Wastewater Treatment Facility

Facilities Plan

Prepared For The

CITY OF KIEL

CALUMET & MANITOWOC COUNTIES
WISCONSIN

DECEMBER 2015

McM. No. K0015-9-15-00262.00

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- Chapter I -
INTRODUCTION

A. INTRODUCTION

The City of Kiel, Wisconsin, operates a Wastewater Treatment Facility under Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-0020141-08-00, which is issued by the Wisconsin Department Of Natural Resources (DNR). Although currently expired, it is anticipated that permits will be re-issued, watershed-wide, in 2016.

Originally constructed in 1965, modifications and upgrades have been made to the Wastewater Treatment Facility in response to changing flows, loadings, permit requirements, aging of facilities and equipment, and a need to improve efficiencies. As a result, the following projects were undertaken:

1965	Original Wastewater Treatment Facility Construction
1979	Phase 1 Wastewater Treatment Facility
1985	Phase 2, Part 1 & 2 Wastewater Treatment Facility
1996	Pretreatment Facility Modifications
1997	Modifications To Wastewater Treatment Facility
2001	River Road Pump Station Improvements
2008	Wastewater Treatment Facility Aeration System Improvements
2012	Process Modifications For Bio-P Removal
2013	River Road Pump Station Improvements

A significant number of unit processes and control systems have been in service beyond their design life. Many of the structures and piping systems have been in service for 30 to 50-years. Age, environmental factors and continued use have taken a toll on tankage, equipment, processes and controls throughout the Wastewater Treatment Facility's life-time.

Additionally, flows and loadings have continued to increase, with many unit processes operating beyond their rated capacity. Growth within the City of Kiel, along with expansion of prominent industrial contributors, is expected to continue.

The Facilities Planning process will allow the City of Kiel Wastewater Treatment Facility to comply with DNR Administrative Code NR 110 and 204, and address current and future needs. In addition, the Facilities Planning process will develop the most cost effective, best fit, and environmentally sound solutions for wastewater treatment and biosolids management issues facing the City of Kiel for the 20-year planning period.

- Chapter II -
WATER QUALITY OBJECTIVES

A. FEDERAL BACKGROUND

During the past five (5) decades, major Federal legislation has been enacted in an effort to alleviate the pollution of the Nation's waters. The basic Federal Water Pollution Control Legislation is Public Law (PL 84-660), approved July 9, 1956, which has been amended by: 1) The Federal Water Pollution Control Act Amendment Of 1961 (PL 87-88); 2) The Water Quality Act Of 1965 (PL 89-234); 3) The Federal Water Pollution Control Act Amendment Of 1972 (PL 92-500); 4) The Clean Water Act Of 1977 (PL 95-217), with amendments in 1981; and 5) The Water Quality Act Of 1987.

The Water Quality Act of 1965 required each State adopt water quality criteria applicable to interstate waters or portions thereof within the State, and adopt a plan for implementing and enforcing those criteria. It was soon found that the water quality standards were difficult, if not impossible, to enforce from an administrative viewpoint. The 1972 Federal Amendments sought to correct this situation by establishing restrictions for municipalities, based upon the concentration of certain pollutants in their wastewater. If these guidelines were found to be insufficient to ensure water quality criteria adopted under the 1965 Amendments, further treatment of wastes would be required to achieve the applicable standards.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) replaced the previous language of Act (PL 84-660) and its amendments entirely. The 1977 Amendments to the Clean Water Act (PL 95-217) includes, in part, as its declared goals:

1. To restore and maintain the chemical, physical and biological integrity of the Nation's waters by:

    a. Eliminating the discharge of pollutants into navigable waters by 1985.

    b. Attaining, where possible, an interim goal of water quality, which provides for the protection and propagation of fish, shellfish and wildlife, and provides for recreation in and on the water, be achieved by July 1, 1983.

    c. Prohibiting the discharge of toxic pollutants in toxic amounts.

2. To recognize, preserve and protect the primary responsibilities and rights of states to reduce and eliminate pollution, to plan and use (including restoration, preservation and enhancement) land and water resources…[1]

[1] Clean Water Act, as amended.

Although substantial progress has been made since passage of PL 92-500 and the 1987 Amendments, nevertheless, many waterways (notably marine estuaries, lakes and rivers in heavily populated areas) still suffer from degradation. In amending the Clean Water Act of 1987, the basic issue lawmakers had to confront was that, after most technology standards called for in the 1970's had been issued and the final push to get cities to provide a minimum of secondary treatment for sewage was at hand, some stubborn water pollution problems still remained. The most serious of these remaining problems are excessive levels of toxic pollutants in some waters (even where discharges have installed required pollution control technologies) and contained in runoff from 'non-point' sources, such as farmland and city streets.

The Water Quality Act of 1987 sought to correct these problems. The Amendments direct the Environmental Protection Agency (EPA) and State officials to supplement existing, nationwide technology-based standards with a water-quality-based approach to control persistent pollution problems. Essentially, Congress said regulators should identify waterways that are still polluted and do what is needed to restore them.

In other key changes, the Amendments:

1. Require permits for all discharges of storm water from industrial facilities, and set deadlines for cities to obtain permits for storm water discharges.

2. Limit the ability of industrial facilities to get exemptions or 'variances' from Federal pollution control regulations.

3. Prohibit, except in certain, narrowly-defined circumstances, 'backsliding' on permits or the weakening of treatment requirements when industrial and municipal discharge permits are renewed or reissued.

4. Extend deadlines for industries to comply with national pollution control standards to account for the fact that the EPA has not finished issuing some of these regulations.

5. Specify deadlines for the EPA to issue remaining, needed industrial effluent limitations.

6. Require the EPA to promulgate regulations to control toxic pollutants in sewage sludge.

7. Limit availability of modifications of Federal treatment standards for non-conventional pollutants for five well understood substances.

Recent Federal regulations have dealt with sludge management and toxins impacting the Great Lakes.

40 CFR, Part 503, sets standards for the use or disposal of sewage sludge. These regulations set metals limits, establish pathogen reduction standards and establish vector attraction reduction

standards for sludge being land applied. The Wisconsin Department of Natural Resources (DNR) administers these regulations through the Wisconsin Administrative Code, NR 204.

40 CFR, Part 132, establishes water quality guidance for the Great Lakes system. This regulation sets limits on bio-accumulating compounds. The Wisconsin DNR administers these regulations through NR 105 and 106, and via the Commission's Wisconsin Pollutant Discharge Elimination System (WPDES) permit.

Pretreatment regulations are also established by the Federal government for specific categories of industrial dischargers.

B. SANITARY SEWER SYSTEM OVERFLOWS

The EPA proposed revisions to National Pollutant Discharge Elimination System (NPDES) permit regulations to improve the operation of municipal sanitary sewer collection systems, reduce the frequency and occurrence of sewer overflows, and provide more effective public notification when overflows do occur. This proposal will provide communities with a framework for reducing health and environmental risks associated with overflowing sewers. The result will be fewer overflows, better information for local communities, and extended lifetime for the Nation's infrastructure. This rule primarily addresses sanitary sewer overflows, not combined sewer overflows.

A draft Notice Of Proposed Rulemaking was signed by EPA Administrator Browner on January 4, 2001. In accordance with the January 20, 2001 Memorandum from the Assistant to the President and Chief of Staff, entitled "Regulatory Review Plan", published in the Federal Register on January 24, 2001, 66 FR 7701, the EPA withdrew this document from the Office of the Federal Register to give the incoming Administration the opportunity to review it.

Key elements of the proposed rule include:

1. **Capacity Assurance, Management, Operation & Maintenance Programs**. These programs will help communities ensure they have adequate wastewater collection and treatment capacity, and incorporate many standard operation and maintenance activities for good system performance. When implemented, these programs will provide for efficient operation of sanitary sewer collection system.

2. **Notifying The Public & Health Authorities**. Municipalities and other local interests will establish a locally-tailored program that notifies the public of overflows according to the risk associated with specific overflow events. The EPA is proposing that annual summaries of sewer overflows be made available to the public. The proposal also clarifies existing record-keeping requirements and requirements to report to the State.

3. **Prohibition Of Overflows**. The existing Clean Water Act prohibition of sanitary sewer overflows that discharge to surface waters is clarified to provide communities with limited

protection from enforcement in cases where overflows are caused by factors beyond their reasonable control or severe natural conditions, provided there are no feasible alternatives.

4. **Expanding Permit Coverage To Satellite Systems**. Satellite municipal collection systems are those collection systems where the owner or operator is different from the owner or operator of the Treatment Facility. Some 4,800 satellite collection systems will be required to obtain NPDES permit coverage to include the requirements under this proposal.

C. WISCONSIN ADMINISTRATIVE CODE REVISIONS

1. Wisconsin Department Of Natural Resources (DNR) Ammonia Policy

The DNR Natural Resources Board approved the proposed ammonia regulations on October 22, 2003. A summary of the rule changes related to ammonia water quality criteria are:

a. NR 104 - Uses & Designated Standards. The ammonia water quality criteria and effluent limitations of 3 and 6 mg/L that applied in summer and winter, respectively, for discharges to limited forage fish streams were deleted. Criteria for limited forage fish streams are included in NR 105 and effluent limitations are to be calculated similar to other aquatic life waters as described in NR 106.

b. NR 105 - Surface Water Quality Criteria & Secondary Values For Toxic Substances. Acute and chronic ammonia criteria are included in NR 105. The acute criteria relate to the pH of the effluent; the chronic criteria relate to both the pH and temperature of the receiving water body. These criteria were developed consistent with the EPA 1999 criteria update and reflect the fish species present in Wisconsin. Criteria were developed for cold water fish, warm water sport fish, limited forage fish and limited aquatic life classifications. These criteria are also protective for wildlife and human health uses. This approach establishes criteria that are necessary to assure attainment of the designated use for the water body receiving the discharge.

c. NR 106 - Procedures For Calculating Water Quality Based Effluent Limitations For Toxic & Organoleptic Substances Discharged for Surface Waters. A new subchapter, entitled 'Effluent Limitations For Ammonia Discharges', was included. Although conceptually the same, the specific calculation procedures for determining an ammonia effluent limitation differs significantly from those used for other toxicants. Temperature, pH and the percent of stream flow used, and the presence of early life stages of fish are all considered in determining the limits. It was, therefore, appropriate to establish a separate subchapter for ammonia. Additionally, the subchapter contains implementation procedures for lagoon and pond systems treating primarily domestic wastewater that is unique to ammonia. A one-time categorical variance procedure with an approximate 5-year term was developed for these systems.

d. **NR 210 - Sewage Treatment Works**. As in NR 104, the limits of 3 and 6 mg/L in the summer and winter, respectively, for discharges to intermediate (limited forage fish) streams were deleted. This was replaced with criteria in NR 105 and the effluent limitation calculation procedures in NR 106.

2. NR 217 Phosphorus Regulations

NR 217 was adopted in 1992, and established a technology based effluent phosphorus limit of 1.0 mg/L for Wastewater Treatment Facilities. A limit of up to 2.0 mg/L was applicable for facilities that employed biological phosphorus removal systems. Municipalities discharging less than 150 lbs./month and industries discharging less than 60 lbs./month were exempt from the 1.0 mg/L limit. Revisions to the NR Codes were adopted on December 1, 2010. A summary of the rule changes related to phosphorus water quality criteria are as follows:

a. **NR 102 - Water Quality Standards For Wisconsin Surface Waters.** New numeric water quality criteria for phosphorus were established as follows for Wisconsin surface waters:

1)	Large Streams	0.1 mg/L
2)	Small Streams	0.075 mg/L
3)	Non-Stratified Lakes & Impoundments	0.040 mg/L
4)	Stratified Lakes & Impoundments	0.015 - 0.030 mg/L
5)	Great Lakes	0.005 - 0.007 mg/L

The new water quality criteria generally do not apply to the following water classifications:

1) Ephemeral streams.
2) Lakes and reservoirs of less than 5-acres.
3) Wetlands.
4) Waters identified as limited aquatic life water under NR 104.

However, discharges to the above water classes could be subject to phosphorus Water Quality Based Effluent Limits (WQBEL) to ensure the applicable water quality criteria for downstream water classes are being achieved.

b. **NR 217 - Effluent Standards & Limitations.** New Subchapter III repealed and replaced NR 102.06, and includes detailed procedures for establishing WQBEL's for phosphorus discharges. NR 217 also provided provisions for different types of phosphorus limits including:

1) WQBEL's - Takes stream flow and background phosphorus concentration into account, where the limit is established at a concentration where resulting phosphorus concentration downstream of the discharge is equal

to the water quality criterion at the combined base stream and discharge flow.

2) Total Maximum Daily Load (TMDL)-Based Limits In Addition To Or In Lieu Of The WQBEL's - Considers contributions and potential reductions from non-point source discharges in determining discharge limits for point sources. A mass based limit is included, in addition to or in lieu of the WQBEL. Up to two permit terms or 'specified implementation period' are provided for compliance with the TMDL, where the WQBEL may be applied if no progress is observed in the receiving water body.

3) Technology-Based Limits if more stringent than the WQBEL.

In addition, the regulations are no longer wastewater specific, applying to other point source dischargers of phosphorus including non-contact cooling water discharges, Concentrated Animal Feeding Operations (CAFO), and other sites where NR 151 and NR 216 regulations are not sufficient to meet the water quality criteria established in NR 102. The WPDES permit limits will be expressed as a concentration (30-day rolling average) and a mass limit if the discharge is to a lake or reservoir, outstanding or exceptional resource water, impaired water, or surface water with approved TMDL for phosphorus.

NR 217 also allows for an allowable load to be divided amongst multiple dischargers, establishes that the effluent limit cannot be more restrictive than NR 102 criteria, and new sources cannot discharge to an impaired water unless a TMDL has established reserve capacity, the discharger improves the water quality or a pollutant trade occurs. NR 217 provides some flexibility for compliance with WPDES permit effluent phosphorus limits including approved TMDL's, extended compliance schedules, and variances for municipal stabilization ponds and storage lagoons, as well as adaptive management plans and pollutant trading options.

c. **NR 151 - Runoff Management.** New provisions were established to control runoff from farmland, including new agricultural performance standards, which place a numerical limit on the amount of phosphorus that can be applied to agricultural fields. There are three major changes to the previous NR 151 rules.

1) NR 151.03 prohibits crop producer from conducting a tillage operation that negatively impacts stream bank integrity or deposits soil directly in surface waters and establishes tillage setbacks of greater than 5-feet but no more than 20-feet.
2) NR 151.04 establishes an average phosphorus index of 6 or less over the accounting period and no greater than 12 in any individual year during the period for croplands, pastures and winter grazing areas.
3) NR 151.055 restricts significant discharge of process wastewater to waters of the state.

Permitted non-point sources (CAFO's) are subject to these rules under their WPDES permits; however, unpermitted non-point sources are subject to these rules to the extent of cost-share or funding dollars offered to the non-point source for implementation of Best Management Practices (BMP's).

The changes to NR 151 affect Wastewater Treatment Facilities two-fold:

1) It may be increasingly difficult to obtain suitable land for application of biosolids generated at Wastewater Treatment Facilities.
2) Providing cost-share dollars for implementation of agricultural performance standards may provide a means of meeting NR 217 regulations through available Adaptive Management and Watershed-Based Effluent Trading.

NR 217 also allows for an 'Adaptive Management' approach, where up to three (3) permit terms would be available for achieving compliance with water quality standards. In order to be eligible for the adaptive management option:

1) The exceedance of phosphorus water quality criterion must be attributed to both point (Wastewater Treatment Facilities) and non-point (agricultural) sources.
2) The sum of the non-point source plus permitted municipal separate storm sewer systems must be at least 50% or water quality criteria cannot be met without non-point source control.
3) The permittee will be required to implement advance filtration or an equivalent technology to achieve compliance.
4) The Adaptive Management Plan identifies specified actions that will achieve compliance with the water quality criterion.

Several reduction strategies are available under the Adaptive Management option, including:

1) Providing financial support to non-point sources to implement BMP's, such as nutrient management plans.
2) Working with other point sources to reduce phosphorus loading.
3) Using Water Quality Trading to either meet the effluent limit or to meet an Adaptive Management tool.
4) Completing wetlands restoration within the watershed.
5) Creation of a bubble limit or watershed permit that integrates the aggregate phosphorus load on the watershed under a group or under a single permit.
6) Creation of a third party TMDL.

Watershed Trading is an option that can be used in conjunction with other compliance options, where another source reduces phosphorus to satisfy the difference between the permittee's discharge and the WPDES permit limit. The DNR and EPA impose a number of conditions on acceptable trades, unless the trading is used to meet an Adaptive Management goal; in which case, the conditions are much more flexible because the trades are being used to meet a management goal, and not a specific effluent limit. Generally, trades will only be allowed with sources that contribute to the same stream segment unless the trade is within the context of a TMDL, which would allow for a broader reach. A trade ratio (typically 2:1) would be included to address the uncertainty in non-point source reduction practices. Based on the restrictions imposed under the trading protocol, trading applications are only economically viable under certain circumstances including:

1) Permittee discharges at the downstream end of the impaired watershed.
2) Permittee only needs a relatively small reduction in total phosphorus discharge to avoid a large capital expenditure.
3) Long-term (10 to 20-year) trading practices, such as manure digesters, riparian corridors, wetland restoration or other practices are available.
4) Multiple point sources can coordinate with counties or other entities for efficient program administration.

A fixed interim limit of 0.6 mg/L would apply to the first permit term after the plan approval, and 0.5 mg/L would apply to the second permit term. Each of these limits is achievable with conventional mechanical treatment facilities.

3. Temperature Regulations

Water quality standards for temperature have been established in NR 102 to protect fish and other aquatic life from lethal and sub-lethal effects. The rules primarily affect power plants and other industrial dischargers that add heat to process wastewater and non-contact cooling water; however, the rules also apply to municipal Wastewater Treatment Facilities. The 'thermal limits' are based on both acute and chronic or sub-lethal impacts on aquatic life.

a. Acute limits are established is the effluent discharge exceeds default values assigned to a particular classification of water body on a monthly basis or exceeds site specific stream temperatures based on Wastewater Treatment Facility data. For 'effluent dominated' streams, the temperature at the outfall can be used as the ambient temperature.

b. Chronic limits are established if the effluent discharge exceeds default values or measured values, and the DNR determines, by examining several site specific factors, that the effluent has a reasonable potential to cause or contribute to the inability of the water body to support aquatic life.

Specific procedures for calculating WQBEL for temperature are specified in NR 106. These rule changes became effective on October 1, 2010. Temperature sampling requirements and a compliance schedule to meet temperature limits would be set in the WPDES permit. The limitations and compliance schedule may be invalidated if testing indicates that the temperature limit is not necessary.

D. SLUDGE REGULATIONS

1. 503 Regulations

Land application of sewage sludge is regulated under CFR 40, Part 503, 'Standards For The Use Or Disposal Of Sewage Sludge'. This regulation establishes two (2) levels of sewage sludge quality, with respect to heavy metal concentrations [ceiling concentrations and exceptional quality (see below)]; two (2) levels of quality, with respect to pathogen densities (Class A or Class B); and two (2) types of approaches for meeting vector attraction reduction. In order for the sludge to qualify for land application, metals must be below ceiling limits, and the sludge must meet Class B requirements for pathogens and vector attraction reduction requirements.

a. Metals:

Metals limits for land application of sewage sludge are summarized below:

LAND APPLICATION POLLUTANT LIMITS
(All Weights Are On Dry Weight Basis)

Table In 503 Rule	Table #1	Table #2	Table #3	Table #4
Pollutant	Ceiling Concentration Limits* (mg/kg)	Cumulative Pollutant Loading Rates (kg/ha)	"High Quality" Pollutant Concentration Limits * (mg/kg)	Annual Pollutant Loading Rates (lbs./acre/yr.)
Arsenic	75	41	41	1.78
Cadmium	85	39	39	1.69
Copper	4,300	1,500	1,500	66.9
Lead	840	300	300	13.4
Mercury	57	17	17	0.76
Molybdenum	75	N/A	N/A	N/A
Nickel	420	420	420	18.7
Selenium	100	100	100	4.4
Zinc	7,500	2,800	2,800	125

* Absolute Values
** Monthly Averages

To be land applied, bulk sewage sludge must meet the pollutant Ceiling Concentrations and Cumulative Pollutant Loading or Pollutant Concentrations limits.

b. Pathogen Reduction:

Sewage sludge that is land applied must meet Class A or B pathogen requirements.

For Class A, the sludge must meet one of the following criteria:

1) Fecal coliform density less than 1,000 Most Probable Number (MPN) per gram of total dry solids; or
2) Salmonella density less than 3 MPN/4 grams of total dry solids.

Class B sewage sludge must meet one of the following pathogen requirements:

1) The sewage sludge must be treated by a process to significantly reduce pathogens (PSRP) process; or
2) At the time of disposal, the geometric mean of sewage sludge samples must be less than 2,000,000 MPN/gram total solids (dry weight).

c. Vector Attraction:

Vector attraction reduction reduces the potential for spreading of infectious disease agents by vectors (flies, rodents and birds). At a minimum, one (1) of the following must be met prior to land application of the sludge for anaerobic processes:

1) Minimum volatile solids reduction of 38% of raw sludge, compared to stabilized sludge.
2) Injection - Liquid sludge should be injected beneath the soil surface, with no significant amount of sewage sludge present after 1-hour of injection (Class B) or 8-hours for Class A.
3) Incorporation - Sewage sludge that is land applied on a surface disposal site shall be incorporated into the soil within 6-hours of application (Class B) or 8-hours for Class A. This applies to dewatered sludge.

