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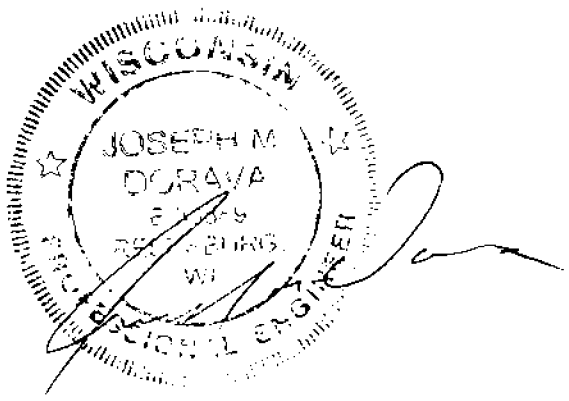
LAKE PROTECTION AND STORM WATER MANAGEMENT PLAN VILLAGE OF OXFORD, WISCONSIN

ENGINEERING
ARCHITECTURE
ENVIRONMENTAL
SURVEYING
COMMUNITY DEVELOPMENT

Lake Protection And Storm Water Management Plan Village of Oxford, Wisconsin



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LAKE PROTECTION AND STORM WATER MANAGEMENT PLAN VILLAGE OF OXFORD, WISCONSIN April, 2000

I. INTRODUCTION

The Village of Oxford encompasses an area of about 450 acres in west central Marquette County. The Village drains into Oxford Lake, Neenah Lake, and Neenah Creek, and ultimately into the Fox River and Green Bay (Figure 1 and enclosed maps). The Village is characterized by relatively small commercial and industrial areas downtown and along State Highway 82 respectively. Residential areas surround downtown, Neenah Lake, and are along the northern and western fringes of the village. The developed areas have replaced older farmland and the underlying fine-grained soils are poorly drained. The result of the land development and the naturally wet soils in the area is an increase in the rate and volume of storm water runoff. There has been a subsequent increase in concern about protecting the quality of the area's water bodies, especially Neenah and Oxford Lakes and Neenah Creek.

Neenah Lake drains an area of about 28 square miles upstream from Highway 82. Much of this area draining to Neenah Lake is undeveloped and either forested or agricultural lands. Only about 45 acres of primarily residential property within the boundaries of the Village of Oxford drain into Neenah Lake (see enclosed maps).

Oxford Lake has a much smaller drainage area, less than 3 square miles, of which about 240 acres are within the Village of Oxford. About 97 acres of this area that drains into Oxford Lake is currently developed, primarily as single family residential properties. By 2015, about 10 additional acres of land draining to Oxford Lake are projected to be developed as industrial and business use (see enclosed maps).

About 165 acres within the Village of Oxford does not drain into these two lakes but drains into Neenah Creek. Primarily as a result of existing and recommended storm water management practices, Neenah Creek receives runoff from the most urbanized portions of the Village of Oxford (see enclosed maps).

Water quality mitigation opportunities in the Village of Oxford for protecting Neenah and Oxford Lakes and Neenah Creek are emphasized in this report. Non-structural and structural measures are considered with a primary focus on alterations to the storm sewer system that can alleviate storm water flooding in the village and help protect water quality.

II. PROBLEMS AND SCOPE

Two Lake Management Planning Grants were obtained from the Wisconsin Department of Natural Resources to assist the Village of Oxford with protecting Oxford and Neenah Lakes. This report provides an identification of water quality concerns in the village and recommends opportunities for mitigation. Implementation of the recommendations in this report is the responsibility of the Village of Oxford in conjunction with applicable programs and concerned staff of the appropriate local, State, or Federal Government agencies. Included in this report is a description of some of the most applicable agency programs that may provide financial or technical assistance with implementing lake protection and storm water management recommendations (appendix).

Water quality is an important issue in the Village of Oxford because the local water bodies are attractive natural features that support numerous fish and wildlife species. In addition, the lakes and creeks improve the quality of life for local residents and attract tourists who help to support the local economy. Potential problems with water quality in the Village of Oxford include storm water flowing in the streets, in storm sewers, and over land, and draining untreated directly into the two local lakes and Neenah Creek. Generally, water quality problems such as those described above result from a combination of causes. These causes might include unplanned land use changes, limited water quality treatment of storm water, existing storm sewer systems that need repair or maintenance, and changes in regulatory program emphasis that may have occurred over time since the community was planned. Commonly, appropriate land use and storm water management plans, maintenance, cleaning, and repairing the existing storm sewer system, adding additional storm sewers, and providing water treatment facilities within the watershed can be used to address these problems.

One general concern is that there are few or no storm sewers and limited treatment of storm water quality in the Village of Oxford. This study along with the accompanying land use report, (appendix) provide a comprehensive lake protection and storm water management plan for the Village of Oxford. Substantial investment has been made in the few existing storm sewer systems. As a result the initial analysis focuses on an evaluation of the performance of the existing storm sewer system and provides recommendations for cost effective rehabilitation and improvements.

