ADAPTIVE MANAGEMENT PLAN

Tomah Wastewater Treatment Facility
City of Tomah, Wisconsin

January 2017

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1. INTRODUCTION AND BACKGROUND

1.1 Introduction

In 2010 the State of Wisconsin modified NR 102 and NR 217 to include new water quality based effluent limits for phosphorus. As a result, wastewater treatment facilities (WWTF) have begun to receive water quality based phosphorus limits in their new or re-issued WPDES permits. As a part of the new rule WWTF permits include a compliance schedule to evaluate compliance with these new effluent limits. The Tomah WWTF received a re-issued permit in December of 2012. The re-issued permit includes an interim phosphorus limit of 1.0 mg/L for monthly averages, a compliance schedule of 7-9 years with annual requirements, and a target effluent limit of 0.075 mg/L for a 6-month average, with 0.225 mg/L being the limit for monthly averages.

The City of Tomah analyzed compliance options in the November 2015 Phosphorus Compliance Alternatives Plan and selected Adaptive Management, due to the uncertainty of the impact future TMDLs will have on the City's discharge limit.

1.2 Existing Facilities

Wastewater flowing to the Tomah WWTF comes from a combination of residential, commercial, and industrial sources. The population of the City is 9,093 people based upon the 2010 census. The Department of Administration (DOA) estimates the City will continue to grow, with a population projection of 10,860 by the year 2035. The WWTF has three significant industrial dischargers: Band Box (a commercial laundry) Toro (lawn equipment manufacturer), and Cardinal TG (a tempered glass manufacturer).

The WWTF is located on the east side of the City, near the split of the Interstates 90 and 94 and south of the South Fork of the Lemonweir River. Treated effluent is discharged to this river via a 36" outfall pipe extended north to the diffusers located in the river.

The WWTF, constructed in 1998, includes preliminary treatment (influent screening, grit removal, flow metering, and sampling), fermentation tank, selector basins, activated sludge oxidation ditch with enhanced biological phosphorus removal, final clarification, UV disinfection, re-oxygenation, effluent flow metering, and sampling.

Waste activated sludge (WAS) is stored in aerobic tanks, fed to a belt filter press for dewatering, and treated to produce a Class A exceptional quality biosolids through lime stabilization. Stabilized sludge is land applied on nearby agricultural fields, while the filtrate from the belt filter press is equalized prior to being pumped to the head of the WWTF for treatment.

Other than minor issues associated with age, the Tomah WWTF is in good condition with adequate capacity for the foreseeable future. Wastewater flow to the WWTF averages 1.18 million gallons per day (MGD) based upon data from 2009 through August 2015. Average influent BOD and TSS is 3,423 pounds per day and 3,623 pounds per day, respectively. The WWTF's current and design loadings are summarized in Table 1-1 below:

Table 1-1
Tomah WWTF Loadings Summary

Parameter	Current	Design	% Design
Average Flow (MGD)	1.18	2.282	52%
Max Day Flow (MGD)	n/a	6.400	
BOD (lbs/day)	3,423	4,500	76%
TSS (lbs/day)	3,623	4,750	76%
TKN (lbs/day)	220 (NH3)	540	41%
Total Phosphorus (lbs/day)	59	190	31%

1.3 Phosphorus Compliance Evaluation

Per the requirements of the 2012 WPDES permit and its phosphorus compliance schedule, the City of Tomah completed a phosphorus compliance evaluation for the treatment facility, which consists of a series of annual reports.

For the year one report (November 2013), Tomah created an optimization plan for its facility. The optimization plan identified the following six "Actions Plans" in order to reduce the effluent phosphorus concentrations:

1. Contact major industrial contributors to optimize pre-treatment systems and minimize spike loadings.
2. Contact local establishments to minimize loadings associated with wet manufacturing processes, cleaning processes, and detergent products.
3. Collect hauled waste data.
4. Collect recycle loading data.
5. Electronic tracking of hauled waste, industrial and recycle loading data.
6. Review and optimize polyphosphate use in drinking water systems.

For the year two report (November 2014) the city generated a phosphorus planning update, which summarized the progress of the optimization plan, as well as identified the possible compliance options for the facility. The compliance alternatives included:

1. Mechanical upgrade to the existing facility.
2. Consolidation with nearby sewerage system.
3. Alternative discharge locations.
4. Watershed based approaches.
   a. Water Quality Trading
   b. Watershed Adaptive Management
5. Water quality variance

6. New statewide phosphorus variance

The year three report (November 2015) consisted of a phosphorus compliance alternatives plan. In this plan, the alternatives from the year two report were evaluated based on economic and non-economic factors. Economic evaluations considered capital and operational costs through a present worth analysis. Non-economic evaluation considered the feasibility, long term benefit to the City, and environmental benefits of each alternative.

The lowest cost, feasible alternative was found to be Water Quality Trading followed by Adaptive Management and Disk Filtration. Due to the high level of uncertainty associated with the WWTF's future TMDL effluent limits, the City decided to pursue Watershed Adaptive Management.

1.4 Adaptive Management Eligibility

In order to be eligible for Adaptive Management, the Wis. Admin Code NR 217.18 states the watershed in question must meet the following criteria:

1. The phosphorus concentration in the receiving water exceeds the applicable water quality criteria.
2. The amount of phosphorus coming from nonpoint sources (NPS) in the watershed exceeds the phosphorus loading from point sources or NPS must be controlled to comply with the water quality criteria.
3. Filtration or equivalent technology is required to meet the WQBEL.

Based on this criteria, the eligibility of the City of Tomah WWTF with respect to Adaptive Management is as follows:

1. The median phosphorus concentration upstream of the effluent discharge is 0.15-0.24 mg/L, as calculated from sampling in 2012-2016. This exceeds the applicable phosphorus concentration of 0.075 mg/L for streams. A complete list of in-stream sampling data is attached in Appendix A.
2. Per the DNR's Pollutant6 Load Ratio Estimation Tool (PRESTO) model, the Tomah WWTF discharges to a nonpoint source dominated receiving stream. The point to nonpoint source phosphorus ratio is 2:98.
3. In 2013, the Tomah WWTF staff developed an Optimization Action Plan that determined that the WWTF is already optimized to a great extent, and thus additional optimization will not likely yield a significant reduction in effluent phosphorus level. It is anticipated that filtration of an equivalent technology would be required to achieve an effluent concentration of 0.075 mg/L.

It was determined that Tomah was eligible for Adaptive Management, since all three criteria were met.

1.5 Adaptive Management Plan Components

The DNR has created a guideline for a successful Adaptive Management Program, which is outlined below and addressed in the subsequent chapters. The components to develop a successful management plan include:

1. Identify partners
2. Describe the watershed and set load reduction goals
3. Conduct a watershed inventory
4. Identify where reductions will occur
5. Describe management measures
6. Estimate load reductions expected by permit term
7. Measuring success
8. Financial security
9. Implementation schedule with milestones

A schedule of where these components will be addressed is included in Table 1-2.

Table 1-2
DNR Adaptive Management Components

Component	Addressed in
Identify Partners	Section 4.1
Describe the watershed and set load reduction goals	Sections 2 & 3
Conduct a watershed inventory	Section 3
Identify where reductions will occur	Section 4.2
Describe management measures	Section 4.3
Estimate load reductions expected by permit term	Section 3.4
Measuring success	Section 5.8 & 5.9
Financial security	Section 6
Implementation schedule with milestones	Section 5.10

2. WATERSHED DESCRIPTION

The Tomah WWTF is located in the Little Lemonweir River (LLR) Watershed of the Lower Wisconsin River Basin. Throughout this report, the term "LLR watershed" will be used to refer to the watershed upstream of the WWTF outfall. This section presents general information about the LLR watershed characteristics, which are important when evaluating phosphorus loading conditions and modeling future phosphorus reduction strategies. Data were collected from on-line tools and geographic information systems (GIS), such as the DNR Surface Water Data Viewer, and the Nations Resources Conservation Service (NRCS) Web Soil Survey. The data included watershed boundaries, soil data, land use, land cover, and temperature and precipitation statistics.

2.1 HUC and Watershed Information

The LLR watershed is located in HUC 10 #0707000315, and consists of approximately 22% of the HUC 10 watershed. The watershed area upstream of the WWTF outfall is roughly 32,000 acres and is composed primarily of agriculture, forest, and pasture lands. Figure 2-1 shows both the LLR and HUC 10 watershed, for clarification. A map of the HUC 10 watershed, with permitted surface outfalls displayed as triangles, is provided in Figure 2-2, and included in Appendix B.