2. NR 204 Regulations

The DNR regulates sludge disposal through Chapter NR 204 of the Wisconsin Administrative Code. The 1996 Revisions to NR 204, for the most part, mirror the 503 Regulations. The NR 204 major revisions are summarized as follows:

a. Additional testing requirements are required of the sludge, depending upon its end use and facility size. These will be specified in the WPDES permit. Additional tests could include SOUR, salmonella, viruses, viable helminth ova and a priority of pollutant scan.

b. The DNR defines an 'Exceptional Quality Sludge' as one that meets Class A pathogen requirements, high quality pollutant concentrations and vector reduction requirements of the 503 Regulations. Sludge certified as 'Exceptional Quality' is exempt from the minimum separation distances to residences, businesses, recreational areas or property lines, if land applied. A permit is not required to land apply the sludge and site life is unlimited. Sludge may be commercially distributed in bulk, only if it is certified as exceptional quality.

c. Application of sludge on frozen or snow covered ground is prohibited, unless a permittee can demonstrate that there are no other reasonable disposal methods available and there is absolutely no likelihood that the sludge will enter the waters of the State. Application may be approved on a case by case basis until storage is available.

d. Sludge quality standards, with respect to vector attraction reduction, pathogen reduction and metals from the 503 Regulations are incorporated into these regulations, including site restrictions.

e. All municipal mechanical Wastewater Treatment Facilities shall have the ability to store sludge for 180-days.

E. WISCONSIN WATER QUALITY OBJECTIVES

The State of Wisconsin enforces the requirements of the Federal Water Pollution Control Act through the WPDES. This system is a permitting process, which permits point discharges of treated effluent to receiving waters. Effluent requirements are established by the DNR, based upon water quality limitations associated with the receiving waters; and are established for the protection of public health and welfare for the propagation of fish and wildlife, and for domestic, recreational, agricultural, commercial, industrial and other legitimate uses.

F. EFFLUENT REQUIREMENTS

The existing Wastewater Treatment Facility discharges to the Sheboygan River, in compliance with WPDES Permit No. WI-0020141-08-0, which expired on September 30, 2013. Refer to Appendix II-1.

1. Current Effluent Limitations

Parameter		Effluent Limitation	Frequency
BOD_5	May - October	10 mg/L	Weekly & Monthly Average
		72 lbs./day	Weekly Average
	November - April	15 mg/L	Weekly & Monthly Average
		108 lbs./day	Weekly Average
Total Suspended Solids	May - October	10 mg/L	Weekly and Monthly Average
	November - April	15 mg/L	Weekly and Monthly Average
Ammonia (in addition to limits shown above)	April	5.2 mg/L	Weekly Average
pH		6.0 to 9.0 s.u.	Daily Maximum
Dissolved Oxygen		6.0 mg/L	Daily Minimum
Fecal Coliforms		400 counts /100 mL	Monthly Geo. Mean, May - September
Total Residual Chlorine		38 μg/L	Daily Maximum
		8.4 μg/L	Weekly Average
Total Phosphorus		1.0 mg/L	Monthly Average
Ammonia	Year-Round	11 mg/L	Daily Maximum
	April - May	5.2 mg/L	Weekly Average
		2.2 mg/L	Monthly Average
	June - September	3.7 mg/L	Weekly Average
		1.7 mg/L	Monthly Average
	October - March	5.3 mg/L	Monthly Average
Chlorides		mg/L	Monthly Monitoring Only

The City is currently awaiting renewal of the permit. A request for an evaluation of WQBEL's was previously requested. A Memorandum was provided by Jim Schmidt, Wisconsin DNR, on September 30, 2013, which provided recommendations for effluent limitations to be included in the WPDES permit reissuance, with consideration given to new monthly low flow (7Q10 and 7Q2) estimations by the United States Geological Survey (USGS) that were submitted by the City. Anti-degradation policy was considered in the evaluation due to increases in some discharge limits above the current effluent limits. A copy of the Memorandum is included in Appendix II-2.

The Memorandum recommended revised or new limits for phosphorus, ammonia, chlorides, temperature and Dissolved Oxygen (DO), as well as alternative sets of limits for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS) and ammonia limits, based on options available to the City because the anti-degradation rule requires evaluations be completed by the permittee before increased effluent limits can be determined.

Subsequent to the September 2013 Memorandum, effluent limitations were requested during Master Planning in August 2014 based on eight (8) design flow alternatives ranging from 0.98 to 3.01 mgd. A copy of Jim Schmidt's reply letter, dated September 19, 2014, is included in Appendix II-3.

The following is a summary of the recommended limits.

2. Effluent Limitations That Are The Same For All Design Flow Alternatives

Parameter		Effluent Limitation	Frequency
Dissolved Oxygen	July - September	8.7 mg/L	Daily Minimum
	October - June	6.0 mg/L	Daily Minimum
pH		6.0 to 9.0 s.u.	Daily Maximum
Total Phosphorus	Water Quality Based	0.72 lbs./day	Annual Average
		0.1 mg/L	6-Month Average
		0.3 mg/L	Monthly Average
	Interim	1.0 mg/L	Monthly Average
Fecal Coliforms		400 counts / 100 ml	Monthly Geo Mean, May - September
Total Residual Chlorine		38 μg/L	Daily Maximum
		8.4 μg/L	Weekly Average

3. Daily Maximum Ammonia Nitrogen (NH3-N) Limits Based On Effluent pH

Effluent pH (s.u.)	NH3-N Limit (mg/L)
pH ≤ 7.5	No Limit
7.5 < pH ≤ 7.6	34*
7.6 < pH ≤ 7.7	29*
7.7 < pH ≤ 7.8	24*
7.8 < pH ≤ 7.9	20*
7.9 < pH ≤ 8.0	17
8.0 < pH ≤ 8.1	14
8.1 < pH ≤ 8.2	11
8.2 < pH ≤ 8.3	9.4
8.3 < pH ≤ 8.4	7.8
8.4 < pH ≤ 8.5	6.4
8.5 < pH ≤ 8.6	5.3
8.6 < pH ≤ 8.7	4.4
8.7 < pH ≤ 8.8	3.7
8.8 < pH ≤ 8.9	3.1
8.9 < pH ≤ 9.0	2.6

4. Effluent Limits That Vary Based On Design Flow For The Range 0.98 & 3.01 mgd

Parameter		Effluent Limitation	Frequency
Chlorides		414-452 mg/L	Weekly Average
Temperature	January	50 to 53°F	Weekly Average
	February	51 to 54°F	Weekly Average
	March	55 to 60°F	Weekly Average
	April	59 to 68°F	Weekly Average
	May	66 to 70°F	Weekly Average
	June	77 to 79°F	Weekly Average
	July	82 to 84°F	Weekly Average
	August	82 to 84°F	Weekly Average
	September	74 to 75°F	Weekly Average
	October	62 to 64°F	Weekly Average
	November	50 to 52°F	Weekly Average
	December	50 to 53°F	Weekly Average
BOD	January	9.1 to 17	Weekly/Monthly Average
	February	8.9 to 17	Weekly/Monthly Average
	March	12 to 26	Weekly/Monthly Average
	April	24/24 - 45/30	Weekly/Monthly Average
	May	8.8 to 20	Weekly/Monthly Average
	June	5.4 to 11	Weekly/Monthly Average
	July	7.1 to 11	Weekly/Monthly Average
	August	6.9 to 9.6	Weekly/Monthly Average
	September	7.9 to 11	Weekly/Monthly Average
	October	6.1 to 11	Weekly/Monthly Average
	November	9.0 to 18	Weekly/Monthly Average
	December	9.2 to 18	Weekly/Monthly Average
TSS	January	10 to 17	Weekly/Monthly Average
	February	10 to 17	Weekly/Monthly Average
	March	12 to 26	Weekly/Monthly Average
	May	10 to 20	Weekly/Monthly Average
	June	10 to 11	Weekly/Monthly Average
	July	10 to 11	Weekly/Monthly Average
	August	10 to 10	Weekly/Monthly Average
	September	10 to 11	Weekly/Monthly Average
	October	10 to 11	Weekly/Monthly Average
	November	10 to 18	Weekly/Monthly Average
	December	10 to 18	Weekly/Monthly Average
Ammonia	January	12 to 114	Weekly Monthly
		5.5 to 7.4	Monthly Average
	February	12 to 14	Weekly Average
		5.6 to 7.7	Monthly Average
	March	13 to 18	Weekly Average
		7.2 to 13	Monthly Average
	April	8.5 to 15	Weekly Average
		4.3 to 8.8	Monthly Average

Parameter		Effluent Limitation	Frequency
Ammonia (continued)	May	7.5 to 12	Weekly Average
		3.9 to 7.7	Monthly Average
	June	5.8 to 9.4	Weekly Average
		3.1 to 6.2	Monthly Average
	July	4.8 to 7.2	Weekly Average
		2.3 to 3.9	Monthly Average
	August	4.8 to 6.7	Weekly Average
		2.3 to 3.9	Monthly Average
	September	5.6 to 6.8	Weekly Average
		2.5 to 3.5	Monthly Average
	October	8 to 9.1	Weekly Average
		3.5 to 4.6	Monthly Average
	November	8 to 12	Weekly Average
		4.6 to 6.7	Monthly Average
	December	10 to 12	Weekly Average
		4.6 to 6.6	Monthly Average

5. Chlorides

Chloride limits are based on acute and chronic toxicity criteria (NR 105). The water quality-based limit based on the current design flow of 0.862 mgd is 460 mg/L (weekly average), based on dilution in one-quarter (¼) of the year-round 7Q10 low flow of 0.93 cfs to meet a chronic toxicity criterion of 395 mg/L. The current WPDES permit contains a variance limit of 510 mg/L (weekly average). Effluent data available at that time of permit reissuance will be used to determine the need for a variance. The weekly average limits provided in the Memorandum varied with the design flow, based on the 395 mg/L criterion, an ambient concentration of 22 mg/L, and the relative dilution factors associated with the increased design flow.

6. Temperature

Thermal limits were calculated based on the new water quality standards that became effective in late 2010. The thermal limits provided in the Memorandum, based on the range design flows, were provided for informational purposes in the dissipative cooling evaluation. Except for April, with its high 7Q10, the remaining months have a 5^{o}F difference or less between limits at the lowest and highest design flows.

7. BOD, TSS & Ammonia

BOD, TSS and ammonia limits for each month of the year at each of the requested design flows were provided in the September 2014 Memorandum from Jim Schmidt. As mentioned in the 2013 memorandum from Jim Schmidt, any calculated limits that are increased above the current permit limits are subject to an anti-degradation evaluation (NR 207). However, the circumstances of the more recent request for limits are different than the September 30, 2013 evaluation, because of the requested increased design flows.

The process for justifying increased limits is still the same in that: 1) there must be a demonstration of the need for increased limits, and 2) a demonstration of the ability of the increased discharge to accommodate important social or economic development. The limits provided in the September 2014 Memorandum were calculated under the assumption that increased limits are needed. It was also assumed that the increased discharge would be allowed based on demonstration of social and economic importance through anticipated industrial, commercial or residential growth in the community. Therefore, two (2) sets of limits may be calculated; one (1) representing the limits based on the full assimilative capacity available in the Sheboygan River, and two (2) representing prevention of Significant Lowering Of Water Quality (SLOWQ). Both the SLOWQ-based limits and the full assimilative capacity-based limits are provided in the tables included in the September 2014 Memorandum.

The September 2014 Memorandum from Jim Schmidt also noted that it is likely the City of Kiel discharge would be considered a major municipal discharge in the future when actual flows exceed 1 mgd annual average. Major municipal discharge designation would require that Kiel test for all of the substances on the EPA priority pollutant list, including mercury. Since many large Wastewater Treatment Facilities are unable to comply with mercury limits, a variance may be needed in the future depending on effluent mercury results.

APPENDIX II-1

WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES)
PERMIT No. WI-0020141-08-0

WISCONSIN
DEPT. OF NATURAL RESOURCES

WPDES PERMIT

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

City of Kiel

is permitted, under the authority of Chapter 283, Wisconsin Statutes, to discharge from a facility located at
100 E. Park Avenue, Kiel, Wisconsin
to

the Sheboygan River (Water Body Identification Code number 50700) at Rockville Flowage in the Sheboygan River Watershed (SH03) of the Sheboygan River Drainage Basin in Manitowoc County

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit, according to Chapter NR 200, Wis. Adm. Code, at least 180 days prior to the expiration date given below.

State of Wisconsin Department of Natural Resources
For the Secretary

By [signature]
Richard Sachs
Wastewater Specialist

March 31, 2009
Date Permit Signed/Issued

PERMIT TERM: EFFECTIVE DATE - April 01, 2009 **EXPIRATION DATE - September 30, 2013**

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1 Influent Requirements

1.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
701	Influent - Representative influent samples shall be collected from the composite sampling device drawing samples from the open channel following screening or comminution.

1.2 Monitoring Requirements

The permittee shall comply with the following monitoring requirements.

1.2.1 Sampling Point 701 - Influent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Continuous	Continuous	
BOD_5, Total		mg/L	2/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	2/Week	24-Hr Flow Prop Comp	
Phosphorus, Total		mg/L	2/Week	24-Hr Flow Prop Comp	

2 Surface Water Requirements

2.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
001	Effluent - Representative effluent samples shall be collected from the composite sampling device drawing samples from the acid mix basin following disinfection except that samples for pH, fecal colifom, total residual chlorine, and Whole Effluent Toxicity shall be collected from the post aeration basin.

2.2 Monitoring Requirements and Effluent Limitations

The permittee shall comply with the following monitoring requirements and limitations.

2.2.1 Sampling Point (Outfall) 001 - Effluent

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
BOD_5, Total	Weekly Avg	10 mg/L	2/Week	24-Hr Flow Prop Comp	Applies May 1 through October 31, each year.
	Monthly Avg	10 mg/L			
	Weekly Avg	72 lbs/day		Calculated	
	Weekly Avg	15 mg/L	2/Week	24-Hr Flow Prop Comp	Applies November 1 through April 30, each year.
	Monthly Avg	15 mg/L			
	Weekly Avg	108 lbs/day		Calculated	
Suspended Solids, Total	Weekly Avg	10 mg/L	2/Week	24-Hr Flow Prop Comp	Applies May 1 through October 31, each year.
	Monthly Avg	10 mg/L			
	Weekly Avg	15 mg/L	2/Week	24-Hr Flow Prop Comp	Applies November 1 through April 30, each year.
	Monthly Avg	15 mg/L			
pH (Minimum)	Daily Min	6.0 su	Daily	Continuous	
pH (Maximum)	Daily Max	9.0 su	Daily	Continuous	
Dissolved Oxygen	Daily Min	6.0 mg/L	Daily	Continuous	
Fecal Coliform	Geometric Mean	400 #/100 ml	Weekly	Grab	Applies May 1 through September 30, each year.
Chlorine, Total Residual	Daily Max	38 µg/L	5/Week	Grab	Applies whenever chlorine is used. See Section 2.2.1.1 for applicable mass limits.
	Weekly Avg	8.4 µg/L			
Phosphorus, Total	Monthly Avg	1.0 mg/L	2/Week	24-Hr Flow Prop Comp	

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Nitrogen, Ammonia (NH_3-N) Total	Daily Max	11 mg/L	2/Week	24-Hr Flow Prop Comp	
	Weekly Avg	5.2 mg/L	2/Week	24-Hr Flow Prop Comp	Applies April 1 through May 31, each year.
	Monthly Avg	2.2 mg/L			
	Weekly Avg	3.7 mg/L	2/Week	24-Hr Flow Prop Comp	Applies June 1 through September 30, each year.
	Monthly Avg	1.7 mg/L			
	Monthly Avg	5.3 mg/L	2/Week	24-Hr Flow Prop Comp	Applies October 1 through March 31, each year.
Copper, Total Recoverable			Monthly	24-Hr Flow Prop Comp	Monitoring only April 1, 2009 – March 31, 2012. See Section 4.1.
	Weekly Avg	39 µg/L			Limit effective April 1, 2012.
	Weekly Avg - Variable	lbs/day		Calculated	Variable limit effective April 1, 2012, see Section 2.2.1.2.
Chloride		mg/L	Monthly	24-Hr Flow Prop Comp	Monitoring only, required October 1, 2011 - September 30, 2012.
Acute WET		TU_a	See Listed Qtr(s)	24-Hr Flow Prop Comp	See Section 2.2.1.3 for WET testing schedule and requirements.
Chronic WET		rTU_c	See Listed Qtr(s)	24-Hr Comp	See Section 2.2.1.3 for WET testing schedule and requirements.

2.2.1.1 Applicable Mass Limits for Total Residual Chlorine

The applicable mass limits for Total Residual Chlorine are 0.98 pounds per day (daily maximum), 0.060 pounds per day (non-wet weather weekly average), and 0.094 pounds per day (wet weather weekly average). See Standard Requirements for "Applicability of Alternative Wet Weather Limitations".

2.2.1.2 Non-Wet Weather and Alternative Wet Weather Mass Limit – Total Recoverable Copper

Total Recoverable Copper has a mass limit based on weather conditions. The applicable non-wet weather mass limit is 0.28 pounds/day. The applicable wet weather mass limit is 0.46 pounds/day. Report the applicable mass limit on the Discharge Monitoring Report form in the variable limit column. See Standard Requirements for "Applicability of Alternative Wet Weather Mass Limitations" and "Appropriate Formulas for Effluent Calculations".

Note: 1000 ug/l = 1 mg/L (divide ug/L by 1000 to convert to mg/L).

2.2.1.3 Whole Effluent Toxicity (WET) Testing

Primary Control Water: Grab sample collected from the Sheboygan River, upstream and out of the influence of the permittee's discharge and any other known discharge – unless the use of a different control water source is approved by the Department prior to use.

Instream Waste Concentration (IWC): 78%

Dilution series: At least five effluent concentrations and dual controls must be included in each test.

- **Acute:** 100, 50, 25, 12.5, 6.25% and any additional selected by the permittee.
- **Chronic:** 100, 75, 50, 25, 12.5% and any additional selected by the permittee.

WET Testing Frequency: Tests are required during the following quarters.

Acute:

- July 1, 2009 – September 30, 2009
- October 1, 2010 - December 31, 2010
- January 1, 2013 – March 31, 2013

Chronic:

- July 1, 2009 – September 30, 2009
- April 1, 2010 – June 30, 2010
- October 1, 2010 – December 31, 2010
- January 1, 2011 – March 31, 2011
- July 1, 2011 – September 30, 2011*
- April 1, 2012 – June 30, 2012
- October 1, 2012 – December 31, 2012*
- January 1, 2013 – March 31, 2013
- July 1, 2013 – September 30, 2013*

Potential Reduction in Chronic WET Testing Frequency: If the chronic WET results from the first two years (through the 1st quarter of 2011) all indicate negative toxicity, then the permittee may request a reduction in chronic WET testing frequency to once per year through the remainder of the permit term. In such case the Department may eliminate the chronic WET tests marked with an * in the above list.

Concurrent Monitoring: Effluent monitoring for Ammonia Nitrogen and Total Recoverable Copper shall be conducted concurrently with WET testing.

Reporting: The permittee shall report test results on the Discharge Monitoring Report form, and also complete the "Whole Effluent Toxicity Test Report Form" (Section 6, "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*"), for each test. The original, complete, signed version of the Whole Effluent Toxicity Test Report Form shall be sent to the Biomonitoring Coordinator, Bureau of Watershed Management, 101 S. Webster St., P.O. Box 7921, Madison, WI 53707-7921, within 45 days of test completion. The original Discharge Monitoring Report (DMR) form and one copy shall be sent to the contact and location provided on the DMR by the required deadline.

Determination of Positive Results: An acute toxicity test shall be considered positive if the Toxic Unit - Acute (TU_a) is greater than 1.0 for either species. The TU_a shall be calculated as follows: If $LC_{50} \geq 100$, then $TU_a = 1.0$. If LC_{50} is < 100, then $TU_a = 100 \div LC_{50}$. A chronic toxicity test shall be considered positive if the Relative Toxic Unit - Chronic (rTU_c) is greater than 1.0 for either species. The rTU_c shall be calculated as follows: If $IC_{25} \geq IWC$, then $rTU_c = 1.0$. If $IC_{25} < IWC$, then $rTU_c = IWC \div IC_{25}$.

Additional Testing Requirements: Within 90 days of a test which showed positive results, the permittee shall submit the results of at least 2 retests to the Biomonitoring Coordinator on "Whole Effluent Toxicity Test Report Forms". The retests shall be completed using the same species and test methods specified for the original test (see the Standard Requirements section herein).

3 Land Application Requirements

3.1 Sampling Point(s)

The discharge(s) shall be limited to land application of the waste type(s) designated for the listed sampling point(s) on Department approved land spreading sites or by hauling to another facility.

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
004	Cake Sludge - Representative samples of the cake sludge shall be collected. Compliance with Class A fecal coliform or salmonella requirements shall be demonstrated immediately after the treatment process and again prior to land application if that is more than 3 weeks later. See also the Standard Requirements section for "Class A Fecal Coliform".

3.2 Monitoring Requirements and Limitations

The permittee shall comply with the following monitoring requirements and limitations.

3.2.1 Sampling Point (Outfall) 004 - Cake Sludge

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Quarterly	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Quarterly	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Quarterly	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Quarterly	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Quarterly	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Quarterly	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Quarterly	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Quarterly	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Quarterly	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	Quarterly	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Quarterly	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Quarterly	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Quarterly	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Quarterly	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Quarterly	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Quarterly	Composite	
Nitrogen, Total Kjeldahl		Percent	Quarterly	Composite	
Nitrogen, Ammonium (NH_4-N) Total		Percent	Quarterly	Composite	
Phosphorus, Total		Percent	Quarterly	Composite	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Phosphorus, Water Extractable		% of Tot P	Quarterly	Composite	
Potassium, Total Recoverable		Percent	Quarterly	Composite	
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	See Sections 3.2.1.4 and 5.4.6 for monitoring requirements.
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	See Sections 3.2.1.4 and 5.4.6 for monitoring requirements.