Because the Wisconsin Department of Transportation is planning to upgrade State Highway 82 through the Village of Oxford in the next few years, a high priority is being placed on storm sewer improvements and water quality protection measures that can be implemented in conjunction with this planned project.

III. ANALYSIS OF EXISTING DRAINAGE NETWORK

A. Field Surveying

Analysis of the current storm water management practices in the Village of Oxford was initiated with detailed documentation of the existing storm water drainage network. Many of the existing storm water inlet and outlet structures had to be surveyed, whereas details of the storm sewer systems along Chauncy Street and Miller Street were documented on construction plans supplied by the village. Documenting the existing storm sewers and other components of the storm drainage network such as individual culverts and creeks was required to reliably model the flow of storm water through the village. As a result of this study, each culvert and each storm sewer inlet, outlet, and connecting pipe's size, location, and elevation are now accurately known and documented with a common set of coordinates (see enclosed maps).

B. Field Reconnaissance

The initial data gathering and field surveying was followed by a field reconnaissance of the area. Our engineers visited suspected problem areas, interviewed public works department staff and local residents, and documented potential storm water drainage problems. One of the most substantial problems observed during the field reconnaissance was a lack of storm sewer collection systems in much of the village.

The field surveying and field reconnaissance resulted in identification of several areas in the village with special concerns (see enclosed maps).

1. Extensive impervious areas, including roofs and pavement near the intersection of Highway 82 and Franklin Street, concentrate and accumulate storm water which flows south along Franklin Street toward Chauncy Street.

2. Excess storm water accumulates at Valette Street as it drains south along Franklin Street.

3. Storm water that flows farther down Franklin Street south of Chauncy Street ponds at Jaeger Street.

4. Storm water also accumulates north of Highway 82 along Franklin Street. This storm water typically drains to the east down Hillyer Street and commonly remains on the road surface for an extended period of time before it drains into the lower stockyard area.

5. Similar to the drainage problems described along Franklin Street near Highway 82, excess storm water also accumulates at Miller Street near Highway 82. North of Highway 82, storm water flows to the low area by the stockyards, whereas south of Highway 82, storm water flows toward Valette Street.

6. Storm water runoff from the school building and schoolyard creates a pool of standing water along Chauncy Street between Franklin Street and Miller Street.

7. Chauncy Street from Miller Street to the west is drained by an existing storm sewer system that discharges into Neenah Creek. Towards the east, a storm sewer currently does not service Chauncy Street, but rather a small creek between Highway 82 and Chauncy Street collects overland flow. There are substantial storm water related problems near the creek road crossings along east Chauncy Street. Water seeps into the basements of local homes and the road is overtopped during severe storms. Water from the north flows under the railroad and Highway 82 before entering this small creek. Storm water runoff crosses under Chauncy Street in three culverts (a 36-inch and two 15-inch diameter). Inadequate storm water drainage creates problems for the homes and empty lots along east Chauncy Street.

8. There is a low area along Oscar Street between Franklin Street and Oxford Street. The accumulation of storm water in this area creates problems for property owners and vehicles.

9. Near the extreme western end of Hillyer Street, storm water drains overland to the northwest directly into local properties. There have been reports that garages and yards are being flooded in this area during severe storms.

In addition to these areas of special concern, possible degradation of water quality in the local lakes was addressed during this study with the collection of background data on the quality of Neenah Lake. During July, August, and September 1999 secchi disk readings documenting the visible clarity of the water were made by Mr. Kenneth Kelly, a local resident who volunteered his time for this task. Mr. Kelly recorded the secchi disk depth readings and some ancillary environmental conditions on at least six occasions during each month (Table 1).

TABLE 1

SECCHI DISK READINGS FOR NEENAH LAKE NEAR OXFORD
BY KENNETH KELLY

Date	Reading (ft)	Water Temp (°F)	Cloud Cover %	Wind Speed (mph)/Direction
7/6/99	8.5	N/A	0	15/NW
7/9/99	8.5	79	10	CALM
7/12/99	8.0	79	30	10/SW
7/16/99	8.5	80	100	15/NW
7/23/99	5.0	81	40	5/W
7/31/99	8.0	79	30	10/SW
July Average	7.75			
8/3/99	8.5	74	10	5/SW
8/6/99	8.5	74	100	10/NW
8/10/99	9.0	74	50	10/NW
8/13/99	7.5	73	100	10/N
8/17/99	7.5	71	50	15/NW
8/20/99	7.5	71	100	CALM
8/24/99	6.0	70	50	15/NW
8/27/99	6.5	70	20	5/W
August Average	7.625			
9/3/99	7.5	68	50	5/W
9/7/99	8.0	67	0	CALM
9/10/99	8.0	67	10	5/SW
9/14/99	8.0	67	50	10/W
9/17/99	8.0	67	30	10/NW
9/21/99	8.0	66	100	15/N
9/24/99	7.5	66	50	10/N
9/28/99	7.5	66	30	CALM
September Average	7.8125			
Three Month Average	7.727			

C. Hydrologic Modeling

Once the field data were collected, the Village of Oxford was divided into areas that contribute flow to the local water bodies and each of the existing storm sewer systems (see enclosed maps, Table 2). This watershed sub-dividing used topographic information from U.S. Geological Survey quadrangle maps and information from the field surveying and field reconnaissance. Using this information, the size of each storm sewer service area was calculated.

