to Designated Areas: Transport acceptable excess excavated material to designated soil storage areas selected and controlled by Contractor.
- B. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, unsuitable topsoil and trash, and legally dispose of all unsuitable material off site.

****END OF SECTION****

SECTION 02211
ROUGH GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of topsoil and subsoil.
- B. Cutting, grading, and filling the site for paths, demolition activities, and wetland construction.

1.2 RELATED SECTIONS

- A. Section 02060 - Building Demolition.
- B. Section 02110 - Site Clearing.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Topsoil Fill: By the square yard. Includes excavating existing soil, stockpiling, and placing where required,.
- B. Subsoil Fill: By the cubic yard. Includes excavating existing subsoil, stockpiling, and placing where required.
- C. Limestone Screenings: By the square yard. Includes supplying screenings, stockpiling, placing where required, and compacting.

1.4 REFERENCES

- A. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- E. ASTM D2419 - Test Method For Sand Equivalent Value of Soils and Fine Aggregate.
- F. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- G. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Wisconsin, City of Sturgeon Bay standards.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit two copies at the completion of the project.
- B. Accurately record actual locations of structures and utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: As specified in Section 02200.
- B. Biofilter Mix: As defined on Plan Sheets.
- C. Common Fill: As specified in Section 02200.
- D. Berm Fill: As defined on Plan Sheets.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.
- B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

- A. Call Diggers Hotline.
- B. Identify required lines, levels, contours, and datum.
- C. Stake and flag locations of known utilities.
- D. Locate, identify, and protect utilities that remain, from damage.
- E. Notify utility company to remove and relocate utilities if necessary. Notify ENGINEER prior to notifying utility company.
- F. Protect above and below grade utilities that remain.
- G. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

- H. Protect bench marks, survey control point, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 EQUIPMENT

- A. Use low pressure grading equipment in wetland, stormwater infiltration and shoreland areas as shown on the Drawings.

3.4 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be re-graded.
- B. Do not excavate wet subsoil.
- C. Remove excess subsoil from site.
- D. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 FILLING

- A. Install Work in accordance with State of Wisconsin, City of Sturgeon Bay standards.
- B. Fill areas to contours and elevations with unfrozen materials.
- C. Place fill material on continuous layers and compact in accordance with the schedule at end of this section.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building and pavements minimum 2 inch in 10 foot, unless noted otherwise.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Remove surplus fill materials from site.

3.6 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.7 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Field inspection and testing.
- B. Testing: In accordance with ASTM D1556, ASTM D1557, ASTM D698, ASTM D2922, and ASTM D3017.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: 1/100 foot of path and 1/1,000 cubic yard placed material.

3.8 SCHEDULES

A. Subsoil Fill:

1. Fill Type: Maximum 8 inches compacted depth.
2. Compact to minimum 88 percent and maximum 94 percent of maximum dry density.

B. Topsoil Fill:

1. Fill Type: Minimum 6 inches final depth.
2. Do not compact.

*** END OF SECTION ***

SECTION 02222
SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Selective removal and subsequent disposal of utilities, pavements, portions of buildings, and other items indicated to be removed.
 - 1. Demolition includes:
 - a. Bridge
 - b. Portion of asphalt drive
 - c. Pipes
 - d. Valves and concrete vault
- B. Related Section: Refer to the following section for related work:
 - 1. Section 02200, "Earthwork" for areas requiring backfill.

1.2 REFERENCES

- A. Code of Federal Regulations (CFR):
 - 1. 29 CFR Part 1910 – Occupational Safety and Health Standards.
 - 2. 20 CFR Part 1926 – Safety and Health Regulations for Construction.
- B. Uniform Federal Accessibility Standards (UFAS) FED-STD-795.

1.3 SUBMITTALS (Not Used)

1.4 PROJECT/SITE CONDITIONS

- A. Occupancy: The park will be open during construction. Conduct demolition work in manner that will minimize need for disruption of park use. Protect all excavations to prevent accidental falls.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions prior to beginning on-site demolition operations.

- B. Verify that utilities, if any, have been disconnected and capped.

3.2 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect against damage during demolition operations.

3.3 PREPARATION

- A. Conduct demolition operations and remove debris in manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent facilities designated to remain.
 - 1. Provide temporary barricades and other forms of protection as required for safety and security.
 - 2. Provide barriers and appropriate signs meeting requirements of 29 CFR 1910 (OSHA) for size and color where necessary to restrict pedestrians from wandering into construction areas.
- C. Provide and maintain interior and exterior shoring, bracing or structural support to preserve stability and prevent movement, settlement, or collapse of adjacent facilities that are not part of demolition.

3.4 DEMOLITION

- A. General: Perform demolition work in accordance with 29 CFR 1926, with particular attention to requirements set forth in Subpart T, "Demolition".
 - 1. Perform work in safe and systematic manner.
 - 2. Use such methods as required to complete work indicated on Contract Drawings and minimize disturbance of normal park operations.
- B. Demolish and remove existing construction only to extent required, and as indicated in Contract Drawings.
- C. Wear proper personal protective equipment at all times.
- D. Use water as necessary to lay dust when chipping, coring, or sawing concrete, masonry or similar materials.
- E. Completely backfill below-grade areas and voids resulting from utility removal and other demolition work.
- F. Follow the requirements of any permits.
- G. Prevent debris and soil from entering the lake.

3.5 BRIDGE

- A. Remove and dispose of bridge deck, handrail, fence, abutments, and piers.
- B. Abutments, and piers shall be removed to a depth of 3 feet below grade. Those portions in the lade shall be removed one foot below the lake bed.
- C. Place a silt curtain across the channel to prevent soil and sediment from entering the lake.

3.6 VALVES, PIPE, AND VAULT

- A. Remove and dispose of valves, piping, and vault adjacent to the bridge.
- B. Remove concrete to a depth of 3 feet below planned final grades.
- C. Break up any slabs that remain in place.
- D. Backfill vault with granular material.

3.7 CULVERTS

- A. Remove and dispose the end twenty feet of each culvert as shown on the drawings to be demolished.
- B. Crush the remaining end of the pipe.
- C. Backfill with native soils.

3.8 GRADING

- A. Grade the slopes near all demolished structures at a 6H:1V slope or flatter to blend into existing area.
- B. Protect base soil with erosion control blanket. Place topsoil and seed per the landscape plan under the erosion control blanket.

3.9 REPAIRS

- A. Repair demolition performed in excess of that required.
- B. Return structures and surfaces not part of demolition, to conditions existing prior to commencement of demolition work.
- C. Promptly repair adjacent construction or surfaces soiled or damaged by demolition work.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of debris, rubbish, and other materials resulting from building site demolition operations.

- B. If Contractor encounters material during removal that is suspected to be potential hazard, stop work immediately and notify the ENGINEER.

3.11 CLEANING

- B. Remove tools, equipment and demolished materials from site upon completion of demolition work.
- B. Remove protections.
- C. Seed and mulch exposed soil. Use an erosion control blanket on all slopes steeper than 10%.

*** END OF SECTION ***

SECTION 02231
DENSE AGGREGATE BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Dense aggregate base.

1.2 RELATED SECTIONS

- A. Section 01025 - Measurement and Payment: Requirements applicable to unit prices for the work of this section.
- B. Section 01400 - Quality Control: Inspection of bearing surfaces.
- C. Section 02211 - Rough Grading: Preparation of site for base course.
- D. Section 02223 - Backfilling: Compacted fill under base course.
- E. Section 02225 - Trenching: Compacted fill under base course.
- F. Section 02510 - Asphaltic Concrete Paving: Binder and finish asphalt courses.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Coarse Aggregate Fill: By the ton. Includes supplying material, stockpiling, placing where required, and compacting.

1.4 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Coarse Aggregate Fill Type: ¾-inch size as specified in Section 305 of the Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify subgrade has been inspected, gradients and elevations are correct, and is dry. Proof roll the subgrade with a loaded double axle dump truck.

3.2 PREPARATION

- A. Correct irregularities in subgrade gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to a total compacted thickness of 8 inches.
- B. Place aggregate in maximum 8 inch layers and compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Flatness: Maximum variation of ½-inch measured with 10-foot straight edge.
- B. Scheduled Compacted Thickness: 8 inches.

3.5 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Field inspection.
- B. Compaction testing will be performed in accordance with ASTM D698.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: 1/1,000 cubic yard.

3.6 SCHEDULES

- A. Under Asphalt Pavement:

1. Compact placed aggregate materials to achieve dry density compaction of 98%.

*** END OF SECTION ***

SECTION 02500
DREDGING

PART 1-GENERAL

1.1 DEFINITION

- A. Firm soil is located below the soft sediment and is defined as material requiring the use of special equipment for economical removal, and includes boulders or fragments too large to be removed in one piece by the dredge.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit drawings of surveys during progress of work by soundings or other approved method.
 - 2. Show soundings or progress on a daily basis on a clean drawing kept on site. This shall be reviewed by the Engineer prior to demobilization of equipment.

1.3 MATERIAL TO BE REMOVED

- A. Soft Material: Remove soft material to firm soil except where shown on the drawings. The lines shown on the drawings are best available information for depth of soft material.
- B... Firm Soil: Remove firm soil to the lines and grades on the Drawings. Blasting will not be permitted. Prior to removing firm soil, conduct soundings and submit to Engineer.

1.4 ARTIFICIAL OBSTRUCTIONS

- A. Except as indicated, the Owner has no knowledge of cables, pipes, or other artificial obstructions or of any wrecks, wreckage, or other material that would necessitate the use of explosives or the employment of additional equipment for economical removal. If actual conditions differ from those stated or shown, or both, an adjustment in contract price or time for completion, or both, will be made in accordance with the contract documents.

1.5 SIDE SLOPES

- A. Dredging on side slopes shall follow, as closely as practicable, the lines and grades as shown on the drawings. A 1-foot allowance will be made for dredging beyond the indicated or specified side slopes, except as provided herein. The amount of material excavated from side slopes will be determined by either cross-sections or computer, or both.

1.6 PERMIT

- A. The Contractor shall comply with conditions and requirements of the Corps of Engineers Permit and other State or Federal permits. The Owner will secure the permit for dredging and disposal of material as indicated.

1.7 ENVIRONMENTAL PROTECTION REQUIREMENTS

- A. Provide and maintain during the life of the contract, environmental protective measures. Also, provide environmental protective measures required to correct conditions, such as oil spills or debris, that occur during the dredging operations. Comply with Federal, State, and local regulations pertaining to water, air, and noise pollution.

1.8 BASIS FOR BIDS

- A. Base bids on the quantity of dredging indicated. Should the total quantity of dredging vary from that specified as the basis for bidding, the contract price will be adjusted in accordance with the contract documents. The dredging conditions specified and indicated describe conditions which are known. However, the Contractor is responsible for other conditions encountered which are not unusual when compared to the conditions recognized in the dredging business as usual in dredging activities such as those required under this contract.

PART 2 – PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Owner will keep a record of work performed and will require that gages, ranges, and other markers are usable for the intended purpose. Furnish, at the request of the Owner, boats, boatmen, laborers, and materials necessary for inspecting, supervising, and surveying the work. When required, provide transportation for the Owner and inspectors to and from the disposal area and between the dredging plant and adjacent points on shore.

3.2 CONDUCT OF DREDGING WORK

A. Disposal of Excavated Material:

1. Method of Disposal:
 - a. Dredge spoils will be disposed of off-site at a location approved by the Owner.
2. Submerged Pipeline.
 - a. If a leak occurs in the discharge pipeline, immediately discontinue using the line until leaks are repaired. Remove material placed due to leaks or breaks.

B. Navigation Warnings:

1. Furnish and maintain navigation warning signs along the pipeline.

C. Method of Communication:

1. Provide a system of communication between the dredge crew and the crew at the disposal area. A portable two-way radio is acceptable.

D. Salvaged Material:

1. Anchors, chains, firearms, and other articles of value, which are brought to the surface during dredging operations, shall remain or become the property of the Owner and shall be deposited on shore at a convenient location near the site of the work, as directed.

E. Safety of Structures:

1. The prosecution of work shall ensure the stability of piers, bulkheads, and other structures lying on or adjacent to the site of the work, insofar as structures may be jeopardized by dredging operations. Repair damage resulting from dredging operations, insofar as such damage may be caused by variation in locations or depth of dredging, or both, from that indicated or permitted under the contract.

F. Plant Removal:

1. Upon completion of the work, promptly remove plant, including ranges, buoys, piles, and other markers or obstructions.

3.3 MEASUREMENT

- A. Contractor shall take soundings or otherwise record bottom elevation before and after dredging. This record shall be submitted digitally in an approved format to the Engineer.

B. Method of Measurement:

1. The material removed will be measured by cubic yard in place, by means of soundings or other approved means of measurement taken before and after dredging. The drawings represent existing conditions based on current available information, but will be verified and corrected, if necessary, by soundings taken before dredging in each locality. Soundings will be taken by lead line or sonic methods, or both, results of soundings by either or both methods will be the basis for payment. Areas sounded more than 30 days prior to dredging will be re-sounded when requested by the Contractor. The Owner has the option of being present when such soundings are made.

C. Surveys During Progress of Work:

1. Contract depth will be determined by soundings taken behind the dredge as work progresses. The Contractor shall take progress soundings.

D. Monthly Estimates:

1. Monthly estimates of work completed will be based on the result of soundings taken during the progress of the work. Deductions will be made for dredging and disposal not in accordance with the specifications.

3.4 FINAL EXAMINATION AND ACCEPTANCE

- A. As soon as practicable after the completion of areas, which in the opinion of the Contracting Officer, will not be affected by further dredging operations, each area will be examined by the Owner by sounding. The Contractor will be notified when soundings are to be made and will be permitted to accompany the sounding party and to inspect the data and methods used in preparing the final estimate. When areas are found to be in a satisfactory condition, the work therein will be accepted as complete. Final estimates will be subject to deductions or correction of deductions previously made because of excessive overdepth, dredging outside or authorized areas, or disposal of material in an unauthorized manner.

*** END OF SECTION ***

SECTION 02741
HOT-MIX ASPHALT PAVING

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt paving overlay.
 - 4. Asphalt surface treatments.
 - 5. Pavement-marking paint.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTIONS

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.
 - 1. Standard Specification: State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.
- D. Qualification Data: For manufacturer.
- E. Material Test Reports: For each paving material.
- F. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with Section 460 of WDOT Standard Specifications for asphalt paving work.
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of subgrade and preparatory work.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 – PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.

- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Mixture requirements shall be as specified in WDOT Section 455 and 460.
- B. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Water: Potable.
- D. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073 Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Joint Sealant: ASTM D 3405, hot-applied, single-component, polymer-modified bituminous sealant.
- E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or II or AASHTO M 248, Type N or F.
 - 1. Color: Yellow.
 - 2. Color: White.
- F. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
 - 1. Color: Yellow.
 - 2. Color: White.
- G. Glass Beads: AASHTO M 247, Type 1.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by the WDOT; and complying with the following requirements:
 - 1. Provide mixes as listed on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
 - 1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
 - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
- E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled to support truck traffic with no rutting.

3.8 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and pavement according to ASTM D 979.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow excavated materials to accumulate on-site.

* * * END OF SECTION * * *

SECTION 02800
LANDSCAPING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. All landscaped areas, Zones 1 through 6 as shown on landscaping drawing.

1.2 TIMING OF WORK

- A. Time work so that seeding and planting may be executed between late spring and early summer, to optimize establishment before the end of the growing season or so that dormant seeding can be executed after October 15, with planting to follow the next spring. The Landscape Contractor is responsible for notifying the Owner and his representatives, if weather or other circumstances beyond the control of the Landscape Contractor do not allow him to execute this work during this period. In that event the Owner will approve an alternate period of execution at no additional cost.
- B. Landscape Contractor shall stabilize a "segment" of the topsoiled area within 48 hours of being notified by the Owner's Representative. Note: The area of a "segment" will be as determined at the Pre-bid Meeting.
- C. Landscape Contractor shall stabilize a segment of planted and seeded area within the same day as the work was performed.