Other Sludge Requirements	
Sludge Requirements	**Sample Frequency**
List 3 Requirements – Pathogen Control: The requirements in List 3 shall be met prior to land application of sludge.	**Quarterly**
List 4 Requirements – Vector Attraction Reduction: The vector attraction reduction shall be satisfied prior to, or at the time of land application as specified in List 4.	**Quarterly**

3.2.1.1 List 2 Analysis

If the monitoring frequency for List 2 parameters is more frequent than "Annual" then the sludge may be analyzed for the List 2 parameters just prior to each land application season rather than at the more frequent interval specified.

3.2.1.2 Changes in Feed Sludge Characteristics

If a change in feed sludge characteristics, treatment process, or operational procedures occurs which may result in a significant shift in sludge characteristics, the permittee shall reanalyze the sludge for List 1, 2, 3 and 4 parameters each time such change occurs.

3.2.1.3 Sludge Which Exceeds the High Quality Limit

Cumulative pollutant loading records shall be kept for all bulk land application of sludge which does not meet the high quality limit for any parameter. This requirement applies for the entire calendar year in which any exceedance of Table 3 of s. NR 204.07(5)(c), is experienced. Such loading records shall be kept for all List 1 parameters for each site land applied in that calendar year. The formula to be used for calculating cumulative loading is as follows:

[(Pollutant concentration (mg/kg) x dry tons applied/ac) ÷ 500] + previous loading (lbs/acre) = cumulative lbs pollutant per acre

When a site reaches 90% of the allowable cumulative loading for any metal established in Table 2 of s. NR 204.07(5)(b), the Department shall be so notified through letter or in the comment section of the annual land application report (3400-55).

3.2.1.4 Sludge Analysis for PCBs

The permittee shall analyze the sludge for Total PCBs one time during 2010. The results shall be reported as "PCB Total Dry Wt". Either congener-specific analysis or Aroclor analysis shall be used to determine the PCB concentration. The permittee may determine whether Aroclor or congener specific analysis is performed. Analyses shall be performed in accordance with Table EM in s. NR 219.04, Wis. Adm. Code and the conditions specified in Standard Requirements of this permit. PCB results shall be submitted by January 31, following the specified year of analysis.

3.2.1.5 Lists 1, 2, 3, and 4

List 1 **TOTAL SOLIDS AND METALS** See the Monitoring Requirements and Limitations table above for monitoring frequency and limitations for the List 1 parameters
Solids, Total (percent)
Arsenic, mg/kg (dry weight)
Cadmium, mg/kg (dry weight)
Copper, mg/kg (dry weight)
Lead, mg/kg (dry weight)
Mercury, mg/kg (dry weight)
Molybdenum, mg/kg (dry weight)
Nickel, mg/kg (dry weight)
Selenium, mg/kg (dry weight)
Zinc, mg/kg (dry weight)

List 2 **NUTRIENTS** See the Monitoring Requirements and Limitations table above for monitoring frequency for the List 2 parameters
Solids, Total (percent)
Nitrogen Total Kjeldahl (percent)
Nitrogen Ammonium (NH4-N) Total (percent)
Phosphorus Total as P (percent)
Phosphorus, Water Extractable (as percent of Total P)
Potassium Total Recoverable (percent)

List 3 **PATHOGEN CONTROL FOR CLASS B SLUDGE** The permittee shall implement pathogen control as listed in List 3. The Department shall be notified of the pathogen control utilized and shall be notified when the permittee decides to utilize alternative pathogen control. The following requirements shall be met prior to land application of sludge.		
Parameter	**Unit**	**Limit**
Fecal Coliform*	MPN/gTS or CFU/gTS	2,000,000
OR, ONE OF THE FOLLOWING PROCESS OPTIONS		
Aerobic Digestion	Air Drying	
Anaerobic Digestion	Composting	
Alkaline Stabilization	PSRP Equivalent Process	
* The Fecal Coliform limit shall be reported as the geometric mean of 7 discrete samples on a dry weight basis.		

List 4 **VECTOR ATTRACTION REDUCTION** The permittee shall implement any one of the vector attraction reduction options specified in List 4. The Department shall be notified of the option utilized and shall be notified when the permittee decides to utilize an alternative option. One of the following shall be satisfied prior to, or at the time of land application as specified in List 4.		
Option	**Limit**	**Where/When it Shall be Met**
Volatile Solids Reduction	$\geq$38%	Across the process
Specific Oxygen Uptake Rate	$\leq$1.5 mg O_2/hr/g TS	On aerobic stabilized sludge
Anaerobic bench-scale test	<17 % VS reduction	On anaerobic digested sludge
Aerobic bench-scale test	<15 % VS reduction	On aerobic digested sludge
Aerobic Process	>14 days, Temp >40°C and Avg. Temp > 45°C	On composted sludge
pH adjustment	>12 S.U. (for 2 hours) and >11.5 (for an additional 22 hours)	During the process
Drying without primary solids	>75 % TS	When applied or bagged
Drying with primary solids	>90 % TS	When applied or bagged
Equivalent Process	Approved by the Department	Varies with process
Injection	-	When applied
Incorporation	-	Within 6 hours of application

3.2.1.6 Daily Land Application Log

Daily Land Application Log

Discharge Monitoring Requirements and Limitations

The permittee shall maintain a daily land application log for biosolids land applied each day when land application occurs. The following minimum records must be kept, in addition to all analytical results for the biosolids land applied. The log book records shall form the basis for the annual land application report requirements.

Parameters	Units	Sample Frequency
DNR Site Number(s)	Number	Daily as used
Outfall number applied	Number	Daily as used
Acres applied	Acres	Daily as used
Amount applied	As appropriate * /day	Daily as used
Application rate per acre	unit */acre	Daily as used
Nitrogen applied per acre	lb/acre	Daily as used
Method of Application	Injection, Incorporation, or surface applied	Daily as used

*gallons, cubic yards, dry US Tons or dry Metric Tons

4 Schedules of Compliance

4.1 Copper

The permittee may be required to conduct facility modifications necessary to achieve compliance with effluent limitations for copper.

Required Action	Date Due
Report on Effluent Discharges: Submit a report on effluent discharges of copper with conclusions regarding compliance.	03/31/2010
Action Plan or Facility Plan Amendment: Submit an action plan or facility plan amendment for treatment facility modifications for complying with the copper effluent limitations as needed.	06/30/2010
Plans and Specifications: Submit plans and specifications for treatment facility modifications as needed.	12/31/2010
Complete Actions: Complete actions necessary to achieve compliance with the copper effluent limitations.	03/31/2012

4.2 Sewer System Evaluation Survey (SSES)

The permittee may be required to submit a Sewer Service Evaluation Survey that meets the requirements of s. NR 110.09(6), Wis. Adm. Code.

Required Action	Date Due
Submittal of SSES: The permittee shall complete and submit for Department review and approval a Sewer System Evaluation Survey (SSES). Submittal of a SSES is not required if the infiltration/inflow analysis, conducted in accordance with the January 2009 Compliance Agreement, demonstrates that excessive infiltration/inflow does not exist.	11/30/2011
Complete Construction: Complete construction of the proposed sewer system rehabilitation, if identified in the SSES.	09/30/2013

5 Standard Requirements

NR 205, Wisconsin Administrative Code: The conditions in ss. NR 205.07(1) and NR 205.07(2), Wis. Adm. Code, are included by reference in this permit. The permittee shall comply with all of these requirements. Some of these requirements are outlined in the Standard Requirements section of this permit. Requirements not specifically outlined in the Standard Requirement section of this permit can be found in ss. NR 205.07(1) and NR 205.07(2).

5.1 Reporting and Monitoring Requirements

5.1.1 Monitoring Results

Monitoring results obtained during the previous month shall be summarized and reported on a Department Wastewater Discharge Monitoring Report. The report may require reporting of any or all of the information specified below under 'Recording of Results'. This report is to be returned to the Department no later than the date indicated on the form. When submitting a paper Discharge Monitoring Report form, the original and one copy of the Wastewater Discharge Monitoring Report Form shall be submitted to the return address printed on the form. A copy of the Wastewater Discharge Monitoring Report Form or an electronic file of the report shall be retained by the permittee.

All Wastewater Discharge Monitoring Reports submitted to the Department should be submitted using the electronic Discharge Monitoring Report system. Permittees who may be unable to submit Wastewater Discharge Monitoring Reports electronically may request approval to submit paper DMRs upon demonstration that electronic reporting is not feasible or practicable.

If the permittee monitors any pollutant more frequently than required by this permit, the results of such monitoring shall be included on the Wastewater Discharge Monitoring Report.

The permittee shall comply with all limits for each parameter regardless of monitoring frequency. For example, monthly, weekly, and/or daily limits shall be met even with monthly monitoring. The permittee may monitor more frequently than required for any parameter.

An Electronic Discharge Monitoring Report Certification sheet shall be signed and submitted with each electronic Discharge Monitoring Report submittal. This certification sheet, which is not part of the electronic report form, shall be signed by a principal executive officer, a ranking elected official or other duly authorized representative and shall be mailed to the Department at the time of submittal of the electronic Discharge Monitoring Report. The certification sheet certifies that the electronic report form is true, accurate and complete. Paper reports shall be signed by a principal executive officer, a ranking elected official, or other duly authorized representative.

5.1.2 Sampling and Testing Procedures

Sampling and laboratory testing procedures shall be performed in accordance with Chapters NR 218 and NR 219, Wis. Adm. Code and shall be performed by a laboratory certified or registered in accordance with the requirements of ch. NR 149, Wis. Adm. Code. Groundwater sample collection and analysis shall be performed in accordance with ch. NR 140, Wis. Adm. Code. The analytical methodologies used shall enable the laboratory to quantitate all substances for which monitoring is required at levels below the effluent limitation. If the required level cannot be met by any of the methods available in NR 219, Wis. Adm. Code, then the method with the lowest limit of detection shall be selected. Additional test procedures may be specified in this permit.

5.1.3 Recording of Results

The permittee shall maintain records which provide the following information for each effluent measurement or sample taken:

- the date, exact place, method and time of sampling or measurements;

- the individual who performed the sampling or measurements;
- the date the analysis was performed;
- the individual who performed the analysis;
- the analytical techniques or methods used; and
- the results of the analysis.

5.1.4 Reporting of Monitoring Results

The permittee shall use the following conventions when reporting effluent monitoring results:

- Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 0.1 mg/L, report the pollutant concentration as < 0.1 mg/L.
- Pollutant concentrations equal to or greater than the limit of detection, but less than the limit of quantitation, shall be reported and the limit of quantitation shall be specified.
- For the purposes of reporting a calculated result, average or a mass discharge value, the permittee may substitute a 0 (zero) for any pollutant concentration that is less than the limit of detection. However, if the effluent limitation is less than the limit of detection, the department may substitute a value other than zero for results less than the limit of detection, after considering the number of monitoring results that are greater than the limit of detection and if warranted when applying appropriate statistical techniques.

5.1.5 Compliance Maintenance Annual Reports

Compliance Maintenance Annual Reports (CMAR) shall be completed using information obtained over each calendar year regarding the wastewater conveyance and treatment system. The CMAR shall be submitted by the permittee in accordance with ch. NR 208, Wis. Adm. Code, by June 30, each year on an electronic report form provided by the Department.

In the case of a publicly owned treatment works, a resolution shall be passed by the governing body and submitted as part of the CMAR, verifying its review of the report and providing responses as required. Private owners of wastewater treatment works are not required to pass a resolution; but they must provide an Owner Statement and responses as required, as part of the CMAR submittal.

A separate CMAR certification document, that is not part of the electronic report form, shall be mailed to the Department at the time of electronic submittal of the CMAR. The CMAR certification shall be signed and submitted by an authorized representative of the permittee. The certification shall be submitted by mail. The certification shall verify the electronic report is complete, accurate and contains information from the owner's treatment works.

5.1.6 Records Retention

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit for a period of at least 3 years from the date of the sample, measurement, report or application. All pertinent sludge information, including permit application information and other documents specified in this permit or s. NR 204.06(9), Wis. Adm. Code shall be retained for a minimum of 5 years.

5.1.7 Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or correct information to the Department.

5.2 System Operating Requirements

5.2.1 Noncompliance Notification

- The permittee shall report the following types of noncompliance by a telephone call to the Department's regional office within 24 hours after becoming aware of the noncompliance:
  - any noncompliance which may endanger health or the environment;
  - any violation of an effluent limitation resulting from an unanticipated bypass;
  - any violation of an effluent limitation resulting from an upset; and
  - any violation of a maximum discharge limitation for any of the pollutants listed by the Department in the permit, either for effluent or sludge.

- A written report describing the noncompliance shall also be submitted to the Department's regional office within 5 days after the permittee becomes aware of the noncompliance. On a case-by-case basis, the Department may waive the requirement for submittal of a written report within 5 days and instruct the permittee to submit the written report with the next regularly scheduled monitoring report. In either case, the written report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times; the steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance; and if the noncompliance has not been corrected, the length of time it is expected to continue.

NOTE: Section 292.11(2)(a), Wisconsin Statutes, requires any person who possesses or controls a hazardous substance or who causes the discharge of a hazardous substance to notify the Department of Natural Resources **immediately** of any discharge not authorized by the permit. The discharge of a hazardous substance that is not authorized by this permit or that violates this permit may be a hazardous substance spill. To report a hazardous substance spill, call DNR's 24-hour HOTLINE at **1-800-943-0003**

5.2.2 Flow Meters

Flow meters shall be calibrated annually, as per s. NR 218.06, Wis. Adm. Code.

5.2.3 Raw Grit and Screenings

All raw grit and screenings shall be disposed of at a properly licensed solid waste facility or picked up by a licensed waste hauler. If the facility or hauler are located in Wisconsin, then they shall be licensed under chs. NR 500-536, Wis. Adm. Code.

5.2.4 Sludge Management

All sludge management activities shall be conducted in compliance with ch. NR 204 "Domestic Sewage Sludge Management", Wis. Adm. Code.

5.2.5 Prohibited Wastes

Under no circumstances may the introduction of wastes prohibited by s. NR 211.10, Wis. Adm. Code, be allowed into the waste treatment system. Prohibited wastes include those:

- which create a fire or explosion hazard in the treatment work;
- which will cause corrosive structural damage to the treatment work;
- solid or viscous substances in amounts which cause obstructions to the flow in sewers or interference with the proper operation of the treatment work;
- wastewaters at a flow rate or pollutant loading which are excessive over relatively short time periods so as to cause a loss of treatment efficiency; and
- changes in discharge volume or composition from contributing industries which overload the treatment works or cause a loss of treatment efficiency.

5.2.6 Unscheduled Bypassing

Any unscheduled bypass or overflow of wastewater at the treatment works or from the collection system is prohibited, and the Department may take enforcement action against a permittee for such occurrences under s. 283.89, Wis. Stats., unless:

- The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
- There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
- The permittee notified the Department as required in this Section.

Whenever there is an unscheduled bypass or overflow occurrence at the treatment works or from the collection system, the permittee shall notify the Department within 24 hours of initiation of the bypass or overflow occurrence by telephoning the wastewater staff in the regional office as soon as reasonably possible (FAX, email or voice mail, if staff are unavailable).

In addition, the permittee shall within 5 days of conclusion of the bypass or overflow occurrence report the following information to the Department in writing:

- Reason the bypass or overflow occurred, or explanation of other contributing circumstances that resulted in the overflow event. If the overflow or bypass is associated with wet weather, provide data on the amount and duration of the rainfall or snow melt for each separate event.
- Date the bypass or overflow occurred.
- Location where the bypass or overflow occurred.
- Duration of the bypass or overflow and estimated wastewater volume discharged.
- Steps taken or the proposed corrective action planned to prevent similar future occurrences.
- Any other information the permittee believes is relevant.

5.2.7 Scheduled Bypassing

Any construction or normal maintenance which results in a bypass of wastewater from a treatment system is prohibited unless authorized by the Department in writing. If the Department determines that there is significant public interest in the proposed action, the Department may schedule a public hearing or notice a proposal to approve the bypass. Each request shall specify the following minimum information:

- proposed date of bypass;
- estimated duration of the bypass;

- estimated volume of the bypass;
- alternatives to bypassing; and
- measures to mitigate environmental harm caused by the bypass.

5.2.8 Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. The wastewater treatment facility shall be under the direct supervision of a state certified operator as required in s. NR 108.06(2), Wis. Adm. Code. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training as required in ch. NR 114, Wis. Adm. Code, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

5.3 Surface Water Requirements

5.3.1 Permittee-Determined Limit of Quantitation Incorporated into this Permit

For pollutants with water quality-based effluent limits below the Limit of Quantitation (LOQ) in this permit, the LOQ calculated by the permittee and reported on the Discharge Monitoring Reports (DMRs) is incorporated by reference into this permit. The LOQ shall be reported on the DMRs, shall be the lowest quantifiable level practicable, and shall be no greater than the minimum level (ML) specified in or approved under 40 CFR Part 136 for the pollutant at the time this permit was issued, unless this permit specifies a higher LOQ.

5.3.2 Appropriate Formulas for Effluent Calculations

The permittee shall use the following formulas for calculating effluent results to determine compliance with average limits and mass limits:

Weekly/Monthly average concentration = the sum of all daily results for that week/month, divided by the number of results during that time period.

Weekly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the week.

Monthly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the month.

5.3.3 Visible Foam or Floating Solids

There shall be no discharge of floating solids or visible foam in other than trace amounts.

5.3.4 Percent Removal

During any 30 consecutive days, the average effluent concentrations of BOD_5 and of total suspended solids shall not exceed 15% of the average influent concentrations, respectively. This requirement does not apply to removal of total suspended solids if the permittee operates a lagoon system and has received a variance for suspended solids granted under NR 210.07(2), Wis. Adm. Code.

5.3.5 Fecal Coliforms

The limit for fecal coliforms shall be expressed as a monthly geometric mean.

5.3.6 Seasonal Disinfection

Disinfection shall be provided from May 1 through September 30 of each year. Monitoring requirements and the limitation for fecal coliforms apply only during the period in which disinfection is required. Whenever chlorine is used for disinfection or other uses, the limitations and monitoring requirements for residual chlorine shall apply. A dechlorination process shall be in operation whenever chlorine is used.

5.3.7 Applicability of Alternative Wet Weather Mass Limitations

- An alternative wet weather mass limitation applies when:
  - The applicable mass limitation (based on annual average design flow) is exceeded; and
  - The permittee demonstrates to the satisfaction of the Department that the discharge exceedance is caused by and occurs during a wet weather event. For the purposes of this demonstration, a wet weather event occurs during and immediately following periods of precipitation or snowmelt, including but not limited to rain, sleet, snow, hail or melting snow during which water from the precipitation, snowmelt or elevated groundwater enters the sewerage system through infiltration or inflow, or both. The permittee shall present demonstrations to the Department by attaching them to the Wastewater Discharge Monitoring Report Form(s).

Note: In making this demonstration, the permittee may want to consider presenting a discussion of normal effluent flow rates, the effluent flow rates that resulted in the exceedance and identification of the event, including intensity and duration, which caused the high flow rates. A graph of effluent flow over time may also be helpful.

5.3.8 Whole Effluent Toxicity (WET) Monitoring Requirements

In order to determine the potential impact of the discharge on aquatic organisms, static-renewal toxicity tests shall be performed on the effluent in accordance with the procedures specified in the *"State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition" (PUB-WT-797*, November 2004) as required by NR 219.04, Table A, Wis. Adm. Code). All of the WET tests required in this permit, including any required retests, shall be conducted on the *Ceriodaphnia dubia* and fathead minnow species. Receiving water samples shall not be collected from any point in contact with the permittee's mixing zone and every attempt shall be made to avoid contact with any other discharge's mixing zone.

5.3.9 Whole Effluent Toxicity (WET) Identification and Reduction

Within 60 days of a retest which showed positive results, the permittee shall submit a written report to the Biomonitoring Coordinator, Bureau of Watershed Management, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, which details the following:

- A description of actions the permittee has taken or will take to remove toxicity and to prevent the recurrence of toxicity;

- A description of toxicity reduction evaluation (TRE) investigations that have been or will be done to identify potential sources of toxicity, including some or all of the following actions:

  (a) Evaluate the performance of the treatment system to identify deficiencies contributing to effluent toxicity (e.g., operational problems, chemical additives, incomplete treatment)

  (b) Identify the compound(s) causing toxicity

(c) Trace the compound(s) causing toxicity to their sources (e.g., industrial, commercial, domestic)
(d) Evaluate, select, and implement methods or technologies to control effluent toxicity (e.g., in-plant or pretreatment controls, source reduction or removal)

- Where corrective actions including a TRE have not been completed, an expeditious schedule under which corrective actions will be implemented;
- If no actions have been taken, the reason for not taking action.

The permittee may also request approval from the Department to postpone additional retests in order to investigate the source(s) of toxicity. Postponed retests must be completed after toxicity is believed to have been removed.

5.4 Land Application Requirements

5.4.1 Sludge Management Program Standards And Requirements Based Upon Federally Promulgated Regulations

In the event that new federal sludge standards or regulations are promulgated, the permittee shall comply with the new sludge requirements by the dates established in the regulations, if required by federal law, even if the permit has not yet been modified to incorporate the new federal regulations.

5.4.2 General Sludge Management Information

The General Sludge Management Form 3400-48 shall be completed and submitted prior to any significant sludge management changes.

5.4.3 Sludge Samples

All sludge samples shall be collected at a point and in a manner which will yield sample results which are representative of the sludge being tested, and collected at the time which is appropriate for the specific test.

5.4.4 Land Application Characteristic Report

Each report shall consist of a Characteristic Form 3400-49 and Lab Report, unless approval for not submitting the lab reports has been given. Both reports shall be submitted by January 31 following each year of analysis.