Land use characteristics also documented as part of this study were then used to determine composite run-off coefficients in each storm sewer service area. The run-off coefficients for each area were determined from standard methods and publications for both the Rational Method and the Soil Conservation Service (SCS) TR-20 and TR-55 Methods (Table 3).

The Village of Oxford encompasses about 450 acres of which, Neenah Lake, Neenah Creek, and Oxford Lake each drain about 45, 165, and 240 acres respectively (Table 2). Land use in Oxford is a mixture of residential, institutional, commercial, industrial, and open or undeveloped land. About 97 acres of the area that drains into Oxford Lake is currently developed primarily as single family residential properties, however, by 2015 about 10 additional acres is projected to be developed as industrial and commercial use. Oxford Lake and Neenah Creek receive storm water runoff from several land uses whereas Neenah Lake receives runoff only from residential and open land uses.

TABLE 2

GENERAL LAND-USE CHARACTERISTICS OF AREAS DRAINING TO THREE WATER BODIES NEAR OXFORD WISCONSIN

	Neenah Lake	Neenah Creek	Oxford Lake
Residential	40	76	97
Institutional		4	2
Commercial		5	8
Industrial		3	
Open	5	77	133
TOTAL	45	165	240

TABLE 3

COMPARISONS OF RUN-OFF COEFFICIENTS FOR DIFFERENT LAND USES

HYDROLOGIC SOIL TYPE 'D'

Cover Type	C (Rational)	CN (SCS)
Open Spaces fair Condition 50-75% grass covered	0.21	84
Asphalt/Roofs	0.95	98
Commercial/Business	0.72	95
Industrial	0.69	93
Residential Areas		
½ acre lots	0.28	85
¼ acre lots	0.36	87
1/8 acre lots	0.53	92
Multi-Family	0.64	93
Grassways Good Condition >75% covered	0.30	73

D. Hydraulic Modeling

Using the size of the storm sewer service area in acres, and the appropriate composite run-off coefficient for each service area, the 10-year storm design discharge for each storm sewer system in the village was determined (Table 4). The discharge values were determined using long-term precipitation data for Marquette County and the City of LaCrosse (Table 5 and 6).

The generally accepted practice is to design storm sewer systems to collect and discharge the 10-year storm without flooding the streets. During larger less-frequent storms, such as the 25, 50, or 100-year events, design practices typically allow some flooding of the streets but not to an extent that traffic movement is substantially impeded. Commonly, bridges and culverts are designed to pass the 50 or 100-year storm event.

This report evaluates the capability of the existing storm sewer system to pass the 10-year storm under current development conditions without flooding the streets. Recommended improvements to existing storm sewers provide that level of service during future developed conditions. Furthermore, new storm sewer service areas were designed to pass the 10-year storm without flooding the street under future development conditions.

TABLE 4

DESIGN STORM DISCHARGE VALUES
AT SELECTED STORM SEWER OUTFALLS FOR EXISTING AND FUTURE LEVELS OF DEVELOPMENT IN THE VILLAGE OF OXFORD

Storm Sewer ID	Area in Acres Existing/ Future	Runoff Coefficient C Existing	Runoff Coefficient C Future	10-year discharge (cfs) Existing	10-year discharge (cfs) Future
West Chauncy	6.2	.44	.44	8	8
Miller Street	27	.37	.37	32.3	32.3
West Hwy 82	5.22/45.7	.66	.48	14	45.7
East Hwy 82	16.7		0.42		26.7
East Chauncy St.	14		0.4		18.5
East Wood St.	15.6		0.37		19
West Oscar	9.5		0.36		15.3
West Hillyer	2.30		0.36		3.6

TABLE 5

24-HOUR RAINFALL IN INCHES FOR MARQUETTE COUNTY
(FROM US DEPARTMENT OF COMMERCE TECHNICAL PAPER 25)

Return Period in Years	Rainfall
2	2.7
5	3.5
10	4.1
25	4.6
50	5.2
100	5.8

TABLE 6

RAINFALL INTENSITIES IN INCHES PER HOUR FOR LACROSSE, WISCONSIN
(FROM US DEPARTMENT OF COMMERCE TECHNICAL PAPER 25)

Duration	Return Period in Years 10
5 minutes	6.5
10 minutes	4.5
30 minutes	3
60 minutes	2

E. Water Quality Modeling

Water quality concerns for this study were focused on the potential problems associated with four primary pollutants, (suspended solids, total phosphorus, lead, and zinc). These pollutants are generally unhealthy for water bodies and the fish and wildlife that live in, on, or around them. Suspended solids and phosphorus typically are concentrated in storm water runoff from sites that are susceptible to erosion such as construction sites, steep undeveloped sites, and agricultural lands. Lead and zinc on the other hand are commonly found in storm water runoff from urbanized sites, especially where industrial activities are prevalent or where vehicle traffic is concentrated such as along highways and in parking lots.