1.3 CONTRACTOR QUALIFICATION

- A. The work described herein consists of furnishing, transporting, and installing all seeds, plant materials, and other materials as required for the restoration and establishment of the lower shoreland, upper shoreland and sideslopes, buffer meadow, biofiltration basin, wooded area, and wetland; completing all earthwork and grading, including excavation and placement of fill; constructing stormwater management appurtenances; construction of erosion control improvements; management and monitoring of planting areas after final acceptance; and such additional, extra and incidental work as may be necessary to complete the work in accordance with the plans and specifications. The Contractor shall furnish all required materials, equipment, tools, labor, and incidentals, unless otherwise provided in the specifications or plans.
- B. The Contractor shall provide proof to the Owner that the Contractor's on-site field supervisor(s) overseeing project implementation have a minimum of 5 years experience conducting ecological restoration [and management] services as defined in this specification package. Contractor will provide owner or owners representative with resumés of key staff, both supervisory and ecological practitioners (i.e. laborers), that will play a critical role in the installation and management of said project. Contractor shall provide a qualification package containing a minimum of 5 ecological projects similar in size and scope within the last 3 years.

PART 2 - MATERIALS

2.1 MATERIALS

- A. Herbicide: Broad-spectrum, non-persistent glyphosate-based herbicide (“Roundup” or similar).
- B. Mulch: Chopped, weed-free straw (no field hay marsh hay, reed canary grass or other invasives) and/or cellulose based hydromulch without tackifier.
- C. Erosion Control Blanket: Biodegradable wood excelsior, straw or coconut-fiber enclosed in photodegradable plastic mesh with ½ inch openings, with 12 to 18 month service life.
- D. Erosion Control Blanket Anchors: Biodegradable or Photodegradable anchors recommended by blanket manufacturer. No metal anchors may be used.
- E. Topsoil or Biofilter Mix per Plan Specifications.
- F. Cover Crop: Annual rye (*Lolium multiflorum*).
- G. Biofilter Mix: Per Plan Specifications.
- H. Topsoil or Salvaged Topsoil: As Natural loam, sandy loam, silty clay loam, or clay loam humus-bearing soil adapted to the sustenance of plant life. If using topsoil (not salvaged) it shall: not be excessively acid or alkaline, be free of pests, pests’ larvae and matter toxic to plants, have maximum soluble salts of 500 ppm, have a maximum 5% by volume of slag, cinders, stones, or other extraneous matter exceeding 2 inches in diameter, be free of viable weeds or invasive species and free of substances harmful to growth of plants.
- I. Native Seed Mixes: Seed mixtures shall be comprised of species specified in PLANT SCHEDULE FOR ZONES 1-6 below. Seed mixes should be comprised of species as noted below. No substitutions are permitted without approval by Design Engineer. Mix shall be comprised of pure live seed. No improved varieties or cultivars of native species are permitted. Landscape Contractor shall submit certification identifying source, species, weight, purity and viability of seed to Design Engineer for approval.

Zone 1 (Lower Shoreland) - Mix shall be comprised of a minimum of 7 the 11 species of the grasses and sedges in roughly equal quantities and 14 species of the 18 forbs in roughly equal quantities listed in Plant Schedule for Zone 1 below. Total seed mix shall be comprised of approximately 60 percent grasses and sedges and 40 percent forbs. *Elymus Canadensis*, *carexvulpinoidea*, *carexstipata* must be used in Zone 1.

Zone 2 (Upper Shoreland and Sideslopes) - Mix shall be comprised of a minimum of 4 of the 7 species of the grasses and sedges in roughly equal quantities and 16 species of the 20 forbs in roughly equal quantities listed in Plant Schedule for Zone 2 below. Total seed mix shall be comprised of approximately 50 percent grasses and sedges and 50 percent forbs. *Elymus Canadensis* must be used in Zone 2.

Zone 3 (Buffer Meadow) - Mix shall be comprised of a minimum of 4 of the 8 species of the grasses and sedges in roughly equal quantities and 16 species of the 23 forbs in roughly equal quantities listed in Plant Schedule for Zone 3 below. Total seed mix shall be comprised of approximately 60 percent grasses and sedges and 40 percent forbs. *Sorghastrum nutans*, *schiz. scoparium* must be used in Zone 3.

Zone 4 (Biofiltration Basin) - Mix shall be comprised of a minimum of 8 of the 15 species of the grasses and sedges in roughly equal quantities and 18 species of the 30 forbs in roughly equal quantities listed in Plant Schedule for Zone 4 below. Total seed mix shall be comprised of approximately 50 percent grasses and sedges and 50 percent forbs.

Zone 5 (Wooded Area) - Mix shall be comprised of a minimum of 2 of the 2 species of the grasses and sedges in roughly equal quantities and 5 species of the 10 forbs in roughly equal quantities listed in Plant Schedule for Zone 5 below. Total seed mix shall be comprised of approximately 50 percent grasses and sedges and 50 percent forbs.

Zone 6 (Wetland) - Mix shall be comprised of a minimum of 10 of the 16 species of the grasses and sedges in roughly equal quantities and 6 species of the 7 forbs in roughly equal quantities listed in Plant Schedule for Zone 6 below. Total seed mix shall be comprised of approximately 75 percent grasses and sedges and 25 percent forbs.

Suggested Sources:

- a. J.F. New, 708 Roosevelt Road, Walkerton, IN 46574, 574-586-3400 (voice), 574-586-3446 (fax).
 - b. Prairie Nursery, P.O. Box 306, Westfield, WI 53964, 800-476-9453 (voice), 608-296-2741 (fax).
 - c. Agrecol Corporation, 2918 Agricultural Drive, Madison, WI 53718, 608-223-3571 (voice), 608-223-3575 (fax).
 - d. Applied Ecological Services, Inc. Wisconsin Office, 17921 Smith Road, Brodhead, WI 53520, 608-897-8641 (voice), 608-897-8486 (fax).
- J. Plant Stock: Species are specified in PLANT SCHEDULE FOR ZONES 1, 2, 4 and 6 below. Plants shall be equal or exceed 2 – 2.5 inch plugs (typically 32 – 38 per flat). No substitutions are permitted without approval by Design Engineer. No improved varieties or cultivars of native species are permitted. Plants shall have a habit of growth that is normal for the species and shall be sound, healthy, vigorous and free from insect pests and diseases. Requirements for measurements, branching and grading quality in Plant Schedule generally follow the Code of Standard currently recommended by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock.
- Zone 1 (Lower Shoreland) – Plant stock shall be comprised of a minimum of 7 of the 11 species of the grasses and sedges in roughly equal quantities and 14 species of the 18 forbs in roughly equal quantities listed in Plant Schedule for Zone 1 below. Total plant stock shall be comprised of 57-60 percent grasses and sedges and 40-43 percent forbs. Live stock need not be same species as seed mix.

Zone 2 (Upper Shoreland and Sideslopes) – Plant stock shall be comprised of a minimum of 4 of the 7 species of the grasses and sedges in roughly equal quantities and 16 species of the 20 forbs in roughly equal quantities listed in Plant Schedule for Zone 2 below. Total plant stock shall be comprised of 57-60 percent grasses and sedges and 40-43 percent forbs. Live stock need not be same species as seed mix.

Zone 6 (Wetland) - Plant stock shall be comprised of a minimum of 10 of the 16 species of the grasses and sedges in roughly equal quantities and 6 species of the 7 forbs in roughly equal quantities listed in Plant Schedule for Zone 1 below. Total plant stock shall be comprised of 57-60 percent grasses and sedges and 40-43 percent forbs. Live stock need not be same species as seed mix.

Suggested Sources:

- a. J.F. New, 708 Roosevelt Road, Walkerton, IN 46574, 574-586-3400 (voice), 574-586-3446 (fax).
 - b. Prairie Nursery, P.O. Box 306, Westfield, WI 53964, 800-476-9453 (voice), 608-296-2741 (fax).
 - c. Agrecol Corporation, 2918 Agricultural Drive, Madison, WI 53718, 608-223-3571 (voice), 608-223-3575 (fax).
 - d. Applied Ecological Services, Inc. Wisconsin Office, 17921 Smith Road, Brodhead, WI 53520, 608-897-8641 (voice), 608-897-8486 (fax).
- J. Native seed and plants: Seed and plant material must be from a recognized native seed and plant nursery. The origin of the seed and plants must be from within 150 miles of the project. This criteria must be established prior to the award of contract.

PLANT SCHEDULE FOR ZONES 1-6

Common Name	Species Name	Plant Type	Flower Color	Bloom Time
Zone 1 - Lower Shoreline				
Big Bluestem	<i>Andropogon gerardii</i>	Grass/Sedge/Rush	bronze/red	Aug-Oct
Fringed Brome	<i>Bromus ciliatus</i>	Grass/Sedge/Rush	green	June-July
Blue-Joint Grass	<i>Calamagrostis canadensis</i>	Grass/Sedge/Rush	straw	June-July
Bebb's Sedge	<i>Carex bebbii</i>	Grass/Sedge/Rush	green	June-Aug
Bristly Sedge	<i>Carex comosa</i>	Grass/Sedge/Rush	green	May-July
Bottlebrush Sedge	<i>Carex hystericina</i>	Grass/Sedge/Rush	green	June-July
Fox Sedge	<i>Carex stipata</i>	Grass/Sedge/Rush	green	June-July
Tussock Sedge	<i>Carex stricta</i>	Grass/Sedge/Rush	green	June-July
Brown Fox Sedge	<i>Carex vulpinoidea</i>	Grass/Sedge/Rush	green	May-June
Canada Wild Rye	<i>Elymus canadensis</i>	Grass/Sedge/Rush	straw	July-Aug
Bottlebrush Grass	<i>Elymus hystrix</i>	Grass/Sedge/Rush	green	June-July
Canada Anemone	<i>Anemone canadensis</i>	Wildflower	white	May-June
Red Milkweed	<i>Asclepias incarnata</i>	Wildflower	red/pink	July-Aug
New England Aster	<i>Aster novae-angliae</i>	Wildflower	purple/blue	Aug-Oct
Nodding Bur Marigold	<i>Bidens cernuus</i>	Wildflower	yellow	Aug-Oct
Common Beggar's Ticks	<i>Bidens frondosus</i>	Wildflower	yellow	June-Oct

Zone 1 - Lower Shoreline Continued				
Turtlehead	<i>Chelone glabra</i>	Wildflower	cream	July-Sept
Joe Pye Weed	<i>Eupatorium maculatum</i>	Wildflower	pink	July-Sept
Boneset	<i>Eupatorium perfoliatum</i>	Wildflower	white	July-Oct
Bottle Gentian	<i>Gentiana andrewsii</i>	Wildflower	blue	Aug-Oct
Sneezeweed	<i>Helenium autumnale</i>	Wildflower	yellow	Aug-Oct
Jewelweed	<i>Impatiens capensis</i>	Wildflower	orange	June-Sept
Blue Flag Iris	<i>Iris virginica</i>	Wildflower	blue	May-July
Cardinal Flower	<i>Lobelia cardinalis</i>	Wildflower	scarlet	July-Sept
Monkey Flower	<i>Mimulus ringens</i>	Wildflower	blue	June-Aug
Obedient Plant	<i>Phystostegia virginiana</i>	Wildflower	pink	June-Sept
Purple Meadowrue	<i>Thalictrum dasycarpum</i>	Wildflower	white	May-July
Blue Vervain	<i>Verbena hastata</i>	Wildflower	purple	July-Oct
Ironweed	<i>Vernonia fasciculata</i>	Wildflower	purple	July-Sept
Zone 2 - Upper Shoreline				
Big Bluestem	<i>Andropogon gerardii</i>	Grass/Sedge/Rush	bronze/red	Aug-Oct
Fringed Brome	<i>Bromus ciliatus</i>	Grass/Sedge/Rush	green	June-July
Blue-Joint Grass	<i>Calamagrostis canadensis</i>	Grass/Sedge/Rush	straw	June-July
Canada Wild Rye	<i>Elymus canadensis</i>	Grass/Sedge/Rush	straw	July-Aug
Bottlebrush Grass	<i>Elymus hystrix</i>	Grass/Sedge/Rush	green	June-July
Little Bluestem	<i>Schizachyrium scoparium</i>	Grass/Sedge/Rush	crimson-red	Aug-Oct
Indian Grass	<i>Sorghastrum nutans</i>	Grass/Sedge/Rush	green	Aug-Sept
Nodding Wild Onion	<i>Allium cernuum</i>	Wildflower	white/pink	July-Aug
Columbine	<i>Aquilegia canadensis</i>	Wildflower	red/yellow	May-June
Common Milkweed	<i>Asclepias syriaca</i>	Wildflower	lavender	June-Aug
Whorled Milkweed	<i>Asclepias verticillata</i>	Wildflower	white	July-Sept
Smooth Aster	<i>Aster laevis</i>	Wildflower	blue	Aug-Oct
New England Aster	<i>Aster novae-angliae</i>	Wildflower	purple/blue	Aug-Oct
Canada Milk Vetch	<i>Astragalus canadensis</i>	Wildflower	yellow	July-Aug
Showy Tick-Trefoil	<i>Desmodium canadense</i>	Wildflower	purple	July-Aug
Fireweed	<i>Epilobium angustifolium</i>	Wildflower	pink	June-Sept
Joe Pye Weed	<i>Eupatorium maculatum</i>	Wildflower	pink	July-Sept
Grass-Leaved Goldenrod	<i>Euthamia graminifolia</i>	Wildflower	yellow	July-Sept
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>	Wildflower	yellow	June-Sept
Prairie Blazing Star	<i>Liatris pycnostachya</i>	Wildflower	purple	July-Sept
Bergamot	<i>Monarda fistulosa</i>	Wildflower	lavender	July-Sept
Evening Primrose	<i>Oenothera biennis</i>	Wildflower	yellow	July-Oct
Obedient Plant	<i>Phystostegia virginiana</i>	Wildflower	pink	June-Sept
Yellow Coneflower	<i>Ratibida pinnata</i>	Wildflower	yellow	July-Sept
Black Eyed Susan	<i>Rudbeckia hirta</i>	Wildflower	yellow	June-Sept
Green Headed Coneflower	<i>Rudbeckia laciniata</i>	Wildflower	yellow	July-Oct
Sweet Black Eyed Susan	<i>Rudbeckia subtomentosa</i>	Wildflower	yellow	Aug-Sept
Zone 3 - Buffer/Meadow				
Big Bluestem	<i>Andropogon gerardi</i>	Grass/Sedge/Rush	bronze/red	Aug-Oct
Canada Wild Rye	<i>Elymus canadensis</i>	Grass/Sedge/Rush	straw	July-Aug
Virginia Wild Rye	<i>Elymus virginicus</i>	Grass/Sedge/Rush	straw	July-Aug
Junegrass	<i>Koeleria macrantha</i>	Grass/Sedge/Rush	gold	May-June
Little Bluestem	<i>Schizachyrium scoparium</i>	Grass/Sedge/Rush	crimson-red	Aug-Oct
Indian Grass	<i>Sorghastrum nutans</i>	Grass/Sedge/Rush	green	Aug-Sept
Sand Dropseed	<i>Sporobolus cryptandrus</i>	Grass/Sedge/Rush	straw	May-Nov
Needle Grass	<i>Stipa spartea</i>	Grass/Sedge/Rush	green	May-July