The permittee shall use the following convention when reporting sludge monitoring results: Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 1.0 mg/kg, report the pollutant concentration as < 1.0 mg/kg .

All results shall be reported on a dry weight basis.

5.4.5 Calculation of Water Extractable Phosphorus

The permittee shall use the following formula to calculate and report Water Extractable Phosphorus:
Water Extractable Phosphorus (% of Total P) =
[Water Extractable Phosphorus (mg/kg, dry wt) ÷ Total Phosphorus (mg/kg, dry wt)] x 100

5.4.6 Monitoring and Calculating PCB Concentrations in Sludge

When sludge analysis for "PCB, Total Dry Wt" is required by this permit, the PCB concentration in the sludge shall be determined as follows.

Either congener-specific analysis or Aroclor analysis shall be used to determine the PCB concentration. The permittee may determine whether Aroclor or congener specific analysis is performed. Analyses shall be performed in accordance with the following provisions and Table EM in s. NR 219.04, Wis. Adm. Code.

- EPA Method 1668 may be used to test for all PCB congeners. If this method is employed, all PCB congeners shall be delineated. Non-detects shall be treated as zero. The values that are between the limit of detection and the limit of quantitation shall be used when calculating the total value of all congeners. All results shall be added together and the total PCB concentration by dry weight reported. **Note:** It is recognized that a number of the congeners will co-elute with others, so there will not be 209 results to sum.
- EPA Method 8082A shall be used for PCB-Aroclor analysis and may be used for congener specific analysis as well. If congener specific analysis is performed using Method 8082A, the list of congeners tested shall include at least congener numbers 5, 18, 31, 44, 52, 66, 87, 101, 110, 138, 141, 151, 153, 170, 180, 183, 187, and 206 plus any other additional congeners which might be reasonably expected to occur in the particular sample. For either type of analysis, the sample shall be extracted using the Soxhlet extraction (EPA Method 3540C) (or the Soxhlet Dean-Stark modification) or the pressurized fluid extraction (EPA Method 3545A). If Aroclor analysis is performed using Method 8082A, clean up steps of the extract shall be performed as necessary to remove interference and to achieve as close to a limit of detection of 0.11 mg/kg as possible. Reporting protocol, consistent with s. NR 106.07(6)(e), should be as follows: If all Aroclors are less than the LOD, then the Total PCB Dry Wt result should be reported as less than the highest LOD. If a single Aroclor is detected then that is what should be reported for the Total PCB result. If multiple Aroclors are detected, they should be summed and reported as Total PCBs. If congener specific analysis is done using Method 8082A, clean up steps of the extract shall be performed as necessary to remove interference and to achieve as close to a limit of detection of 0.003 mg/kg as possible for each congener. If the aforementioned limits of detection cannot be achieved after using the appropriate clean up techniques, a reporting limit that is achievable for the Aroclors or each congener for the sample shall be determined. This reporting limit shall be reported and qualified indicating the presence of an interference. The lab conducting the analysis shall perform as many of the following methods as necessary to remove interference:

3620C – Florisil	3611B - Alumina
3640A - Gel Permeation	3660B - Sulfur Clean Up (using copper shot instead of powder)
3630C - Silica Gel	3665A - Sulfuric Acid Clean Up

5.4.7 Land Application Report

Land Application Report Form 3400-55 shall be submitted by January 31, following each year non-exceptional quality sludge is land applied. Non-exceptional quality sludge is defined in s. NR 204.07(4), Wis. Adm. Code.

5.4.8 Other Methods of Disposal or Distribution Report

The permittee shall submit Report Form 3400-52 by January 31, following each year sludge is hauled, landfilled, incinerated, or when exceptional quality sludge is distributed or land applied.

5.4.9 Approval to Land Apply

Bulk non-exceptional quality sludge as defined in s. NR 204.07(4), Wis. Adm. Code, may not be applied to land without a written approval letter or Form 3400-122 from the Department unless the Permittee has obtained permission from the Department to self approve sites in accordance with s. NR 204.06 (6), Wis. Adm. Code. Analysis of sludge characteristics is required prior to land application. Application on frozen or snow covered ground is restricted to the extent specified in s. NR 204.07(3) (l), Wis. Adm. Code.

5.4.10 Soil Analysis Requirements

Each site requested for approval for land application must have the soil tested prior to use. Each approved site used for land application must subsequently be soil tested such that there is at least one valid soil test in the four years prior to land application. All soil sampling and submittal of information to the testing laboratory shall be done in accordance with UW Extension Bulletin A-2100. The testing shall be done by the UW Soils Lab in Madison or Marshfield, WI or at a lab approved by UW. The test results including the crop recommendations shall be submitted to the DNR contact listed for this permit, as they are available. Application rates shall be determined based on the crop nitrogen recommendations and with consideration for other sources of nitrogen applied to the site.

5.4.11 Land Application Site Evaluation

For non-exceptional quality sludge, as defined in s. NR 204.07(4), Wis. Adm. Code, a Land Application Site Request Form 3400-053 shall be submitted to the Department for the proposed land application site. The Department will evaluate the proposed site for acceptability and will either approve or deny use of the proposed site. The permittee may obtain permission to approve their own sites in accordance with s. NR 204.06(6), Wis. Adm. Code.

5.4.12 Class A Sludge: Fecal Coliform Density Requirement

The fecal coliform density which must be < 1000 MPN/g TS as required in s. NR 204.07, Wis. Adm. Code, shall be satisfied immediately after the treatment process is completed. If the material is bagged or distributed at that time, no re-testing is required. If the material is bagged, distributed or land applied at a later time, the sludge shall be re-tested and this requirement satisfied at that time also, to ensure that regrowth of bacteria has not occurred. See Municipal Wastewater Sludge Guidance Memo #3 (Fecal Coliform Monitoring - Sampling and Analytical Procedures).

5.4.13 Class A Sludge: Pasteurization Process

Maintain the temperature of the sludge at 70° Celsius or higher for 30 minutes or longer.

5.4.14 Class A Sludge: Alkaline Treatment Process

The pH of the sewage sludge shall be raised to greater than 12 for at least 72 hours. During this time, the temperature of the sewage sludge shall be greater than 52° C for at least 12 hours. In addition, after the 72 hour period, the sewage sludge shall be air dried to at least 50% total solids.

5.4.15 Vector Control: pH Adjustment

The pH of the sewage sludge shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 2 hours and then at 11.5 or higher for an additional 22 hours.

6 Summary of Reports Due

FOR INFORMATIONAL PURPOSES ONLY

Description	Date	Page
Copper -Report on Effluent Discharges	March 31, 2010	11
Copper -Action Plan or Facility Plan Amendment	June 30, 2010	11
Copper -Plans and Specifications	December 31, 2010	11
Copper -Complete Actions	March 31, 2012	11
Sewer System Evaluation Survey (SSES) -Submittal of SSES	November 30, 2011	11
Sewer System Evaluation Survey (SSES) -Complete Construction	September 30, 2013	11
Compliance Maintenance Annual Reports (CMAR)	by June 30, each year	12
General Sludge Management Form 3400-48	prior to any significant sludge management changes	17
Characteristic Form 3400-49 and Lab Report	by January 31 following each year of analysis	17
Land Application Report Form 3400-55	by January 31, following each year non-exceptional quality sludge is land applied	18
Report Form 3400-52	by January 31, following each year sludge is hauled, landfilled, incinerated, or when exceptional quality sludge is distributed or land applied	18
Wastewater Discharge Monitoring Report	no later than the date indicated on the form	11

Report forms shall be submitted to the address printed on the report form. Any facility plans or plans and specifications for municipal, industrial, industrial pretreatment and non industrial wastewater systems shall be submitted to the Bureau of Watershed Management, P.O. Box 7921, Madison, WI 53707-7921. All other submittals required by this permit shall be submitted to:
Northeast Region, 2984 Shawano Avenue, Green Bay, WI 54313-6727

APPENDIX II-2

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR) MEMORANDUM
Quality Based Effluent Limitations (WQBEL) / September 30, 2013

CORRESPONDENCE / MEMORANDUM **State of Wisconsin**

DATE: September 30, 2013 FILE REF: 3200

TO: Dick Sachs – East District / Green Bay

FROM: Jim Schmidt – WQ/3

SUBJECT: Water Quality-Based Effluent Limitations for the Kiel Wastewater Treatment Facility (WPDES Permit # WI-0020141)

This is in response to your request for an evaluation of water quality-based effluent limitations using chs. NR 102, 105, 106, 207, and 217 of the Wisconsin Administrative Code (where applicable), for Kiel's discharge to the Sheboygan River in Manitowoc County. This facility is located in the Sheboygan River Watershed (SH03) of the Sheboygan River basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

The attached evaluation was developed in consideration of new monthly low flows (7Q10 and 7Q2) which were estimated by USGS. Since those flows would allow increased discharges for some parameters above the limits included in Kiel's current WPDES permit, antidegradation must be considered. **The following recommendations are made for parameters that do not need an antidegradation evaluation because either the limits are equal to or more stringent than limits in the current permit, do not involve lowering of water quality, or are the initial imposition of limits which are exempt from antidegradation review:**

Substance	Effluent Limitations
pH	6.0 – 9.0 s.u. daily range (1)
Dissolved Oxygen:	
July – September	7.0 mg/L daily minimum
October – March	6.0 mg/L daily minimum
May – June	6.0 mg/L daily minimum
Fecal Coliforms	400 counts / 100 mL monthly geometric mean, May – September (1)
Total Residual Chlorine	38 ug/L daily maximum, 8.4 ug/L weekly average (1)
Total Phosphorus:	
Water Quality-based	0.72 lbs/day annual average, 0.1 mg/L six-month average (May – October, November – April), 0.3 mg/L monthly average (3)
Interim	1.0 mg/L monthly average (2)
Chlorides	460 mg/L and 3,300 lbs/day weekly average (1)(5)
Temperature (3):	
September	75°F weekly average
October	64°F weekly average
November	52°F weekly average
December	53°F weekly average
January	53°F weekly average
February	55°F weekly average
March	57°F weekly average
April	60°F weekly average

(continued on next page)

Ammonia:

Year-round	6.7 mg/L daily maximum (6)
April	2.2 mg/L monthly average (4)
May	5.2 mg/L weekly average, 2.2 mg/L monthly average (4)
June – September	3.7 mg/L weekly average, 1.7 mg/L monthly average (4)
October	9.4 mg/L weekly average (3), 5.3 mg/L monthly average (4)
November	13 mg/L weekly average (3), 5.3 mg/L monthly average (4)
December	12 mg/L weekly average (3), 5.3 mg/L monthly average (4)
January - February	15 mg/L weekly average (3), 5.3 mg/L monthly average (4)
March	19 mg/L weekly average (3), 5.3 mg/L monthly average (4)

Footnotes:
(1) – No change to existing permit limits because the applicable water quality standards do not change.
(2) – Recommended limits are equal to or more stringent than those in the current permit.
(3) – Initial imposition of limits, exempt from antidegradation under s. NR 207.02(6)(b).
(4) – No change from existing permit limits because the need for increased limits cannot be shown under ss. NR 207.04(1)(a) and (2)(a).
(5) – If Kiel wishes to pursue a chloride variance, the recommended interim limit would be 630 mg/L weekly average, which is 105% of the highest reported weekly concentration.
(6) - A variable daily maximum ammonia limit table based on effluent pH is available to Kiel if desired, to replace the new year-round limit of 6.7 mg/L. These alternative daily maximum limits are not subject to antidegradation because weekly and monthly average limits are not changing (also see (4)).

Daily Maximum Ammonia Nitrogen (NH_3-N) Limits

Effluent pH - s.u.	NH_3-N Limit – mg/L	Effluent pH - s.u.	NH_3-N Limit – mg/L
pH ≤ 7.5	No Limit	8.2 < pH ≤ 8.3	9.4
7.5 < pH ≤ 7.6	34*	8.3 < pH ≤ 8.4	7.8
7.6 < pH ≤ 7.7	29*	8.4 < pH ≤ 8.5	6.4
7.7 < pH ≤ 7.8	24*	8.5 < pH ≤ 8.6	5.3
7.8 < pH ≤ 7.9	20*	8.6 < pH ≤ 8.7	4.4
7.9 < pH ≤ 8.0	17	8.7 < pH ≤ 8.8	3.7
8.0 < pH ≤ 8.1	14	8.8 < pH ≤ 8.9	3.1
8.1 < pH ≤ 8.2	11	8.9 < pH ≤ 9.0	2.6

* During the months of May through October if the pH is less than or equal to 7.9 there is no daily maximum limit for NH_3-N for municipal WWTF's treating primarily domestic wastewater. Limits shown in the table above with an asterisk* apply from November through April only.

As noted earlier, some parameters have increased effluent limits available compared to those in the existing WPDES permit. Increased limits are available for the following parameters and averaging periods based on a showing of need under s. NR 207.04(1)(a) using data reported during the current permit term:

BOD5 = Weekly average limits for every month of the year
Total Suspended Solids = Weekly average limits for every month of the year
Ammonia = Weekly average limit in April

As such, several alternative sets of limits are available in terms of recommended limits based on options available to the permittee. These alternatives are available because the antidegradation rule (ch. NR 207) requires certain steps or evaluations to be done by the permittee before increased effluent limitations can be determined by the Department. When the need for increased limitations has been demonstrated, the permittee is required to perform an evaluation of whether or not the increased discharge will accommodate important social or economic development, pursuant to s. NR 207.04(1)(c)1. If the demonstration is not made, or if it is made and there is a showing that the increased discharge would not accommodate important social or economic development, no change from the current permit limits would be allowed under s. NR 207.04(2):

Limits based on inability to show accommodation of important social or economic development:

Substance	Effluent Limitations
BOD5:	
May - October	10 mg/L and 72 lbs/day weekly average, 10 mg/L monthly average
November - April	15 mg/L and 108 lbs/day weekly average, 15 mg/L monthly average
Total Suspended Solids:	
May - October	10 mg/L weekly average, 10 mg/L monthly average
November - April	15 mg/L weekly average, 15 mg/L monthly average
Ammonia (in addition to limits shown earlier in this cover document):	
April	5.2 mg/L weekly average

If Kiel as able to show that the increased discharge would accommodate important social or economic development, effluent limits would be recommended based on the prevention of significant lowering of water quality, as defined in s. NR 207.05. If the increased discharge exceeds the levels which represent significant lowering of water quality, Kiel has the opportunity to demonstrate whether there are cost-effective alternatives available under s. NR 207.04(1)(d) which prevent the significant lowering of water quality. Based on this evaluation, two additional alternative sets of effluent limits are available.

Limits based on prevention of significant lowering of water quality, applicable if either the discharge is below these levels or if the significant lowering of water quality can be prevented in a cost-effective manner:

Substance	Effluent Limitations
Ammonia (in addition to limits shown earlier in this cover document):	
April	9.0 mg/L weekly average

BOD5 & Total Suspended Solids (TSS):

Month:	BOD5	TSS	Month:	BOD5	TSS
January	16 mg/L and 117 lbs/day weekly average	19 mg/L weekly average	July	10 mg/L, and 75 lbs/day weekly average	11 mg/L weekly average
February	16 mg/L and 116 lbs/day weekly average	18 mg/L weekly average	August	10 mg/L and 72 lbs/day weekly average	10 mg/L weekly average
March	20 mg/L and 142 lbs/day weekly average	29 mg/L weekly average	September	11 mg/L and 76 lbs/day weekly average	12 mg/L weekly average
April	30 mg/L monthly ave., 36 mg/L and 117 lbs/day weekly average	30 mg/L monthly average, 45 mg/L weekly average	October	11 mg/L, and 76 lbs/day weekly average	12 mg/L weekly average
May	14 mg/L and 102 lbs/day weekly average	23 mg/L weekly average	November	17 mg/L and 120 lbs/day weekly average	20 mg/L weekly average
June	11 mg/L and 76	12 mg/L weekly	December	17 mg/L and 139	20 mg/L weekly

	lbs/day weekly ave.	average		lbs/day weekly ave.	average

Limits based on full assimilative capacity of receiving water, applicable if the discharge exceeds levels which represent significant lowering of water quality and the significant lowering of water quality cannot be prevented in a cost-effective manner under s. NR 207.04(1)(d):

Substance | Effluent Limitations

Ammonia (in addition to limits shown earlier in this cover document):

April — 17 mg/L weekly average

BOD5 & Total Suspended Solids (TSS):

Month:	BOD5	TSS	Month:	BOD5	TSS
January	19 mg/L and 134 lbs/day weekly average	19 mg/L weekly average	July	11 mg/L and 82 lbs/day weekly average	11 mg/L weekly average
February	18 mg/L, and132 lbs/day weekly average	18 mg/L weekly average	August	10 mg/L, and73 lbs/day weekly average	10 mg/L weekly average
March	29 mg/L and 210 lbs/day weekly average	29 mg/L weekly average	September	12 mg/L and 84 lbs/day weekly average	12 mg/L weekly average
April	30 mg/L monthly average, 45 mg/L weekly average	30 mg/L monthly average, 45 mg/L weekly average	October	12 mg/L and 85 lbs/day weekly average	12 mg/L weekly average
May	23 mg/L, and 163 lbs/day weekly average	23 mg/L weekly average	November	20 mg/L and 143 lbs/day weekly average	20 mg/L weekly average
June	12 mg/L and 85 lbs/day weekly average	12 mg/L weekly average	December	20 mg/L and 140 lbs/day weekly average	20 mg/L weekly average

NOTE: Since there are no water quality standards available for total suspended solids, there is no level at which significant lowering of water quality can be defined under NR 207. As a result, the total suspended solids limits in the previous two tables are the same, since the need for increased limits was able to be demonstrated.

Along with the chemical-specific recommendations mentioned above, acute and chronic whole effluent toxicity testing is recommended for this permittee. Accordingly, following the guidance provided in the most recent version of the Department's Whole Effluent Toxicity Program Guidance Document, three acute whole effluent toxicity test batteries are recommended during the permit term, and twice per year chronic whole effluent toxicity test batteries are also recommended. Please consult the attached report regarding relevant monitoring conditions that relate to this discharge.

If there are any questions or comments, please contact Jim Schmidt at (608) 267-7658 or via e-mail at jamesw.schmidt@wisconsin.gov.

Attachment

cc: David Gerdman – Water District East / Green Bay

Water Quality-Based Effluent Limitations for
Kiel WWTF
WPDES Permit # WI-0020141
Prepared by:
Jim Schmidt - WQ/3

Existing Permit Limitations (WPDES Permit # WI-0020141, effective April 1, 2009 and expiring September 30, 2013):

Outfall 001 - Activated sludge system (extended aeration) followed by clarification, phosphorus removal by chemical precipitation, tertiary filtration and disinfection with chlorine gas followed by dechlorination with sulfur dioxide gas.

Substance	Effluent Limitations
BOD5:	
May - October	10 mg/L and 72 lbs/day weekly average, 10 mg/L monthly average
November - April	15 mg/L and 108 lbs/day weekly average, 15 mg/L monthly average
Total Suspended Solids:	
May - October	10 mg/L weekly average, 10 mg/L monthly average
November - April	15 mg/L weekly average, 15 mg/L monthly average
pH	6.0 – 9.0 s.u. daily range
Dissolved Oxygen	6.0 mg/L daily minimum
Fecal Coliforms	400 counts / 100 mL monthly geometric mean, May – September
Total Residual Chlorine	38 ug/L daily maximum, 8.4 ug/L weekly average
Total Phosphorus	1.0 mg/L monthly average
Total Recoverable Copper	39 ug/L and 0.28 lbs/day weekly average, 0.46 lbs/day wet weather weekly average
Ammonia:	
Year-round	11 mg/L daily maximum
April – May	5.2 mg/L weekly average, 2.2 mg/L monthly average
June – September	3.7 mg/L weekly average, 1.7 mg/L monthly average
October – March	5.3 mg/L monthly average

Since monthly low flows are now available for the receiving water, all of the above limits are being re-evaluated in this report along with anything else tested and detected in Kiel's effluent.

Information for Permit Reissuance Evaluation:

Receiving Water Information

Name: Sheboygan River (WBIC = 50700)
Classification: Warmwater sport fish community, not used as a public water supply
NOTES: (1) For bioaccumulative chemicals of concern (BCCs), criteria are based on a classification as a coldwater community and public water supply since this permittee is located in the Great Lakes basin. However, no BCCs were detected in the discharge.
(2) Sheboygan River is listed as an Impaired Water for PCBs over the first 33.9 miles upstream of its mouth. At this time, this designation does not affect Kiel since Kiel is not required to test PCBs in its effluent.
Year-round flows (updated by USGS in August of 2008):

7Q10 =	0.93 cfs	7Q2 =	2.1 cfs
30Q5 or 90Q10 =	1.6 cfs	Estimated Harmonic Mean Flow =	11.4 cfs

% of Flow used to calculate limits = 25 (default)

Monthly low flows:

Month	30Q5 (cfs)	7Q2 (cfs)	7Q10 (cfs)	Month	30Q5 (cfs)	7Q2 (cfs)	7Q10 (cfs)
January	3.4	4.7	1.7	July	2.9	3.2	1.5
February	4.4	5.1	1.7	August	2.3	2.8	1.1
March	26	13.3	3.4	September	2.2	2.8	1.1
April	32	24	11.6	October	2.9	4.1	1.4
May	10.9	10.1	3.9	November	4.6	6.4	2.2
June	5.1	5.4	2.1	December	4.3	6.1	1.9

Monthly 4Q3 flows are also available, but are not listed here because those flows are not used for limit calculations due to the fact they do not represent "biologically-based" design low flows.

Source of background concentration data = Sheboygan River near Sheboygan for everything except chlorides and hardness. Chloride data came from the Mullet River above Plymouth and hardness data came from ambient water samples in Kiel's whole effluent tests. Although the Sheboygan River site is downstream of Kiel, dilution and results (compared to other locations) suggest Kiel has little impact on downstream metals levels.