Land area and land-use characteristics for each of the three primary receiving waters around the Village of Oxford (Oxford Lake, Neenah Creek and Neenah Lake), were determined and used in the Source Loading And Management Model (SLAMM) to estimate the likely annual loading of the four primary pollutants listed above. Appropriate mitigation measures to limit the loading of these pollutants were then recommended and cost opinions for implementation of these measures were generated.

IV. MODELING RESULTS

A. Water Quantity Modeling

Results of the hydrologic and hydraulic modeling of the existing storm drainage system indicates that there is considerable street flooding in the Village of Oxford during the 10-year storm. The existing storm sewers along Chauncy Street and west along Highway 82 are adequately sized to pass the 10-year storm without flooding in the street. However, there are no storm sewers servicing many of the areas of concern in the village. Furthermore, the existing storm sewer along Miller Street is undersized for current levels of development. The result is substantial volumes of water ponding on or flowing down the streets, which interrupts traffic and potentially threatens the safety of local homes and businesses.

To address storm water flooding there is a need to upgrade the existing storm sewer system and to provide additional storm water or drainage in the Village of Oxford. To address many of the storm water related water quality concerns there is a need to provide some water treatment prior to discharging storm water to the receiving lakes and creek. Because these two tasks can be very expensive, the most cost-effective solution may be to concentrate initial remediation efforts in those areas identified as having specific concerns. Addressing those areas with specific concerns during planned construction of the Highway 82 upgrade will likely be the most economical approach.

B. Water Quality Modeling

Based on water samples from urban settings in a state-wide study, the currently developed 450 acres of land area in the Village of Oxford would most likely generate about 0.46 pounds per acre of phosphorus annually in storm water runoff (Panuska and Lillie, 1995). On the basis of water quality sampling data from urban settings in the Southeaster Wisconsin Till Plain Ecoregion, about 0.49 pounds per acre of phosphorus and about 406 pounds per acre of solids would be generated annually in storm water runoff from the Village of Oxford (Corsi and others, 1997).

This investigation included a water quality modeling effort for the Village of Oxford using the SLAMM model. Although little data are available to verify or confirm the modeling results for lead and zinc, the total solids and total phosphorus loads from the SLAMM model are comparable to the state-wide and ecoregion estimates cited above (Table 7).

TABLE 7

POUNDS PER ACRE ANNUAL LOADING OF SELECTED POLLUTANTS IN THREE WATER BODIES NEAR OXFORD WISCONSIN

	Neenah Lake	Neenah Creek	Oxford Lake
Total Solids	315	490	674
Total Phosphorous	0.48	0.35	0.45
Lead	0.06	0.26	0.75
Zinc	0.08	0.40	0.40

Once the pollutant loads were estimated another investigation was undertaken to document information on the treatment efficiency of various mitigation techniques (Table 8). Preventing pollution from entering a lake or creek is certainly less costly than restoration or correction of a serious pollution problem. Therefore the Village of Oxford should also consider the benefit of non-structural management practices such as educational programs that are designed to prevent pollution, along with relative efficiency of structural management alternatives when implementing a strategy to protect local lakes and creeks. Site specific recommendations are provided later in this report to address both water quantity and quality concerns.

TABLE 8

EFFECTIVENESS ASSESSMENT OF BEST MANAGEMENT PRACTICES

BMP Control	Runoff Volume	Suspended Solids	Phosphorus	Zinc	Lead
	Average Percent Reduction	Average Percent Reduction	Average Percent Reduction	Average Percent Reduction	Average Percent Reduction
Land Management (100% Participation)	21	30	30	N/A	N/A
Wet Detention	58	87	64	66	66
Greenways and Infiltration Channels	22	46	44	45	45
Roof Disconnections	6	N/A	N/A	23	23
Street Cleaning	N/A	14	N/A	12	13
Catch Basin Sumps and Cleaning	N/A	14	N/A	13	13

V. RECOMMENDATIONS

Generally, local water quality will benefit from appropriate land-use planning and storm water management. However, implementation and in some cases enforcement of the recommended management strategies is required to achieve desired levels of protection. Implementing low-cost, non-structural pollution prevention measures such as educational programs and adoption of regulations such as storm water and erosion control ordinances are commonly very helpful steps toward meeting water quality protection goals in communities such as the Village of Oxford. Implementing structural modifications to storm water management can also be very helpful but at the same time quite expensive.