Nodding Wild Onion	<i>Allium cernuum</i>	Wildflower	white/pink	July-Aug
Zone 3 - Buffer/Meadow Continued				
Canada Anemone	<i>Anemone canadensis</i>	Wildflower	white	May-June
Thimbleweed	<i>Anemone cylindrica</i>	Wildflower	white	June-Aug
Columbine	<i>Aquilegia canadensis</i>	Wildflower	red/yellow	May-June
Common Milkweed	<i>Asclepias syriaca</i>	Wildflower	lavender	June-Aug
Butterflyweed	<i>Asclepias tuberosa</i>	Wildflower	orange	June-Aug
Smooth Aster	<i>Aster laevis</i>	Wildflower	blue	Aug-Oct
Sky-blue Aster	<i>Aster oolentangiensis</i>	Wildflower	blue	Aug-Oct
Silky Aster	<i>Aster sericeus</i>	Wildflower	lavender	Aug-Oct
Canada Milk Vetch	<i>Astragalus canadensis</i>	Wildflower	yellow	July-Aug
Indian Paintbrush	<i>Castilleja coccinea</i>	Wildflower	red	May-July
Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	Wildflower	yellow	May-Aug
Fireweed	<i>Epilobium angustifolium</i>	Wildflower	pink	June-Sept
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>	Wildflower	yellow	June-Sept
Rough Blazingstar	<i>Liatris aspera</i>	Wildflower	purple/pink	Aug-Sept
Bergamot	<i>Monarda fistulosa</i>	Wildflower	lavender	July-Sept
Dotted Mint	<i>Monarda punctata</i>	Wildflower	lavender	July-Sept
Evening Primrose	<i>Oenothera biennis</i>	Wildflower	yellow	July-Oct
Prairie Cinquefoil	<i>Potentilla arguta</i>	Wildflower	yellow	June-July
Yellow Coneflower	<i>Ratibida pinnata</i>	Wildflower	yellow	July-Sept
Black Eyed Susan	<i>Rudbeckia hirta</i>	Wildflower	yellow	June-Sept
Showy Goldenrod	<i>Solidago speciosa</i>	Wildflower	yellow	Aug-Sept
Hoary Vervain	<i>Verbena stricta</i>	Wildflower	blue	July-Sept
Zone 4 - Biofiltration Basin				
Big Bluestem	<i>Andropogon gerardi</i>	Grass/Sedge/Rush	bronze/red	Aug-Oct
Fringed Brome	<i>Bromus ciliatus</i>	Grass/Sedge/Rush	green	June-July
Blue-Joint Grass	<i>Calamagrostis canadensis</i>	Grass/Sedge/Rush	straw	June-July
Bebb's Sedge	<i>Carex bebbii</i>	Grass/Sedge/Rush	green	June-Aug
Bristly Sedge	<i>Carex comosa</i>	Grass/Sedge/Rush	green	May-July
Fox Sedge	<i>Carex stipata</i>	Grass/Sedge/Rush	green	June-July
Brown Fox Sedge	<i>Carex vulpinoidea</i>	Grass/Sedge/Rush	green	May-June
Canada Wild Rye	<i>Elymus canadensis</i>	Grass/Sedge/Rush	straw	July-Aug
Bottlebrush Grass	<i>Elymus hystrix</i>	Grass/Sedge/Rush	green	June-July
Virginia Wild Rye	<i>Elymus virginicus</i>	Grass/Sedge/Rush	straw	July-Aug
Reed Manna Grass	<i>Glyceria grandis</i>	Grass/Sedge/Rush	green	July
Vanilla Sweet Grass	<i>Hierochloa ordata</i>	Grass/Sedge/Rush	straw	July-Aug
Path Rush	<i>Juncus tenuis</i>	Grass/Sedge/Rush	green	June
Little Bluestem	<i>Schizachyrium scoparium</i>	Grass/Sedge/Rush	crimson-red	Aug-Oct
Indian Grass	<i>Sorghastrum nutans</i>	Grass/Sedge/Rush	green	Aug-Sept
Nodding Wild Onion	<i>Allium cernuum</i>	Wildflower	white/pink	July-Aug
Canada Anemone	<i>Anemone canadensis</i>	Wildflower	white	May-June
Red Milkweed	<i>Asclepias incarnata</i>	Wildflower	red/pink	July-Aug
New England Aster	<i>Aster novae-angliae</i>	Wildflower	purple/blue	Aug-Oct
Swamp Aster	<i>Aster puniceus</i>	Wildflower	white	Aug-Oct
Canada Milk Vetch	<i>Astragalus canadensis</i>	Wildflower	yellow	July-Aug
Turtlehead	<i>Chelone glabra</i>	Wildflower	cream	July-Sept
Showy Tick-Trefoil	<i>Desmodium canadense</i>	Wildflower	purple	July-Aug
Fireweed	<i>Epilobium angustifolium</i>	Wildflower	pink	June-Sept
Joe Pye Weed	<i>Eupatorium maculatum</i>	Wildflower	pink	July-Sept
Boneset	<i>Eupatorium perfoliatum</i>	Wildflower	white	July-Oct

Grass-Leaved Goldenrod	<i>Euthamia graminifolia</i>	Wildflower	yellow	July-Sept
Bottle Gentian	<i>Gentiana andrewsii</i>	Wildflower	blue	Aug-Oct
Zone 4 - Biofiltration Basin Continued				
Sneezeweed	<i>Helenium autumnale</i>	Wildflower	yellow	Aug-Oct
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>	Wildflower	yellow	June-Sept
Prairie Blazing Star	<i>Liatris pycnostachya</i>	Wildflower	purple	July-Sept
Cardinal Flower	<i>Lobelia cardinalis</i>	Wildflower	scarlet	July-Sept
Great Blue Lobelia	<i>Lobelia siphilitica</i>	Wildflower	blue	Aug-Sept
Pale Spiked Lobelia	<i>Lobelia spicata</i>	Wildflower	lavender	May-Aug
Bergamot	<i>Monarda fistulosa</i>	Wildflower	lavender	July-Sept
Evening Primrose	<i>Oenothera biennis</i>	Wildflower	yellow	July-Oct
Obedient Plant	<i>Physostegia virginiana</i>	Wildflower	pink	June-Sept
Yellow Coneflower	<i>Ratibiba pinnata</i>	Wildflower	yellow	July-Sept
Black Eyed Susan	<i>Rudbeckia hirta</i>	Wildflower	yellow	June-Sept
Green Headed Coneflower	<i>Rudbeckia laciniata</i>	Wildflower	yellow	July-Oct
Sweet Black Eyed Susan	<i>Rudbeckia subtomentosa</i>	Wildflower	yellow	Aug-Sept
Ohio Goldenrod	<i>Solidago ohioensis</i>	Wildflower	yellow	July-Oct
Purple Meadowrue	<i>Thalictrum dasycarpum</i>	Wildflower	white	May-July
Blue Vervain	<i>Verbena hastata</i>	Wildflower	purple	July-Oct
Ironweed	<i>Vernonia fasciculata</i>	Wildflower	purple	July-Sept
Zone 5 - Wooded Area				
Bottlebrush Grass	<i>Elymus hystrix</i>	Grass/Sedge/Rush	green	June-July
Virginia Wild Rye	<i>Elymus virginicus</i>	Grass/Sedge/Rush	straw	July-Aug
Tall Anemone	<i>Anemone virginiana</i>	Wildflower	white	June-Aug
Columbine	<i>Aquilegia canadensis</i>	Wildflower	red/yellow	May-June
Jack in the Pulpit	<i>Arisaema triphyllum</i>	Wildflower	green	April-June
Wild Ginger	<i>Asarum canadense</i>	Wildflower	red	May-June
Bellflower	<i>Campanula rotundifolia</i>	Wildflower	blue	June-Sept
Dutchman's Britches	<i>Dicentra cucullaria</i>	Wildflower	white	April-May
Wild Geranium	<i>Geranium maculatum</i>	Wildflower	lavender	April-July
Woodland Sunflower	<i>Helianthus strumosus</i>	Wildflower	yellow	Aug-Oct
Jewelweed	<i>Impatiens capensis</i>	Wildflower	orange	June-Sept
Labrador Violet	<i>Viola labradorica</i>	Wildflower	lavender	June-Aug
Zone 6 - Wetland				
Bristly Sedge	<i>Carex comosa</i>	Grass/Sedge/Rush	green	May-July
Bottlebrush Sedge	<i>Carex hystericina</i>	Grass/Sedge/Rush	green	June-July
Lake Sedge	<i>Carex lacustris</i>	Grass/Sedge/Rush	green	May-June
Tussock Sedge	<i>Carex stricta</i>	Grass/Sedge/Rush	green	June-July
Brown Fox Sedge	<i>Carex vulpinoidea</i>	Grass/Sedge/Rush	green	May-June
Needle Spike Rush	<i>Eleocharis acicularis</i>	Grass/Sedge/Rush	green	June-Oct
Blunt Spike Rush	<i>Eleocharis ovata</i>	Grass/Sedge/Rush	green	May-Sept
Great Spike Rush	<i>Eleocharis palustris</i>	Grass/Sedge/Rush	green	July
Reed Manna Grass	<i>Glyceria grandis</i>	Grass/Sedge/Rush	green	June
Fowl Manna Grass	<i>Glyceria striata</i>	Grass/Sedge/Rush	green	May-June
Common Rush	<i>Juncus effusus</i>	Grass/Sedge/Rush	green	June
Hard-stem Bulrush	<i>Schoenoplectus acutus</i>	Grass/Sedge/Rush	green	June-Aug
Three Square Bulrush	<i>Schoenopletus pungens</i>	Grass/Sedge/Rush	green	May-Sept
Soft-stem Bulrush	<i>Schoenopletus tabermontanii</i>	Grass/Sedge/Rush	green	May-Aug
Dark Green Bulrush	<i>Scirpus atrovirens</i>	Grass/Sedge/Rush	green	July-Aug
Woolgrass	<i>Scirpus cyperinus</i>	Grass/Sedge/Rush	green	July-Aug
Sweet Flag	<i>Acorus americanus</i>	Wildflower	green	May-June

Water Plantain	<i>Alisma subcordatum</i>	Wildflower	white	July-Sept
Turtlehead	<i>Chelone glabra</i>	Wildflower	cream	July-Sept
Zone 6 – Wetland Continued				
Northern Blue Flag Iris	<i>Iris versicolor</i>	Wildflower	blue	May-July
Blue Flag Iris	<i>Iris virginica</i>	Wildflower	blue	May-July
Common Arrowhead	<i>Sagittaria latifolia</i>	Wildflower	white	June-Sept
Bur-reed	<i>Sparganium eurycarpum</i>	Wildflower	white	May-Aug

PART 3 - EXECUTION

3.1 PREPARATION

- A. Landscape Contractor shall coordinate preparation of site and seeding/planting with grading contractor as appropriate.
- B. Staking of work zone shall be executed by Owner’s Representative.

3.2 INSPECTION

- A. Examine area to receive soil preparation to ensure work of other trades has been completed.
- B. Verify that plants to remain undisturbed have been identified.
- C. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

3.3 VEGETATION REMOVAL/HERBICIDE APPLICATION:

- A. Remove all existing vegetation in Zones 4 and 6, moving memorial trees as directed by owner. Remove existing vegetation, excluding trees, in Zones 1, 2, and 3. Clearing and grubbing of trees should be confined to the areas of the storm water facilities as marked on the plans.
- B. Remove invasive species only in Zone 5 (wooded area), by use of herbicide and/or removal. Do not remove all vegetation in Zone 5.
- C. Apply broad spectrum herbicide when plants are actively growing several times throughout the growing season as needed to remove annual and perennial weeds. Mid-spring, mid-summer, early fall (can be started in growing season before planting begins i.e. spray fall and next spring).
- D. If vegetation 1-foot tall or higher is present, mow and remove clippings. Apply herbicide at intervals when weeds have grown 3-6 inches and **before they have set seed**. A minimum of 2 applications shall be made. After consultation with the Design Engineer to determine if site is sufficiently free of weeds, the native seed mix may be installed 10 days after last herbicide application.
- E. If pernicious weeds, such as Spotted Knapweed, Canada Thistle or Horsenettle, are present, a broadleaf herbicide and surfactant shall be added to glyphosate-based herbicide. Follow manufacturer’s instructions.

- F. Obtain appropriate permits in coordination with Owner for herbicide treatments along lake and shoreline.

3.3 PREPARING SITE

- A. Zones 4 and 6 should be covered by at least 6 inches of biofiltration basin mix per plan sheet 5. Zones 1, 2, 3 and 6 should be covered by at least 6 inches of topsoil or biofiltration basin mix per grading plan. Zone 5 does not require any soil amendment.
- B. Till surface soil to a depth of at least 6 inches prior to placing topsoil compost or biofilter mix. Remove and dispose of existing grass, weeds and other vegetation. Do not turn debris into soil, which is being prepared for seeding. Rake or mow remnants of previous vegetation. Do not cultivate debris into soil. Cultivate the soil to prepare for seeding to a depth of 6 inches. Remove clumps of sod, stones larger than 1.5 inches, sticks, roots, rubbish, thatch and any extraneous material
- C. Fine grade seeding areas to a smooth, even surface with loose, uniformly fine texture. Limit fine grading to areas that can be seeded in the immediate future. Remove stones larger than 1.5 inches in any dimension and sticks, roots, rubbish and other extraneous materials. Trim high areas and fill in depressions. Restore prepared areas if eroded or otherwise disturbed after fine grading and before seeding. Restore surface to loose, uniformly fine texture if soil has been compacted by rain or other action.

3.4 SEEDING

- A. Do not seed or plant for at least 10 days after herbicide is applied.
- B. Do not seed if perennial weeds are still present on site.
- C. Seed should be stratified before seeding (either dry or damp) if seeded in spring.
- D. Landscape Contractor shall deliver seed to site in original sealed, labeled and undamaged containers showing source, weight and analysis. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- E. Install seed mix at a rate specified by supplier.
- F. Overseeding techniques may be employed in Zone 5 (wooded area) due to the presence of already established native vegetation.
- G. Seeding may be done by hand broadcasting, mechanically using a Brillion drop seeder (or equivalent) or hydro-seeding. Rake seed lightly into top 1/8 inch of topsoil and roll lightly. Separate water seed bed with a fine spray immediately after planting.
- H. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
- I. Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.
- J. Seed mix shall be installed with a cover crop of annual ryegrass (*Lolium multiflorum*), applied at a rate of 10 pounds per acre in Zones 1, 2, 3, 4 and 6. Cover crop / erosion

stabilization for winter. Planting rate: 50 lbs per acre – only if dormant seeding, pick proper planting rate.

- K. If hand broadcasting seed, seed should be mixed with slightly dampened sawdust or vermiculite (two bushels per 1000 square feet), divided in half, with each half being spread perpendicular across the site. The seed should then be raked or dragged and rolled.
- L. Seeding should be followed directly by mulching and then installation of the erosion control blanket.

3.5 PLANTING

- A. In the zones that are to be planted as well as seeded (Zones 1, 2, 4 and 6), install plants after seeding, mulching and installing erosion control blanket.
- B. Plant the native grasses and forbs, listed in PLANT SCHEDULE FOR ZONES 1, 2, 4 and 6 above, in a uniform grid on 12” centers. Randomly mix all species so that they are uniformly distributed throughout planting area.
- C. Landscape Contractor shall deliver plant stock in good condition and shall take precautions to protect plants on site from sun, drying winds and mishandling. Plants shall not be removed from containers until immediately before installation.
- D. Thoroughly water plants immediately after planting.

3.6 MULCHING, EROSION CONTROL BLANKET AND TEMPORARY FENCING

- A. After seeding, Zones 1, 2, 3, 4 and 6, should be mulched either with a cellulose based hydro-mulch without a tackifier or with 1 inch weed free (no field hay, marsh hay, or Reed Canary Grass) straw. Zone 5 does not require mulching
- B. Hydro-seeding should be accompanied by hydro-mulch.
- C. If using straw mulch: Apply weed-free straw mulch after completion of seeding. Spread mulch uniformly to form a continuous blanket 1-2 inches loose depth over seeded areas. Spread by hand, blower other suitable equipment.
- D. In zones without erosion control blanket, anchor straw mulch by crimping into topsoil by suitable mechanical equipment.
- E. After mulching or hydro-mulching is completed in Zones 1, 2, 4 and 6, secure the mulch with the erosion control blanket. The entirety of Zones 1, 2, 4, and 6 shall be covered with erosion control blankets.
- F. Erosion control mats should be secured with biodegradable/ photodegradable staples recommended by manufacturer spaced according to manufacture’s recommendation, but no less than at 1-2 foot intervals.
- G. After seeding, mulching, installing erosion control blanket, and planting, temporary fencing should be installed around the entire perimeter of the planting zone (or zones if

they adjoin). This includes the water side of the planting as well as the upland side. The purpose of the fencing is to exclude people and animals (especially nuisance waterfowl) from traversing the planted area.