Figure 2-1: HUC 10 and LLR Watersheds

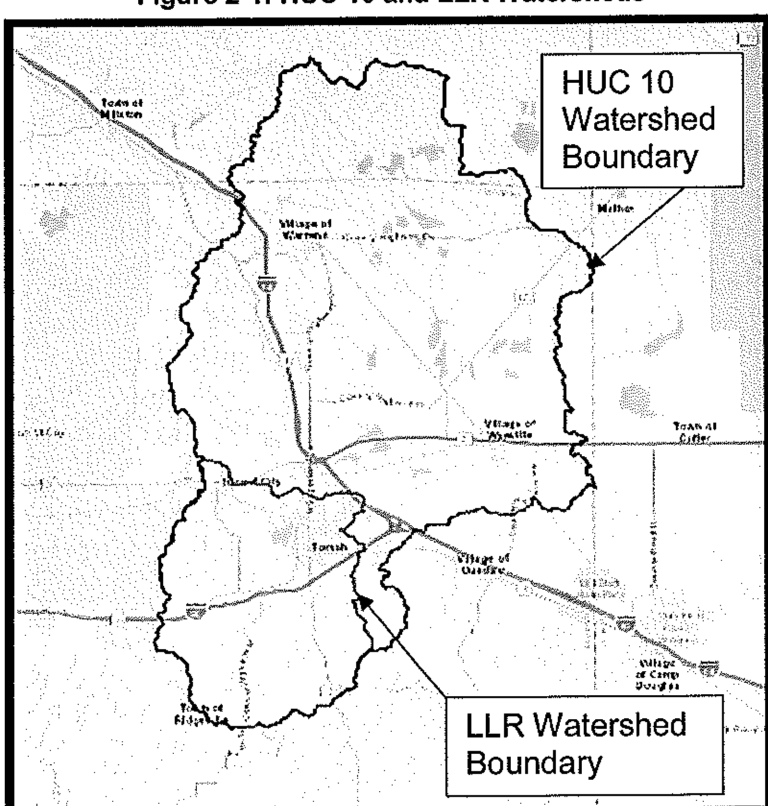
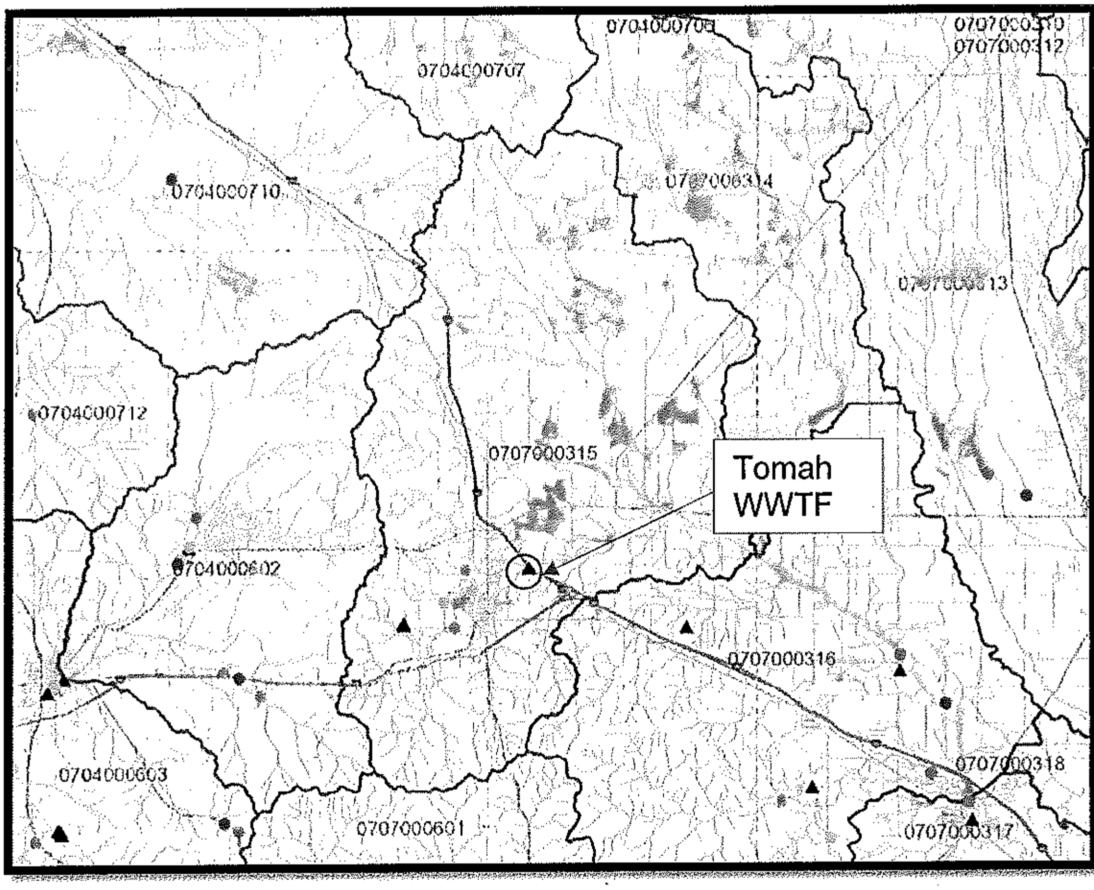


Figure 2-2: HUC 10 Watershed

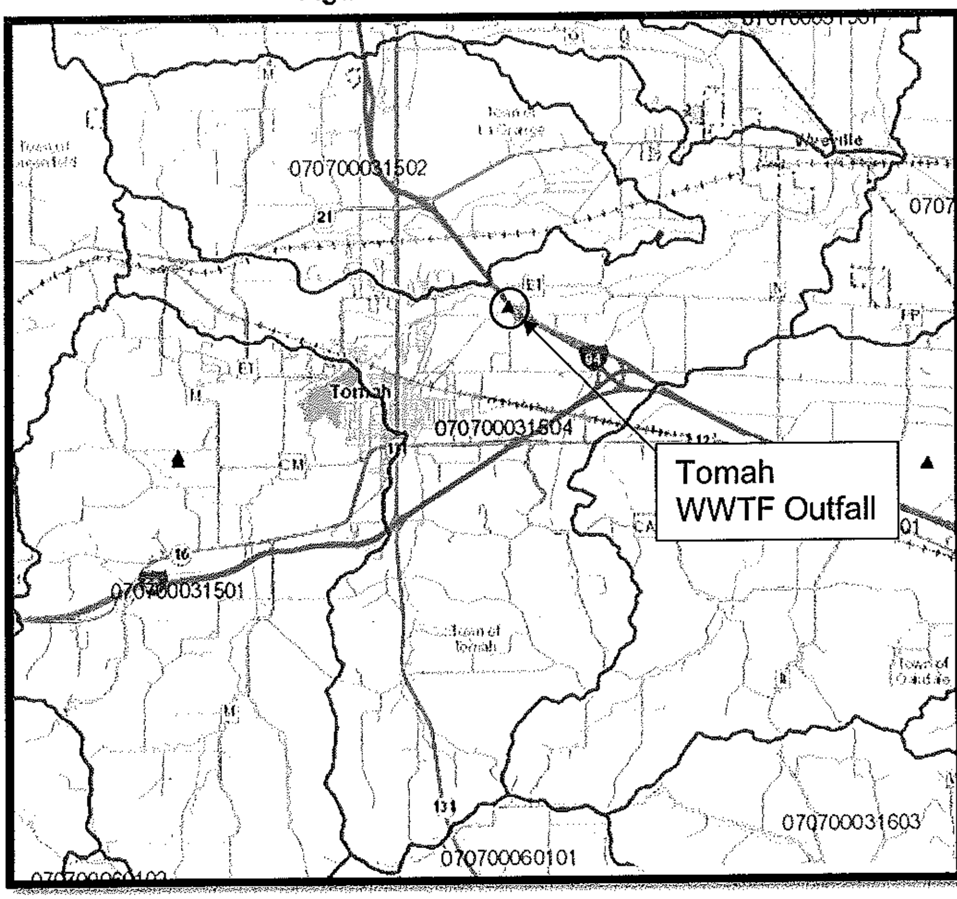


This figure was provided by the DNR's Surface Water Data Viewer Application.