A. Non-Structural Management Practices

It is recommended that a substantial pollution prevention program be implemented in the Village of Oxford. The non-structural management practices listed below should be a component of the program. Because pollution prevention is very cost effective, these non-structural efforts should be continued indefinitely.

- Education Programs
- Storm Water Ordinances
- Erosion Control Ordinances
- Shoreland and Agricultural Land Management
- Street and Parking Lot Sweeping
- Pet/Animal Waste Management
- Maintenance of Existing Storm Sewers
- Water Quality Monitoring (Secchi Disk Readings)

B. Structural Management Practices

In addition to non-structural management practices, altering the existing storm water management practices or building a water treatment facility may be required to meet water quality goals. In such a case, the potential structural management practices might include those listed below. Because these practices are often very expensive, consideration of the pollution removal efficiency (Table 8) and the expected life of a project is required. In this report we recommend numerous structural management practices beginning with modifications to the existing storm sewers and incorporation of water quality treatment provisions.

- Wet Detention Ponds
- Infiltration / Dry Detention
- Erosion Protection
- Flooding Protection
- Multi-Chambered Treatment Devices

East Chauncy Street — Oxford Lake watershed

This area of the village is not currently serviced by an underground storm sewer. Rather the area is drained by overland flow to a small creek that enters the north end of Oxford Lake. This creek begins well north of the Village of Oxford in undeveloped uplands at an elevation of about 910 feet above sea level. The creek enters the developed area of the Village of Oxford once it passes under the Northwestern Railroad tracks. However, development along the creek is currently quite sparse including only a small industrial park on the extreme eastern fringe of the village and a few single-family homes along East Chauncy Street.

This area is considered a high priority due to the health and safety hazards associated with the storm water related problems and because the creek flows directly into Oxford Lake. About 240 acres of land in the village contribute runoff to Oxford Lake, of this about 94 acres are upstream from the railroad tracks and are currently undeveloped. Controlling storm water runoff from the undeveloped land upstream from the tracks can be accomplished by reducing the size of the culvert opening under the tracks. If the 66-inch diameter culvert opening were reduced to 24-inches, hydraulic modeling indicates that the 100-year-peak discharge would be reduced from 270 cubic feet per second to about 26 cubic feet per second.

This flow restriction results in considerable temporary storage of water in natural depressions upstream from the tracks. However, the impounded water is expected to remain at least five feet below the top of the embankment and drain away in less than two days. Consultations with the railroad and Wisconsin Department of Transportation would be required before such a recommendation could be implemented. Considerable advantages result from this flow reduction. For example, downstream east Chauncy Street is no longer overtopped during severe storms and subsequently the basements of local homes should be flooded less frequently by storm water.

Farther downstream at the culverts under Wood Street; however, flooding is still expected to be severe and two additional 24-inch diameter culverts are necessary to pass the 100-year storm without overtopping the road. In addition, it is recommended that a detention pond with about 2-acre-feet of water storage be constructed along the creek prior to the lake. This pond will remove sediment and many associated pollutants from the creek water. In addition, the pond provides an area to remove any accumulated solids during routine pond maintenance.

In addition to the culvert modifications and the pond construction described above, it is recommended that considerable storm drainage improvements be constructed along East Chauncy Street (see enclosed maps).

These recommended improvements include construction of new drainage ditches or re-shaping of the existing roadside drainage ditches to improve movement of storm water. The recommended ditch improvements would follow along both the north and south sides of East Chauncy Street from Smith Street to the east end of Chauncy Street. New culverts would be installed at driveway and road intersections where existing culverts are damaged or where no culverts are currently in place. These new or improved grass-lined swales should be about three feet wide at the bottom, at least two feet deep, and have gently sloping sides that allow maintenance of the grass cover.

Re-grading of lots at the extreme eastern end of Chauncy Street is required to adequately drain storm water to the new roadside grass-lined swales. In addition, grading to improve storm water flow to and through an existing 15-inch culvert near the eastern end of Chauncy Street is also required.

Lowering of an existing culvert near the southern berm of an existing pond along East Chauncy Street is required to allow adequate drainage of the north side of Chauncy Street. Lowering this culvert and the 36-inch culvert to the west will improve the flow of storm water under Chauncy Street and reduce basement flooding and the associated health and safety hazards.

Improvement of the flow of storm water in the existing creek channel running from the railroad tracks south to Oxford Lake is also recommended. Storm water flows frequently overwhelm this small channel and flow unconfined overland. Improvements to the creek channel would move storm water away from local homes faster and help prevent their basements from flooding. An enlarged channel with a bottom width of 4 feet and 3 to 1 side slopes was evaluated with the hydraulic model during this investigation and showed greatly improved storm water movement.