Background results used in limit calculations:

Substance	Result	Substance	Result
Chloride	22.0 mg/L	Hardness	288 PPM
Cadmium	0.061 ug/L	Chromium	0.519 ug/L
Copper	2.46 ug/L	Lead	0.555 ug/L
Nickel	2.94 ug/L	Zinc	3 ug/L

Effluent Information

Actual Flow (4/1/2009 – 9/30/2013):

- Peak daily = 3.115 MGD (4/10/2013)
- Peak 7-day average = 2.645 MGD (4/8 – 4/14/2013)
- Peak 30-day average = 2.016 MGD (3/31 – 4/29/2013)
- Peak 365-day average = 1.066 MGD (latest = 6/12/2010 – 6/11/2011)

Design Flow:

- Annual average = 0.862 MGD (from permit reissuance application)

For the peak daily, weekly, and monthly flows, the peak actual flows are used because the peak actual 365-day flow exceeded the annual average design flow. Only the peak annual average is used to calculate water quality-based concentration limits, while the other peak flows are used to calculate mass limits. NOTE: The high flows, in particular the reported flows, may warrant Kiel being treated as a major municipality for the next permit reissuance and warranting testing of the entire EPA priority pollutant list.

Acute dilution factor used = Not applicable

Effluent concentration data)

Substances tested:

During permit term = Ammonia, chloride, copper, phosphorus, residual chlorine, hardness (during WET tests)

As part of permit reissuance application = Arsenic, cadmium, chromium, lead, nickel, zinc, hardness

Results:

Single test results are available for arsenic, cadmium, lead, chromium, nickel and zinc. Of those, only the last three were detected, so those results are summarized below alongside the calculated limits. For the remaining substances, multiple test results are available and summarized here.

Hardness)
Daily average results from effluent WET tests in current permit term:

9/15/2009	397 PPM
5/18/2010	396 PPM
3/15/2011	364 PPM
4/10/2012	378 PPM
3/19/2013	412 PPM
From permit application:	
1/13/2013	332 PPM
1/16/2013	346 PPM
1/20/2013	359 PPM
1/28/2013	299 PPM
Mean of all results	365 PPM

Chloride)

Date	Chloride (mg/L)	Date	Chloride (mg/L)	Date	Chloride (mg/L)
10/19/2011	600	2/1/2012	450	6/5/2012	400
11/17/2011	390	3/13/2012	350	7/17/2012	450
12/1/2011	420	4/25/2012	360	8/1/2012	460
1/4/2012	390	5/8/2012	270	9/4/2012	440

Statistics}

Mean =	415 mg/L
1-day P99 =	633.2 mg/L
4-day P99 =	515.6 mg/L
30-day P99 =	449.8 mg/L

Because of the large number of results available for ammonia, phosphorus, copper and chlorine, only the statistics are presented here.

	Phosphorus	Ammonia	Copper	Chlorine
# of Results	434	437	28	478
# of Detects	434	431	28	0
Mean	0.849 mg/L	0.238 mg/L	13.86 ug/L	0
Maximum	16.542 mg/L (4/20/2011)	10.92 mg/L (12/28/2010)	27 ug/L (4/13/2011)	0 (all results were less than 100 ug/L)
1-day P99	7.57 mg/L	2.65 mg/L	29.30 ug/L	
4-day P99	5.41 mg/L	1.73 mg/L	20.63 ug/L	
30-day P99	1.89 mg/L	0.72 mg/L	16.10 ug/L	

"P99" values are the 99th upper percentile values calculated using the procedure in s. NR 106.05(5) when 11 or more detected results are available.

Mean results are calculated using zeroes in place of non-detected results, the reason why the mean chlorine concentration is zero.

NOTE: Because some of the copper values were excluded due to high levels of detection, the copper data are summarized in this report. That information is on the following page.

Effluent Copper Data reported since 3/10/2011, results in ug/L

Date	Cu result	Date	Cu result
03/10/2011	15	06/05/2012	9.4
04/13/2011	27	07/17/2012	15
05/02/2011	22	08/01/2012	14
06/02/2011	18	09/04/2012	14
07/07/2011	19	10/09/2012	11
08/04/2011	19	11/15/2012	8.1
09/12/2011	18	12/03/2012	7
10/10/2011	19	01/02/2013	8
11/01/2011	16	02/03/2013	9.6
12/01/2011	15	03/06/2013	7.4
01/04/2012	18	05/06/2013	8.7
02/01/2012	16 #	05/21/2013	12
03/01/2012	11	6/12/2013	8.9
04/17/2012	12		
05/01/2012	10		

NOTES:

< - Copper was not detected at the indicated level of detection.

* - Data were actually available throughout the entire permit term back to April of 2009. However, as requested by the permittee, only the copper data reported on or after March 10, 2011 were considered here due to a change in laboratories which was in part due to issues with high levels of detection.

- Result was corrected from the submitted discharge monitoring reports, as documented within Kiel's April 1, 2013 Dissipative Cooling request submittal.

Out of the 72 total results submitted between the effective date of the current permit and the end of June, 2013, 16 results were excluded. That left 56 accepted results, 45 of which were detected.

Effluent Limit Summary

Limits are calculated only for the substances detected in Kiel's effluent that have water quality criteria, as well as the chlorine limit since chlorine was limited in the current WPDES permit. Results are in units of ug/L unless noted otherwise.

DAILY MAXIMUM LIMITS based on ACUTE TOXICITY CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99	Max.
Chlorine	**19.03**	**38.06**		**Limited in current permit**		
Chromium (total or +3)	4445.84 *	8891.68	1778.34	1.1		
Copper	52.64 *	105.28			29.30	27
Nickel	1048.88 *	2097.76	419.55	2.1		
Zinc	344.68 *	689.36	137.87	20		
Chlorides (mg/L)	757	1514			633.2	600

* - Criteria are calculated using an effluent hardness of 365 PPM except for nickel (268 PPM) and zinc (333 PPM) where the values represent the maximum endpoint of the range over which criteria are applied in Table 2A of ch. NR 105.

NOTE: The NR 105 criteria are not considered to be seasonal in that they don't vary by pH or temperature, meaning parameters that vary by season. As a result, the chronic toxicity criteria-based limits are calculated using 25% of the year-round 7Q10 low flow of 0.93 cfs, rather than limits that vary from month to month based on monthly 7Q10 values. This won't be the case for the evaluation of other parameters such as BOD5, ammonia, and temperature.

WEEKLY AVERAGE LIMITS based on CHRONIC TOXICITY CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99
Chlorine	**7.28**	**8.55**	**1.71**	**Limited in current permit**	
Chromium (total or +3)	314.18 *	368.86	73.77	1.1	
Copper	25.59 *	29.62			20.63
Nickel	120.18 *	140.62	28.12	2.1	
Zinc	303.58 *	355.98	71.20	20	
Chlorides (mg/L)	**395**	**460.02**			**515.60**

* - Criteria are calculated using a receiving water hardness of 288 PPM except for nickel (268 PPM) where the value represents the maximum endpoint of the range over which criteria are applied in Table 2A of ch. NR 105.

MONTHLY AVERAGE LIMITS based on HUMAN THRESHOLD CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99
Chromium (total or +3)	3.82E+06	1.20E+07	2.40E+06	1.1	
Nickel	4.30E+04	1.35E+05	2.70E+04	2.1	

Limits were not calculated based on wildlife or human cancer criteria since none of the substances with those criteria were required to be tested in Kiel's effluent.

Permit Recommendations:

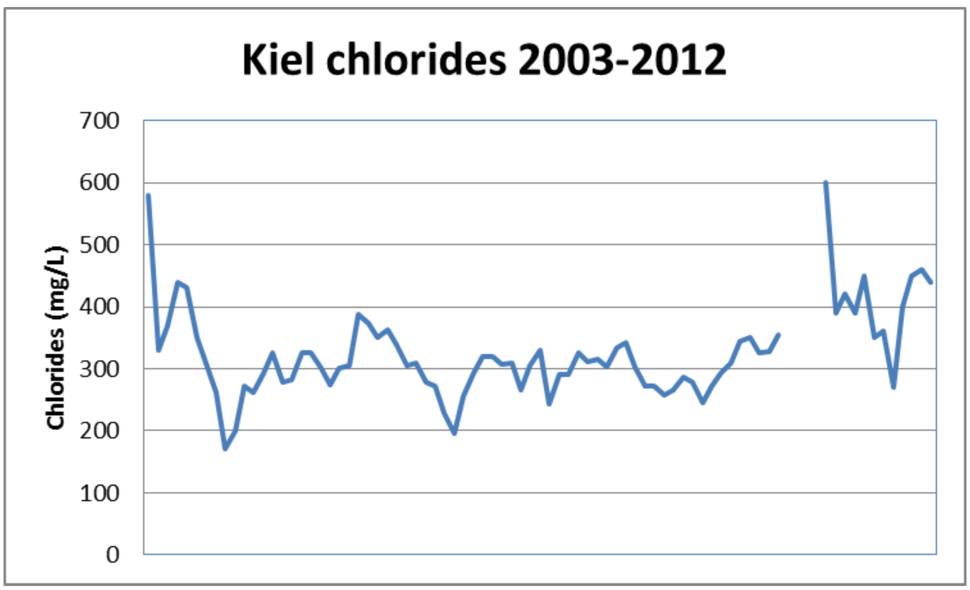
Chlorine) Since chlorine was limited in the current WPDES permit and Kiel adds sulfur dioxide for dechlorination purposes, chlorine limits must be included in the reissued permit. The daily maximum limit of 38 ug/L stays the same, but the weekly average limit increases slightly due to the new low flows estimated by USGS. The limit would increase from 8.4 ug/L to 8.6 ug/L (rounded from 8.55). However, since the previous limit was not exceeded during the permit term, Kiel is therefore unable to demonstrate the need for increased limits, no matter how slight the increase is. Pursuant to antidegradation rule language in s. NR 207.04(2), since the permittee has shown its ability to meet the 8.4 ug/L limit, that limit shall remain in the permit. Mass limits are no longer necessary for residual chlorine pursuant to s. NR 106.07(2).

Chlorides) A weekly average limit is recommended because the 4-day P99 value of 515.6 mg/L exceeds the effluent limit of 460.02 mg/L. The calculated and recommended water quality-based limit is 460 mg/L (rounded) and 3,300 lbs/day (0.862 MGD at 460.02 mg/L, rounded). Since Kiel does not have chloride limits in its current WPDES permit, Kiel may wish to pursue a variance to water quality standards under Subchapter VII of ch. NR 106. Under current guidance from 2010, the suggested variance (or interim) limit is equal to the greater of the 4-day P99 or 105% of the highest weekly average effluent concentration. At Kiel, the highest concentration was 600 mg/L in October of 2011. Since that exceeds the P99 of 515.6 mg/L, the proposed variance limit would be 630 mg/L weekly average (600 mg/L X 1.05).

It is noted that a fairly large chloride database is available from the previous permit term, covering 2003 through 2009. The overall chloride results from 2003 through 2012 are presented in a separate attachment to this report. Although more than 11 detected results are already available during the current permit term, it is possible to use this older information to either support or revise the permit recommendations. In fact, another 67 results are available over this period, so the following table summarizes the statistics from those 67 results when combined with the 12 results from 2011 to 2012, alongside the statistics for only the 12 results from 2011-2012 which were presented earlier in this report:

	Chloride – all data	Chloride (2011-2012)
# of Results	79	12
# of Detects	79	12
Mean	323.87 mg/L	415 mg/L
Maximum	600 mg/L (10/19/2011)	600 mg/L (10/19/2011)
1-day P99	528.29 mg/L	633.2 mg/L
4-day P99	417.10 mg/L	515.6 mg/L
30-day P99	355.82 mg/L	449.8 mg/L

It is noted that none of the results in the previous database exceeded the maximum value of 600 mg/L from 2011. From this table, it appears that the overall P99 values are much lower than that calculated from the 2011-2012 data, and the 4-day P99 of 417.10 mg/L from the overall database is now less than the calculated weekly average limit of 460.02 mg/L. This suggests the chloride limits could be removed from the permit recommendations. However, the fact that the recent data has higher P99 values suggests a potential upward trend in Kiel's chloride results. The following graph was developed from the overall database.



Although many of the results are below the 460 mg/L limit, there appears to be a trend towards higher values near the end of this period, covering the 2011 – 2013 data although, as summarized earlier, theonly result that exceeds 460 mg/L was the peak result of 600 mg/L from October 19, 2011. Results since then have been below the limit, but several results are closer to the limit compared to the results from 2009 and earlier. With a fairly long break containing no results between March of 2009 and October of 2011 (as noted by the break in the graph, also see data in the attachment), it isn't clear whether these recent high values were part of a trend that extended over this 2-1/2 year break. Because there was only a single day exceedance of the weekly average limit in 2011 along with another single day exceedance back in 2003 (the first result of the database), these exceedances do not constitute the trigger of a weekly average permit limit under s. NR 106.05(3)(b). There aren't exceedances of a weekly average limits based on 4 consecutive days of data because chloride wasn't sampled on 4 consecutive days at any time during the 2003 – 2012 database.

Because the 4-day P99 of the 2011 – 2012 exceeds the 460 mg/L limit and because there's a long break within the database, the permit recommendation shall be based only on the most recent information under the asusmption that the pre-2009 data are not representative of current discharge conditions. Therefore, no change is made to the permit limits recommended above. As data are collected during the upcoming permit term, it may be appropriate to revise these recommendations again in the future especially if the upward trend is no longer apparent.

EVALUATIONS OF OTHER PARAMETERS:
Not only has the year-round 7Q10 and 7Q2 changed, but we now have monthly 7Q10 and 7Q2 estimates. Because of this, effluent limits for BOD5, TSS, and ammonia shall be re-evaluated in this report to determine if there are any significant changes from the current and previous permit terms.

BOD5 and TSS: BOD5 limits have been in-place for several terms of Kiel's WPDES permit, calculated based on the annual average design flow of 0.862 MGD and a 7Q10 of 0.80 cfs. TSS limits are typically set equal to the BOD5 limits based on the expected achievability of municipal sewage treatment plants. Although the effluent design flow has not changed, limits are re-calculated due to the availability of monthly 7Q10 flow estimates on the Sheboygan River as provided by USGS. Several exceedances of the current permit limits for both parameters during the current permit term warrants re-examining the limits at this time. The weekly average limit exceedances are summarized below (monthly average limit exceedances aren't summarized here because they would essentially be double-counting many of the weekly exceedances given that the concentration limits are the same):

BOD5 – Weekly average limit of 10 mg/L, May – October = Three exceedances during May of 2010, maximum calculated weekly average was 93.0 mg/L over May 2 – 4.

BOD5 – Weekly average limit of 72 lbs/day, May – October = Three exceedances during May of 2010, maximum calculated weekly average was 828 lbs/day over May 2 – 4.

BOD5 – Weekly average limit of 15 mg/L, November – April = Six exceedances during March and April of 2010, two more during December of 2010, and two more during April of 2011, maximum calculated average was 304.4 mg/L over March 28 – 30, 2010.

BOD5 – Weekly average limit of 108 lbs/day, November – April = Six exceedances during March and April of 2010, two more during December of 2010, three more during April of 2011 and three more during April of 2013, maximum calculated average was 2,537 lbs/day over March 28 – 30, 2010.

TSS – Weekly average limit of 10 mg/L, May – October = One exceedance during June of 2009, one during October of 2009, and two during May of 2010, maximum calculated weekly average was 136 mg/L over May 2 – 4, 2010.

TSS – Weekly average limit of 15 mg/L, November – April = Five exceedances during March and April of 2010, three more over December 2010 and January 2011, and two more in April of 2011, highest calculated average = 470 mg/L over April 20 – 25, 2011. Although some of these exceedances are extreme, the results will be used as part of the antidegradation process if increased limits are calculated based on the new monthly stream low flows.

As before, BOD5 limits are calculated based on a factor of 26 pounds per day of BOD5 discharged per cfs of total (effluent plus stream) flow in order to reduce instream DO levels by 2 mg/L and meet a DO criterion of 5 mg/L. This factor is adjustable based on the temperature of the receiving water as well as the instream DO concentrations after mixing. Background temperatures for the Sheboygan River are taken from Table 2 of ch. NR 102, which provides new ambient levels for small warmwater streams as part of the new thermal standards that became effective in late 2010. Using the monthly ambient temperatures and the new 7Q10 flows, the following table summarizes the updated weekly average BOD5 limits for Kiel's discharge at an annual average design flow of 0.862 MGD and the 6 mg/L daily minimum DO limit from the current WPDES permit.

	Jan.	Feb.	March	April	May	June
7Q10 (cfs)	1.7	1.7	3.4	11.6	3.9	2.1
BOD5 Limit:						
mg/L	19	18	29	> 45	23	12
lbs/day	134	132	210	No limit	163	85
	July	Aug.	Sept.	Oct.	Nov.	Dec.
7Q10 (cfs)	1.5	1.1	1.1	1.4	2.2	1.9
BOD5 Limit:						
mg/L	11 *	10 *	12 *	12	20	20
lbs/day	82	73	84	85	143	140

* - Daily minimum DO limit would be raised from 6 mg/L to 7 mg/L because mix DO conditions based on 6 mg/L effluent would result in a BOD5 limit below 10 mg/L that would be representative of an effluent-dominated situation that normally warrants a 7 mg/L DO limit.

The current permit limits are 10 mg/L and 72 lbs/day in May – October, with 15 mg/L and 108 lbs/day in November – April. Basically, this means the limits increase in every month of the year for both concentration and mass except for August, where the 1 lb/day mass difference is basically no change after rounding. Because of the high BOD5 concentration and mass values reported during the current permit term and the fact those high values have occurred during all seasons, the need for increased discharge limits would be justified under s. NR 207.04(1)(a). However, the difficult part comes in the next demonstration, which is the social/economic justification for an increased discharge under s. NR 207.04(1)(c)1. In that part of the code, if the increased discharge limits result in any lowering of water quality, the permittee would be required to demonstrate that the proposed increased discharge that is allowed with the new flows would accommodate important social or economic development in any of seven available factors (subd. 1.a. through g.) Several of those factors are industry-related and would not apply to a municipal discharge such as Kiel (increased employment, increased production, avoiding a reduction in employment, or increased efficiency). The other three would relate to municipal as well as industrial discharges, namely s. NR 207.04(1)(c)1.e. through g, these are the demonstrations which a municipal discharge would be expected to make, any of which would satisfy the social/economic requirement of the code:

e. There will be industrial, commercial, or residential growth in the community.
f. The discharger will be providing economic or social benefit to the community, or
g. The discharger will be correcting an environmental or public health problem.

Although BOD5 levels have exceeded current permit limits on several occasions during the term of the permit, there is no proposed change to the design discharge rate. Kiel would need to satisfy any of the conditions in subds. 1.e. through g. in order to qualify for the increased limits. The information is not currently available to satisfy any of those three situations since the proposed increase in limits is due to stream conditions rather than anything originating from the discharger. Under ss. NR 207.04(2)(b)2 or 3, discharges that are unable to demonstrate the social/economic need for an increased discharges would have limits set equal to the existing levels of the affected substances adjacent to the discharge site, meaning no change in the limits.

In a situation like this, the typical Department response is to note the issue regarding the social/economic demonstration in the formal limit recommendations, but also to indicate what the limits would be if a social/economic demonstration could be made. If Kiel was able to show that an increased discharge of BOD5 would satisfy any of the three issues listed above, the Department response would be to provide limits to cover either of two situations under ch. NR 207. That response involves the determination of the levels associated with the "significant lowering of water quality" (or SLOWQ) as defined in s. NR 207.05. SLOWQ represents the level (concentration or mass) that would essentially use up one-third of the available assimilative capacity associated with the increased streamflows. In other words, SLOWQ represents one-third of the difference between the current permit limits and the limits based on the new monthly low flows.

If a permittee's increased discharge exceeds the level associated with SLOWQ, under s. NR 207.04(1)(d) the permittee would have to demonstrate whether or not SLOWQ could be prevented in a cost-effective manner by the use of pollution control alternatives such as conservation measures, recycling measures, other applicable process or operational changes, source reduction, or other pollution minimization alternatives. With these available options, an increased limit scenario such as that which is available for BOD5 would be addressed by the Department providing the limits based on SLOWQ as well as those based on full assimilative capacity. If the proposed increase in discharge does not exceed SLOWQ, or if SLOWQ could be prevented in a cost-effective manner under s. NR 207.04(1)(d), then the SLOWQ limits would apply. If the proposed discharge exceeded SLOWQ and the exceedance could not be prevented in a cost-effective manner under s. NR 207.04(1)(d), then the full assimilative capacity-based limits would apply. The full assimilative capacity-based limits are those listed in the previous table (19 mg/L and 134 lbs/day for January, etc.).

NOTE: For August, there is essentially no increase in limits so August is exempt from these demonstrations; the SLOWQ limit rounds off to be equal to the current permit limit. For April, the new BOD5 limit is not water quality-based because the 45 mg/L weekly average is based on ch. NR 210, so SLOWQ for April is based on the difference between the existing limit of 10 mg/L and the actual calculated water quality-based limit, with that result also being compared to the NR 210 limit.