3.7 INVASIVE SPECIES REMOVAL

- A. May be preformed along with site preparation for seeding and planting.
- B. Management of invasive species needs to begin before planting or seeding of other areas in the project, so that if done in phases or segments, the invasive species do not provide a source of propagules to these restored areas.
- C. Remove invasive species including (but are not limited to) Giant Reed Grass (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Purple Loosestrife (*Lythrum salicaria*), Crown Vetch (*Coronilla varia*), Honeysuckle (*Lonicera* sp.), Garlic Mustard (*Alliaria petiolata*), Dame's Rocket (*Hesperis matronalis*), Spotted Knapweed (*Centurea biebersteinii*), Glossy Buckthorn (*Rhamnus frangula*) and Common Buckthorn (*Rhamnus cathartica*) from Zones 1-6.
- D. Species may be removed manually or by herbicide treatment before planting or seeding. Species may only be removed by direct herbicide application (no spraying) after planting and/or seeding has taken place. Pulling may disturb establishment of seedlings and spraying may result in drifting of herbicide to non-target plants.
- E. All invasive plant material (treated or pulled) should be gathered and disposed of properly off-site.
- F. Obtain appropriate permits needed for plant removal or herbicide treatment along shoreline and lake.

3.08 LOW GROUND PRESSURE EQUIPMENT

- A. All equipment used in grading and landscaping should be low-ground pressure equipment, as to not cause soil compaction.
- B. Any areas trafficked by non-low ground pressure equipment must be remediated per instruction of design engineer.
- C. Low ground pressure equipment shall be rated for working ground pressures that are less than 5 pounds per square inch (PSI).

PART 4 - POST PLANTING MANAGEMENT

4.1 FOLLOW-UP MAINTENANCE

- A. Landscape Contractor shall manage Zones 1-6 for 3 growing seasons after planting. Management includes plant establishment, invasive species removal, necessary care for plantings, maintenance of erosion control blanket, and any necessary maintenance re-grading/re-planting.
- B. Warranty all planted and seeded areas for two growing seasons.

- C. Landscape Contractor shall report progress of establishment to the Owner and the Design Engineer on a bi-monthly basis and execute measures as directed by Owner.
- D. Landscape Contractor shall coordinate with the owner the operation and monitoring of the temporary water control structure to control water level in the establishing treatment wetland area. When the wetland vegetation is satisfactorily established to bring the system on-line the owner shall be responsible for removal of the temporary structure and grading of the final inlet and outlet structures. These areas should then be planted according to the Planting Schedule.
- E. Maintain temporary fencing for at least one growing season after planting.
- F. In areas that are **seeded only** (Zone 3) areas mow plantings on a regular basis during first growing season when vegetation exceeds 6 inches, but is less than 12 inches in height. Mowing frequency will depend upon rainfall and weed density and height.

In **seeded and planted areas**, cut back vegetation to a height of 6 inches when height of weeds reach 12-16 inches in height or before they set seed, using a string trimmer or flail mower. Rotary or sickle bar mowers may be used with approval by design engineer. Preferably use a flail-type mower, which prevents clippings from smothering seedlings. If rotary or sickle bar mowers are employed, clippings must be raked and removed from the site. Mow planted areas to a height of 1 foot in late spring or early summer, or when weeds reach 1 foot in height. Biennial weeds, including Burdock, Sweet Clover, Wild Parsnip, Bull Thistle, Curly Dock and Queen Anne's Lace must be cut to a height of 1 foot when in full bloom, but before setting seed (usually early to late June).
- G. Before the second growing season begins, mow standing dead vegetation from previous year.
- H. During the second growing season, mow to a height of 12 inches when weeds are in first flower, before they set seed.
- I. Continue to mow plantings in Zone 3 to suppress weeds and promote growth of native plants in second and third growing season (some species require 2 years to germinate) as necessary.
- J. Inspect plantings monthly for weeds in the first 2 growing seasons, apply herbicide as necessary.
- H. Avoid pulling weeds in the first year as native seedlings are weak and are easily dislodged.
- I. Apply herbicide individually to weeds by hand. Do not spray, drift of herbicide may kill non-target native seedlings.
- N. Water plants whenever soil under mulch begins to dry out during initial season: once a week in absence of rainfall.
- K. Provide and maintain temporary piping, hoses and watering equipment to convey water from sources for irrigation as needed of any and all Zones 1-6.

- L. Fertilize sparingly only. If it is necessary to fertilize, use a slow-release, balanced fertilizer with equal portions of nitrogen, phosphorous and potassium which are derived from organic sources.
- M. Reseed bare spots. For purposes of establishing acceptable standard, scattered bare spots, none larger than 1 sq. ft. will be allowed up to a maximum of 3% of seeded areas.
- O. It is expected that successful installation and maintenance program will result in the presence of no invasive species within the project area after completion of the third growing season.

* * * END OF SECTION * * *

SECTION 02930
LAWN REPAIR

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Soil preparation, seeding, mulching, fertilizing and establishing lawn in areas needing turf repair.
- B. Does not include landscaping in Zones 1-6.

1.2 QUALITY ASSURANCE

- A. Comply with requirements of state regulations regarding grass seed.
- B. Seed shall not be used later than one year later than the test date appearing on the label.
- C. Sampling and testing of seed for purity, germination, and weed seed content shall be in accordance with *Rules for Testing Seed* published by the Association of Official Seed Analysts.
- D. A Comply with requirements of state regulations regarding fertilizer.

1.3 SUBMITTALS

- A. Provide composition of seed mixture.
- B. Provide, upon request, manufacturer's certification that materials meet specification requirements.
- C. Provide, upon request, results of seed purity and germination tests.

1.4 JOB CONDITIONS

- A. Perform seeding only after preceding work affecting ground surface and fertilizer is complete.
- B. Environmental Requirements
 - 1. Do not prepare or place frozen soils or soils with excessive moisture.
 - 2. Do not plant seed on frozen soil.
 - 3. Protect trees and shrubs from damage.
 - 4. Do not seed when wind exceeds 15 mph.

1.5 PACKAGING

- A. Each container shall be plainly marked with the seed composition in percent by weight.
- B. Each container shall be marked with the test date.
- C. Containers shall be new and unopened.

D. Fertilizer:

1. Each container shall be plainly marked with the analysis of the contents showing minimum percentages of total nitrogen, available phosphoric acid, and soluble potash.
2. When furnished in bulk, each shipment shall be accompanied by an invoice indicating minimum percentages of contents listed above.
3. Containers or packages shall be new and unopened.

PART 2 - PRODUCTS

2.1 SEED

- A. Seed mixtures shall comply with the following table except that mixtures of similar characteristics may be used upon approval by Engineer:

Species	Min % Purity	Min. % Germination	Mixture %
Kentucky 31 Fescue	97	85	65
Kentucky Bluegrass	85	80	15
Creeping Red Fescue	97	80	15
Perennial Rye Grass	95	90	5

2.2 MULCH

- A. Chopped, weed-free straw (no field hay marsh hay, reed canary grass or other invasives) and/or cellulose based hydromulch without tackifier.

2.3 FERTILIZER

- A. Available nutrients by weight:

1. Nitrogen – not less than 16%
2. Phosphorus – not less than 6%
3. Potash – not less than 6%

- B. Sum of nitrogen, phosphoric acid and potash shall not be less than 32%.

- C. Total nitrogen shall not be less than the sum of the phosphoric acid and potash.

2.4 TOPSOIL OR SALVAGED TOPSOIL

- A. Natural loam, sandy loam, silty clay loam, or clay loam humus-bearing soil adapted to the sustenance of plant life.

- B. Shall not be excessively acid or alkaline.

- C. Free of pests, pests' larvae and matter toxic to plants.

- D. Maximum soluble salts of 500 ppm.

- E. Maximum 5% by volume of slag, cinders, stones, or other extraneous matter exceeding 2 inches in diameter.
- F. Free of viable Bermuda grass, quack grass, Johnson grass, nut sedge, dandelions or poison ivy.
- G. Free of substances harmful to growth of plants.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine area to receive soil preparation to ensure work of other trades has been completed.
- B. Verify that ground is unfrozen.
- C. Verify that plants to remain undisturbed have been identified.
- D. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

3.2 PERFORMANCE

A. Subsoil:

1. Scarify undisturbed or compacted subsoil to a depth of 4 inches before placing topsoil.
2. Remove rocks and other objects over 2 inches in diameter.

B. Topsoil:

1. Place to the lines and grades shown on the Drawings.
2. Place salvaged and sufficient new topsoil to a minimum depth of 6 inches.
3. Remove rocks and other objects over 2 inches in diameter.

C. Fertilizer:

1. Till fertilizer into top 2 inches of soil at a rate of 5 pounds per 1,000 square feet.
2. If seed is applied by means of a stream of water, the required amount of fertilizer may be mixed with the water and seed.

- B. Water dry topsoil to a depth of 4 inches at least 48 hours prior to seeding to obtain a loose seed bed.

3.3 APPLICATION

- A. Application Rate: 5 lb./1000 square feet minimum.

B. Broadcasting:

1. Broadcast one half of seed.
2. Broadcast remaining half of seed at right angles to first seed pattern.

3. Cover seed to a depth of 1/4" by raking, dragging, or cultipacking.
4. Roll seeded area with roller weighing a maximum of 150 pounds per foot of roller width.
5. Place mulch within 3 days after seeding.
6. Spread mulch uniformly to a loose depth of 1/2" to 1-1/2". Mulch shall be loose enough to allow some sunlight to penetrate and air to circulate slowly, but thick enough to shade ground, conserve moisture, and prevent or reduce erosion.
7. Watering is desirable but not required.

C. Hydroseeding:

1. Prepare homogeneous slurry with appropriate amounts of seed, water, and wood cellulose. Fertilizer may also be included.
2. Distribute slurry uniformly at a rate that provides the specified amount of seed and fertilizer.

3.4 APPLICATION

- A. Immediately clean up soil on paved and finished surface areas.
- B. Remove debris and excess materials from project site.

3.5 ESTABLISHMENT

- A. Watering is desirable.
- B. Reseed areas that fail to grow a uniform stand of grass.
- C. Establishment period to extend until stand of grass is acceptable to Engineer.

* * * END OF SECTION * * *

**Maintenance Plan
for
Lake and Storm Water Management Plan**

Bradley (Little) Lake

**City of Sturgeon Bay
Door County, Wisconsin**

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Project No. 07-1-17612

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1 INTRODUCTION

Miller Engineers & Scientists (Miller) prepared this manual to provide the City of Sturgeon Bay, Wisconsin the information necessary to maintain the improvements and storm water facilities detailed in the Little Lake Management & Storm Water Management Plan. Little Lake is located in Sunset Park, in the City of Sturgeon Bay. The plan includes improvements to the lake and surrounding area, intended to restore the lake to a more naturally functioning ecosystem and provide for future lake and storm water management. Some of these improvements include restoration of native plant communities and storm water management facilities. These improvements will require periodic maintenance to perform properly. They are shown on the *Site Plan* and include a storm water forebay, treatment wetland, biofiltration basin and native plant buffer/shoreline plantings. The purpose of the maintenance is to keep the storm water management system in working order and remove contaminants from runoff and storm water. This plan is intended for the long-term care and management of the elements of the Lake and Storm Water Management Plan.

2 BACKGROUND

The storm water management facilities are intended to reduce contamination from storm water to the lake. The storm water management facilities are also incorporated into lake and shoreline restoration elements. The restoration elements and storm water facilities work together to manage the storm water runoff to the lake. The storm water system includes a biofiltration basin, a retention forebay and a treatment wetland. The biofiltration basin allows storm water to slowly infiltrate and filter through the filter berm and soil, thereby removing contaminants. The storm water forebay captures water from the storm sewer and allows particulate contaminants to settle out. The treatment wetland receives water from the retention forebay and provides secondary treatment of the storm water. Contaminants and nutrients are removed by adsorption, uptake, filtration and infiltration by the vegetation and soil. In addition to the storm water facilities, buffers and shoreline restoration also contribute to the runoff management. These elements are designed to reduce sources and lower levels of contamination that reach the lake.

3 INSPECTION AND MAINTENANCE

Individuals who understand the purpose and function of the storm water management system components should perform the inspection and maintenance of these facilities. These facilities are living systems; therefore, the components should be aesthetically pleasing as well as functional.

Both preventative and corrective maintenance will be needed. Some long-term maintenance must be considered as the system ages. Records of inspection and maintenance should be kept on a long-term basis. *Maintenance Logs* are included in this Maintenance Plan. They will be useful in determining system function and long-term maintenance needs. The maintenance tasks and schedules are given for each of the elements of the management plan.

Storm water facilities should be inspected semi-annually, after the spring melt and during the autumn. Each facility should also be inspected after heavy rain events (defined as 4 inches or more rain from one storm or storms with less than 1 day interval between rainfalls) irrespective of the next scheduled inspection date. The inspection should consist of a walk around each component of the facility. During the inspection, look for the items detailed in the *Inspection and Maintenance Forms* provided. Copies of the completed forms should be archived after each inspection. The owner should hold a regular yearly review of storm water management system status. Future needs and long-term planning should be a part of this review.

Maintenance of facilities should occur as soon as possible after issues are detected. Schedules for individual tasks will be dictated by individual facility and temporal conditions. Usually, maintenance will need to be done in the spring and the fall. As maintenance may require personnel and equipment, it should be scheduled in advance if possible. Maintenance should be performed when the components are dry, if possible, to eliminate damage caused by working in wet soils.

Healthy vegetation is required for the system to function properly. The plant species that have been chosen are all native to Door County. They are adapted to living within lakeside conditions and should not require the use of herbicides or pesticides. Tall, thick vegetation is preferred in all areas. Invasive vegetation should be removed from storm water facilities and native plantings. Examples of invasive species include (but are not limited to) Common Reed (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Purple Loosestrife (*Lythrum salicaria*), Spotted Knapweed (*Centaurea maculosa*) and Cattails (*Typha sp.*). The vegetation performs several functions: removes contaminants, slows the speed of the water, reduces the peak flow and absorbs water. Vegetation should not be fertilized in or around storm water management system facilities.

3.1 Buffer and Shoreline Plantings

The buffer/meadow and shoreline plantings are located around the entire lake. This section details the essentials for the long-term vegetation management of these areas. These areas will require more management in the first few years while they become established, which is detailed in the landscape specifications in the *Lake and Storm Water Management Plan*. After establishment, maintenance of vegetation should decrease. The buffer/meadow may require a more detailed long term vegetation management plan that can be prepared by a landscape contractor or other suitable contractor after the species and plant material have been chosen.

The long-term maintenance of the buffer/meadow and shoreline plantings should include weed and invasive species removal, reseeding or replanting bare areas and necessary plant care. The buffer/meadow area will also require regular (2 to 3 year cycle) removal of dead vegetation. Since the lake is located in a park and urban setting vegetation removal is best accomplished by a flail mower, rather than traditional controlled burning techniques.

Repeated visits should be made throughout the year to assess and address landscape maintenance issues. Locations of problem areas should be mapped for ease of tracking over the long-term. Use of the Maintenance Log will facilitate good maintenance. A calendar of regular maintenance needs and staff with plant identification skills is also helpful.

Areas of the buffer/meadow and shoreline that are bare or experience washouts should be reseeded or replanted as soon as possible. Re-establishing these areas quickly reduces the chances that more aggressive invasive species will take hold. Re-establish according to Landscape Specifications in the Lake and Storm Water Management Plan. The species found in these plant communities should reflect the planting plan as well as other native species that may colonize the area over time. Fertilizers should not be used in either of these areas.