Many of these recommended enhancements would most likely qualify for partial funding from state grant programs. A breakdown of possible grant funding support for the recommendations is included below.

Possible Community Development Block Grant Funding

- Re-grade land around existing homes near the east end of Chauncy Street to improve drainage. Construct grass-lined drainage swale along both sides of Chauncy Street from the east end back toward the west to the existing pond $55,000

- Install new culvert under Chauncy Street near the existing pond, but about four feet lower to help reduce the water table elevation and reduce health and safety hazards associated with flooding basements of local homes $10,000

- Re-construct pond bottom to reflect similar depth relative to lower invert at new culvert. Estimate bed lowered about five feet for 0.5 acre area $30,000

- Improve outlet ditch from the new culvert near the existing pond, south to the confluence with the creek draining from the north $10,000

Total $105,000

Possible Lake Protection Grant Funding

- Reduce flow into the East Chauncy Street area from the north by restricting flow under the railroad and highway $30,000

- Improve creek channel from railroad south to Oxford Lake and install new 36-inch culvert under Chauncy Street about 2.4 feet lower $25,000

- Provide two new 24-inch diameter culverts under Wood Street $15,000

- Construct new grass-lined swales and improve existing ditches along both sides of Chauncy Street from Smith Street east to the existing pond. Include new 18-inch diameter culverts at road and driveway crossings $80,000

- Construct wet detention pond with approximately 2-acre feet of water storage capacity upstream from Oxford Lake. Include erosion control at the pond inlet and outlet $100,000

Total $250,000

These recommended enhancement to storm water management would reduce the health and safety hazards associated with flooding along east Chauncy Street and protect the water quality of Oxford Lake. The engineer's opinion of probable costs for these improvements totals about $355,000 (see enclosed maps and Table 9 appendix).

West Highway 82

Along Highway 82 west of the Village of Oxford, the existing storm sewer includes a set of four inlets near Oxford Street and a pipe under the highway that discharges to Neenah Creek, near the dam. This storm sewer services a limited area and discharges directly to the creek without any water quality treatment.

The areas of Oxford draining to the west along Highway 82 are the most urbanized and include many of the downtown business sites. This area is also a high priority because it has numerous storm water related problems and because it is planned for an upgrade by Wisconsin Department of Transportation. As a result it is recommended that this storm sewer service area be substantially expanded to include more of the downtown area and many of the sites with reported storm water problems (see enclosed maps).

More specifically, the recommended improvements would include extending storm sewer service along Oxford Street and Franklin Street between Hillyer Street and Valette Street and east along Hillyer Street to the stockyard (see enclosed maps). These improvements along with an enhancement of water treatment prior to discharge to the creek would reduce storm water flooding and help protect water quality.

New technology, including a pre-discharge multi-chambered water treatment basin and an infiltration channel have been recommended for use at the western end of the new storm sewer to help remove potential contaminants from the storm water. Anticipated discharge for the 10-year storm at the western outlet of this new storm sewer would be about 54 cubic feet per second. The engineer's opinion of probable costs for these improvements is about $475,000 (see enclosed maps and Table 9 appendix). Some cost sharing with the Wisconsin Department of Transportation has been assumed for these improvements including substantial material and construction costs associated with installing new storm sewer under Highway 82.

East Highway 82

A new storm sewer draining the eastern half of the downtown portion of the Village of Oxford is anticipated as part of the Highway 82 up-grade. Wisconsin Department of Transportation will have design responsibility for this system, which should collect storm water from about Franklin Street and discharge it east of the village. It is recommended that adequate inlets be provided along Highway 82 to prevent water from ponding in the street. In addition, the discharge point for this new storm sewer should be far enough east to allow planned development of lots along the south side of the highway (see appendix – Land Use Report maps).

The enclosed map shows a possible alignment of a new storm sewer, which drains about 16.7 acres of primarily residential property. The inlets shown on the enclosed map depict an assumed configuration of four at each major intersection and two at about mid-block between intersections. Preliminary analysis indicates the storm sewer would be about 18-21 inches in diameter depending on installation grades. A discharge outfall including adequate erosion protection and infiltration capacity to prevent water quality degradation of the receiving water is recommended. A copy of this report will be provided to Wisconsin Department of Transportation to assist them with their planning and design of Highway 82 improvements.

Miller Street Storm Sewer

The existing Miller Street storm sewer service area includes about 65 acres of primarily single family residential properties generally south of Chauncy Street between Franklin Street and Abbott Street. Results of this study indicate that the existing storm sewer pipes are substantially under size and there are not enough inlets available to prevent considerable flooding of the street during a 10-year storm. As a result it is recommended that this storm sewer be upgraded and the storm sewer service area be expanded.