In addition to the Tomah WWTF, there are two other surface water outfalls within the LLR watershed; both for a Concentrated Animal Feeding Operation (CAFO) belonging to Chapman Brothers Farms. This CAFO is permitted under NR 243 and is defined as follows: "A Wisconsin animal feeding operation with 1,000 animal units or more is a large Concentrated Animal Feeding Operation (CAFO). The DNR may designate a smaller-scale animal feeding operation (fewer than 1,000 animal units) as a CAFO if it has pollutant discharges to navigable waters or contaminates a well."

Per the DNR's guidance, the Adaptive Management action area should be limited to the HUC 12 watershed where the point source is located. However, if the HUC 12 does not have a sufficient area to target for the required load reduction, areas upstream in the HUC 10 can be targeted. The Tomah WWTF is located within HUC 12 is #070700031504 which has an approximate area of 24,000 acres and is composed of primarily agricultural and forested land, making up 38 and 30 percent of the total area, respectively, and includes northerna and western portions of the City of Tomah. The City of Tomah will look within the entire LLR watershed to target potential phosphorus reductions. A complete list of land use for the action area is included in Appendix E. A map of the HUC 12 watershed is provided in Figure 2-3, and is included in Appendix B.

Figure 2-3: HUC 12 Watershed



This figure was provided by the DNR's Surface Water Data Viewer Application.

2.2 Receiving Water Description

The Tomah WWTF discharges to the South Fork of the Lemonweir River, located in the Little Lemonweir River (LLR) watershed of the Lower Wisconsin River basin. This river is classified as a warm water sport fishery, a nonpublic water supply, and is impaired. A complete map of impaired stream designations in the LLR watershed is included in Appendix C. Per NR 102.60 Section (3) Paragraph (a), South Fork of the Lemonweir River is not listed as having a total phosphorus criterion of 0.1 mg/L, so it shall meet a total phosphorus criterion of 0.075 mg/L.

Per the DNR's PRESTO model, the Tomah WWTF discharges to a nonpoint source dominated receiving stream. The point to nonpoint source phosphorus ratio is 2:98. The PRESTO model indicates the nonpoint source phosphorus load from upstream of the WWTF is 37,262 pounds per year, compared to the point source load of 702 pounds. The Tomah WWTF is the only point source in the LLR watershed. A copy of the PRESTO results are included in Appendix C.

Lake Tomah is located with the LLR watershed and is upstream of the Tomah WWTF outfall. According to the Lake Tomah Management Plan, Lake Tomah has been a valuable recreational resource for the community of Tomah since the lake was formed by damming the South Fork of the Lemonweir River in 1938. The lake and its shoreline is used by community residents for boating, hunting, fishing, and many other recreational activities.

Lake Tomah covers approximately 245 acres and is classified as hypereutrophic by the WDNR. Lake Tomah has a long history of actions taken to try and improve its quality. The first project took place in 1992 and 1993, when the lake was dredged, and a new dam and sediment fore bay were created. After the project took place, there was a drastic increase in the number of carp in the lake. The carp rooted up the bottom of the lake, tearing out aquatic vegetation, and made it more difficult for desirable fish species to reproduce. In 2009, Lake Tomah was drawn down and chemically treated to kill all fish species in it, as a way to eradicate the invasive carp. In 2010 the DNR restocked the lake with bluegill, largemouth bass and northern pike. Since then, the fish population has bounced back, although there are still high phosphorus levels, possibly due to excessive runoff of nutrients contributing significantly to poor water quality.

2.3 Climate and Precipitation

Climatological information can play an important role when modeling phosphorus loads in runoff and calculating phosphorus reductions. Climate and precipitation data for the LLR watershed from 1995 to 2015 were obtained from the National Oceanic and Atmospheric Administration (NOAA). Data from the Tomah weather station were selected to represent the watershed. Average monthly temperatures range from a high of 72.2°F in July to a low of 16.4°F in January. Average monthly precipitation (both rainfall and snowfall) ranged from a high of 5.39 inches in June to a low of 0.96 inches in January. The average annual precipitation over the 21 years reported was 32.93 inches. Table 2-1 represents average monthly data for the reporting period.

Table 2-1
NOAA Climate Data

	Temperature			Precipitation		
Month	Min (°F)	Max (°F)	Average (°F)	Min (inches)	Max (inches)	Average (inches)
Jan	6.0	29.5	16.4	0.44	2.17	0.96
Feb	6.4	32.7	20.3	0.07	2.19	1.03
Mar	22.9	48.9	32.4	0.00	3.50	1.65
Apr	40.0	51.7	45.9	0.65	7.45	3.61
May	52.3	63.0	57.5	1.34	10.08	4.66
June	64.8	72.6	67.9	1.10	10.42	5.39

July	66.2	78.4	72.2	0.75	9.40	3.58
Aug	64.5	75.3	69.9	1.29	11.91	4.16
Sept	57.7	66.4	61.5	0.61	8.00	2.71
Oct	43.2	54.8	48.4	0.75	5.17	2.39
Nov	25.7	46.5	35.2	0.18	3.53	1.56
Dec	9.0	29.2	21.6	0.05	2.85	1.21

It is important to recognize the impact of extreme weather events on erosion and subsequent transport of sediment, including phosphorus, into surface water. Extreme precipitation can result in excessive loads of phosphorus entering surface water, carried by runoff.

2.4 Soil Types

Data on soil types was available through the NRCS's Web Soil Survey (WSS) and Soil Survey Geographic Database (SSURGO). The predominant soil types in the watershed were silt loam and sandy loam. Soil data was used in conjunction with additional data, such as land cover, in several modeling applications. Soil data can be used in calculating the Phosphorus Index (PI) of the land, selecting locations for phosphorus reducing projects, and modeling future phosphorus reductions. A complete map and table of soil types for the LLR watershed is attached in Appendix D.

2.5 Land Use

Land use data was obtained through Purdue University's long Term Hydrologic Impact Analysis (L-THIA) model. As with soil type, land use was used in the modeling of phosphorus loads and reduction, as well as to help determine where management measures should take place. The LLR Watershed is primarily made up of agricultural land, deciduous forest, and pasture/hay land. These major land use types make up 41%, 23%, and 14% of the watershed, respectively. The LLR watershed also contains most of the City of Tomah, so land use adjacent to the city may change due to future development. A complete breakdown of land use for the LLR watershed, as well as the HUC 10 and HUC 12 watersheds, is included in Appendix E.

2.6 Wetlands

The HUC 10 spotted with several small emergent and woody wetlands. Respectively, these wetlands make up 1.1% and 1.4% of the watershed by area. A complete map of the wetland results from the Surface Water Data Viewer is attached in Appendix F. It is important to remember that wetland can be both a source of phosphorus or can aid in phosphorus reduction. For these reasons, wetland areas should be evaluated before starting any wetland restoration projects.

3. WATERSHED INVENTORY

This watershed inventory for the Little Lemonweir River (LLR) watershed expands on the watershed characteristics from the previous section to provide insight into where phosphorus management measures could be implemented.

3.1 Point Sources-Current Phosphorus Loads

The EPA defines point sources as "any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack." With respect to water pollution, common point sources are municipal WWTFs and industries/factories. In the LLR watershed, there are no sources from industries or factories, only the Tomah WWTF.

3.1.1 Municipal WWTFs

The Tomah WWTF discharges to the South Fork of the Little Lemonweir River. Current effluent phosphorus data for the Tomah WWTF is summarized in Table 3-1. Values for the daily loads were calculated by using annual averages. A complete summary of effluent phosphorus data for Tomah can be found in Appendix G.

Table 3-1
Effluent Phosphorus Summary

	Flow	Phos. Conc.	Phos. Loading	Phos. Loading
Year	MGD	mg/L	lbs/ day	lbs/ year
2009	1.11	0.12	1.15	418
2010	1.17	0.23	2.27	827
2011	1.31	0.17	2.32	847
2012	1.04	0.14	1.24	452
2013	1.17	0.30	2.92	1,065
2014	1.18	0.24	2.38	867
2015	1.06	0.33	3.01	1,097

3.2 Nonpoint Sources of Phosphorus

According to the EPA, "Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters."

In the LLR watershed, typical NPS pollution originates from erosion of farmland and streambanks, as well as runoff from barnyards.