The shoreline plantings consist of herbaceous vegetation as well as existing shrubs and trees. The trees and shrubs should require no maintenance once established, unless pruning is desired to control the height of the shrubs. The shoreline plantings are designed to deter nuisance waterfowl from congregating and using the shoreline. For this reason, thick vegetation is desired to form a visual and physical barrier for the waterfowl. It is very important that **no mowing of the upper or lower shoreline area** take place. Mowing is not needed for plant community maintenance. If desired for esthetic reasons, woody vegetation may be removed by hand cutting or direct herbicide application. Mowing should not be used to control woody vegetation establishment. Herbicide may also be used to control weeds and invasive species (see below). The goal of shoreline maintenance should be thick and healthy vegetation around the entire lake.

Unlike the shoreline area, the Buffer/Meadow does require periodic removal of dead vegetation. Traditionally this is accomplished by burning, but due to the urban setting, mowing is preferred. During the first few years of establishment mowing is used for weed and invasive species control. After establishment, less frequent mowing is required. Mowing should be performed in early spring, before plants begin growing. The dead vegetation should be mowed down, preferably with a flail mower, which chops the vegetation up rather than cutting it off and folding it over, which can smother the plants later. Mowing should be carried out on a 2 to 3 year cycle. Mowing helps prevent woody plant establishment and cool season weeds. It is best to divide the area into sections, which are mowed on a rotating cycle, so that the entire buffer is not mowed in one year. Not mowing the whole buffer area every year creates varying conditions which creates more community diversity and allows butterfly and other insect pupae and eggs to remain intact so they can repopulate. Mowing every year isn't recommended as it will increase the dominance of warm season grasses and flowers.

Invasive species removal and management is crucial to the function and sustainability of the native buffer and shoreline plantings. If invasive species are allowed to grow unchecked, they will certainly take over these areas, and destroy the investments made in these resources. Invasive species will not only have a negative effect on the plant

communities, but also the lake, riparian and terrestrial habitats. Invasive species management should become a regular part of landscape maintenance. Herbicide treatments may be necessary to control aggressive species. Hand application of herbicide is always preferred to spraying, as drift may kill non-target native species. All necessary permits should be obtained for herbicide treatments in and around the lake. Herbicide application is best performed by a licensed pesticide applicator. The invasive species likely to be of concern (but are not limited too) are: Giant Reed Grass (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Purple Loosestrife (*Lythrum salicaria*), Crown Vetch (*Coronilla varia*), Honeysuckle (*Lonicera* sp.), Garlic Mustard (*Alliaria petiolata*), Dame's Rocket (*Hesperis matronalis*), Spotted Knapweed (*Centurea biebersteini* or *C. maculosa*), Buckthorn (*Rhamnus cathartica* and *R. frangula*), Cattails (*Typha* sp.) and other common weeds. Early treatment and removal of invasive species is much easier and less costly than removal of established stands. Vigilant, regular monitoring and maintenance is the key to successful establishment and sustainability of these plant communities. The species found in the buffer/meadow and shoreline areas should reflect the landscaping plan as well as species native to Door County that may colonize the area over time.

3.2 Biofiltration Basin

The biofiltration basin is located northeast of the lake. It should be functional as well as aesthetically appealing. Proper maintenance is vital to keeping the biofiltration basin in proper order. It is designed to capture water after a rain event and slowly releases water while removing contaminants. It should usually be dry or moist. Maintenance should be performed when the basin is dry if possible, to eliminate damage caused by working in saturated soils.

- Basin – The biofiltration basin is planted with a mixture of native plants. It should be completely vegetated, with no areas of bare soil. If bare spots of soil are exposed they should be replanted according to landscape plan specifications. Species in the biofiltration basin should match the planting plan. Invasive plants (see above), weeds, trash and debris should be removed. After initial establishment no mowing is necessary, but if desired the plants can be mowed on a 2 to 3 year cycle along with the buffer. If the area is mowed, it should be done with low pressure equipment (such as a small mower) when the soil is dry. Mowing with heavy equipment will cause soil compaction and working in moist soils will create ruts. Care for the plants as you would plants in a garden. Do not fertilize the plants and minimize use of pesticides if they become necessary. Check for erosion, rills or short circuiting within the basin and on the side embankments. If areas of channelization or erosion are found, repair promptly. Any of these areas or places that have pockets of standing water should be re-graded and re-vegetated. Re-vegetate bare soil areas according to the planting plan.

- Inlets – Water enters the biofiltration basin via overland flow from the storm sewer outlet. The flow of water should not be obstructed. Any pools, scouring, rills or erosion caused by water flowing out of the inlet should be repaired, replanted and mulched. Dispersed flow should be maintained. Sediments accumulated around the inlet areas should be removed. Make sure that exposed structures and pipes are not cracked or broken. Make repairs if any of these items are found.
- Overflow/Outlet – The outlet of the biofiltration basin is the berm on the lake side. Water filters through pervious sections of the berm. The emergency overflow of the biofiltration basin is the top of the berm. Maintenance of the overflow structure is important because this structure controls the depth of water in the biofiltration basin. The berm should be kept free of debris. The berm and overflow area should be checked for structural integrity. Both the inner and outer sides of the embankments of the basins should be checked for erosion. If erosion is present, or if the elevation of the overflow becomes irregular, the area should be re-graded, replanted and immediately reinforced to limit the possibility of further erosion. If erosion of the overflow is allowed to go on unchecked, failure of the berm and the entire facility may occur. Look for animal burrows in the side of the berms. These burrows may allow discharge of water to occur through the walls. This could cause a failure of the berm. Pressure grout any burrows found. Undermining and erosion of the overflows should be filled and reinforced. The pervious sections of the berm are enclosed by a geotextile fabric. This fabric should remain under soil. If the edge of the fabric is exposed on either side of the berm cover it with 3 inches of concrete sand or biofiltration soil mix.
- Dewatering – The biofiltration basin is designed to dewater or drain completely within a day or two after a storm event.
- Sedimentation – Sediments may accumulate over time in the basin that needs to be removed. Remove sediment whenever it exceeds 1-inch in depth. The sediment may be worked into the soil matrix as a method of removal. Sources of excessive sedimentation should be identified and repaired. Long-term records should be kept to determine when sediment removal is warranted. After sediments are removed the filter bed should be re-graded and re-vegetated. If sediments are excavated, dispose of the removed material as regulations allow.

3.3 Retention Forebay

The retention forebay is located at the southeast end of the lake. It captures the storm water from several storm sewer outlets. The maintenance tasks are separated by routine and long-term maintenance.

Routine Maintenance

- Inlets – The culverts discharging water into the forebay should be free of sediment and debris. Clear debris and sediment if present and dispose of properly. Check areas around culvert. There should be no under-cutting or erosion around culverts and rip-rap should be in place and clean of debris. If there is erosion, repairs should be made promptly. Make sure that exposed structures and pipes are not cracked or broken.
- Emergency Overflow – The emergency overflow is the berm that separates the forebay from the lake. It should be inspected for signs of erosion on the inner and outer sides. If erosion is present, or if the elevation of the emergency overflow becomes irregular, the area should be re-graded and immediately reinforced to limit the possibility of further erosion. If erosion of the emergency overflow were allowed to go on unchecked, failure of the berm and the entire facility may occur. The berm should be free from obstructions and woody or invasive vegetation. Reseed bare areas according to the planting plan.
- Shoreline (Side Slopes) – The side slopes of the forebay are planted the same as the lake shoreline. Maintain according to shoreline maintenance directions (see Section 3.1). If areas of channelization or erosion are found, repair promptly and reseed according to the planting plan. Woody (trees and shrubs) or invasive vegetation should be removed. Trash and debris should be removed and disposed of properly. Do not mow side slopes.
- Animal Burrows – Look for animal burrows in the side slopes and overflow berm. These burrows may allow discharge of water to occur through the walls instead of through the treatment wetland. This could cause a failure of the berm. Pressure grout any burrows found. Burrows may also be found along the waters edge. These should also be repaired, and then re-vegetated.
- Outlets – Maintenance of the outlet structure is important because this structure controls the function of the forebay. The outlet should remain a flat even surface to provide sheet flow of water into the wetland. This is essential to optimum function of the wetland. The outlet should be inspected for signs of undercutting, erosion or channelization. If erosion is present, or if the elevation of the emergency overflow becomes irregular, the area should be re-graded and immediately reinforced to limit the possibility of further erosion. If erosion of the emergency overflow were allowed to go on unchecked, failure of the outlet and wetland may occur. The outlet should be free from obstructions and woody or invasive vegetation. Reseed bare areas according to the planting plan.
- Forebay – Floating and sunken trash or debris should be removed from the forebay. Remove debris and invasive or woody plant growth from the forebay as they reduce its performance. Sediment depths in the forebay should be monitored. Long-term records should be kept to determine when sediment removal is warranted.

Long-Term

Over time, the forebay accumulates sediment that needs to be removed. The sediment levels in the forebay should be inspected annually during the fall. Measurements should be made in the preliminary forebay and main portion of the forebay. Dredging should be scheduled if, during the inspection, the sediment depth in the center of the forebay is measured to be 2 feet. Usually dredging is required every 10 to 20 years, depending on input. Dredging of the preliminary forebay on a more regular basis may reduce the amount and frequency of dredging that needs to be done in the main forebay.

Dredging should be done during the winter months. At that time, the ground will be frozen, and vegetation will be dormant. The forebay should be pumped down and allowed to freeze. Excavate the sediment from the pond and stockpile it on-site until any remaining water is allowed to drain out of the material, and then haul it off-site, or haul the moist material away in watertight trucks. Appropriate City or WDNR approvals and permits should be obtained prior to either process. Dispose of the material as regulations allow.

3.4 Treatment Wetland

The treatment wetland is located at the south end of the lake. It captures the overflow from the retention forebay. Maintaining a slow, even flow of water through the wetland is essential to achieve system performance.

- Inlets and Outlet – Maintenance of even and level inlet and outlet structure is important because this structure controls the water flow and pool level through the wetland. Both of these areas should remain a flat even surface to provide sheet flow of water into the wetland. This is essential to optimum function of the wetland. The inlet and outlet should be inspected for signs of undercutting, erosion or channelization. If erosion is present, or if the elevation of the inlet or outlet becomes irregular, the area should be re-graded and immediately reinforced to limit the possibility of further erosion. If erosion of these structures were allowed to go on unchecked, failure of the wetland may occur. The structures should be free from debris, obstructions and woody or invasive vegetation. Reseed bare areas according to the planting plan. The storm water outlet pipe that discharges water into the wetland on the southwest side should be free of sediment and debris. Clear debris and sediment if present and dispose of properly. Check areas around culvert. There should be no undercutting or erosion around culverts and rip-rap should be clean of debris and in place. If there is erosion, repairs should be made promptly. Make sure that exposed structures and pipes are not cracked or broken.
- Basin and Water Level – The water level in the wetland is designed to be shallow, no more than 1.5 feet deep, and no less than 4 inches deep (this may be impacted by future fluctuations in the bay water level). However, to perform work

within the wetland and for establishment of the wetland, lower water levels are required. The Lake and Storm Water Management Plan Specifications detail how this water level should be controlled, if work in the basin is necessary, by use of a temporary water control structure. The wetland is designed to have vegetation across the entire basin which is adapted to living in the marshy conditions. If bare patches occur replant areas according to the planting plan. The vegetation in the basin should not require removal, except for invasive species, and woody species on or near the berms and side slopes (see Section 3.1). Floating and sunken trash or debris should be removed and disposed of properly.

- Shoreline (Side Slopes) – The side slopes of the wetland are planted the same as the lake shoreline. Maintain according to shoreline maintenance directions (see Section 3.1). If areas of channelization or erosion are found repair promptly and reseed according to the planting plan. Woody (trees and shrubs) or invasive vegetation should be removed. Trash and debris should be removed and disposed of properly. Do not mow side slopes.
- Animal Burrows – Look for animal burrows in the side slopes and berms. These burrows may allow discharge of water to occur through the walls instead of through the treatment wetland. This could cause a failure of the berm. Pressure grout any burrows found. Burrows may also be found along the waters edge. These should also be repaired, and then re-vegetated.
- Sedimentation – It is possible that sedimentation may accumulate over the long-term, but if the retention forebay functions correctly, this should not be a concern for many years to come. If excessive sedimentation does occur, the sediment may be worked into the soil matrix as a method of removal. After sediments are removed the filter bed should be re-graded and re-vegetated. If sediments are excavated, dispose of the removed material as regulations allow.

4 CONTACTS

Lake Owner

City of Sturgeon Bay
421 Michigan Street
Sturgeon Bay, Wisconsin 54235
(920)746-2900

Engineer

Miller Engineers & Scientists
5308 S. 12th Street
Sheboygan, WI 53081
(920)458-6164

I:\DATA\2007\17000\1-17612 Little Lake\Little Lake Maintenance Plan.doc

5 INSPECTION AND MAINTENANCE FORMS

Forebay Inspection and Maintenance Form

Inspector Name	Overall Facility Condition	
Inspection Date		Acceptable
Maintenance Date		Unacceptable

Forebay Components	Inspected (Y/N)	Maintenance Needed (Y/N)	Maintenance Performed (Y/N)	Comments
Shoreline/Sideslopes				
1. vegetation adequate/no bare soil areas				
2. woody or invasive vegetation				
3. embankment erosion				
4. animal burrows				
5. litter/debris				
Emergency Overflow				
1. clear of obstructions				
2. vegetation adequate/no bare soil areas				
3. woody or invasive vegetation				
4. outer embankment erosion				
5. inner embankment erosion				
6. animal burrows				
Forebay				
1. sedimentation of preliminary forebay				
2. sedimentation of main forebay				
3. woody or invasive vegetation				
4. floating or sunken litter/debris				
Inlet				
1. area around culvert not undercut or eroded				
2. orifice free from obstruction				
3. rip-rap or slope protection failures				
4. sedimentation				
5. channelization of water course				
6. vegetation adequate/no bare soil areas				
7. woody or invasive vegetation				
8. culvert structural integrity				
Outlet				
1. area around culvert not undercut or eroded				
2. orifice free from obstruction				
3. rip-rap or slope protection failures				
4. sedimentation				
5. channelization of water course				
6. vegetation adequate/no bare soil areas				
7. woody or invasive vegetation				

Inspector Remarks:

Maintenance Needs:

Treatment Wetland Inspection and Maintenance Form

Inspector Name	Overall Facility Condition
Inspection Date	Acceptable
Maintenance Date	Unacceptable

Wetland Components	Inspected (Y/N)	Maintenance Needed (Y/N)	Maintenance Performed (Y/N)	Comments
Inlet from Retention Forebay				
1. inlet area not undercut or eroded				
2. orifice free from obstruction				
3. rip-rap or slope protection failures				
4. channelization of water course				
5. vegetation adequate/no bare soil areas				
6. woody or invasive vegetation				
7. no scouring or erosion around inlet				
8. even surface with sheet flow into wetland				
Inlet from Park Storm Sewer				
1. area around pipe not undercut or eroded				
2. orifice free from obstruction				
3. rip-rap protection failures				
4. channelization of water course around inlet				
5. vegetation adequate/no bare soil areas				
6. pipe not damaged or cracked				
Outlet				
1. outlet area not undercut or eroded				
2. orifice free from obstruction				
3. rip-rap or slope protection failures				
4. channelization of water course				
5. vegetation adequate/no bare soil areas				
6. woody or invasive vegetation				
7. no scouring or erosion around inlet				
8. even surface with sheet flow out of wetland				
Shoreline/Sideslopes & Berms				
1. vegetation adequate/no bare soil areas				
2. woody or invasive vegetation				
3. sideslope erosion				
4. litter/debris				
5. berm top clear of obstructions				
6. berm outer embankment erosion				
7. berm inner embankment erosion				
8. animal burrows				
Basin				
1. channelization of water course				
2. floating or sunken litter/debris				
3. vegetation adequate/no bare soil areas				
4. woody or invasive vegetation				
5. sedimentation				

Inspector Remarks (continue on back of sheet):

Maintenance Needs (continue on back of sheet):

Biofiltration Basin Inspection and Maintenance Form

Inspector Name	Overall Facility Condition
Inspection Date	Acceptable
Maintenance Date	Unacceptable