Recommended improvements include extending storm sewer service along Miller Street north to Chauncy Street and then west along Chauncy Street to about mid-block. Additionally, storm sewer service would be extended west along Jaeger Street to Franklin Street and east along Wood Street to Smith Street. These improvements will considerably reduce street flooding. In addition, if an easement is available for the present outlet ditch's location, extending this to the south in a dedicated flow path would allow unimpeded planned future residential development in the area. The recommended outlet and ditch design would include a greenway and infiltration channel to help protect and improve water quality. The engineer's opinion of probable costs for these improvements is about $466,000 (see enclosed maps and Table 9 appendix).

West Chauncy Street Storm Sewer

The existing storm sewer along west Chauncy Street services a relatively small area of only about 7 acres. The service area includes a portion of the school grounds otherwise the remainder of the service area is primarily residential property. This storm sewer discharges to a ditch along the north side of Chauncy Street that flows into Neenah Creek. This study indicates that the 10-year storm passes through the storm sewer without flooding in the street.

Although this storm sewer is functioning as designed, it is recommended that the service area be expanded to include additional inlets north and south along Franklin Street to collect storm water currently flowing in the street (see enclosed maps). In addition, improving water treatment along the ditch before discharge to Neenah Creek with some infiltration enhancement would help protect water quality. The engineer's opinion of probable costs for these improvements is about $61,000 (see enclosed maps and Table 9 appendix).

Oscar Street Storm Sewer

There is an extremely low area along Oscar Street between two small hills where storm water accumulates and vehicle traffic is impeded during severe storms. To correct this drainage problem we recommend installation of four inlets at the low point of the street that drain to a discharge pipe flowing to the west toward Neenah Lake (see enclosed maps). In addition to the inlets and pipe, a dedicated grass lined swale or greenway with some infiltration enhancement such as small gabbion flow weirs would help to protect water quality before discharging the storm water into Neenah Lake. The engineer's opinion of probable costs for these improvements is about $80,000 (see enclosed maps and Table 5).

West Hillyer Street

Along the western end of Hillyer Street storm water drains overland to the northwest directly into local properties. There have been reports that garages and yards are being flooded during severe storms. To correct this drainage problem we recommend installing two inlets on the street, installing a culvert under Hillyer Street, and grading the adjacent land to facilitate drainage to the culvert (see enclosed maps). In addition to the inlets and culvert, a dedicated grass lined swale or greenway with some infiltration enhancement, such as small gabbion flow weirs, would help to protect water quality before discharging storm water into Neenah Lake. The engineer's opinion of probable costs for these improvements is about $51,000 (see enclosed maps and Table 9 appendix).

East Wood Street Storm Sewer

The eastern Wood Street area includes about 27 acres of residential or planned residential properties that drain to a small creek that flows into the north end of Oxford Lake (see enclosed maps). Increased concern for protecting water quality in Oxford Lake prompted a recommendation that storm drainage improvements be constructed in this area. Directing storm water drainage into new grass-lined swales in the western portion of this area from Abbott Street to the existing 24-inch diameter culvert would improve street flooding problems and direct storm water to the previously recommended wet detention pond for treatment. The engineer's opinion of probable costs for these improvements is about $73,000 (see enclosed maps and Table 9 appendix). However, these improvements are likely a lower priority because much of this area is not currently developed and other areas in the Village of Oxford have more urgent storm water related needs.

C. Future Storm Water Management

Coordinating storm water drainage improvements recommended in this report with those planned for the near future by the Wisconsin Department of Transportation when they complete upgrading Highway 82 through the Village of Oxford is essential. This coordination is especially important for the East Highway 82 and West Highway 82 improvements, but will play a role in any planned improvements since coordination can reduce construction cost.

The inadequacy of the existing storm sewer system and the lack of water quality treatment in the Village of Oxford will require special consideration. It is recommended that the Village of Oxford develops, adopts, and implement, stringent storm water management and erosion control ordinances so that future development does not increase storm water runoff or further degrade water quality. The use of adequate site selection and design, along with Best Management Practices can help control off-site movement of storm water and its related contaminants from new developments, and limit adverse affects on the local receiving waters. A sample storm water and an erosion control ordinance are included in the appendix.

Public education and public involvement in storm water management in the Village of Oxford is also essential. When the public understands how storm water affects rivers and lakes, they will be more willing to support management activities. In addition, if the public is involved in management decisions, such as ordinance development, they are more likely to support the outcome. Furthermore, the public should see the village setting an example for storm water management. The village must stay current with maintenance of the storm sewer systems it manages and manage all village activities to comply with applicable storm water regulations and Best Management Practices.

VI. SUMMARY

Specific concerns about the water quality of the local lakes and creeks and substantial problems with storm water drainage in the Village of Oxford can be resolved by implementing the recommendations in this report. In addition, storm water drainage and water quality concerns from future development will be greatly reduced by following the management strategies outlined in this report.