3.2.1 Areas of High Erosion

One way to prioritize areas within a watershed that may be vulnerable to water erosion is with the DNR EVAAL tool, which was used in correlation with soil, land cover and watershed data. This tool allows for the identification of areas that may be most vulnerable to erosion. The EVAAL tool results in a graphic and tabular data set that depicts areas of high vulnerability and can be used to prioritize and focus efforts by identifying fields with high nutrient and sediment transportation.

In order to use the EVAAL tool, the following datasets had to be obtained: LiDAR-based Digital Elevation Model, Area of Interest Boundary, USDA-NRCS Soil Survey Geographic, and Culvert Lines. Using these datasets and the DNR's EVAAL tool, EVAAL maps for the watershed and subbasins were created and are attached in Appendix H.

The results of the EVAAL tool revealed the highest vulnerability areas to be steep sloping areas on the hills in the south and west portions of the HUC 10 watershed. Because of Monroe County's topography, gully erosion is a noteworthy concern. The Soil Survey of Monroe County states "The southern and western two-thirds of the county is in the Driftless Area of Wisconsin. This region consists of a highly dissected plateau characterized by narrow ridges and deep, fairly broad valleys. The remaining one-third of the county, in the northeast and east-central area, is in the basin of the glacial Lake Wisconsin." This Driftless Area can be vulnerable to erosion due to the nature of the topography. Although areas that may be vulnerable to erosion should be targeted for management measures, the accessibility of the land ultimately determines which areas can be targeted.

3.2.2 CAFOs

CAFOs (Concentrated Animal Feeding Operations) may generate a substantial amount of manure, which naturally contains phosphorus. This manure is typically disposed of by land applying it as fertilizer. This fertilizer can subsequently be washed off after a large storm event and enter surface water. The fact that the fertilizer is land applied played a large part in the U.S. Court of Appeals case that led to the EPA creating its 2008 CAFO rule. This rule states that agricultural stormwater is exempted from being considered a point source, but the EPA may treat the land application of excessive manure as a point source. This result of the rule is that while CAFOs are not considered a point source, they may have to apply for a NPDES permit, or in Wisconsin, a WPDES permit.

Currently in the LLR watershed, there is one farm, with two outfalls, defined as a CAFO with a WPDES permit. Detailed CAFO information states that this permit, number 0062774, issued to Chapman Brothers Farm, expired on September 30, 2015. The permit listed the animal type as "Dairy" with 1047 units.

3.2.3 Barnyards

Outdoor dairy and beef cattle lots can be a significant source of phosphorus entering into surface water. Since Wisconsin has a large beef and dairy industry, it is important that barnyards be examined as a possible target area to reduce phosphorus concentrations. The 2016 Monroe County LCD inventory counted 17 active barnyards and 3 free stall barns in the Lake Tomah Watershed, which is a subsection of the LLR watershed.

3.2.4 Streambanks

Streambank erosion can be a source of sediment and nutrients entering into surface water, as well as having a damaging effect on the habitat. Sedimentation can fill pore spaces, reduce oxygen content, and increase turbidity. Excessive phosphorus loading can lead to eutrophication.

Streambank erosion has historically been an issue in the LLR watershed due to the steep gradient of slopes, high stream velocities, and the extent of agricultural activities in the watershed.

3.2.5 Phosphorus Nonpoint Source Summary

According to the DNR PRESTO model results, non-point sources are estimated to contribute 98% of the phosphorus load within the LLR watershed. While the quantities of phosphorus contributed from each of the nonpoint sources listed above are not known, it is recognized that erosion of land and streambanks, and runoff from barnyards and feedlots are all potential targets for phosphorus management measures.

3.3 Stream Monitoring Program

3.3.1 Historic Phosphorus Data

Background phosphorus data for the South Fork of the Lemonweir River was obtained from the DNR's Surface Water Data Viewer mapping software. There were several sampling stations on tributaries of the South Fork of the Lemonweir River, Deer Creek and Council Creek. Additionally, there were sampling stations on Lake Tomah, which drains to the South Fork of the Lemonweir River via Council Creek. Recent phosphorus concentrations (within the last 10 years) for these sites ranged from 0.035 mg/L to 1.18 mg/L. Due to changes within the watershed, these samples may not be representative of existing conditions. A map of these sampling stations, as well as a complete summary of sampling data is attached in Appendices A and C.

3.3.2 In-Stream Sampling Program

To obtain a better idea of in-stream conditions, the Tomah staff began periodically sampling upstream of the WWTF on the South Fork of the Lemonweir River and Council Creek, and downstream on the South Fork of the Lemonweir River beginning in February 2012 until May 2013. Lemonweir River is sampled upstream at the Glendale Avenue Bridge, downstream at the Industrial Avenue Bridge, and Council Creek is sampled at the Town Line Bridge. Bi-monthly in-stream sampling began in April of 2015 and is ongoing. In 2012-2016 forty-one (41) samples were taken at each location, with twenty-seven (27) of those sample being between May and October and used to calculate the median in-stream phosphorus concentration. The upstream phosphorus concentration for Lemonweir River is 0.18 mg/L, while the downstream concentration is 0.24 mg/L, and the concentration for Council Creek is 0.30 mg/L. This information is included in Appendix A. A map of sampling points is located in Appendix C.

Samples are collected from the center of the stream then placed into preserved sample bottles for future analysis by method SM4500-PE-1999. Care is taken while sampling to avoid disturbing the sampling site. The samples are analyzed by the Tomah WWTF lab (#642007190) with a total phosphorus limit of detection/limit of quantification (LOD/LOQ) of 0.038/0.13 mg/L in 2014, 0.12/0.45 mg/L in 2015 and 0.013/0.043 mg/L in 2016.

In addition to in-stream phosphorus sampling, the Tomah WWTF staff also collects composite effluent phosphorus samples at the outfall three times a week, in accordance with the WPDES permit.

For Adaptive Management, the only required monitoring parameters are in-stream phosphorus and flow, and the only required sampling area is at the outfall location, which serves as the point of compliance.

3.3.3 Future Stream Monitoring Program

The City of Tomah will continue to sample at both upstream locations on the South Fork of the Little Lemonweir River and Council Creek, as well as downstream on the South Fork of Little Lemonweir River. Samples will be collected bi-monthly, and tested for phosphorus concentrations at the Tomah WWTF using the same procedures as the current sampling.

3.4 Required Phosphorus Load Reduction

Following the guidance for Adaptive Management, phosphorus reductions were calculated for the first permit term. Although the calculation will be for the minimum reduction per permit term, it may be advantageous to offset more than the minimum reduction required to improve the chances of success for Adaptive Management.

Variables for calculations:

- Average flow (2012-2015) of the Tomah treatment plant= **1.11 MGD**
- 4-year (2012-2015) monthly average effluent phosphorus concentration = **0.25 mg/L**
- Annual mean flow of South Fork of Lemonweir Creek (from DNR) at the point of Compliance= **38.3 MGD**
- Average phosphorus concentration of South Fork of Lemonweir Creek (as stated in Section 3.3.2) = **0.18 mg/L**
- 8.34= unit conversion
- Water Quality Criterion for phosphorus= **0.075 mg/L**

Term1:

Step 1: Calculate the current discharge as an annual load.

$$1.11\ MGDx\ 0.25\frac{mg}{L}x\ 8.34\ x\ 365\frac{days}{year} = \mathbf{845\frac{pounds}{year}}$$

Step 2: Calculate the current load in the receiving water just downstream from the discharge

$$845\ \frac{pounds}{year} + \left(38.3\ MGD * 0.18\frac{mg}{L} * 8.34 * 365\frac{days}{year}\right) = \mathbf{21,831\frac{pounds}{year}}$$

Step 3: Calculate the applicant's percent contribution of load.

$$\frac{845\frac{pounds}{year}}{21{,}831\frac{pounds}{year}} * 100 = \mathbf{3.87\%}$$

Step 4: Calculate the allowable load in the receiving water.

$$(38.3\ MGD + 1.11\ MGD) * 0.075\frac{mg}{L} * 8.34 * 365\frac{days}{year} = \mathbf{8,998\frac{pounds}{year}}$$

Step 5: Calculate the needed reduction in the receiving water

$$21{,}831\frac{pounds}{year} - 8{,}998\frac{pounds}{year} = \mathbf{12.833\frac{pounds}{year}}$$

Step 6: Calculate the applicant's proportional share of the needed reduction.

$$12{,}833\frac{pounds}{year} * 3.87\% = \mathbf{497\frac{pounds}{year}}$$

For the first permit term of 5 years, the Tomah WWTF needs to reduce at least 497 pounds of phosphorus a year throughout the Adaptive Management program. This will be accomplished by a combination of management measures as described in Section 4.3. In order to calculate the expected phosphorus load reductions, modeling tools (such as SNAP-Plus and BARNY) will be employed. If measures employed during the first permit term of Adaptive Management do not show water quality improvement, the Adaptive Management plan will be modified in subsequent permit terms to offset more of the phosphorus load than required for the first permit term.