Basin Components	Inspected (Y/N)	Maintenance Needed (Y/N)	Maintenance Performed (Y/N)	Comments
Vegetation 1. vegetation adequate/no bare soil areas 2. woody or invasive vegetation or weeds 3. vegetation composition matches plan 4. plants in good condition				
Inlets 1. area around culvert not undercut or eroded 2. orifice free from obstruction 3. rip-rap or slope protection failures 4. sedimentation 5. channelization of water course 6. vegetation adequate/no bare soil areas 7. woody or invasive vegetation 8. culvert structural integrity 9. no scouring or erosion at inlet				
Basin Area 1. litter/debris 2. channelization of water course 3. sedimentation 4. basin dewatering after storms 5. slope erosion				
Berm/Outlet/Emergency Overflow 1. vegetation adequate/no bare soil areas 2. woody or invasive vegetation 3. outer embankment erosion 4. inner embankment erosion 5. animal burrows 6. litter/debris 7. clear of obstructions 8. geotextile fabric exposed 8. evidence of pervious sections clogging				

Inspector Remarks:

Maintenance Needs:

6 SITE PLANS

NOTE: See Appendix D – Engineered Plans in the Lake and Storm Water Management Plan

LAKE AND STORMWATER MANAGEMENT PLAN

FOR

BRADLY (LITTLE) LAKE

STURGEON BAY

DOOR COUNTY, WISCONSIN

5308 S. 12th Street
 Sheboygan, WI 53081-8099
 Phone 920-458-6164
 Fax 920-458-0369
 www.starwithmiller.com

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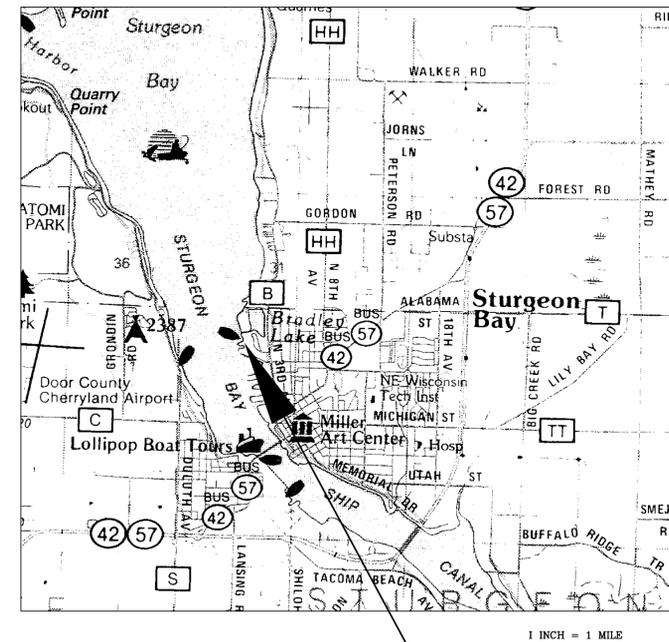
INDEX TO DRAWINGS

SHEET NO.	DESCRIPTION
1	TITLE SHEET, INDEX, AND LOCATION MAP
2	SITE PLAN NORTH
3	SITE PLAN SOUTH
4	GRADING AND DREDGING NORTH
5	GRADING AND DREDGING SOUTH
6	LANDSCAPE NORTH
7	LANDSCAPE SOUTH
8	DETAILS

BENCHMARKS

BM – NAIL IN THE WEST FACE OF LIGHT POLE SOUTH OF PICNIC SHELTER.
 ELEV.= 585.60

LOCATION MAP



SITE



TO OBTAIN LOCATION OF PARTICIPANTS' UNDERGROUND FACILITIES BEFORE YOU DIG IN WISCONSIN

CALL DIGGERS HOTLINE
 1-800-242-8511
 TOLL FREE

TELEFAX (414) 259-0947
 TDD (FOR HEARING IMPAIRED) 1-800-542-2289

WS. STATUE 182.0175 (1974)
 REQUIRES MIN. OF 3 WORK DAYS NOTICE BEFORE YOU EXCAVATE.

ALL UNDERGROUND UTILITY LOCATIONS SHOWN HEREON ARE BASED UPON FIELD SURVEY OF VISIBLE ABOVE GROUND STRUCTURES, RECORD MAPS OR DIGGERS HOT LINE MARKINGS. THE SURVEYOR HAS NOT LOCATED THE ACTUAL UNDERGROUND UTILITY. THE EXACT LOCATION OF ALL UTILITIES MUST BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO BEGINNING ANY CONSTRUCTION.

NO.	DATE	BY	DESCRIPTION

CITY OF STURGEON BAY
 BEACH RECONSTRUCTION & STORM WATER MANAGEMENT
 SUNSET PARK BEACH
 747 NORTH 3rd AVENUE, STURGEON BAY, WISCONSIN

SCALE	HOR. 1"=30'
VER.	
DATE	6-19-2009
JOB	17326-K
BY	KAH
CK	RES

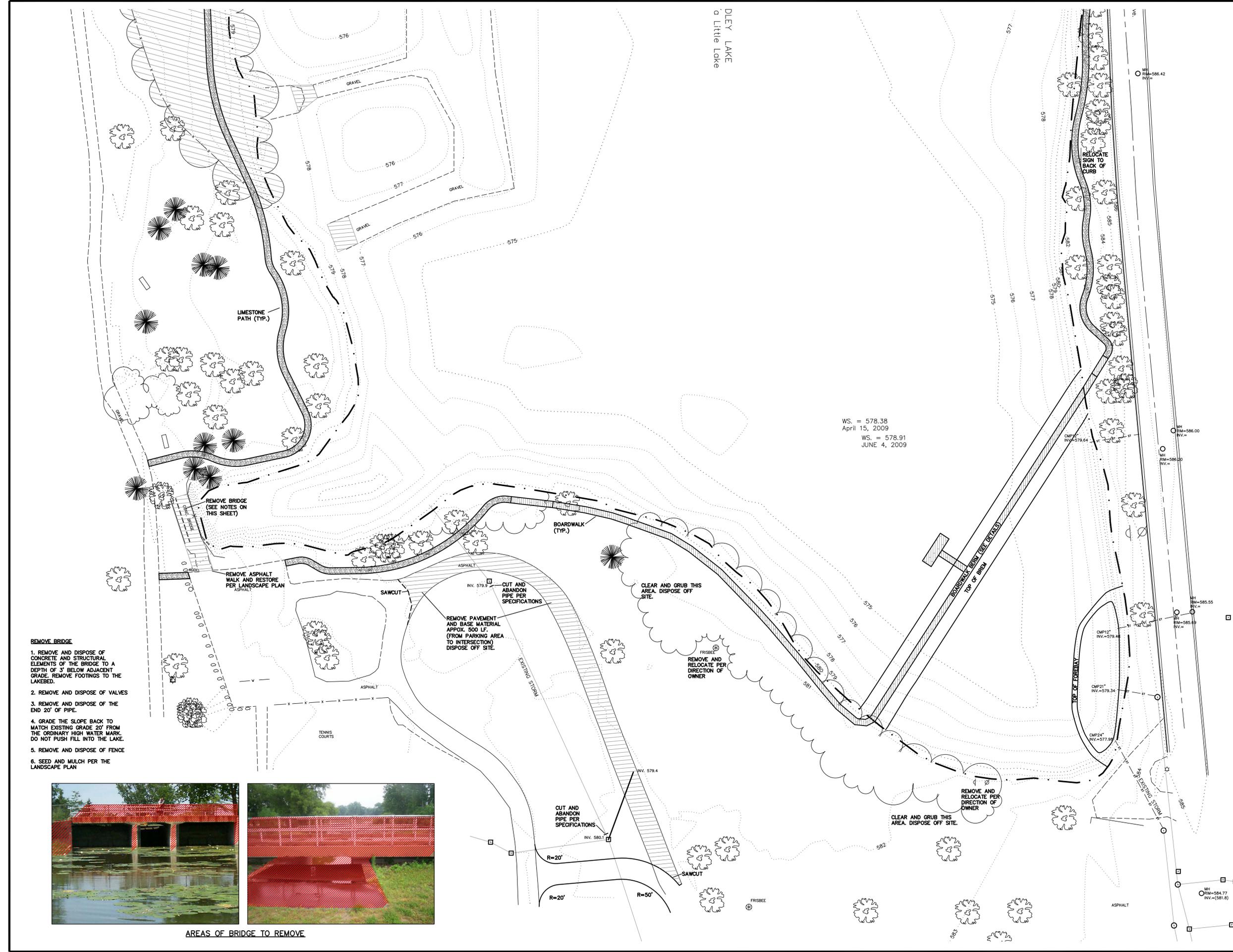
SHEET
1
 OF
8

TITLE SHEET

NO.	DATE	DESCRIPTION	BY

CITY OF STURGEON BAY
 LAKE AND STORM WATER MANAGEMENT
 LITTLE LAKE
 STURGEON BAY, WISCONSIN

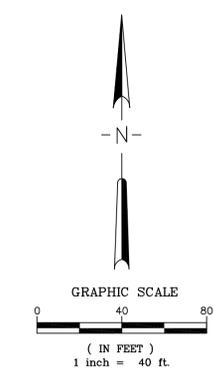
SCALE	HOR. 1"=40'
VER.	
DATE	6-19-09
JOB	07-17612-G
BY	SMW
CK	RES



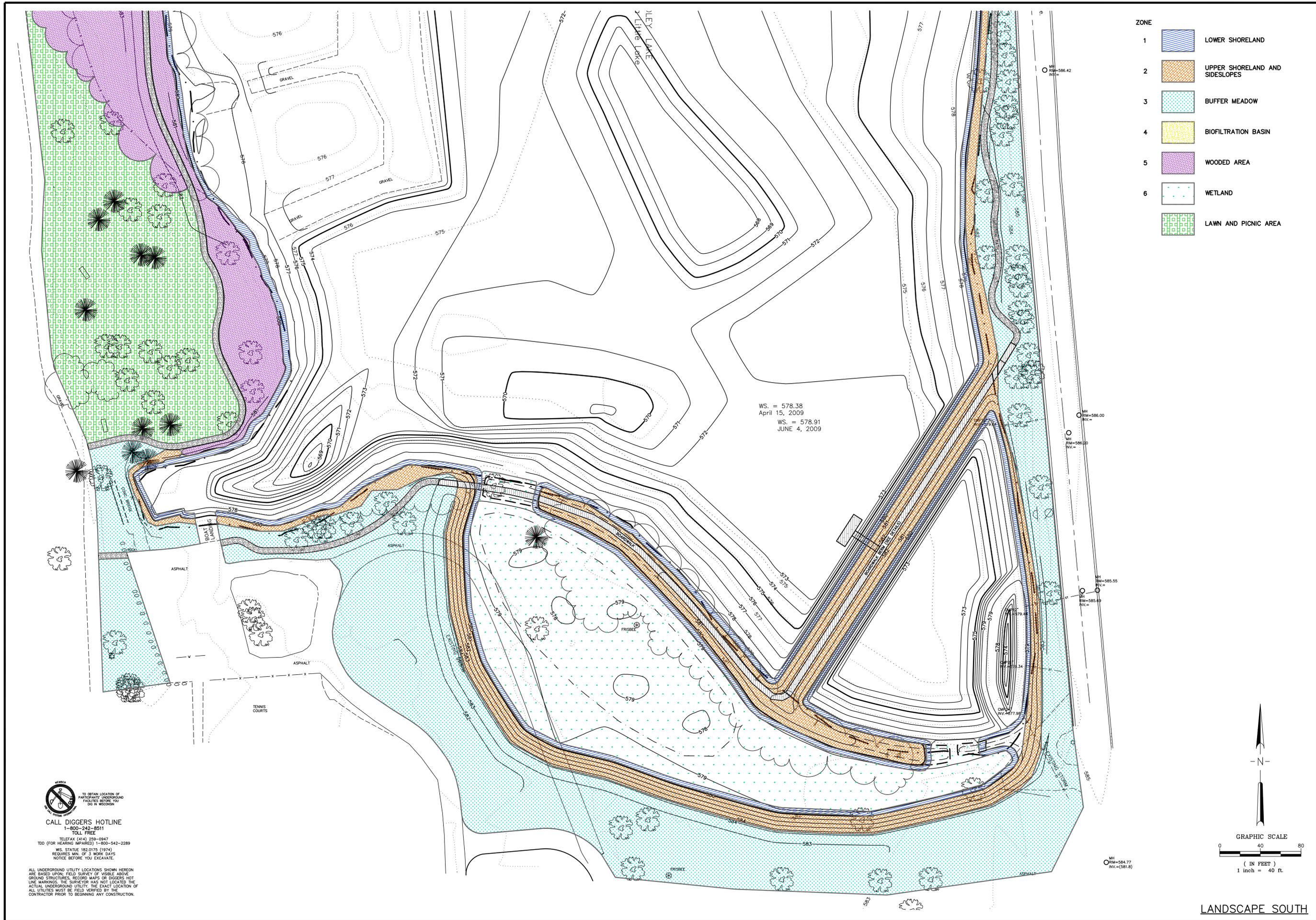
- REMOVE BRIDGE**
1. REMOVE AND DISPOSE OF CONCRETE AND STRUCTURAL ELEMENTS OF THE BRIDGE TO A DEPTH OF 3' BELOW ADJACENT GRADE. REMOVE FOOTINGS TO THE LAKEBED.
 2. REMOVE AND DISPOSE OF VALVES
 3. REMOVE AND DISPOSE OF THE END 20' OF PIPE.
 4. GRADE THE SLOPE BACK TO MATCH EXISTING GRADE 20' FROM THE ORDINARY HIGH WATER MARK. DO NOT PUSH FILL INTO THE LAKE.
 5. REMOVE AND DISPOSE OF FENCE
 6. SEED AND MULCH PER THE LANDSCAPE PLAN



AREAS OF BRIDGE TO REMOVE



SITE PLAN SOUTH



- ZONE**
- 1 LOWER SHORELAND
 - 2 UPPER SHORELAND AND SIDESLOPES
 - 3 BUFFER MEADOW
 - 4 BIOFILTRATION BASIN
 - 5 WOODED AREA
 - 6 WETLAND
 - LAWN AND PICNIC AREA

WS. = 578.38
 April 15, 2009
 WS. = 578.91
 JUNE 4, 2009

CALL DIGGERS HOTLINE
 1-800-242-8511
 TOLL FREE

TELEFAX (414) 259-0947
 TDD (FOR HEARING IMPAIRED) 1-800-542-2289
 WIS. STATUTE 182.0175 (1974)
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 Fax 920-458-0369
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NO.	DATE	DESCRIPTION	BY