Based on the above discussions, the recommended limits for BOD5 (after rounding) are as follows, only if the social/economic justification in s. NR 207.04(1)(b) can be made by Kiel:

Weekly average BOD5 limits based on prevention of SLOWQ pursuant to s. NR 207.05)

	Jan.	Feb.	March	April	May	June
mg/L	16	16	20	36 #	14	11
lbs/day	117	116	142	257	102	76
	July	Aug.	Sept.	Oct.	Nov.	Dec.
mg/L	10	10	11	11	17	17
lbs/day	75	72	76	76	120	139

Weekly average BOD5 limits based on full assimilative capacity)

	Jan.	Feb.	March	April	May	June
mg/L	19	18	29	45 #	23	12
lbs/day	134	132	210	No limit	163	85
	July	Aug.	Sept.	Oct.	Nov.	Dec.
mg/L	11	10	12	12	20	20
lbs/day	82	73	84	85	143	140

- Since the weekly average limit exceeds 30 mg/L, a monthly average limit of 30 mg/L would also apply during the indicated month pursuant to s. NR 210.05(1)(b). No mass limit is associated with the monthly average limit, and the monthly average limit is not subject to NR 207 since the initial imposition of a monthly average BOD5 limit is exempt from antidegradation under s. NR 207.02(6)(b).

Dissolved oxygen limits would be 7.0 mg/L daily minimum in July – September when the receiving water is effluent-dominated, 6.0 mg/L in October – March and May - June , and no limit would apply during April.

It is noted that the only months in which there appears to be a significant difference between SLOWQ and full assimilative capacity limits are March through May. During the other months, the mass and concentration limits are fairly close to each other, so March through May would be the suggested months of focus in a cost-effective SLOWQ prevention evaluation.

For TSS, the process is noticeably simpler. Although as noted earlier, TSS limits are normally set equal to BOD5, the SLOWQ determination doesn't really apply because there are no water quality criteria for TSS. As a result, Kiel would still have to make the determination of need for increased limits, and that has been satisfied with the finding of multiple exceedances of the current permit limits. The social/economic demonstration and therefore the SLOWQ determination would not apply because with no criteria, there cannot be a showing or even an assumption that increased TSS levels represent a lowering of water quality. It may be true that increased TSS lowers water quality, but without a benchmark representing a standard or criterion, the degree of lowering cannot be assessed under the existing rules. Therefore, Kiel would get TSS limits equal to the full assimilative capacity-based BOD5 limits. Because there are no water quality standards for TSS, TSS limits are expressed only as concentrations.

Weekly average TSS limits)

	Jan.	Feb.	March	April	May	June
mg/L	19	18	29	45 #	23	12
	July	Aug.	Sept.	Oct.	Nov.	Dec.
mg/L	11	10	12	12	20	20

- Since the weekly average limit exceeds 30 mg/L in April, a monthly average limit of 30 mg/L would also apply during April pursuant to s. NR 210.05(1)(b).

Phosphorus – Technology Based: Wisconsin Administrative Code, ch. NR 217, requires municipal wastewater dischargers that discharge greater than 150 pounds of Total Phosphorus per month to comply with a Monthly Average limit of 1.0 mg/L – or an approved Alternative Concentration limit – unless a more restrictive WQBEL is applicable. The current permit for Kiel contains a technology-based phosphorus limit of 1.0 mg/L monthly average. The effluent flow and concentration data reported during the previous permit term are summarized in the table on the following page.

Calendar Year	Mean Annual Effluent Flow (MGD)	Annual Average P Concentration (mg/L)	Estimated Annual Total P Loading (lbs/year)
2009	0.924	0.52	1463
2010	1.01	1.58	4858
2011	0.975	0.85	2523
2012	0.851	0.57	1481

Since the previous permit contained the 1.0 mg/L technology-based limit, it is recommended that this limit be retained in the reissued permit pending the evaluation of water quality-based limits. It is also noted that Kiel's discharge exceeded 150 pounds per month or 1,800 pounds per year twice in the last four years anyway, another reason the 1.0 mg/L limit is still applicable.

Phosphorus – Water Quality Based: Revisions to the administrative rules for phosphorus discharges took effect on December 1, 2010. These revisions require an evaluation of the need for water quality based effluent limits. For the Sheboygan River, the new rules specify a water quality criterion (WQC) for phosphorus of 100 ug/L pursuant to s. NR 102.06(3)(a)38, Wis. Adm. Code, since the Kiel outfall is downstream of the Sheboygan Marsh outlet.

Ambient stream data are available from the Sheboygan River in Fond du Lac County, upstream of Kiel. Ten results were available over the period of May 20, 2002 through July 11, 2012 with all ten values being collected during the months of May through October. This potentially qualifies all ten results for calculation of background concentrations under s. NR 217.13(2)(d) since only three of the results were collected during the last four years. Of the ten results, seven of them exceed 0.1 mg/L with an eight result exactly equal to 0.100 mg/L, meaning the median calculated under NR 217.13(2)(d) will also exceed 0.1 mg/L. In fact, the criterion in Fond du Lac County is only 0.075 mg/L since the data collection sites are above Sheboygan Marsh, so the median will exceed that criterion as well. Based on the high ambient concentrations, the recommended phosphorus limits for Kiel are 0.1 mg/L as a six-month average (May – October and November – April) and three times that, or 0.3 mg/L, as a monthly average limit. A mass limit of 0.72 lbs/day annual average is also recommended based on the 0.1 mg/L concentration limit and the 0.862 MGD annual average design flow.

However, it is noted that the ambient concentrations could be affected one way or the other by the presence of Sheboygan Marsh, so it may be prudent (but not required) for Kiel to collect ambient phosphorus data during May – October as part of its future compliance schedule activities. This could also be added to future Department ambient monitoring plans.

Compliance with an effluent phosphorus concentration limit as stringent as 100 ug/L may not be technically or economically feasible; but the new rules allow alternatives for achieving comparable reductions in phosphorus loading. Options for the company to consider may include requesting an alternate phosphorus limitation (APL) with compliance schedule, pollutant trading with other phosphorus discharges (point and/or nonpoint sources) that may be controlled more effectively, stream monitoring above and below the outfall to document actual instream changes related to the effluent discharge, and development of an adaptive management strategy that combine a broader range of efforts to reduce phosphorus loading. According to the PRESTO Estimation Tool, Kiel is likely to be eligible for the Adaptive Management option presented in s. NR 217.18, Wis. Adm. Code, since the point source loading from the permittee is far less than 50% of the estimated phosphorus load contribution in the watershed due to its location far from the headwaters of the Sheboygan River. During the phosphorus compliance schedule period, the current 1.0 mg/L monthly average limit shall serve as an Interim Limit.

Ammonia: The State of Wisconsin promulgated revised water quality standards for this substance during the term of the current permit. Those revisions became effective March 1, 2004, and include criteria based on both acute and chronic toxicity to aquatic life. The current WPDES permit for Kiel contains a daily maximum limit of 11 mg/L based on effluent pH data evaluated in 2008, so the typical approach taken would be to evaluate current effluent pH data to determine if the limit changes. The current permit also contains seasonal weekly average and monthly average limits calculated based on default background conditions (pH, temperature, ammonia) as well as the old year-round 7Q10 estimate of 0.80 cfs. At this time, the background values have changed based on new default data, but the more important change relates to the fact that not only has the year-round 7Q10 increased from 0.80 to 0.93 cfs, but monthly 7Q10 (and 7Q2) estimates have now been generated by USGS which may provide additional relief from the existing permit limits. Therefore, all of the current permit limits for ammonia shall be re-evaluated. Where increased limits are available, antidegradation provisions of ch. NR 207 shall be incorporated as well.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC): Daily maximum limitations are based on acute toxicity criteria, which are a function of the effluent pH and the receiving water classification. A 99th upper percentile pH value of 8.2 s.u. was used to establish the current daily maximum permit limit of 11 mg/L. During the current permit term, a total of 1,552 sample results were reported from April 1, 2009 through June 30, 2013. Generally the department has only grab sampling data and the ATC is based upon a maximum reasonably expected pH. However, the Kiel WWTF is equipped with continuous pH monitoring, and the daily maximum and daily minimum are reported on the monthly Discharge Monitoring Reports. The highest reported daily maximum pH value was 9.29 s.u. on January 31, 2012. More importantly, the new 99th upper percentile value, as represented by the 16th highest result out of a database of 1,552 values, was estimated at 8.48 s.u., which is significantly above the 8.2 s.u. value used in 2008. This results in a lower daily maximum pH limit. At pH 8.48, the acute toxicity criterion for ammonia in warmwater sportfish streams is 3.33 mg/L, resulting in a daily maximum limit of 6.7 mg/L after rounding.

However, it is also noted that over this period, the daily maximum pH has ranged from the above-mentioned high of 9.29 down to a reported value of 7.1 s.u. on March 25, 2010. For that reason, an alternative is available which would provide a table of daily maximum pH limits based on a range of daily maximum pH values. This alternative may be included in the permit in place of the 6.7 mg/L daily maximum limit.

Daily Maximum Ammonia Nitrogen (NH_3-N) Limits

Effluent pH - s.u.	NH_3-N Limit – mg/L	Effluent pH - s.u.	NH_3-N Limit – mg/L
pH ≤ 7.5	No Limit	8.2 < pH ≤ 8.3	9.4
7.5 < pH ≤ 7.6	34*	8.3 < pH ≤ 8.4	7.8
7.6 < pH ≤ 7.7	29*	8.4 < pH ≤ 8.5	6.4
7.7 < pH ≤ 7.8	24*	8.5 < pH ≤ 8.6	5.3
7.8 < pH ≤ 7.9	20*	8.6 < pH ≤ 8.7	4.4
7.9 < pH ≤ 8.0	17	8.7 < pH ≤ 8.8	3.7
8.0 < pH ≤ 8.1	14	8.8 < pH ≤ 8.9	3.1
8.1 < pH ≤ 8.2	11	8.9 < pH ≤ 9.0	2.6

* During the months of May through October if the pH is less than or equal to 7.9 there is no daily maximum limit for NH_3-N for municipal WWTF's treating primarily domestic wastewater. Limits shown in the table above with an asterisk* apply from November through April only.

Weekly Average & Monthly Average Limits based on Chronic Toxicity Criteria (CTC): Weekly average and monthly average limits for Ammonia Nitrogen are based on chronic toxicity criteria, both of which are a function of background pH and temperature. Criteria updates are available based on updated ambient information. Ambient pH data have been updated for hardwater streams such as the Sheboygan River, while ambient temperature have been updated as part of the Department's development of thermal water quality standards (updated ambient values for small warmwater streams are now listed in Table 2 of ch. NR 102).

The 4-Day criterion is simply equal to the 30-Day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7Q10 low flow to derive weekly average limitations. The 30-day criteria are used with the 30Q5 low flow to derive monthly average limitations. The stream flow value is further adjusted to temperature, with variable percentages of streamflow available for dilution based on seasonal temperature. The rules provide a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 ºC, during the winter and spring months. Burbot, an early spawning species, are not believed to be present in the Sheboygan River system. So "ELS Absent" criteria apply from October through March, and "ELS Present" criteria will apply from April through September. The following table summarizes the ambient values and criteria for each month of the year.

Month:	Jan. *	Feb. *	March *	April	May	June
Ambient Values:						
pH (s.u.)	7.90	7.90	7.90	8.09	8.09	8.09
Ammonia (mg/L)	0.16	0.16	0.16	0.16	0.16	0.1
Temp. (°F)	33	34	38	48	58	66
Temp. (°C)	< 7	< 7	< 7	8.9	14.4	18.9
Updated Chronic Criteria:						
4-d (mg/L)	11.36	11.36	11.36	5.32	5.32	4.02
30-d (mg/L)	4.54	4.54	4.54	2.13	2.13	1.61
Criteria Used to Calculate Current Permit Limits:						
4-d (mg/L)	10.31	10.31	10.31	4.41	4.41	2.10
30-d (mg/L)	4.12	4.12	4.12	1.76	1.76	0.84

Month:	July	Aug.	Sept.	Oct. *	Nov. *	Dec.*
Ambient Values:						
pH (s.u.)	8.08	8.08	8.08	8.06	8.06	8.06
Ammonia (mg/L)	0.1	0.1	0.1	0.16	0.16	0.16
Temp. (°F)	69	67	60	50	40	35
Temp. (°C)	20.6	19.4	15.5	10	< 7	< 7
Updated Chronic Criteria:						
4-d (mg/L)	3.66	3.93	5.06	7.45	9.04	9.04
30-d (mg/L)	1.46	1.57	2.02	2.98	3.62	3.62
Criteria Used to Calculate Current Permit Limits:						
4-d (mg/L)	2.10	2.10	2.10	10.31	10.31	10.31
30-d (mg/L)	0.84	0.84	0.84	4.12	4.12	4.12

* - ELS absent criteria applied

"< 7" is listed for temperature because chronic ammonia criteria are constant below 7°C.
Ambient ammonia values are used to calculate limits, not criteria. Those values do not change from the previous effluent limit calculation in 2008.
Source of information used to calculate current permit limits = May 5, 2008 effluent limits memo from Susan Sylvester (prepared by Jeff Haack) to Dick Sachs.

It is noted that there are some limited ambient pH data available, but it's from late summer and from 1994 and earlier. The ambient pH data aren't used here because it's not certain whether this is representative of current conditions, so default data were used. Although there is an impoundment downstream of Kiel, the default data represent statewide information on pH values in non-impounded conditions. Default ambient pH results for impounded waters are a little bit higher than those for non-impounded waters, which in turn would result in slightly higher criteria and lower effluent limits because ammonia is more toxic in higher pH waters. However, in the Kiel situation it is felt that the lower pH values based on non-impounded waters is more representative of the situation in the river because the residence time in the impoundment below Kiel is less than the 14-day threshold used to define reservoirs for phosphorus criteria implementation purposes in s. NR 102.06(2)(f). For that reason, the lower default ambient pH values are used.

The net effects of the updated default pH and temperature data are:

1. Increased or relaxed 4-day and 30-day chronic criteria in the months of January – March and June – September.
2. No change in criteria in the months of April – May.
3. Decreased or tightened 4-day and 30-day chronic criteria in the months of October – December.

The following table lists the calculated limits based on the updated criteria and the new streamflows. Antidegradation shall be assessed based on the comparison of these limits with the limits in the existing WPDES permit.

April – May	5.2 mg/L weekly average, 2.2 mg/L monthly average
June – September	3.7 mg/L weekly average, 1.7 mg/L monthly average
October – March	5.3 mg/L monthly average

Month:	Jan.	Feb.	March	April	May	June
Current Permit Limits:						
Weekly Ave. (mg/L)	No limit	No limit	No limit	5.2	5.2	3.7
Monthly Ave. (mg/L)	5.3	5.3	5.3	2.2	2.2	1.7
Revised Limits Based on Updated Criteria and New Streamflows:						
Weekly Ave. (mg/L)	**14.94**	**14.94**	**18.51**	**16.68**	**12.96**	**10.18**
Monthly Ave. (mg/L)	**7.37**	**8.21**	**26.19**	**14.30**	**10.42**	**7.37**

Month:	July	Aug.	Sept.	Oct.	Nov.	Dec.
Current Permit Limits:						
Weekly Ave. (mg/L)	3.7	3.7	3.7	No limit	No limit	No limit
Monthly Ave. (mg/L)	1.7	1.7	1.7	5.3	5.3	5.3
Revised Limits Based on Updated Criteria and New Streamflows:						
Weekly Ave. (mg/L)	**7.67**	**7.10**	**7.10**	**9.38**	**12.73**	**12.23**
Monthly Ave. (mg/L)	**4.43**	**4.12**	**3.61**	**4.55**	**6.65**	**6.45**

Based on the above calculations, all of the revised limits based on updated monthly low flows exceed the corresponding limits in the existing permit, with the exception of the October monthly average limit which decreases from 5.3 to 4.55 mg/L. In addition the October – March weekly average limits do not represent increases as defined in NR 207 because there were no corresponding weekly average limits for those months in the current permit. As a result, the only limits subject to the antidegradation provisions in NR 207 are the weekly average limits in April – September and the monthly average limits in every month except October. The evaluation process is basically the same as that discussed earlier for BOD5.

First, though, it is noted that some of these limits are more restrictive than the new daily maximum limit of 6.7 mg/L based on the effluent pH of 8.48 s.u. If only the single daily maximum limit is included in the reissued permit, only the monthly average limits less than 6.7 mg/L (meaning July – December) would need to be included in the permit because in the other cases the daily maximum limit would be protective of chronic toxicity concerns as well as acute. If the variable daily maximum limit table is included in the permit, then all of the average limits should be included as well because of the pH conditions in which the daily maximum limit would be less restrictive and therefore may not be protective of chronic toxicity considerations. Since the option of the table is still available, antidegradation is assessed where applicable without consideration of the daily maximum limit(s) at this point.

Returning to the antidegradation evaluation, the first evaluation is of the need for increased permit limits. Comparing past effluent test results to the current permit limits, it was determined that the only exceedance of weekly or monthly average limits in Kiel's current permit was the 5.2 mg/L weekly average limit during April, when the reported weekly average concentration of 5.48 mg/L on April 11 – 14, 2010 exceeded that 5.2 mg/L limit. In all the remaining months for both weekly and monthly limits where available, the existing discharge from Kiel was in compliance with the existing permit limits. This situation is definitely different than the BOD5 situation discussed earlier in this report because for ammonia, s. NR 207.04(2)(a) concludes that based on the treatment plant's ability to meet existing permit limits except for the weekly average April limit, no <u>increases</u> are allowed from the current permit limits. For the weekly average April limit, relaxed limits may be calculated under NR 207.

As with BOD5, a limit may be calculated based on significant lowering of water quality (SLOWQ) in April. The SLOWQ limit for April represents 1/3 of the difference between the current weekly average limit of 5.2 mg/L and the new or revised weekly average limit of 16.68 mg/L. The weekly average SLOWQ limit for April is 9.03 mg/L, or 9.0 mg/L after rounding. Since the April 2010 value of 5.48 mg/L is less than 9.0, the SLOWQ limit of 9.0 mg/L weekly average is recommended for the reissued permit for the month of April because the 4-day P99 in April is less than the SLOWQ limit, but that limit is also subject to the same social/economic justification mentioned earlier for BOD5 since the increased limit would represent lowering of water quality.

Where antidegradation does not apply, the limits based on new criteria and streamflows are automatically recommended for the new permit. Those include the weekly average limits for October through March and the monthly average limit in October.

Based on the above discussions, the recommended limits for ammonia are as follows (after rounding to two significant digits), with the new April weekly average limit of 9.0 mg/L being applicable only if the social/economic justification in s. NR 207.04(1)(b) can be made by Kiel. If the social/economic justification cannot be made, the April weekly average limit would revert to the existing limit of 5.2 mg/L.

	Jan.	Feb.	March	April	May	June
Weekly ave.	15	15	19	9.0	5.2	3.7
Monthly ave.	5.3	5.3	5.3	2.2	2.2	1.7
	July	Aug.	Sept.	Oct.	Nov.	Dec.
Weekly ave.	3.7	3.7	3.7	9.4	13	12
Monthly ave.	1.7	1.7	1.7	4.6	5.3	5.3

It is recommended that all of these limits be included in the permit if the pH vs. daily maximum limit table is also included in the permit. If the single daily maximum limit of 6.7 mg/L is included in the permit, the limits in the previous table that exceed 6.7 mg/L may be removed from the permit. Given the variability of effluent pH and ammonia values, the daily maximum limit table is recommended, but not required, for inclusion in the reissued permit for Kiel.

Temperature) New surface water quality standards for temperature took effect on October 1, 2010. These new regulations are detailed in Chapter NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. The following table is used to screen the need to calculate limitations for temperature:

Warm Water and Limited Forage Fish designated Waters	**Cold Water Designated Waters**	**Effluent Temperature Limitation**
$Q_s:Q_e \geq 20:1$	$Q_s:Q_e \geq 30:1$	120°F (no calculation needed)
$20:1 > Q_s:Q_e > 2:1$	$30:1 > Q_s:Q_e > 2.5:1$	120°F or the sub-lethal WQBEL (calculation needed), whichever is lower
$Q_s:Q_e \leq 2:1$	$Q_s:Q_e \leq 2.5:1$	Sub-Lethal and Acute WQBELs (calculation needed)

For unilateral (stream) flow Q_s is determined by using 25% of the ${}_7Q_{10}$. Q_e is the design effluent flow.

Determination of Q_s:Q_e for Kiel:

${}_7Q_{10}$ (cfs)	**Q_s (25% of ${}_7Q_{10}$) (cfs)**	**Q_e (0.862 MGD conv. to cfs)**	**Q_s:Q_e**
Year-round			
0.93	0.233	1.33	0.2 : 1

Limits are calculated for each month of the year, using the effluent flows reported since April 1, 2009. The next two tables (on the following page) summarize the applicable criteria under the new thermal rules as well as the calculated limits based on those criteria. The limit calculation table (second table on the following page) summarizes the effluent flows used to calculate limits, the limits themselves, and the temperatures used to determine the need for permit limits. The "Representative Highest Effluent Flow Rate" values are the peak daily and 7-day average (Sunday through Saturday) flows calculated for each month of the year based on data submitted by the permittee over the period of June 14, 2011 through January 31, 2013. The "Representative Highest Monthly Effluent Temperature" values are the peak daily and 7-day average temperatures reported by Kiel over the same period. Where those representative temperatures exceed the calculated limits, the limits are bold-faced and have shaded backgrounds.