To calculate the phosphorus load reduction for the second term, the phosphorus load of the receiving water will be monitored and recorded. Once the new load is determined, the allowable load of the receiving water will be subtracted from the new phosphorus loading, and the remaining phosphorus load will be the reduction needed for Permit Term 2.

3.5 Sensitivity Analysis

In order to estimate the total acreage needed for management measures, a sensitivity analysis was constructed. For each acre of land, varying loads of phosphorus reduction were assumed in order to calculate total acreage. Table 3-2 shows the total acreage needed meets the minimum offset needed for the Tomah WWTF's first permit term, if only field based practices are utilized.

Table 3-2
Phosphorus Reduction Sensitivity Analysis

Pounds of P reduction/ acre	Acres needed for Permit Term 1
0.5	994
1	497
2	249
3	166

For the first permit term, between 166 and 994 acres would be needed for management measures, assuming between 0.5 and 3 pounds per acre reduction. These numbers are based on previous experience with phosphorus reduction in Wisconsin, but soil testing and additional modeling will be completed by the Monroe County Land Conservation Department (LCD) to determine the actual reductions from management measures.

4. PROJECT PLANNING

4.1 Partners

The success of Adaptive Management depends on the joint effort of many partners, and it is import to identify the roles and responsibilities of each partner at the onset of the project. For the Tomah Adaptive Management Plan, the following governmental, professional, and local partners have been identified:

4.1.1 WPDES Permit Holder

The Tomah WWTF is operated by the City of Tomah and treats domestic wastewater from the City of Tomah and industrial wastewater from Band Box (a commercial laundry), Toro (a lawn equipment manufacturer), and Cardinal TG (a tempered glass manufacturer). The WWTF was constructed in 1998, and has only needed minor upgrades since it began operating.

The Tomah WWTF is the only WPDES permit holder eligible for Adaptive Management in the watershed. There are two additional WPDES outfalls located in the watershed, both originating from Chapman Brothers Farm.

The City of Tomah will be responsible for financial matters, sampling, verification of implemented practices, stream monitoring, meeting the facility's interim phosphorus limits, and generating annual reports.

4.1.2 Town and Country Engineering

Town and Country Engineering is a consulting firm that was organized in 1981, and works with municipalities in Wisconsin. They have experience in wastewater treatment analysis and design, as well as the design and analysis of water and sewer systems, wells and water treatment facilities, stormwater management, and general municipal engineering.

Town and Country designed the Tomah WWTF in 1996-1997 and since has assisted with upgrades and operations. Town & Country works with the City to ensure that the treatment plant is operating most efficiently, and has assisted the City with its phosphorus compliance evaluations.

With respect to Adaptive Management, Town & Country's role will include modeling, mapping, budget review, Adaptive Management Plan development, and evaluation of effluent and stream data.

4.1.3 Monroe County Land Conservation Department

The Monroe Country Land Conservation Department (LCD) is a governmental agency developed to ensure the protection and enhancement of Monroe County's natural resources. The Monroe County LCD administers and assists with a variety of County, State, and Federal conservation programs.

The Monroe County LCD will act as a broker between the City of Tomah and landowners in establishing cost sharing agreements and will assist in field-verifying Adaptive Management practices. Their responsibilities will include modeling with SNAP-Plus (and any other models required), assisting with grants, mapping, estimating load reductions, and conducting site inspections.

4.1.4 Local Landowners and Agricultural Producers

Farmers in the LLR watershed are typically dairy farmers, cash croppers, or cranberry growers. According to the land use data obtained by L-THIA, agricultural land makes up 41% of land in the LLR watershed.

The City of Tomah and the Monroe County LCD will establish contracts with landowners to install or implement management measures. If established in the contract, it will be up to the landowners and farmers to maintain the management measures outlined in their contract, with verification and inspection of the management being conducted by the City or the Monroe County LCD.

4.1.5 Other Stakeholders/Partners

There are several other organizations that could have interest or play a role in future Adaptive Management projects, including:

- *Lake Tomah Committee*: affiliated with the City of Tomah, it aids with determining ordinances for the lake as well as sampling and dredging Lake Tomah.
- *Gathering Waters Conservancy*: helps land trusts, landowners and communities by advocating for funding and policies that support land conservation, and fostering a community of practices that promotes land trust excellence and advancement.
- *Natural Resources Conservation Service (NRCS):* is the federal agency that works with landowners on private lands to conserve natural resources. NRCS is part of the U.S. Department of Agriculture. They were formerly called the Soil Conservation Service or "SCS".
- *Farm Service Agency (FSA):* is a federal agency that administers farm commodity, crop insurance, credit, environmental, conservation, and emergency assistance programs for farmers and ranchers.
- *United States Geological Survey (USGS):* is a scientific agency of the United States government. The USGS works in cooperation with more than 2,000 organizations across the country to provide reliable, impartial

scientific information to resource managers, planners, and other customers.

Currently, there is no association between these organizations and the projects for the Tomah Adaptive Management Plan.

4.1.6 Summary of Partners

The current partners for the Tomah Adaptive Management plan, along with their roles and responsibilities are summarized in Table 4-1.

Table 4-1
Roles and Responsibilities

Party	Roles/Responsibilities
Tomah Wastewater Treatment Facility	• Financial matters • Stream and Wastewater Sampling • Verification of implemented practices • Stream monitoring • Meeting the facility's interim P limits • Annual Reporting
Town & Country Engineering	• Modeling • Mapping • Budget review • Adaptive Management Plan development • Assisting with grants • Data evaluation (effluent and stream)
Monroe County Land Conservation Department	• Modeling • Assisting with grants • Mapping • Estimating load reductions • Conducting site inspections • Negotiating cost-share agreements • Verification of implemented practices
Landowners and Agricultural Producers	• Maintaining management measures

4.2 Areas of Phosphorus Reduction

For the LLR watershed, both point and nonpoint source phosphorus reductions will occur. Traditional point source reductions will occur at the Tomah WWTF, by maximizing the efficiency of the current biological phosphorus removal, in combination with chemical additions when needed. Currently, Tomah is averaging 0.12 mg/L to 0.33 mg/L of effluent phosphorus, so they are confident they will be able to meet the interim limits assigned to them for each permit term, which are 0.80 mg/L for the first term and second term, and 0.50 mg/L for the third term. Non point source reductions are described in the following sections.

4.3 Nonpoint Source Management Measures

Nonpoint reductions will be obtained using a combination of Best Management Practices (BMPs) that are described in the following sections. Information about BMPs was obtained from the NRCS website. Most of these BMP's apply only to agricultural land, but some may also be used in urban areas.

4.3.1 Nutrient Management Planning

Nutrient management plans match nutrient inputs to crop demand, in order to maximize the return on nutrients while simultaneously limiting the nutrient loss. Typically, nutrient management plans are devised using analysis from SnapPlus modeling. Currently, many farmers are already utilizing nutrient management plans, so there may not be many opportunities to reduce phosphorus loading further with this method. The Monroe County LCD will help identify target areas for nutrient management planning.

4.3.2 Cover Crops

According to the USDA NRCS factsheet, "A cover crop is grasses, legumes, forbs or other herbaceous plants that are established for seasonal cover and conservation purposes. Cover crops are planted in the late summer or fall around harvest and before spring planting of the following year's crops. Common cover crops used in Wisconsin include winter hardy plants such as barley, rye and wheat."

Cover crops are used after harvesting, when the soil is loose and vulnerable to erosion. Roots from the cover crop increase the stability of the soil, while the additional vegetation can act as a filter to separate out suspended soils from stormwater runoff. Additional benefits of cover crops include increased soil porosity and infiltration, reduction of soil compaction, and improved soil health.