CITY OF STURGEON BAY
 LAKE AND STORM WATER MANAGEMENT
 LITTLE LAKE
 STURGEON BAY, WISCONSIN

SCALE	HOR. 1"=40'
DATE	04-19-09
JOB	07-17612-1
BY	SMW
CK	RES

SHEET
7
 OF
8

LANDSCAPE SOUTH

GENERAL NOTES

- DIMENSIONS TAKE PRECEDENCE OVER SCALE. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN FIELD.
- THE CONTRACTOR SHALL CALL DIGGERS HOTLINE SERVICE FOR THE LOCATION AND STAKING OF EXISTING UNDERGROUND UTILITIES (GAS, ELECTRIC, AND TELEPHONE) AT 1-800-242-8511, 3 WORKING DAYS PRIOR TO CONSTRUCTION OF ANY IMPROVEMENTS.
- ALL CONSTRUCTION SIGNING TO BE IN ACCORDANCE WITH THE CITY OF STURGEON BAY AND WISCONSIN DEPARTMENT OF TRANSPORTATION REQUIREMENTS.
- THE PROPOSED IMPROVEMENTS SHALL BE CONSTRUCTED ACCORDING TO THE ORDINANCES AND REQUIREMENTS OF THE CITY OF STURGEON BAY AND THE STATE OF WISCONSIN DOT, DCOMM, AND DNR REQUIREMENTS AND PER THE STATE OF WISCONSIN STANDARD SPECIFICATIONS FOR SEWER AND WATER CONSTRUCTION.
- THE PROPOSED IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ENGINEERING PLANS APPROVED BY THE CITY OF STURGEON BAY, FOLLOWING PROPER CONSTRUCTION TECHNIQUES.
- THE CONTRACTOR IS RESPONSIBLE FOR EXAMINING ALL EXISTING SITE CONDITIONS PRIOR TO BEGINNING CONSTRUCTION AND IS TO COMPARE THE SITE CONDITIONS TO THOSE INDICATED ON THE ENGINEERING PLANS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER AND RESOLVED PRIOR TO THE START OF CONSTRUCTION.
- IF ANY ERRORS, DISCREPANCIES OR OMISSIONS ON THE ENGINEERING PLANS BECOME APPARENT DURING CONSTRUCTION, THEY SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER SO THAT CLARIFICATION CAN OCCUR.
- THE CONTRACTOR SHALL VERIFY THE GRADE AND LOCATION OF EXISTING UTILITIES PRIOR TO THE START OF WORK. IF ANY DISCREPANCIES ARE DISCOVERED, THE CONTRACTOR MUST NOTIFY THE ENGINEER. NO WORK SHALL BE DONE UNTIL THE DISCREPANCY IS RESOLVED.
- THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING ALL OF THE UTILITIES PRIOR TO THE INSTALLATION OF ANY UNDERGROUND IMPROVEMENTS.
- THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE MUNICIPALITY 3 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION, TO ARRANGE FOR APPROPRIATE CONSTRUCTION INSPECTION.
- THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE OWNER WITH AS-BUILT INFORMATION OF THE DESIGNED IMPROVEMENTS. ANY CHANGES TO THE DESIGN MUST BE REPORTED TO THE ENGINEER AS WORK PROGRESSES. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE AS-BUILT INFORMATION IN ORDER THAT APPROPRIATE DRAWINGS CAN BE PREPARED, IF REQUIRED.
- THE CONTRACTOR SHALL INSTALL A PEDESTRIAN FENCE AROUND ALL EXCAVATIONS TO BE LEFT OPEN OVERNIGHT.
- THE RESTORATION OF EXISTING IMPROVEMENTS WITHIN ROADWAY RIGHT-OF-WAYS WHICH ARE DAMAGED DURING CONSTRUCTION, IS CONSIDERED INCIDENTAL AND SHOULD INCLUDE PAVEMENT, CURB & GUTTER, SIDEWALK, TOPSOIL, FERTILIZER, SEEDING AND MULCHING.
- THE PRIME CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE WORK OF ALL OTHER CONTRACTORS INVOLVED WITH CONSTRUCTION OF THE PROPOSED IMPROVEMENTS AND FOR REPORTING TO THE ENGINEER ANY DISCREPANCIES BETWEEN THESE PLANS AND PLANS PREPARED BY OTHERS FOR THE PROJECT.
- THE CONTRACTOR IS RESPONSIBLE FOR SITE SAFETY DURING CONSTRUCTION OF THE PROPOSED IMPROVEMENTS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS, PERMIT COSTS, TAP FEES, METER DEPOSITS, BONDS, AND ALL OTHER FEES REQUIRED FOR THE PROPOSED WORK TO BE DONE.
- ANY EXISTING SANITARY SEWER, SANITARY SEWER LATERALS, WATER MAIN, WATER SERVICES, STORM SEWER, STORM SEWER LATERALS OR OTHER EXISTING UTILITIES WHICH ARE DAMAGED DURING CONSTRUCTION, SHALL BE REPAIRED TO THE UTILITY OWNER'S SATISFACTION AND AT THE CONTRACTOR'S EXPENSE.
- EXTERIOR CONCRETE SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF AT LEAST 4000 PSI, CONSIST OF LIMESTONE AGGREGATE, AND HAVE 4% TO 6% AIR ENTRAINMENT.
- THE CONCRETE CONTRACTOR SHALL EMPLOY AN INDEPENDENT TESTING ENGINEER TO VERIFY SLUMP AND AIR ENTRAINMENT, AND PROVIDE ONE SET (3) OF TEST CYLINDER SAMPLES FOR EACH CURS FOUR OR FOR EVERY 50 C.Y. OF CONCRETE, WHICHEVER OCCURS MORE OFTEN.
- PAVEMENT SECTION SHALL BE 2.5" BITUMINOUS CONCRETE BINDER COURSE, 1.5" BITUMINOUS CONCRETE SURFACE COURSE AND 8" OF COMPACTED AGGREGATE BASE. ASPHALT PAVEMENT SHALL MEET THE REQUIREMENTS OF THE WISCONSIN STATE HIGHWAY STANDARD SPECIFICATIONS FOR CONSTRUCTION. SUBGRADE ACCEPTANCE TO BE BASED ON PROOF ROLLING.
- GRANULAR BACKFILL MATERIAL IS REQUIRED IN ALL UTILITY TRENCHES UNDER SIDEWALKS AND PROPOSED PAVED AREAS. ALL UTILITY TRENCH BACKFILL SHALL BE COMPACTED TO AT LEAST 98% STANDARD PROCTOR MAXIMUM DRY DENSITY.

GRADING NOTES

- TOPSOIL STRIPPED FROM WITHIN THE AREAS TO BE GRADED SHALL BE STOCKPILED ON SITE AT A LOCATION SELECTED BY THE OWNER AND SHALL BE USED IN THE REGRADING OF THE AREAS TO BE SEED ONLY. AT THE COMPLETION OF GRADING, THE FINISH GRADE SHALL INCLUDE 6" OF TOPSOIL. THE TOPSOIL IS NOT TO BE USED AS FILL. THE REMOVAL OF ANY EXCESS TOPSOIL OFF THE SITE SHALL BE THE CONTRACTOR'S RESPONSIBILITY AND AT THE DIRECTION OF THE OWNER.
- SUITABLE FILL MATERIAL SHALL BE COMPACTED IN 8" LIFTS TO AT LEAST 98% STANDARD PROCTOR MAXIMUM DRY DENSITY BELOW BUILDING, DRIVES, RAMPS, CURBS, AND WALKS, AND TO AT LEAST 90% STANDARD PROCTOR MAXIMUM DRY DENSITY ELSEWHERE. NO COMPACTION IN WETLAND OR NATIVE PLANTED AREAS.
- IN PAVEMENT AREAS, REMOVE AND REPLACE WITH COMPACTED CONTROLLED FILL ANY AREAS THAT HAVE BEEN SOFTENED BY RAINS, FREEZING, CONSTRUCTION EQUIPMENT, ETC.
- BEFORE ROADWAY BASE COURSE MATERIALS ARE PLACED, THE SUBGRADE SHALL BE INSPECTED BY THE ENGINEER. COMPACTION TESTS SHALL BE TAKEN WHERE FILL IS PLACED AT THE OWNER'S OPTION AND IF TAKEN, OWNER SHALL CARRY COSTS OF THESE TESTS.
- THE GRADING CONTRACTOR SHALL CLEAR, GRUB AND DISPOSE OF, AT THE DIRECTION OF THE OWNER, ALL TREES AND SHRUBS WHICH MAY INTERFERE WITH GRADING AND/OR UTILITY WORK PRIOR TO BEGINNING CONSTRUCTION.
- THE GRADING CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE EROSION CONTROL MEASURES TO ENSURE THE INTEGRITY OF THIS GRADING PLAN.
- THE GRADING CONTRACTOR IS RESPONSIBLE FOR SEEDING, FERTILIZING AND MULCHING ALL TOPSOILED AREAS WITHIN THE GRADING LIMITS.
- EXISTING ROADWAY IMPROVEMENTS WITHIN RIGHT-OF-WAYS DAMAGED DURING CONSTRUCTION ARE TO BE RESTORED TO ORIGINAL GRADE AND CONDITION.
- UNLESS OTHERWISE SHOWN ON THE PLANS, THE MAXIMUM ALLOWABLE GRADED SLOPE SHALL BE 4:1.
- FINISH CONTOURS AND "SPOT" ELEVATIONS SHOWN HEREON INDICATE FINISH GRADE UPON COMPLETION OF THE PROJECT.
- CONTRACTOR SHALL MEET EXISTING GRADE AT THE LIMITS OF THE PROPOSED CONTOURS AS SHOWN ON THESE PLANS.
- ANY EXCESS CUT MATERIAL SHALL BE REMOVED OFF SITE AT THE DIRECTION OF THE OWNER.
- GRADING IN PROPOSED WETLAND AREA AND OTHER NATIVE LANDSCAPE AREAS SHALL BE WITH LOW GROUND PRESSURE EQUIPMENT. PREPARE THE SOIL ACCORDING TO THE LANDSCAPE SPECIFICATIONS.
- GRADING SHALL CONFORM TO PERMIT REQUIREMENTS OF THE WDNR AND COUNTY
- DREDGED MATERIAL MAY BE USED TO CONSTRUCT BERMS.
- WALK VERTICAL SLOPE SHALL NOT EXCEED 5%.
- WALK SHALL BE FIELD ENGINEERED GENERALLY FOLLOWING THE ALIGNMENT SHOWN SO AS TO AVOID REMOVING TREES.

BIOFILTER NOTES

PART 1 - GENERAL

1.01 WORK INCLUDED

- TOPSOIL
- ENGINEERED SOIL MIX
- CAND FILTER LAYER
- DRAINAGE AGGREGATE LAYER
- GEOTEXTILE
- UNDERDRAIN

1.02 QUALITY ASSURANCE

THESE TESTS SHALL BE PERFORMED ON MATERIAL PRIOR TO SHIPMENT TO THE SITE WITH A MINIMUM OF ONE TEST PER MATERIAL TYPE AND FOR EVERY GARDEN.

- ASTM C 117 AND C 136 TESTS ON SAND USED FOR PLANTING SOIL MIX AND FOR SAND USED AS A FILTER BENEATH THE BIOFILTER SOIL MIX.
- MINERAL NUTRIENT ANALYSIS ON PLANTING SOIL MIX.
- SOLUBLE NUTRIENT ANALYSIS ON PLANTING SOIL MIX.
- ASTM D2434 OR FALLING HEAD ASTM D5084 FOR HYDRAULIC CONDUCTIVITY OF THE FILTER BED PLANTING SOIL MIX.
- ASTM D4531 BULK DENSITY TEST FOR THE FILTER BED PLANTING SOIL MIX.
- LOSS ON IGNITION FOR TOP SOIL.

1.03 SUBMITTALS

RESULTS OF LABORATORY TESTS PERFORMED ON REPRESENTATIVE MATERIALS SHALL BE SUBMITTED FOR APPROVAL PRIOR TO DELIVERY TO THE SITE.

- COMPOST TEST RESULTS
- TOPSOIL TEST RESULTS FOR CLASSIFICATION, ORGANIC MATTER, PH
- CERTIFICATION THAT THE DRAINAGE AGGREGATE MEETS SPECIFICATION
- NR338 MINERAL COMPOSITION AND WATER LEACH TESTS ON SAME SOURCE AND PRODUCTION PROCESS WITHIN LAST 12 MONTHS ON ANY INDUSTRIAL BY-PRODUCT SAND USED FOR PLANTING SOIL MIX
- RESULTS FROM TESTS IDENTIFIED IN SECTION 1.02

PART 2 - PRODUCTS

2.01 STORM WATER FILTERING BED PLANTING SOIL MIX

- THE PLANTING SOIL SHALL CONSIST OF A MIXTURE OF SAND, TOPSOIL, AND MATURE COMPOST THAT IS SUITABLE FOR INITIAL AND LONG-TERM SUPPORT OF PLANT GROWTH, WHILE MAINTAINING MODERATE HYDRAULIC CONDUCTIVITY.
- MIXTURE COMPONENTS SHALL BE IN ACCORDANCE WITH THE PROPORTIONS SUMMARIZED IN TABLE 1 AND SHALL HAVE A PH IN THE RANGE OF 6.0 TO 8.0. THEY SHALL HAVE ADEQUATE NUTRIENT CONTENT TO MEET PLANT GROWTH REQUIREMENTS AND SHALL NOT CONTAIN VIABLE WEED OR NOXIOUS PLANT SEED OR MATERIALS. THE MIX SHALL HAVE A HYDRAULIC CONDUCTIVITY OF 01 CM/S AFTER BEING STAGALLY COMPACTED UNDER 300 PSF LOAD. THE MIX SHALL BE FREE OF ROCKS, STUMPS, BRUSH, OR OTHER MATERIAL OVER 1" DIAMETER.

TABLE 1 - FILTERING BED PLANTING SOIL MIX

COMPONENT	PORTION BY BULK VOLUME
SAND	APPROX. 40%, ADJUST AS NEEDED FOR PERFORMANCE
TOPSOIL	10 TO 15% IF LOAM TEXTURE 15 TO 20% IF SANDY LOAM TEXTURE 20 TO 25% IF LOAMY SAND TEXTURE
COMPOST	30 TO 45%

- ADJUSTMENTS TO PROPORTIONS SHALL BE MADE TO MEET HYDRAULIC CONDUCTIVITY REQUIREMENTS. FIBRIC PEAT, GYPSUM, LIME, NUTRIENTS, OR CONDITIONING AGENTS MAY BE ADDED AS NEEDED TO SUPPORT PLANT GROWTH AND/OR MAINTAIN HYDRAULIC CONDUCTIVITY. MAGNESIUM SHALL BE PRESENT AT 35 LB/ACRE, PHOSPHORUS (AS P2O5) AT 75 LB/ACRE, AND POTASSIUM (AS K2O4) AT 85 LB/ACRE. SOLUBLE SALTS SHALL NOT EXCEED 500 PPM.
- SAND SHALL BE NATURAL MINED, MANUFACTURED, OR MIXTURE THEREOF, CONSISTING OF WATER INSOLUBLE MINERALS THAT ARE RESISTANT TO PHYSICAL AND CHEMICAL WEATHERING. PARTICLE SIZE SHALL CONFORM TO TABLE 2. THE AMOUNT OF MATERIAL PASSING THE #200 SIEVE SHALL NOT EXCEED 3.5%.

TABLE 2 - SAND PARTICLE SIZE DISTRIBUTION

SIEVE SIZE	PERCENT PASSING (BY WT.)
3/8"	100
#4	90-100
#10	65-95
#16	40-85
#30	20-60
#50	10-30
#100	2-10
#200	3.5 MAX.

- TOPSOIL MAY BE A USDA CLASSIFICATION LOAM, SANDY LOAM, AND LOAMY SAND, AS VERIFIED BY LABORATORY ANALYSIS OR VISUAL/MANUAL CLASSIFICATION BY QUALIFIED PERSONNEL. TOPSOIL COMPONENT MAY ALSO CONSIST OF "PLANT STARTER MIX" OF PEAT AND MATURE MANURE COMPOST. CLAY LOAM OR CLAY TOPSOIL SHALL NOT BE USED.
- COMPOST SHALL MEET WDNR SPECIFICATION S100 - COMPOST. MATURITY BY DEWAR SELF-HEATING FLASK (3 TO 7 DAY) OR SOLVITA CARBON-DIOXIDE AND AMMONIA EVOLUTION TEST KIT, PH, WATER HOLDING CAPACITY, ORGANIC MATTER/ASH CONTENT, CARBON: NITROGEN RATIO, SOLUBLE SALTS, AND PHYTO-TOXICITY BY WOOD'S END GERMINATION AND 14 DAY PLANT GROWTH ON REPRESENTATIVE SAMPLE OF BATCH THAT WILL BE DELIVERED TO THE SITE. IF COMPOST INCLUDES INDUSTRIAL OR MUNICIPAL WASTEWATER SLUDGE, TESTING SHALL INCLUDE EPA 503 METALS ANALYSIS AND SCREENING FOR PATHOGENS (WDNR NR 204.07(6)(A)) ON SAME SOURCE AND PRODUCTION PROCESS WITHIN LAST 12 MONTHS.