Warmwater Sport Fish Community Thermal Criteria for Sheboygan River (Table 2, ch. NR 102):

	Water Quality Criteria						
Month	Ta (default)	Sub-Lethal WQC	Acute WQC		Ta (default)	Sub-Lethal WQC	Acute WQC
	(°F)	(°F)	(°F)		(°F)	(°F)	(°F)
JAN	33	49	76	JUL	69	81	85
FEB	34	50	76	AUG	67	81	84
MAR	38	52	77	SEP	60	73	82
APR	48	55	79	OCT	50	61	80
MAY	58	65	82	NOV	40	49	77
JUN	66	76	84	DEC	35	49	76

Effluent Flow, Temperature, and Calculated Thermal Limits for Kiel:

Month	Representative Highest Effluent Flow Rate (Qe)			Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit as per s. NR 106.55(7)	
	7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)	f	Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(mgd)	(mgd)		(°F)	(°F)	(°F)	(°F)
JAN	1.118	1.297	0	64	66	**53**	85
FEB	0.946	1.071	0	65	65	**55**	87
MAR	1.683	1.786	0	65	65	**57**	89
APR	2.645	3.115	0	65	65	**60**	98
MAY	1.788	2.333	0	65	72	67	88
JUN	1.819	2.619	0	76	82	78	86
JUL	1.984	2.635	0	78	79	82	86
AUG	1.260	1.329	0	78	79	83	86
SEP	1.049	1.768	0	77	80	**75**	84
OCT	0.920	1.488	0	75	76	**64**	85
NOV	1.015	1.445	0	67	69	**52**	86
DEC	1.139	1.523	0	67	68	**53**	84

Two sets of comments are appropriate based on the above data:
First, some of the effluent results are highly questionable. Over three extended periods, the exact same daily maximum temperature to three decimal places was reported on every single day.

December 14, 2011 – May 29, 2012 = 65.359
June 5, 2012 – October 8, 2012 = 75.898
November 2, 2012 – November 28, 2012 = 66.344

This seems like a very unusual occurrence to have it happen three times within a year for periods over 3 weeks at a time.

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Second, Kiel submitted a Dissipative Cooling Request form on April 1, 2013, apparently in an attempt to avoid the need for sub-lethal effluent limits in its permit. This was done despite the fact that the limits were not known until this report was developed. Several of the items required in s. NR 106.59(4) for reporting with that request were either not provided to the Department or were insufficient to enable the Department to reach a conclusion regarding the applicability of the sub-lethal (or weekly average) limits. The following items are required under s. NR 106.59(4); after each item is the Department's response based on the April 1, 2013 submittal.

s. NR 106.59(4)(a) – Information needed to allow the Department to determine whether or not sub-lethal criteria are exceeded outside a small area of mixing and cooling:
1. A written description of the physical characteristics of the receiving water or outfall that encourage rapid dilution, diffusion, dispersion, or dissipation of heat.

Response: The only documentation was a set of pictures taken from a dye study, almost five years earlier in 2008. There is no indication that this had any relationship to the temperature results reported in June 14, 2011 – January 31, 2013.

2. A written description of the presence or absence of other thermal loads to the receiving stream.

Response: This was apparently satisfied by a statement of the absence of other thermal loads.

3. Minimum and maximum effluent temperatures for each calendar week for each permitted outfall over the past two years.

Response: The above-mentioned thermal data submittal covered only about 18-1/2 months, from mid-January 2011 through January of 2013. During that period, there were questions raised above regarding three extended periods of data.

s. NR 106.59(4)(b) – Information the permittee has collected, generated, reviewed, or received regarding the following site-specific conditions:
1. Information regarding the biological quality of the animal and plant community of the receiving water including, but not limited to, species composition, richness, diversity, density, distribution, age structure, spawning incidence, and presence of any state or federally listed threatened or endangered species.

Response: No documentation was submitted related to any of this.

2. Data concerning the physical characteristics of the receiving water or permitted outfalls that encourage rapid dilution, diffusion, dispersion, and/or dissipation of heat.

Response: The existence of photos of a dye study was mentioned above in response to sub. (4)(a)1. No relevant "data" accompanied those photos.

3. Minimum and maximum temperature of the receiving water upstream of all permitted outfalls for each calendar month over the past two years.

Response: No receiving water temperature data were provided.

Based on the lack of sufficient information provided so far in response to the above items, the Department cannot reach any conclusions at this time regarding the existence of dissipative cooling. Based on the effluent temperature and flow data reported to the Department, weekly average permit limits are recommended for the months of September through April.

Recommended Weekly Average Thermal Limits for Kiel:

Month	Weekly Average Limit (^{o}F)	Month	Weekly Average Limit (^{o}F)
September	75	January	53
October	64	February	55
November	52	March	57
December	53	April	60

Whole Effluent Toxicity Evaluation: WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time. Acute tests predict the concentration that causes lethality of aquatic organisms during a 48-96 hour exposure. Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven day exposure.

Acute WET: In order to assure that the discharge from outfall 001 is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} greater than 100% effluent.

Chronic WET: In order to assure that the discharge from outfall 001 is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} greater than the instream waste concentration (IWC). The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 85% shown in the WET Checklist summary below was calculated according to the following equation:

$$\text{IWC (as \%)} = 100 \times [Qe / ((1-f)\ Qe + Qs)$$

Where:
Qe = annual average design flow = 0.862 MGD = 1.33 cfs
f = fraction of the Q_e withdrawn from the receiving water = 0
Q_s = 1/4 of the 7-Q_{10} = 0.93 cfs / 4 = 0.233 cfs

Dilution Series: According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code), the default acute dilution series is: 6.25, 12.5, 25, 50, 100%, and the default chronic dilution series is 100, 75, 50, 25, 12.5%. Other dilution series may be chosen by the permittee or Department staff, but alternate dilution series must be specified in the WPDES permit. For guidance on selecting an alternate dilution series, see Chapter 2.11 of the WET Guidance Document.

Receiving water: According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code) receiving water must be used as the dilution water and primary control in WET tests, unless the use of another dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on outfall 001 shall be a grab sample collected from the Sheboygan River, upstream/out of the influence of the mixing zone and any other known discharge. The receiving water location must be specified in the WPDES permit.

Historical WET Data: Below is a tabulation of all available WET data for outfall 001.

Date Initiated	Acute Results LC_{50} (% survival in 100% effluent)				Chronic Results IC_{25}					Footnotes
	C. dubia	Fathead minnow	Pass or Fail ?	Use in RPF ?	*C. dubia*	Fathead Minnow	Algae	Pass or Fail ?	Use in RPF ?	
9/15/09	100	100	Pass	Yes	100	100		Pass	Yes	
5/18/10					100	100		Pass	Yes	
10/19/10	100	100	Pass	Yes	100	100		Pass	Yes	
3/15/11					100	100		Pass	Yes	
4/10/12					100	100		Pass	Yes	
3/19/13	100	100	Pass	Yes	100	100		Pass	Yes	

RPF = Reasonable Potential Factor

WET Checklist. Department staff use the WET Checklist when deciding whether WET limits and monitoring are needed. As toxicity potential increases, more points accumulate and more monitoring is needed to insure that toxicity is not occurring. The Checklist recommends acute and chronic WET limits (as needed) based on the Reasonable Potential Factor (RPF), as required by s. NR 106.08, Wis. Adm. Code, and monitoring frequencies based on points accumulated during the Checklist analysis. The completed WET Checklist and monitoring recommendations are summarized in the table below. (For more on the RPF and WET Checklist, see Chapter 1.3 of the WET Guidance Document, at: http://www.dnr.state.wi.us/org/water/wm/ww/biomon/biomon.htm).

WHOLE EFFLUENT TOXICITY (WET) CHECKLIST SUMMARY

	A C U T E	**C H R O N I C**
1. INSTREAM WASTE CONC.	1A. Not Applicable **TOTAL POINTS = 0**	1B. IWC = 85% **TOTAL POINTS** = 15
2. HISTORICAL DATA	2A. 3 tests used in RPF, all passed; RPF = 0 **TOTAL POINTS** = 0	2B. 6 tests used in RPF, all passed; RPF = 0 **TOTAL POINTS** = 0
3. EFFLUENT VARIABILITY	3A. Little variability, a history of violations for BOD5 and TSS, consistent WWTF operations **TOTAL POINTS** = 5	3B. Same as Acute **TOTAL POINTS** = 5
4. STREAM CLASSIFICATION	4A. Warmwater sportfish community **TOTAL POINTS** = 5	4B. Same as Acute **TOTAL POINTS** = 5
5. CHEMICAL SPECIFIC DATA	5A. No acute toxicity criteria-based limits triggered due to high effluent results. Detected substances that did not trigger limits due to the detected results include ammonia, chromium, copper, nickel, zinc, chloride (3 pts). **TOTAL POINTS = 3**	5B. Chronic toxicity criteria-based limits triggered due to high effluent results for chloride and ammonia (6 pts). Detected substances that did not trigger limits due to the detected results include chromium, copper, nickel, and zinc (3 pts). **TOTAL POINTS** = 9
6. ADDITIVES	6A. Chlorine added for disinfection, sulfur dioxide added for dechlorination. Ferric sulfate currently used for phosphorus removal. **TOTAL POINTS** = 5	6B. Additives used more than once per 4 days, same points as acute. **TOTAL POINTS** = 5
7. DISCHARGE CATEGORY	7A. 5 industrial contributors = Two for food processing/dairy and three for metal finishing. **TOTAL POINTS** = 9	7B. Same as Acute **TOTAL POINTS** = 9
8. WASTEWATER TREATMENT	8A. Secondary Treatment **TOTAL POINTS** = 0	8B. Same as Acute **TOTAL POINTS** = 0

Continued from previous page	A C U T E	C H R O N I C
9. DOWNSTREAM IMPACTS	9A. None attributable to discharge. **TOTAL POINTS =** 0	9B. Same as Acute **TOTAL POINTS =** 0
TOTAL POINTS	27	48

WET Monitoring and Limit Recommendations: Based on historical WET data and RPF calculations (as required in s. NR 106.08, Wis. Adm. Code), neither acute nor chronic WET limits are required. Based upon the point totals generated by the WET Checklist, other information given above, and Chapter 1.3 of the WET Guidance Document, three acute WET tests are recommended and twice per year chronic WET testing is recommended in the reissued permit. Tests should be done in rotating quarters, in order to collect seasonal information about this discharge. When including recommended monitoring frequencies in the WPDES permit, staff should specify required quarters (e.g., Jan-Mar, Apr-Jun, Jul-Sep, or Oct-Dec).

ATTACHMENT – SUMMARY OF KIEL CHLORIDE DATA, 2003 - 2012

Date	Chloride (mg/L)	Date	Chloride (mg/L)	Date	Chloride (mg/L)
10/30/03	580	2/1/06	310	6/1/08	287.5
11/30/03	330	3/22/06	278	7/9/08	277.5
12/3/03	370	4/5/06	273	8/6/08	245
1/13/04	440	5/17/06	228	9/3/08	272.5
2/15/04	430	6/1/06	195	10/2/08	292
3/2/04	350	7/4/06	255	11/10/08	310
4/2/04	310	8/2/06	293	12/8/08	345
5/4/04	262	9/13/06	320	1/5/09	350
6/2/04	172	10/13/06	320	1/18/09	325
7/6/04	200	11/15/06	307.5	2/11/09	328
8/4/04	272.5	12/13/06	310	3/1/09	355
9/8/04	262.5	1/3/07	265		
10/13/04	293	2/7/07	305	(break)	
11/7/04	325	3/7/07	330		
12/1/04	277.5	4/4/07	242.5	10/19/11	600
1/13/05	283	5/16/07	290	11/17/11	390
2/2/05	325	6/27/07	290	12/1/11	420
3/2/05	325	7/4/07	325	1/4/12	390
4/2/05	300	8/1/07	312	2/1/12	450
5/5/05	275	9/6/07	315	3/13/12	350
6/1/05	300	10/24/07	302.5	4/25/12	360
7/6/05	305	11/14/07	335	5/8/12	270
8/24/05	388	12/6/07	342.5	6/5/12	400
9/1/05	372.5	1/9/08	302.5	7/17/12	450
10/13/05	350	2/5/08	273	8/1/12	460
11/9/05	362.5	3/5/08	272.5	9/4/12	440
12/7/05	338	4/9/08	258		
1/4/06	305	5/6/08	265		

APPENDIX II-3

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR) LETTER
Facility Planning Effluent Limits / September 9, 2014

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Scott Walker, Governor
Cathy Stepp, Secretary
Telephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

September 19, 2014

Mr. Eric Lynne
Donohue & Associates, Inc.
3311 Weeden Creek Road
Sheboygan, WI 53081

Subject: Facility Planning Effluent Limits for the City of Kiel (WPDES Permit # WI-0020141)

Dear Mr. Lynne:

This letter is written in response to your August 19, 2014 request for effluent limitations on a proposed increased discharge from the City of Kiel to the Sheboygan River. This request covered eight proposed alternative effluent design flows, ranging from 0.98 to 3.01 MGD (current plant design flow is 0.862 MGD) with the discharge being at the current location authorized under WPDES Permit # WI-0020141. Although this request is potentially associated with a regional discharge including the City of New Holstein wastewater treatment facility which is current covered under WPDES Permit # WI-0020893, this response is unchanged regardless of the source of the increased discharge. The limits are the same whether the increase is from New Holstein's relocated discharge, increased flow within the City of Kiel, or a combination of both; the only change in the limits is due to the various design flows which are contained in your request. The calculated effluent limits are summarized below for the requested effluent design flows:

1. 0.98 MGD
2. 1.13 MGD
3. 1.28 MGD
4. 1.68 MGD
5. 2.26 MGD
6. 2.41 MGD
7. 2.46 MGD
8. 3.01 MGD

Effluent limitations which are the same for all proposed design flows:
For some parameters, the calculated limits are the same regardless of the design effluent flow. This applies to parameters with effluent standards (as opposed to water quality-based limits) or situations where there is no assimilative capacity available to handle increased discharges.

Dissolved Oxygen) Limits are carried over from the current permit. Although the daily minimum DO limits are a factor in the calculation of BOD5 limits, it is assumed that no changes will be made to the DO limits themselves because of the ability to control the discharge in response to variable limits in the past.

Recommended DO limits = 6.0 mg/L daily minimum in October through June, 7.0 mg/L daily minimum in July through September.

pH) Limitations for pH are contained in s. NR 210.05(2)(d), which are equivalent to water quality standards in ch. NR 102.04(3)(c). Due to coverage in ch. NR 210, these limitations apply to all municipal discharges.

Recommended pH limits = 6.0 s.u. daily minimum, 9.0 s.u. daily maximum.

Total Phosphorus) Limits are calculated using the new water quality criterion of 0.1 mg/L for the Sheboygan River, which became effective in late 2010 based on new water quality standards in s. NR 102.06(3)(a)38. As determined in an evaluation of the current discharge in a memo dated September 30, 2013 from myself to Dick

Sachs (WPDES permit drafter), median ambient phosphorus concentrations in the Sheboygan River upstream of Kiel are in excess of the 0.1 mg/L based on the fact that seven of the ten values in the ambient database were in excess of 0.1 mg/L (which automatically means that the median is above 0.1 mg/L as implemented through s. NR 217.13(2)(d)). For that reason, the calculated water quality-based limitations are the same regardless of the proposed discharge rate, since no assimilative capacity is available instream at any discharge rate.

Recommended total phosphorus limits = 0.1 mg/L as a six-month average (November – April, May – October), and 0.3 mg/L as a monthly average. Six-month average mass limits may also be recommended based on the proposed discharge at the 0.1 mg/L concentration, along with interim limits based on effluent concentrations reported at the current discharge rate.

Fecal Coliforms) Disinfection is currently required for Kiel's discharge of treated wastewater during the months of May through September. Pursuant to s. NR 210.06(2)(a), a limit is applicable where disinfection is required.

Recommended fecal coliform limits = 400 per 100 mL as a monthly geometric mean in May – September.

Total Residual Chlorine) If chlorine is used for disinfection, water quality-based limits are calculated based on acute and chronic toxicity criteria in ch. NR 105 and the implementation procedures in ch. NR 106. Technically, the weekly average water quality-based limits (based on chronic toxicity) vary based on the discharge rate, but over the range of the proposed discharge rates the limits all represent concentrations that are likely to be below the level of detection as noted in s. NR 210.06(2)(b). Even the daily maximum limit of 38 ug/L based on the acute toxicity criterion is below that level of detection, so for purposes of this summary the weekly average concentration limits shall be expressed as a range of values with the general understanding that regardless of the concentration limit, no detectable discharge of chlorine is permitted. Weekly average limits are calculated based on dilution of the proposed design flow with ¼ of the Sheboygan River 7Q10 low flow (year-round 7Q10 = 0.93 cfs). At an effluent flow of 0.98 MGD (alternative #1 at the beginning of this letter) the weekly average concentration limit is 8.4 ug/L, while at an effluent flow of 3.01 MGD (alternative #8 at the beginning of this letter) the weekly average concentration limit is 7.6 ug/L. For all intents and purposes, the weekly average chlorine limit is 8 ug/L after rounding.

Recommended total residual chlorine limits = 38 ug/L daily maximum, 8 ug/L weekly average

Chloride) Typically, chloride is not seen as a component of items addressed as part of a facility planning request. However, since the current WPDES permit for Kiel contains chloride limits (based on a variance to water quality standards), the water quality limits should be recognized as an item for the permittee to address in the future, especially if the current permit's variance is maintained in the future. Water quality-based chloride limits are based on acute and chronic toxicity criteria in ch. NR 105 and applied in a manner similar to that discussed above for chlorine. The water quality-based limit on the current design flow of 0.862 MGD is 460 mg/L weekly average, based on dilution in ¼ of the year-round 7Q10 low flow of 0.93 cfs to meet a chronic toxicity criterion of 395 mg/L. Kiel's permit currently contains a variance limit of 510 mg/L weekly average, so when the permit is next reissued and/or when the increased discharge is assessed, effluent data available at that time will be used to determine the need for a variance in the future. Based on the 395 mg/L criterion, an ambient concentration of 22 mg/L, and the relative dilution factors associated with the increased discharge, the weekly average limits vary with the design discharge rate. At an effluent flow of 0.98 MGD (alternative #1 at the beginning of this letter) the weekly average concentration limit is 452 mg/L, while at an effluent flow of 3.01 MGD (alternative #8 at the beginning of this letter) the weekly average concentration limit is 414 mg/L. The daily maximum limit based on the acute toxicity criterion is 1,514 mg/L, which does not appear to be needing inclusion in the discharge permit based on past chloride data. NOTE: Since the New Holstein WPDES permit currently has limits based on a chloride variance as well, a new variance may be needed for a permit if regionalization occurs.

Recommended water quality-based chloride limits = 414 to 452 mg/L weekly average

The remaining limits available for facility planning evaluations are variable based on the set of eight alternative effluent flows. These limits cover BOD5, total suspended solids (TSS), ammonia, and temperature. These items shall be discussed separately, with limit summaries for each of the eight alternative design flows being provided later in this document.

Temperature) Thermal limits may be calculated based on the new water quality standards which became effective in late 2010. Typically this is not a parameter for which facility planning is done in municipal dischargers, but since Kiel has been looking into dissipative cooling as a means of addressing the need for permit limits, it is appropriate to calculate limits based on the proposed design flows to determine what those limits will be. The focus here is on limits related to sub-lethal criteria because, in all twelve months, limits based on acute criteria re so high numerically that it is likely that temperatures close to those acute criteria would threaten the effectiveness of the treatment process. Limits are calculated based on sub-lethal criteria for small warmwater streams in Table 2 of ch. NR 102 and looking at dilution with ¼ of the monthly 7Q10 flows. It is noted that thermal limits are calculated based on actual flows rather than design flows, even for municipal discharges. As a result, the limits provided below based on design flow are mainly for informational purposes in the dissipative cooling process. The following table lists the weekly average thermal limits for each months based on the endpoint effluent design flows in the planning limit request, namely 0.98 and 3.01 MGD. That way, the range of thermal limits will be apparent for each month of the year. Except for April, with its high 7Q10, the remaining months have a 5°F difference or less between limits at the lowest and highest design flows, so this summary should be sufficient as a starting point for any future dissipative cooling evaluations.

Recommended thermal limits based on the range of design flows are summarized in the following table:

Month	Weekly Average Limit @ 0.98 MGD (°F)	Weekly Average Limit @ 3.01 MGD (°F)	Month	Weekly Average Limit @ 0.98 MGD (°F)	Weekly Average Limit @ 3.01 MGD (°F)
January	53	50	July	84	82
February	54	51	August	84	82
March	60	55	September	75	74
April	68	59	October	64	62
May	70	66	November	52	50
June	79	77	December	53	50

BOD5, Total Suspended Solids, and Ammonia) These parameters are discussed together because the limits are summarized together in tables for each of the requested design flows. The current permit limits for Kiel are as follows:

<u>Parameter</u>	<u>Effluent Limitations</u>
BOD5:	
May - October	10 mg/L and 72 lbs/day weekly average, 10 mg/L monthly average
November - April	15 mg/L and 108 lbs/day weekly average, 15 mg/L monthly average
Total Suspended Solids (TSS):	
May - October	10 mg/L weekly average, 10 mg/L monthly average
November - April	15 mg/L weekly average, 15 mg/L monthly average
Ammonia:	
Year-round	11 mg/L daily maximum
April – May	5.2 mg/L weekly average, 2.2 mg/L monthly average
June – September	3.7 mg/L weekly average, 1.7 mg/L monthly average
October – March	5.3 mg/L monthly average

Limits had been given on only a semi-annual or quarterly basis in the current permit since monthly low flows were not available. The above limits were based on the current design flow of 0.862 MGD and, most importantly, year-round 7Q10 and 7Q2 low flows in the Sheboygan River at Kiel. Now that USGS has updated not only the year-round low flows, but also provided new monthly 7Q10 and 7Q2 estimates, BOD5 and ammonia limits can be calculated on a weekly and monthly basis for each month of the year. NOTE: Concentration limits for TSS are typically set equal to BOD5 limits due to Best Professional Judgment over treatment capability. The following table summarizes the updated USGS low flow estimates:

Monthly low flows:

Month	7Q2 (cfs)	7Q10 (cfs)	Month	7Q2 (cfs)	7Q10 (cfs)
January	4.7	1.7	July	3.2	1.5
February	5.1	1.7	August	2.8	1.1
March	13.3	3.4	September	2.8	1.1
April	24	11.6	October	4.1	1.4
May	10.1	3.9	November	6.4	2.2
June	5.4	2.1	December	6.1	1.9
Year-round	2.1	0.93			

Weekly average BOD5 limits are calculated based on the state-wide assumption allowing 26 pounds of BOD5 per total flow (effluent plus receiving water) at a temperature of 25°C with a temperature adjustment factor built in, to meet the dissolved oxygen criterion of 5 mg/L for warmwater sport fish communities in ch. NR 102. The adjustment is applied to the instream background temperatures, so in this case those are the ambient values listed in Table 2 of ch. NR 102 for small warmwater streams, the same information used to generate thermal limits.