For the LLR watershed, cover crops may be used at any locations where cover crops are not currently being utilized. Determination of feasibility for this management measure will be made on a case-by-case basis, following initial site inspections.

4.3.3 Conservation Buffers

Referring to the USDA NRCS factsheet, "Conservation buffers are small areas of land in permanent vegetation, designed to intercept pollutants and manage other environmental concerns. Types of buffers include riparian buffers, filter strips, grassed waterways, contour grass strips, field borders, and vegetative barriers. Strategically placed buffer strips in the agricultural landscape can effectively mitigate the movement of sediment, nutrients, and pesticides within farm fields and from farm fields. When coupled with appropriate upland treatments, buffer strips should allow farmers to achieve a measure of environmental sustainability in their operations.

Buffers slow water runoff, trap sediment, and enhance filtration within the buffer. Buffers also trap fertilizers, pesticides, pathogens, and heavy metals, and they help trap snow and cut down on blowing soil in areas with strong winds."

Several types of conservation buffers may be implemented within the LLR watershed. These buffers include grassed waterways, contour grass strip, and buffer strips. Details about these buffers and how each of these buffers may be utilized in the LLR watershed are provided below.

Grassed Waterways

Grassed waterways are broad, shallow channels designed to move surface water across farmland without causing soil erosion. The vegetative cover in waterways slows the water flow and protects the channel surface from rill and gully erosion. Grassed waterways can be used in conjunction with harvestable buffers and cover crops to increase phosphorus reductions. The current use of grassed waterways and their potential use for the future will be assessed during the site visits.

Contour Grass Strips

Contour grass strips are strips of perennial vegetation alternated down the slope with wider cultivated strips that are farmed on the contour. These strips are usually narrower than the cultivated strips. Vegetation in these strips consists of species of grasses or a mixture of grasses and legumes. Contour grass strips established on the contour can significantly reduce sheet and rill erosion, as well as slow runoff and trap sediment. Since the LLR has areas of steep slopes, contour grass strips may be a viable option for these parcels. Farm parcels will be evaluated during site visits to determine the effectiveness of contour grass strips.

Buffer Strips

Buffer strips create soil stability between areas that are utilized for crops and streams or water features. They are designed to intercept sediment and other pollutants before they enter the stream. Currently in Monroe County there is a CREP (Conservation Reserve Enhancement Program) that allows farmers to establish a perennial grass cover in return for an annual payment. Eligible land must have a crop history (been planted with a commodity crop in 2 out of the last 5 years) or meet the qualifications of marginal pastureland. Potential buffer strip areas will be assessed for eligibility during site visits.

4.3.4 Tillage Changes

Changing the tillage practices on cropland can provide effective control to erosion and can improve soil properties and soil quality. A common option is no till practices, which allows a farmer to plant the crop and control weeds without turning the soil. Traditional plowing reduces the farm's long-term productivity by exposing organic-matter-rich top soil to the surface and breaking up clods that slowly and naturally form in the soil.

High organic matter and good clod formation are both crucial aspects of fertile soil. Organic matter attracts and holds onto water, and its slow breakdown releases vital nutrients into the soil. When soil is turned, the organic matter is exposed to the atmosphere and oxidized into carbon dioxide. Less organic matter in the soil means less water retention, less nutrient release and less clod formation. The broken up clods are exposed to rainfall, which further breaks down the clods and forms a soil crust on the field surface, causing surface runoff and soil erosion.

No-till agriculture uses a disk or chisel plow to prepare the field for seeding. These plows create a narrow furrow, just large enough for the seed to be injected. After the seed and fertilizer is injected, an attachment closes up the furrow. This way the farm field can be seeded with minimal soil disturbance.

As with other management measures, the potential for no till practices will be evaluated during site visits.

4.3.5 Manure Management

Phosphorus is present naturally in animal manure, and when subsequently applied to agricultural land, can be a primary source of phosphorus to surface and groundwater. This phosphorus reaches surface waters by being carried in runoff if the manure is not properly stored. In order to reduce the amount of manure, and therefore phosphorus, entering surface water, runoff control practices should be installed. The most common practices for manure management include improved collection and storage, as well as optimizing application rates. The need for and feasibility of manure management will be assessed on a case-by-case basis upon recommendations by the Monroe County LCD.

4.3.6 Runoff Control from Barnyards

Barnyards and feedlots can be a substantial source of phosphorus. This is due to the presence of manure and the phosphorus naturally occurring in it, as well as the phosphorus that has accumulated in the soil. If not managed correctly, manure that accumulates in barnyards can be carried via runoff to surface waters from storm events. These storm events can cause erosion and carry a significant amount of soil in the runoff, which is an additional source of phosphorus in the surface water. In order to reduce phosphorus pollution, it is important to manage the runoff coming through barnyards.

Runoff management allows for the direction of rainwater and other runoff water away from manure storage facilities. Additionally, the barnyard should be on a surface that can be cleaned so that manure may be removed, limiting the quantity of manure that can potentially be washed off. Roof gutters, surface water diversions and drip trenches can also keep water clean, and away from the barnyard.

In 2016, the Monroe County LCD conducted a barnyard inventory to note barnyards that could have potential concerns with regard to resource management, as well as compare results with the previous 1991 barnyard inventory. The previous inventory counted 59 active barnyards (cattle present on site) and 2,656 total head of cattle. The 2016 inventory counted 17 active barnyards, 3 free stall barns, and 2,353 total head of cattle. Out of the 17 barnyards, 10 were considered to be a resource concern. These concerns included runoff draining to the road ditch, having no buffer for the stream, and old filter strips that were no longer effective. These 10 barnyards will be investigated for the potential management measures to reduce phosphorus runoff.

4.3.7 Streambank Restoration

Streambank restoration is accomplished by reinforcing the streambank and reestablishing the general structure and function of the stream. Streambank restoration reduces erosion, but can be a costly management measure. However, restoration can have other benefits such as improvements of fish habitats and aesthetic improvements that may be desirable to landowners and watershed stakeholders. Streambank restoration can be used in both urban and rural areas and may be feasible for parts of the LLR watershed.

4.3.8 Dredging

An option for lakes that are in need of drastic improvement is dredging. This is accomplished with heavy equipment or specialized hydraulic dredges that can remove accumulated lake sediments to increase depth and to eliminate nutrient-rich sediments. Dredging may control rooted aquatic vegetation, deepen the water body, and increase lake volume. By removing nutrient-rich sediment, dredging may improve water quality and reduce phosphorus levels.

Some dredging drawbacks include resuspension of sediments during the dredging operation and the temporary destruction of habitat. Large-scale dredging is extremely expensive due to equipment costs, permitting issues, and disposal of the removed sediment.

Lake Tomah has been previously dredged in 1992 as part of the Lake Tomah Priority Watershed Program, and the fore bay was dredged in 2009 in order to improve the water quality of the lake. An approximate total of 2,500 cubic yards of sediment was removed from the fore bay during the 2009 dredging. The City plans to dredge the fore bay every 10 years in order to maintain the efficiency of the fore bay and improve water quality in Lake Tomah.

4.3.9 Check Dams

A check dam is a small, sometimes temporary, dam that is constructed across a swale or a drainage ditch to counter erosion by slowing the velocity of runoff. These check dams can be constructed of rock, gravel bags, sand bags or even logs. Check dams can also improve the water quality of runoff by trapping sediment in the structure, or causing the sediment to settle out in the ponding conditions created behind the check dam. Potential locations for check dams will be identified during site visits.

4.4 Prioritization of Management Measures

It is recommended that phosphorus reductions target "critical source areas" or CSAs, which are areas that contribute a disproportional amount of phosphorus to the receiving water. These areas typically store and transport phosphorus, and both factors come into play when locating CSAs. In the process of identifying CSAs, the EVAAL tool and site visits were used to find areas of high erosion.

During the site visits, source factors and transport factors will be identified. Source factors include phosphorus soil tests, application rate of phosphorus fertilizer and manure, and application method of phosphorus fertilizer and manure. Transport factors include erosion potential (identified visually to be used in conjunction with EVAAL data), runoff, and connectivity to receiving water.

A representative from the Monroe County LCD, as well as possibly a member of Town & Country Engineering, will conduct site visits with each of the land owners to gather data and assess options for each parcel. Following the enrollment of the initial project partners, the process of identifying CSAs and conducting site visits will be repeated as the Adaptive Management program is expanded.