Complete implementation of the recommended lake protection and storm water management improvements may cost as much as $1.56 Million. These improvements; however, can be implemented over an extended period of time. To help decide when and where to expend funds on recommended improvements we offer the following guidance.

Initially funding should be directed to areas where the greatest number of people are affected and sites that have the most serious issues. These would include the areas along east Chauncy Street, downtown along Highway 82, and areas serviced by the existing Miller Street storm sewer. Then funding should be directed towards specific problem sites where the number of people affected may be smaller but the issues are serious and perhaps safety related. These areas would include Oscar Street and West Hillyer Street. Finally, consider funding improvements at those sites where minor expenditures can greatly enhance service, such as at the west Chauncy Street storm sewer. And along eastern Wood Street where water quality protection can be enhanced when future development warrants the recommended improvements.

The following list summarizes the recommended improvements and their associated costs according to the priority scheme described above:

- East Chauncy Street $355,000
- West Highway 82 ..... $475,000
- Miller Street $466,000
- Oscar Street $80,000
- West Hillyer Street..... $51,000
- West Chauncy Street $61,000
- East Wood Street $73,000

TOTAL..... **$1.56 Million**

VII. FUNDING OPPORTUNITIES

Vierbicher Associates Inc., has extensive experience working with communities to obtain funding for projects like those recommended in this report. Opportunities for State and Federal Grants that address water quality, watershed, and storm water programs (appendix) may be applicable to these projects. In addition, other local funding opportunities will include loans, special assessments, bonding, and taxation. Additionally, we will work closely with you to refine the design of our recommended system improvements to help reduce your overall costs and to help coordinate with your other planned construction projects.

A. Watershed & River Basin Planning & Implementation Program

This federal program from the U.S. Department of Agriculture funds watershed protection plans and flood management practices. The focus of this program is on protection of the waterway. The flood management practices are usually implemented to protect the water from run-off and pollution due to flooding; not to protect privately owned property from flooding. The highest priority of this program are projects which feature "land treatment measures" to protect the watershed and reduce the rate and/or amount of runoff and erosion. A much lower priority is for structural and non-structural measures, which alleviate flood losses by modifying the vulnerability of land, people, and property to flood damage. The Village of Oxford would be eligible under this program. Eligible projects would need to address the priorities of this program. The application cycle is on-going.

B. River Planning & Management Grants

This new state program administered by the Wisconsin Department of Natural Resources was recently passed by the legislature. About $300,000 is available per grant cycle statewide. The Village of Oxford would be eligible for this program. First, the emphasis is placed on the Planning portion of the program. Second, within the Management portion of the program, priorities include (in order) land acquisition, development of local ordinances, restoration of shoreland habitat, and others. It is estimated that approximately 2-3 Management projects will get funded each grant cycle. The overall prevailing priority is to prevent water quality, fisheries habitat, and natural beauty from deteriorating. Applications are due September 1, 2000.

C. Targeted Run-off Management Program (also referred to as Urban Storm Water Grants)

This program is similar to the Wisconsin Department of Natural Resources' Non-Point Source Pollution Grants, but projects in this program are not required to be in a priority watershed area. This program funds projects that develop and use Best Management Practices to reduce the likelihood of pollutants being carried to streams and rivers via runoff and erosion. The Wisconsin Department of Natural Resources will administer grant funds, which target sites posing the greatest threats to surface water and groundwater. The Village of Oxford's project is eligible for funding under this program. Again, the emphasis for this program is to protect the rivers and waterways from pollutants in run-off and to improve water quality. Flood control to protect private property is not a high priority.

D. Community Development Block Grant Public Facilities Grant Program

The CDBG PF Program provides grants to municipalities to alleviate health and safety hazards in their community. CDBG PF is a competitive program with pre-applications due in July and final applications due in September. Oxford would be eligible for funding to address storm water related flooding, safety and health hazards.

E. Tax Incremental Financing (TIF)

TIF can be used to fund storm water improvements if implemented with new private construction. TIF uses the increase in property taxes generated by new development to fund infrastructure projects. TIF is a locally administered financing tool.

F. Developer Fees

Fees to address storm water project can be collected from new development. New developments can be assessed for storm water improvements constructed or improved as a result of the new development.

G. Storm Water Utility

The Village can create a storm water utility. The utility can levy taxes and assessments to pay for storm water improvements.

H. Wisconsin Department of Natural Resources Lake Protection Grant

Lake Protection Grants can be used to fund storm water improvements that address water quality and quantity issues. The Village received two Lake Planning Grants to conduct this study. A Lake Protection Grant could be used to implement the recommendations made in this report. Applications are due May 1 of each year.

As stated above, The Village of Oxford may be eligible for funding under all these programs. Projects will need to demonstrate that they address the priorities of each program. Funding applications will be more competitive if The Village of Oxford demonstrates a direct link between recommended improvements and the appropriate funding program's priorities.