2.02 SAND FILTER LAYER

THE SAND FILTER LAYER MAY CONSIST OF NATURAL MINED MATERIAL. MATERIAL SHALL HAVE PARTICLE SIZE DISTRIBUTION CONFORMING TO WDOT REQUIREMENTS FOR FINE AGGREGATE, OR TABLE 2 ABOVE, AND THE AMOUNT OF MATERIAL PASSING THE #200 SIEVE SHALL NOT EXCEED 3.5% THICKNESS OF THE LAYER AS SHOWN ON THE DRAWINGS.

2.03 DRAINAGE AGGREGATE LAYER

DRAINAGE AGGREGATE SHALL CONSIST OF UNIFORM AGGREGATE OF 3/8" MAXIMUM PARTICLE SIZE ("PEA STONE"), ASTM C33 COARSE AGGREGATE SIZE NUMBER 8, EITHER MINED OR MANUFACTURED.

2.04 GEOTEXTILE FABRIC

GEOTEXTILE FABRIC USED TO PROVIDE PARTICLE SIZE SEPARATION OF THE DRAINAGE AGGREGATE FROM THE UNDERLYING NATURAL SOIL SUBGRADE SHALL CONSIST OF NON-WOVEN POLYPROPYLENE, SUPAC 140N, OR EQUIVALENT.

2.05 UNDER-DRAIN LINES

UNDER-DRAINAGE LINES SHALL CONSIST OF PERFORATED, CORRUGATED, HDPE PIPE WITH FILTER SOCK. SIZE AS SHOWN ON THE DRAWINGS.

PART 3 - EXECUTION

3.01 INSPECTION

NOTIFY ENGINEER WHEN EXCAVATION IS COMPLETED AND READY FOR INSPECTION.

- VERIFY THAT EXISTING GRADES ARE AS SHOWN ON THE DRAWINGS.
- VERIFY THAT GROUND IS NOT FROZEN.
- VERIFY THAT THERE ARE NO SAND SEAMS OR UTILITY TRENCHES CONNECTED TO THE EXCAVATED AREA.
- TEST FOR PERMEABILITY OF THE PLANTING SOIL PRIOR TO PLACEMENT.

3.02 TOPSOIL

STRIP TOPSOIL AS NECESSARY. IF EXISTING TOPSOIL REMAINS STOCKPILED IN THE STORM WATER FILTERING BED AREA, MOVE IT TO ANOTHER LOCATION ON SITE AS DIRECTED BY THE OWNER.

3.03 EXCAVATION

- PROTECT FACILITY FROM SEDIMENTATION UNTIL CONSTRUCTION SITE IS STABILIZED. SUBMIT PROTECTION PLAN TO THE CITY OF STURGEON BAY
- DO NOT EXCAVATE THE FINAL FOOT UNTIL CONSTRUCTION IS SUBSTANTIALLY COMPLETE.
- PROTECT THE FACILITY FROM CONSTRUCTION TRAFFIC AFTER INSTALLATION.
- EXCAVATE TO THE LINES AND GRADES SHOWN ON THE DRAWING.
- DO NOT OVER EXCAVATE OR COMPACT THE BASE OF THE EXCAVATION.

3.04 MIXING

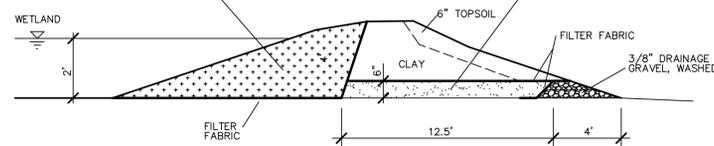
- MIX THE MATERIAL UNTIL IT IS A UNIFORM CONSISTENCY.
- PREFERABLY, MIX THE MATERIAL AT THE SUPPLIER'S FACILITY.
- IF MIXING ON SITE, MIX THE MATERIALS ON A HARD, CLEAN SURFACE. DO NOT MIX ON SOIL OR VEGETATION.

3.05 CONSTRUCTION

- PLACE GEOTEXTILE AS SHOWN ON THE DRAWINGS ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
- PLACE UNDER DRAIN TO THE LINE AND GRADE SHOWN ON THE DRAWINGS.
- PLACE DRAINAGE AGGREGATE TO THE ELEVATION SHOWN ON THE DRAWINGS.
- PLACE SAND FILTER TO THE ELEVATION SHOWN ON THE DRAWINGS. DO NOT COMPACT THE SAND FILTER.
- PLACE THE PLANTING SOIL MIXTURE TO THE ELEVATIONS SHOWN ON THE DRAWINGS IN 12-INCH LIFTS. DO NOT COMPACT THIS LAYER.
- PLACE MULCH AND PLANTINGS AS REQUIRED BY THE LANDSCAPE DRAWINGS AND SPECIFICATION.

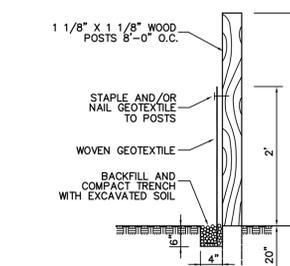
BIOFILTER SOIL

- BIOFILTER SOIL SHALL MEET THE ENGINEERED SOIL REQUIREMENTS OF THESE DRAWINGS.
- MIX MATERIAL UNTIL IT IS OF UNIFORM CONSISTENCY.
- MIX MATERIAL AT THE SUPPLIERS SITE.
- PROVIDE A SAMPLE OF THE MATERIAL TO THE ENGINEER FOR PERMEABILITY TESTING PRIOR TO MIXING THE FULL BATCH.
- PROVIDE AN EXTRA 6" OF MATERIAL FOR SETTLEMENT. DO NOT COMPACT MATERIAL. DO NOT OPERATE EQUIPMENT ON MATERIAL ONCE IT IS PLACED.



BIOFILTER BERMS IN NORTH BASIN

N.T.S.



SILT FENCE

N.T.S.

SILT FENCE CONSTRUCTION SPECIFICATIONS

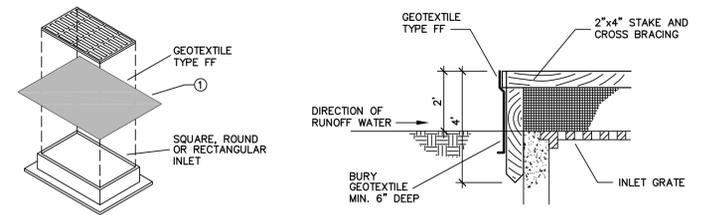
- PLACE SILT FENCE AROUND THE DISTURBED AREAS AS SHOWN ON THE PLANS.
- LOCATE POSTS DOWNSLOPE OF GEOTEXTILE TO HELP SUPPORT FENCING.
- THE GEOTEXTILE SHALL BE ATTACHED TO THE UPSLOPE SIDE OF THE POSTS WITH WIRE, STAPLES OR WOODEN LATH AND NAILS.
- WHEN JOINTS ARE NECESSARY, OVERLAP THE END POSTS AND TWIST OR ROTATE 180 DEGREES.
- THE GEOTEXTILE SHALL BE WOVEN POLYESTER, POLYPROPYLENE, STABILIZED NYLON, POLYETHYLENE OR POLYVINYLIDENE CHLORIDE AND SHALL MEET THE DNR TECHNICAL STANDARDS REQUIREMENTS.
- THE GEOTEXTILE SHALL BE ANCHORED BY SPREADING AT LEAST 8" OF IT IN A 4"x6" TRENCH.
- POSTS TO BE 1 1/8" x 1 1/8" OAK, HICKORY OR STEEL RODS, 3' TO 4' LONG AND SPACED A MAXIMUM OF 8' APART.

IMPLEMENTATION OF EROSION CONTROL METHODS

- ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH THE WISCONSIN DNR CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL TECHNICAL STANDARDS, AND THE CITY OF STURGEON BAY REQUIREMENTS.
- MANUFACTURED ALTERNATIVES APPROVED AND LISTED ON THE D.O.T. EROSION CONTROL PRODUCT ACCEPTABILITY LIST MAY BE SUBSTITUTED.
- ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL AT A MINIMUM BE INSPECTED WEEKLY AND WITHIN 24 HOURS AFTER EVERY PRECIPITATION EVENT THAT PRODUCES 0.5 INCHES OF RAIN OR MORE DURING A 24 HOUR PERIOD. MAINTENANCE SHALL BE COMPLETED AS SOON AS POSSIBLE WITH CONSIDERATION GIVEN TO SITE CONDITIONS.
- ALL SEDIMENT CONTROL MEASURES SHALL BE ADJUSTED TO MEET FIELD CONDITIONS AT THE TIME OF CONSTRUCTION AND INSTALLED BEFORE ANY GRADING OR DISTURBANCE OF EXISTING SURFACE MATERIAL.
- ALL TEMPORARY SOIL EROSION PROTECTION SHALL REMAIN IN PLACE UNTIL THE DISTURBED AREAS ARE PERMANENTLY STABILIZED AND NO LONGER SUSCEPTIBLE TO EROSION.
- TRACKING PADS SHALL BE INSTALLED AT ALL CONSTRUCTION SITE EXITS PRIOR TO ANY TRAFFIC LEAVING THE SITE. TO PREVENT TRACKING OF SOIL OFF THE SITE. ALL SOIL TRACKED OFF SITE ON PAVED SURFACES SHALL BE REMOVED AT THE END OF EACH WORK DAY.
- OVERLAND FLOW SHALL BE PREVENTED FROM LEAVING THE WORK SITE BY INSTALLING EROSION CONTROL DEVICES AS SHOWN ON THE PLANS.
- IF THERE ARE DISCREPANCIES BETWEEN THESE DETAILS AND THE DNR TECHNICAL STANDARDS FOR SEDIMENT AND EROSION CONTROL, THE MORE RESTRICTIVE REQUIREMENT SHALL BE FOLLOWED.
- STORM SEWER CATCH BASINS IN PAVEMENT AREAS SHALL BE PROTECTED FROM RUNOFF BY INLET PROTECTION TYPE A UNTIL PAVEMENT IS PLACED. AT THAT TIME, INLET PROTECTION SHALL BECOME TYPE B.
- STORM SEWER CURB BOXES (INLETS) SHALL BE PROTECTED FROM RUNOFF BY INLET PROTECTION TYPE A UNTIL CURB & GUTTER IS PLACED. AT THAT TIME, INLET PROTECTION SHALL BECOME TYPE C.
- STORM SEWER CATCH BASINS IN NON-PAVEMENT AREAS SHALL BE PROTECTED FROM RUNOFF BY INLET PROTECTION TYPE A UNTIL THE CONTRIBUTING DRAINAGE AREA IS STABILIZED.
- WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN TO PREVENT SEDIMENT TRAPPED ON THE GEOTEXTILE FABRIC FROM FALLING INTO THE INLET. ANY MATERIAL FALLING INTO THE INLET SHALL BE REMOVED IMMEDIATELY.
- TOPSOIL, SEED, AND MULCH ANY NON-PAVED AREA WITHIN 1 WEEK OF COMPLETION OF THE GRADING OPERATION IN THAT AREA AND WITHIN 1 DAY ALONG THE PATHS.
- SEED WITH AN ANNUAL RYE OR PERMANENT VEGETATION AS SPECIFIED ON THE LANDSCAPE PLAN OR THIS DRAWING. ALL STORM WATER FACILITIES WITHIN 7 DAYS OF STOPPING OR COMPLETING WORK IN THAT AREA.
- CLASS I, - TYPE B EROSION CONTROL MAT SHALL BE PLACED ON ALL DISTURBED SLOPES GREATER THAN 10% AND ON THE BOTTOM OF THE DRAINAGE DITCHES.
- ALL TRENCH WATER SHALL BE DISCHARGED INTO A SETTLING BASIN OR FILTERING DEVICE PRIOR TO RELEASE INTO STORM SEWER OR STREAM.
- PLACE LIMESTONE SCREENING ON PATH THE SAME DAY IT'S GRADED

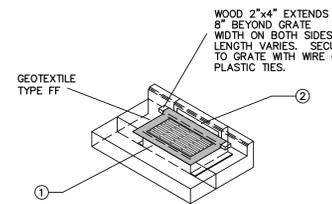
SIEVE SIZE	% PASSING BY WEIGHT
3/8"	100
#4	90-100
#10	85-95
#16	40-85
#30	20-60
#50	10-30
#100	2-10
#200	3.5 MAX.

MASON SAND, P200 ≤ 3.5%
SEE TABLE ABOVE FOR COMPLETE GRADATION. PROVIDE ONE SAMPLE TO ENGINEER PRIOR TO DELIVERY.



INLET PROTECTION, TYPE B (WITHOUT CURB BOX)

N.T.S.



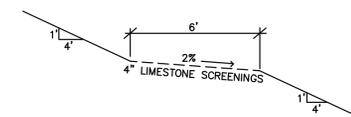
INLET PROTECTION, TYPE A

N.T.S.

INLET PROTECTION, TYPE C (WITH CURB BOX)

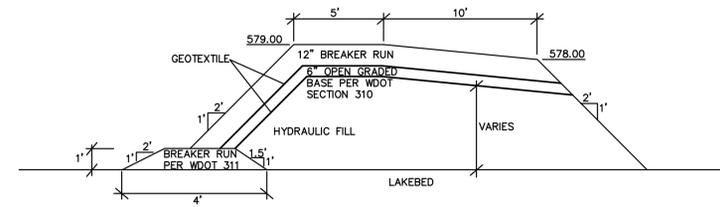
N.T.S.

- FINISHED SIZE, INCLUDING FLAP POCKETS WHERE REQUIRED, SHALL EXTEND A MINIMUM OF 10" AROUND THE PERIMETER TO FACILITATE MAINTENANCE OR REMOVAL. COVER GEOTEXTILE OUTSIDE OF INLET WITH 4" OF STONE OR GRAVEL FILLED BAGS.
- FOR INLET PROTECTION TYPE C WITH A CURB BOX, AN ADDITIONAL 18" OF GEOTEXTILE IS WRAPPED AROUND THE WOOD AND SECURED WITH STAPLES. THE WOOD SHALL NOT BLOCK THE ENTIRE HEIGHT OF THE CURB BOX OPENING.



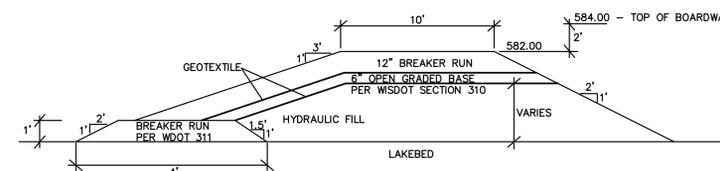
LIMESTONE WALK

N.T.S.



FOREBAY BERM

N.T.S.



BOARDWALK BERM

N.T.S.

- CONTRACTOR SHALL SUBMIT DESIGN OF BOARDWALK INCLUDING CALCULATIONS PRIOR TO CONSTRUCTION.
- MATERIAL SHALL BE EASILY MAINTAINED AND REPLACED.
- MATERIAL AND HARDWARE SHALL HAVE A 10-YR LIFE EXPECTANCY MINIMUM.
- MATERIAL SHALL BE NATURAL LOOKING AND NON-TOXIC TO AQUATIC PLANT AND ANIMAL SPECIES.
- BOARDWALK SHALL BE 6' WIDE AND MEET ADA REQUIREMENTS.
- RAILS SHALL BE 42" HIGH AND WITHSTAND AN IMPACT FORCE OF 500 LBS.
- BOARDWALK SHALL BE ANCHORED AGAINST MOVEMENT BY WATER.

DETAILS

5308 S. 12th Street
Sheboygan, WI 53081-8099
Phone 920-458-6164
Fax 920-458-0369
www.startwithmiller.com

MILLER
ENGINEERS
SCIENTISTS

BY

DATE

NO.

DESCRIPTION

CITY OF STURGEON BAY
LAKE AND STORM WATER MANAGEMENT
LITTLE LAKE
STURGEON BAY, WISCONSIN

SCALE

HOR. 1"=40'

VER.

DATE

6-19-09

JOB

07-17612-J

BY

SMW