4.5 Potential Nonpoint Source Projects

The following potential projects have been identified for the initial implementation of Adaptive Management in the LLR watershed.

Linehan Farm

The Linehan farm is located on the southwest side of Tomah and consists of approximately 430 acres of pasture, forested, and crop land, with the South Fork of the Little Lemonweir River running through it. The pasture is roughly 74 acres in size and runs parallel to the river, and is currently used by 200 head of cattle.

Presently, cattle have access to the river that runs through the pasture, which can cause enhanced erosion from the banks, and the removal of the vegetation adjacent to the river can result in the mobilization of sediment into the water. In order to reduce the load of phosphorus entering the river, the pasture will be taken out of service and turned into a buffer strip that is approximately 150 ft wide on each side of the river. Additionally, the owner intends to reduce the number of cattle from 200 to 20, and install a filter strip between the barnyard and the river.

Chapman Farms

The Chapman Farms-Land LLC owns around 75 parcels totaling 1950 acres on the southwest side of Tomah. Previous meetings between the owners of Chapman Farms and the Monroe County LCD have indicated that there is interest with both parties to explore potential projects for phosphorus reduction.

Currently, the LCD is using the EVAAL results for the area to research which areas would benefit from the installation of check dams. These check dams would slow the velocity of concentrated flows from storm events, reducing gully erosion in the channel and allowing sediment to settle out.

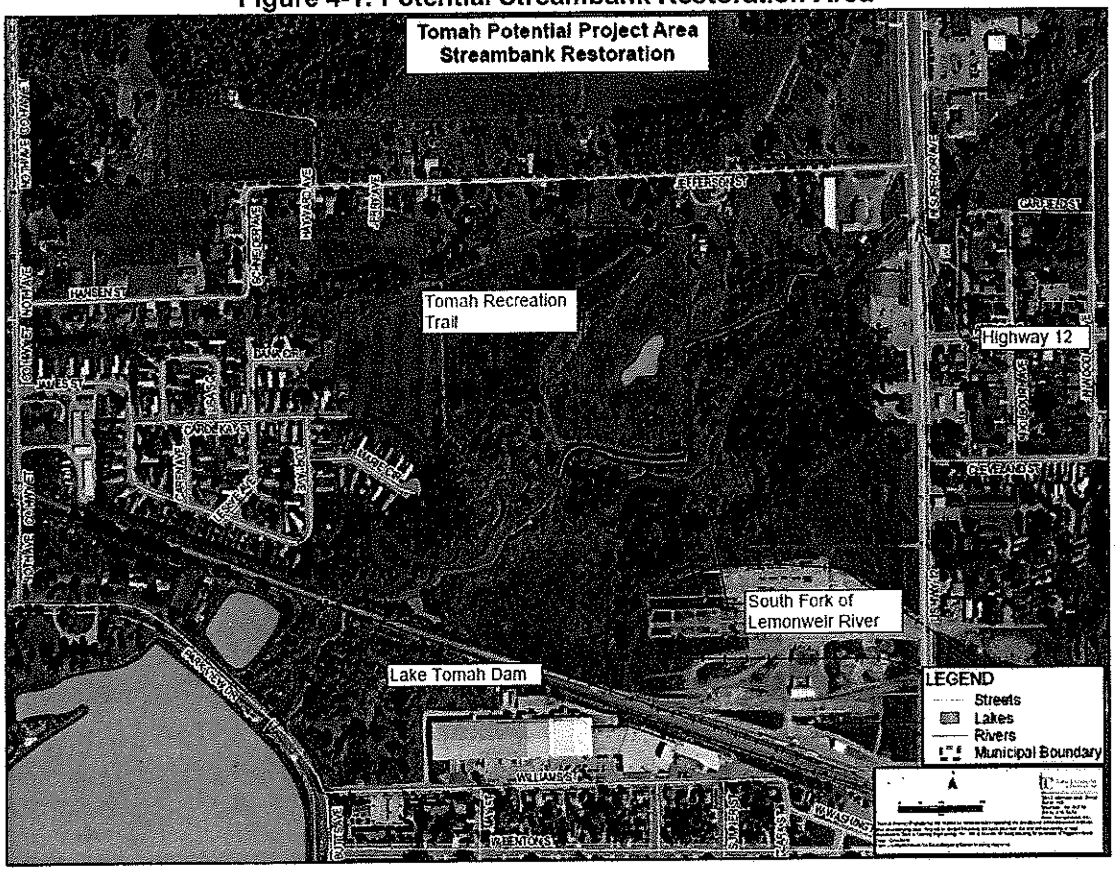
Lake Tomah Sediment Fore Bay

The sediment fore bay for Lake Tomah was last dredged in 2009, and 2500 cubic yards of material was removed. The City plans to dredge the fore bay again in the upcoming years and implement a regular dredging schedule for the fore bay of approximately every 10 years. Dredging the phosphorus-rich sediment from the fore bay will enhance the water quality entering the Lake, and draining into the Council Creek, a tributary of the South Fork of the Little Lemonweir River.

Streambank Restoration

For initial streambank restoration projects, the City will examine the stretch of the South Fork of the Lemonweir River that runs between the dam at Lake Tomah and the crossing at Highway 12. A map of this area is provided below in Figure 4-1. This stretch is vulnerable to streambank erosion and runs parallel to a section of the Tomah Recreation Trail; thus restoration will serve dual purposes as both a community and a conservation benefit.

Figure 4-1: Potential Streambank Restoration Area



Nutrient Management

Just west of the City of Tomah's #10 and #14 Well, there are 40 acres that are currently being utilized for agricultural purposes. In order to improve both the quality of the runoff from land and the water permeating down to the aquifer that supplies these wells, the City plans to implement a nutrient management plan for this parcel, with cooperation by the current landowner.

5. PROJECT IMPLEMENTATION

This section presents the steps that will be taken to implement phosphorus reduction projects during the first permit term of Adaptive Management. As the City and its partners develop experience with Adaptive Management implementation in the LLR watershed, these project implementation steps may be refined or revised.

5.1 Preliminary Site Visits

Following the identification of potential project areas, the first step to implementation is conducting site visits to evaluate options and feasibility. Prior to any site visit, a relationship should be established with the land owner by the Monroe County LCD, so they are informed about Adaptive Management, and how they could play a role in the plan. Site visits should occur in the spring or fall, when the land cover will be more easily identifiable. Site visits will be arranged by the City, and will include members of the City and WWTF staff, Town & Country Engineering, Monroe County LCD, and the land owners themselves.

A typical site visit will usually take approximately 1-2 hours, depending on the size, and consist of a general assessment of areas of concern. These concerns could include streambank erosion, gully erosion, tillage, crop rotations, or nutrient management. General site information and observations will be documented.

5.2 Identification of Reasonable Measures

During the site visits, the most suitable measures for each site will be identified and discussed. Possible management measures are described in Section 4.3. As appropriate, additional management measures may be selected to result in further phosphorus reductions. The reasonable and feasible management measures will depend on the needs of the land owner and the physical properties of the land. These properties include soil type, slope, current land use/cropping practices, and proximity to water bodies/streams. Additional priority may be placed on larger parcels, or parcels with a greater expected phosphorus reduction. This would minimize the initial number of projects in order to gain the same total pounds of phosphorus reduction.

5.3 Data Collection for Modeling

Following the initial site visit, once optional management measures have been identified, there may be a need for additional data. Data collected by the Monroe County LCD will be based on the model being utilized and the resource concern that is being assessed. Typical models used include SNAP-Plus, BARNY, Phosphorus Index, gully erosion calculator, and streambank erosion calculator. Data could include soil samples, survey data, crop practices and other information.

5.4 Modeling

Modeling will be used to estimate expected phosphorus reductions for various management measures that are being considered. The two models that will most commonly be used are described below.

5.4.1 SNAP-Plus

SNAP-Plus (Soil Nutrient Application Planner) was designed as a means to streamline the preparation of Comprehensive Nutrient Management Plans (CNMP) for CAFOs. These CNMPs consist of five components: a conservation plan, a nutrient management plan, a record-keeping program, a manure manager, and feed management. Typically, several software programs were needed to generate these components, so SNAP-Plus was designed to incorporate these programs into one software package. SNAP-Plus is used to prepare nutrient management plans in accordance with Wisconsin's Nutrient Management Standard Code 590.

SNAP-Plus can be used to calculate crop nutrient recommendations for all fields on a farm, a rotational Phosphorus Index (PI) value for all fields as required for using the PI for phosphorus management, and a rotational phosphorus balance using soil test P as the criteria for phosphorus management. The PI is calculated by estimating average runoff phosphorus delivery from each field to the nearest surface water in a year given the field's soil conditions, crops, tillage, manure and fertilizer applications, and long-term weather patterns. The higher the PI number, the greater the likelihood that that field is contributing phosphorus to local water bodies.

For this application, SNAP-Plus will be used to calculate the expected phosphorus reductions for field-based management measures compared to the baseline for current practices. All SNAP-Plus modeling will be completed by the Monroe County LCD.

5.4.2 BARNY

The Wisconsin Barnyard Runoff Model (BARNY) is used to estimate loads of phosphorus and chemical oxygen demand in stormwater runoff from individual barnyards. It can also evaluate the impacts of buffers on reducing these loads. The main use of the BARNY model is to evaluate phosphorus transportation from barnyards and evaluate phosphorus load reductions due to barnyard management activities.

If it is determined that barnyard improvements could be an efficient source of phosphorus reductions, Town and Country Engineering will run BARNY modeling to estimate the reduction in phosphorus loads. The Monroe County LCD will provide assistance with modeling as needed.

5.5 Determine Load Reduction

Once the planned management measures have been identified, the load reductions will be determined using the modeling previously discussed. Then the City and the Monroe County LCD will be able to determine the total load reduction expected for each project area. As stated in Section 3.4, the City is required to provide a reduction of at least 497 pounds/year of phosphorus during the first permit term of Adaptive Management. If the calculated reductions for the planned management measures are less than the required amount, the City will seek out additional project partners. After the first permit term of Adaptive Management, the City may need to install additional management measures if the initial measures do not provide a sufficient reduction in phosphorus loading to the South Fork of Lemonweir River.

5.6 Cost-Share Agreements

Cost share agreements or contracts will be established between the landowners and the City for the management measures to be installed. Contracts will be drawn up by the Monroe Country LCD and made with landowners for a term 15 years or perpetuity. Once the contract is signed, the landowner will be paid with a lump sum incentive and annual payments for the length of the contract.

It will be up to the City to determine the rates for each type of management measure. These rates will be based on typical cost-share models and information provided by the Monroe County LCD. Cost-share rates that have not been previously established will be estimated based on demand, local land rental rates, and crop yields.

5.7 Installation of Management Measures

Once the cost share agreements have been signed between the landowner and the City, it will be the responsibility of the landowner to install and maintain the agreed upon management measures. These measures may consist of one or more of the practices previously described in Section 4.3.

5.8 Verification of Installed Management Measures

Monroe County LCD and the Tomah WWTF staff will verify the status of the practices installed for management measures. These practices will be verified once per permit term after initial establishment has been verified. In addition, in-stream phosphorus monitoring will be conducted by the WWTF staff as an approach to monitor the progress toward the water quality criterion, as described in Section 3.3.3.

Records and data for these practices will be cataloged by Town and County, with practices recorded spatially though GIS software along with LCD's Conservation Planning System software.

Inspection of the installed management measures will include various steps to ensure that these measures are valid, and that the phosphorus reductions can be claimed for the Adaptive Management program. The steps for these inspections are as follows.

1. *Determine status of management measure*
2. *Issue status determination to landowner*
3. *Take corrective measures as needed*
4. *Document that required corrective measures (if any) are completed*
5. *Update data for modeling, as needed*

5.9 Annual Reporting

In order to ensure the City's accountability, the WDNR requires annual reporting on Adaptive Management progress. These reports should evaluate the monitoring data that has been collected (including instream phosphorus loadings as well as effluent loadings), describe the management measures that have been installed in the prior year, and describe any outreach and education that has been completed. Annual reporting will be completed by the City, with assistance from Town & Country Engineering and the Monroe County LCD, as needed.

These annual reports can also be used to help adjust Adaptive Management actions, such as any changes that would require permit modifications. Changes that would require permit modification would include changes to the action area size, adjustments to the minimum monitoring requirements, and changes to the amount of phosphorus being offset in the current permit term. In summary, these reports will be used as a line of communication between the City and the WDNR.

5.10 Implementation Schedule

In order to ensure that the City meets the minimum required phosphorus loading reduction for the first Adaptive Management permit term, they will follow the implementation schedule in Table 5-1. This schedule will ensure that any management measures installed will be verified and inspected. Additionally, annual reporting will be performed to maintain communication between the City and the WDNR, as well as to reinforce accountability.

Table 5-1
Permit Term 1 Implementation Schedule

Action	Date
Site Inspections	Fall 2016 - Spring 2017
Data Collection and Modeling	Spring 2017
Cost Share Agreements Signed	Fall 2017
Management Measures Installed	Spring 2018
Compliance Maintenance Annual Report	September 30, 2018
Compliance Maintenance Annual Report	September 30, 2019
Compliance Maintenance Annual Report	September 30, 2020
Compliance Maintenance Annual Report	September 30, 2021
End of Permit Term 1	September 30, 2022

6. FINANCIAL EVALUATION

The section presents the projected costs for implementation of Adaptive Management for the first permit term and well as certification of the financial security of the Adaptive Management Program.

6.1 Cost Estimate

Table 6-1 presents a breakdown of estimated annual costs associated with Adaptive Management in the LLR watershed for the next permit term. Costs include the implementation of nonpoint source management measures, outreach and education, modeling, sampling, and other administrative duties. Factors relating to these costs and the responsible parties are listed in Table 6-1.

6.2 Funding Sources

Currently, the Tomah Wastewater Treatment Facility will assume sole financial responsibility for Adaptive Management in the LLR watershed and will fund these costs through user fees and cash on hand, but additional sources of funding will be explored. Grants and other funding opportunities will be researched to see if they are applicable to programs for Tomah's Adaptive Management program. Possible grant sources include the following:

- NRCS Regional Conservation Partnership Program (RCPP),
- Department of Agriculture, Trade and Consumer Protection (DATCP), Producer-Led Watershed Protection Grants
- Wisconsin DNR Targeted Runoff Management (TRM) Grants,
- Conservation Reserve Enhancement Program (CREP).

The Monroe County LCD will assist the City with identifying and applying for applicable grants.

6.3 Financial Security

As required by the DNR, this Adaptive Management Plan contains a written statement from the City validating that the financial needs to implement Adaptive Management are feasible. This statement is provided in Appendix I.

Table 6-1
Adaptive Management Cost Estimate

Permit Year / Year	Responsible Party	0 / 2016	1 / 2017	2 / 2018	3 / 2019	4 / 2020	5 / 2021
Treatment Upgrades Capital Cost	City						
Treatment Operating and Maintenance Costs							
Additional Sludge Hauling	City						
Additional Chemicals	City						
Adaptive Management Planning							
Report Preparation/Revision	T&C	$15,000					
Site Visits and Practice Identification	T&C	$5,000	$3,000	$3,000	$3,000	$3,000	$5,000
Modeling and Technical Support							
Monroe County Modeling Costs	County		$3,000	$2,000	$2,000	$2,000	$2,000
Engineering Support	T&C		$3,000	$2,000	$2,000	$2,000	$2,000
BMP Implementation Costs							
Practice Brokering	County	$3,000	$3,000	$1,000	$1,000	$1,000	$1,000
Practice Brokering/Implementation Support	T&C	$2,000	$2,000	$1,000	$1,000	$1,000	$1,000
Cost Share Rates	City		$50,000	$20,000	$20,000	$20,000	$20,000
Outreach and Education							
Meetings with Public/Stakeholders	T&C		$1,000	$1,000	$1,000	$1,000	$1,000
Communication about AM in watershed	City		$1,000	$1,000	$1,000	$1,000	$1,000
In-Stream and Effluent Sampling							
Sample Collection	City	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Sample Analysis	City	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Compliance Checking							
Practice Verification	County		$5,000	$5,000	$5,000	$5,000	$5,000
Compliance Notifications	City		$1,000	$1,000	$1,000	$1,000	$1,000
Administration							
Annual Reports	City		$5,000	$5,000	$5,000	$5,000	$5,000
Meetings/Correspondence with DNR	T&C		$2,000	$2,000	$2,000	$2,000	$2,000
Total		**$31,000**	**$85,000**	**$50,000**	**$50,000**	**$50,000**	**$52,000**