From here, this is where the effluent DO limit comes into play, since the BOD5 limits are calculated based upon a decrease through the mixing zone from a starting point which represents the flow-weighted average of the effluent DO limit (see earlier discussion) and the default background DO of 7 mg/L. This was the basis for the current permit limits. BOD5 limits more stringent than 5 mg/L in May – October and 10 mg/L in November – April are not given to municipal dischargers in recognition of treatment capability. As noted above, TSS limits are typically set equal to BOD5 limits, except no TSS limits below 10 mg/L are given at any time of the year. In addition, limits higher than 30 mg/L monthly average and 45 mg/L weekly average are not given to municipal discharges based on technology-based limits in s. NR 210.05(1)(a). Mass limits are given for BOD5 when the concentration limits are water quality-based (weekly average limits lower than 45 mg/L), but mass limits are not evaluated here because BOD5 mass limits are not typically a component of treatment plant design. Mass limits may be an issue in terms of a future permit based on antidegradation, since the current permit contains mass limits, so for now it's sufficient to state that mass limits will be needed for BOD5 when concentration limits are water quality-based.

For ammonia, the State of Wisconsin promulgated revised water quality standards for this substance during the term of the current permit. Those revisions became effective March 1, 2004, and include criteria based on both acute and chronic toxicity to aquatic life. The current WPDES permit for Kiel contains a daily maximum limit of 11 mg/L based on effluent pH data evaluated in 2008, so the typical approach taken would be to evaluate current effluent pH data to determine if the limit changes. Based on the 99th upper percentile pH anticipated for the upgraded treatment plant, the daily maximum ammonia limits may be re-calculated, but for now the standard approach has been to provide a table of ammonia limits based on ranges of effluent pH. This enables the greatest degree of flexibility on the part of the permittee and also provides an informational basis in the future for limits based on a single effluent pH.

The current permit also contains seasonal weekly average and monthly average limits calculated based on default background conditions (pH, temperature, ammonia) at the year-round 7Q10 estimate of 0.80 cfs. At this time, the background values have changed based on new default data, but the more important change relates to the fact that monthly 7Q10 and 7Q2 estimates have now been generated by USGS which may impact the calculated limits. Therefore, all of the current weekly and monthly average permit limits for ammonia shall be re-evaluated.

Chronic toxicity criteria for ammonia shall be based upon default pH data for hardwater streams in Wisconsin and the default ambient temperature data from Table 2 of ch. NR 102 (same information as that used for thermal limit calculations), since toxicity is related to both pH and temperature. The following table summarizes the data used in the chronic criteria calculation, note that this is the same criteria information used to generate the limits on the current discharge in the September 30, 2013 evaluation.

Month:	Jan. *	Feb. *	March *	April	May	June
Ambient Values:						
pH (s.u.)	7.90	7.90	7.90	8.09	8.09	8.09
Ammonia (mg/L)	0.16	0.16	0.16	0.16	0.16	0.1
Temp. (°F)	33	34	38	48	58	66
Temp. (°C)	< 7	< 7	< 7	8.9	14.4	18.9
Updated Chronic Criteria:						
4-d (mg/L)	11.36	11.36	11.36	5.32	5.32	4.02
30-d (mg/L)	4.54	4.54	4.54	2.13	2.13	1.61

Month:	July	Aug.	Sept.	Oct. *	Nov. *	Dec.*
Ambient Values:						
pH (s.u.)	8.08	8.08	8.08	8.06	8.06	8.06
Ammonia (mg/L)	0.1	0.1	0.1	0.16	0.16	0.16
Temp. (°F)	69	67	60	50	40	35
Temp. (°C)	20.6	19.4	15.5	10	< 7	< 7
Updated Chronic Criteria:						
4-d (mg/L)	3.66	3.93	5.06	7.45	9.04	9.04
30-d (mg/L)	1.46	1.57	2.02	2.98	3.62	3.62

* - ELS absent criteria applied

"< 7" is listed for temperature because chronic ammonia criteria are constant below 7°C.

Ambient ammonia values are used to calculate limits, not criteria. Those values do not change from the previous effluent limit calculation in 2008.

Using all of the above information, limits for BOD5, TSS, and ammonia can be calculated for each month of the year at each of the requested design flows. Before that information is summarized, though, a discussion of increased effluent limits is needed. Since the current discharge permit contains limits for all three parameters, any calculated limits that are increased above the current permit limits are subject to an antidegradation evaluation under ch. NR 207. The circumstances on this are a little different than the September 30, 2013 evaluation, though, because of the increased design flows requested here. The process is still the same in that to justify increased limits there must be a demonstration of the need for increased limits and then a demonstration of the ability of the increased discharge to accommodate important social or economic development.

Based on the fact the design flows have increased above the 0.862 MGD flow used to calculate the current permit limits, the need demonstration may include not only current discharge information but also any information related to proposed increases. Under s. NR 207.04(2)(a), if it is shown that the existing treatment facilities have the capability to treat proposed increases in discharge and still maintain treatment levels sufficient to meet current limits, those limits cannot be changed. Dealing with the larger changes in design flow will probably make this maintenance of current treatment levels more unlikely, but an assessment of future loadings to the upgraded treatment plant are normally expected anyway as part of the facility planning process. As a result, the limits are calculated and presented here under the assumption that increased limits are needed.

As for the demonstration of social and economic importance of the increased discharge, in the past it has been almost a given fact that such a demonstration can be made for an upgraded municipal treatment plant with increased flow, for the simple reason that among the ways to make the demonstration is s. NR 207.04(1)(c)1.e., which states that importance is shown when "there will be industrial, commercial, or residential growth in the community." Increased design flow would automatically mean any or all of those three options, basically since the increased flow has to come from somewhere (including from New Holstein if regionalization occurs). If the social or economic importance cannot be shown, then s. NR 207.04(2)(b)2 and 3 would also prevent increased discharge limits. With this assumption related to the increased design flow, it is assumed the increased discharge would be allowed.

Under those circumstances, two sets of limits may be calculated. One would represent the limits based on the full assimilative capacity available in the Sheboygan River while the other represents prevention of significant lowering of water quality (SLOWQ) which is defined in s. NR 207.05 as limits based on the use of one-third of the available assimilative capacity. If the SLOWQ-based limits are projected to be exceeded, the permittee may evaluate the presence of cost-effective alternatives under s. NR 207.04(1)(d) before a determination of the final limits can be made. For purposes of this evaluation, though, both the SLOWQ-based limits and the full assimilative capacity-based limits are listed here where appropriate. The phrase "where appropriate" is important because, especially at the higher proposed design flows, there might not even be an increase in limits, in which case the antidegradation process doesn't even apply.

NOTE: If there is no current permit limit in a given month (weekly average ammonia limit in October – March, for example), antidegradation does not apply because the initial imposition of a limit is exempt from NR 207.

Recommended BOD5, total suspended solids, and ammonia limits = See tables below: Based on all the above discussions, the following concentration limits are calculated for BOD5, TSS, and ammonia at all of the proposed discharge rates, with SLOWQ limits listed where appropriate. Concentration limits are rounded off to two significant digits for consistency purposes.

Daily Maximum Ammonia Nitrogen (NH_3-N) Limits

Effluent pH - s.u.	NH_3-N Limit – mg/L	Effluent pH - s.u.	NH_3-N Limit – mg/L
$pH \leq 7.5$	No Limit	$8.2 < pH \leq 8.3$	9.4
$7.5 < pH \leq 7.6$	34*	$8.3 < pH \leq 8.4$	7.8
$7.6 < pH \leq 7.7$	29*	$8.4 < pH \leq 8.5$	6.4
$7.7 < pH \leq 7.8$	24*	$8.5 < pH \leq 8.6$	5.3
$7.8 < pH \leq 7.9$	20*	$8.6 < pH \leq 8.7$	4.4
$7.9 < pH \leq 8.0$	17	$8.7 < pH \leq 8.8$	3.7
$8.0 < pH \leq 8.1$	14	$8.8 < pH \leq 8.9$	3.1
$8.1 < pH \leq 8.2$	11	$8.9 < pH \leq 9.0$	2.6

* During the months of May through October if the pH is less than or equal to 7.9 there is no daily maximum limit for NH_3-N for municipal WWTF's treating primarily domestic wastewater. Limits shown in the table above with an asterisk* apply from November through April only.

Design flow = 0.98 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	17 (SLOWQ = 16)	17 (SLOWQ = 16)	14	7.4 (SLOWQ = 6.0)
FEB	17 (SLOWQ = 16)	17 (SLOWQ = 16)	14	7.7 (SLOWQ = 6.1)
MARCH	26 (SLOWQ = 19)	26 (SLOWQ = 19)	18	13 (SLOWQ = 7.8)
APRIL	45 (SLOWQ = 31)	30	15 (SLOWQ = 8.5)	8.8 (SLOWQ = 4.4)
MAY	20 (SLOWQ = 13)	20 (SLOWQ = 13)	12 (SLOWQ = 7.8)	7.7 (SLOWQ = 4.0)
JUNE	11 (SLOWQ = 10)	11 (SLOWQ = 10)	9.4 (SLOWQ = 5.1)	6.2 (SLOWQ = 3.2)
JULY	11 (SLOWQ = 10)	11 (SLOWQ = 10)	7.2 (SLOWQ = 4.8)	3.9 (SLOWQ = 2.4)
AUG	BOD = 9.6 TSS = 10	BOD = 9.6 TSS = 10	6.7 (SLOWQ = 4.7)	3.9 (SLOWQ = 2.4)
SEPT	11 (SLOWQ = 10)	11 (SLOWQ = 10)	6.8 (SLOWQ = 4.7)	3.5 (SLOWQ = 2.3)
OCT	11 (SLOWQ = 10)	11 (SLOWQ = 10)	9.1	4.6
NOV	18 (SLOWQ = 16)	18 (SLOWQ = 16)	12	6.7 (SLOWQ = 5.8)
DEC	18 (SLOWQ = 16)	18 (SLOWQ = 16)	12	6.6 (SLOWQ = 5.7)

Design flow = 1.13 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	16 (SLOWQ = 15)	16 (SLOWQ = 15)	14	7.0 (SLOWQ = 5.9)
FEB	15	15	14	7.3 (SLOWQ = 5.8)
MARCH	23 (SLOWQ = 18)	23 (SLOWQ = 18)	17	12 (SLOWQ = 7.4)
APRIL	45 (SLOWQ = 29)	30	14 (SLOWQ = 8.1)	7.7 (SLOWQ = 4.0)
MAY	18 (SLOWQ = 13)	18 (SLOWQ = 13)	11 (SLOWQ = 7.2)	7.0 (SLOWQ = 3.8)
JUNE	10	10	8.7 (SLOWQ = 6.6)	5.6 (SLOWQ = 3.3)
JULY	10	10	6.7 (SLOWQ = 4.7)	3.6 (SLOWQ = 2.3)
AUG	BOD = 9.1 TSS = 10	BOD = 9.1 TSS = 10	6.4 (SLOWQ = 4.6)	3.6 (SLOWQ = 2.3)
SEPT	10	10	6.6 (SLOWQ = 4.7)	3.3 (SLOWQ = 2.4)
OCT	10	10	8.9	4.4
NOV	16 (SLOWQ = 15)	16 (SLOWQ = 15)	12	6.3 (SLOWQ = 5.6)
DEC	16 (SLOWQ = 15)	16 (SLOWQ = 15)	11	6.2 (SLOWQ = 5.6)

Design flow = 1.28 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	14	14	14	6.8 (SLOWQ = 5.8)
FEB	14	14	14	6.9 (SLOWQ = 5.8)
MARCH	21 (SLOWQ = 17)	21 (SLOWQ = 17)	16	11 (SLOWQ = 7.1)
APRIL	45 (SLOWQ = 27)	30	13 (SLOWQ = 7.8)	7.2 (SLOWQ = 3.9)
MAY	16 (SLOWQ = 12)	16 (SLOWQ = 12)	10 (SLOWQ = 6.9)	6.4 (SLOWQ = 3.6)
JUNE	BOD = 8.9 TSS = 10	BOD = 8.9 TSS = 10	8.2 (SLOWQ = 6.2)	5.1 (SLOWQ = 3.2)
JULY	BOD = 9.5 TSS = 10	BOD = 9.5 TSS = 10	6.4 (SLOWQ = 4.6)	3.3 (SLOWQ = 2.2)
AUG	BOD = 8.7 TSS = 10	BOD = 8.7 TSS = 10	6.1 (SLOWQ = 4.5)	3.3 (SLOWQ = 2.2)
SEPT	BOD = 9.9 TSS = 10	BOD = 9.9 TSS = 10	6.4 (SLOWQ = 4.6)	3.2 (SLOWQ = 2.2)
OCT	BOD = 9.3 TSS = 10	BOD = 9.3 TSS = 10	8.7	4.2
NOV	15	15	12	6.0 (SLOWQ = 5.5)
DEC	15	15	11	5.9 (SLOWQ = 5.5)

Design flow = 1.68 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	12	12	13	6.2 (SLOWQ = 5.6)
FEB	12	12	13	6.4 (SLOWQ = 5.7)
MARCH	17 (SLOWQ = 16)	17 (SLOWQ = 16)	15	9.3 (SLOWQ = 6.6)
APRIL	40 (SLOWQ = 23)	30	11 (SLOWQ = 7.2)	6.0 (SLOWQ = 3.5)
MAY	13 (SLOWQ = 11)	13 (SLOWQ = 11)	9.2 (SLOWQ = 6.5)	5.4 (SLOWQ = 3.3)
JUNE	BOD = 7.4 TSS = 10	BOD = 7.4 TSS = 10	7.2 (SLOWQ = 5.9)	4.3 (SLOWQ = 2.9)
JULY	BOD = 8.5 TSS = 10	BOD = 8.5 TSS = 10	5.7 (SLOWQ = 4.4)	2.9 (SLOWQ = 2.1)
AUG	BOD = 8.0 TSS = 10	BOD = 8.0 TSS = 10	5.6 (SLOWQ = 4.3)	2.9 (SLOWQ = 2.1)
SEPT	BOD = 9.1 TSS = 10	BOD = 9.1 TSS = 10	6.1 (SLOWQ = 4.5)	2.9 (SLOWQ = 2.1)
OCT	BOD = 8.0 TSS = 10	BOD = 8.0 TSS = 10	8.4	3.9
NOV	12	12	11	5.4 (SLOWQ = 5.3)
DEC	12	12	11	5.3

Design flow = 2.26 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	10	10	13	5.8 (SLOWQ = 5.7)
FEB	10	10	13	5.9 (SLOWQ = 5.5)
MARCH	14	14	14	8.1 (SLOWQ = 6.2)
APRIL	30 (SLOWQ = 20)	30	9.6 (SLOWQ = 6.7)	5.0 (SLOWQ = 3.1)
MAY	11	11	8.2 (SLOWQ = 6.2)	4.6 (SLOWQ = 2.9)
JUNE	BOD = 6.3 TSS = 10	BOD = 6.3 TSS = 10	6.4 (SLOWQ = 5.6)	3.6 (SLOWQ = 2.7)
JULY	BOD = 7.7 TSS = 10	BOD = 7.7 TSS = 10	5.2 (SLOWQ = 4.2)	2.8 (SLOWQ = 2.0)
AUG	BOD = 7.3 TSS = 10	BOD = 7.3 TSS = 10	5.1 (SLOWQ = 4.2)	2.6 (SLOWQ = 2.0)
SEPT	BOD = 8.4 TSS = 10	BOD = 8.4 TSS = 10	5.8 (SLOWQ = 4.4)	2.7 (SLOWQ = 2.0)
OCT	BOD = 6.9 TSS = 10	BOD = 6.9 TSS = 10	8.2	3.7
NOV	10	10	10	5.0
DEC	11	11	10	4.9

Design flow = 2.41 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	10	10	13	5.7 (SLOWQ = 5.4)
FEB	BOD = 9.9 TSS = 10	BOD = 9.9 TSS = 10	13	5.8 (SLOWQ = 5.5)
MARCH	14	14	14	7.9 (SLOWQ = 6.2)
APRIL	29 (SLOWQ = 20)	29 (SLOWQ = 20)	9.3 (SLOWQ = 6.6)	4.8 (SLOWQ = 3.1)
MAY	10	10	8.0 (SLOWQ = 6.1)	4.4 (SLOWQ = 2.9)
JUNE	BOD = 6.1 TSS = 10	BOD = 6.1 TSS = 10	6.2 (SLOWQ = 5.5)	3.5 (SLOWQ = 2.6)
JULY	BOD = 7.6 TSS = 10	BOD = 7.6 TSS = 10	5.1 (SLOWQ = 4.2)	2.5 (SLOWQ = 2.0)
AUG	BOD = 7.2 TSS = 10	BOD = 7.2 TSS = 10	5.1 (SLOWQ = 4.2)	2.5 (SLOWQ = 2.0)
SEPT	BOD = 8.2 TSS = 10	BOD = 8.2 TSS = 10	5.8 (SLOWQ = 4.4)	2.6 (SLOWQ = 2.0)
OCT	BOD = 6.7 TSS = 10	BOD = 6.7 TSS = 10	8.1	3.6
NOV	10	10	10	4.9
DEC	10	10	10	4.8

Design flow = 2.46 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	10	10	13	5.7 (SLOWQ = 5.4)
FEB	BOD = 9.8 TSS = 10	BOD = 9.8 TSS = 10	13	5.8 (SLOWQ = 5.4)
MARCH	13	13	14	7.8 (SLOWQ = 6.1)
APRIL	28 (SLOWQ = 19)	28 (SLOWQ = 19)	9.3 (SLOWQ = 6.6)	4.8 (SLOWQ = 3.1)
MAY	10	10	8.0 (SLOWQ = 6.1)	4.4 (SLOWQ = 2.9)
JUNE	BOD = 6.0 TSS = 10	BOD = 6.0 TSS = 10	6.2 (SLOWQ = 5.5)	3.4 (SLOWQ = 2.6)
JULY	BOD = 7.5 TSS = 10	BOD = 7.5 TSS = 10	5.1 (SLOWQ = 4.2)	2.4 (SLOWQ = 2.0)
AUG	BOD = 7.2 TSS = 10	BOD = 7.2 TSS = 10	5.0 (SLOWQ = 4.2)	2.5 (SLOWQ = 2.0)
SEPT	BOD = 8.2 TSS = 10	BOD = 8.2 TSS = 10	5.8 (SLOWQ = 4.4)	2.6 (SLOWQ = 2.0)
OCT	BOD = 6.7 TSS = 10	BOD = 6.7 TSS = 10	8.1	3.6
NOV	10	10	10	4.8
DEC	10	10	10	4.8

Design flow = 3.01 MGD (limits in mg/L)

	BOD & TSS Weekly ave.	BOD & TSS Monthly ave.	Ammonia Weekly ave.	Ammonia Monthly ave.
JAN	BOD = 9.1 TSS = 10	BOD = 9.1 TSS = 10	12	5.5 (SLOWQ = 5.4)
FEB	BOD = 8.9 TSS = 10	BOD = 8.9 TSS = 10	12	5.6 (SLOWQ = 5.4)
MARCH	12	12	13	7.2 (SLOWQ = 6.1)
APRIL	24 (SLOWQ = 18)	24 (SLOWQ = 18)	8.5 (SLOWQ = 6.3)	4.3 (SLOWQ = 2.9)
MAY	BOD = 8.8 TSS = 10	BOD = 8.8 TSS = 10	7.5 (SLOWQ = 6.0)	3.9 (SLOWQ = 2.8)
JUNE	BOD = 5.4 TSS = 10	BOD = 5.4 TSS = 10	5.8 (SLOWQ = 5.4)	3.1 (SLOWQ = 2.5)
JULY	BOD = 7.1 TSS = 10	BOD = 7.1 TSS = 10	4.8 (SLOWQ = 4.1)	2.3 (SLOWQ = 1.9)
AUG	BOD = 6.9 TSS = 10	BOD = 6.9 TSS = 10	4.8 (SLOWQ = 4.1)	2.3 (SLOWQ = 1.9)
SEPT	BOD = 7.9 TSS = 10	BOD = 7.9 TSS = 10	5.6 (SLOWQ = 4.4)	2.5 (SLOWQ = 2.0)
OCT	BOD = 6.1 TSS = 10	BOD = 6.1 TSS = 10	8.0	3.5
NOV	BOD = 9.0 TSS = 10	BOD = 9.0 TSS = 10	10	4.6
DEC	BOD = 9.2 TSS = 10	BOD = 9.2 TSS = 10	10	4.6

These BOD5, TSS, and ammonia limits would be given along with the DO, phosphorus, pH, thermal, chlorine and chloride limits discussed earlier, as well as the daily maximum ammonia limits.

Example calculation - 0.968 MGD design flow, month of April:
BOD5 limits in current permit = 15 mg/L weekly and monthly average
Calculated weekly average BOD5 limit = 64.8 mg/L (> 45 mg/L NR 210 limit)
Full capacity-based limits = 30 mg/L monthly average, 45 mg/L weekly average
SLOWQ limit = [(64.8 – 15)/3] + 15 = 31 mg/L after rounding, TSS limit set equal to BOD5 limit
NOTE: No SLOWQ limit is calculated for the monthly average since the water quality-based limit based on assimilative capacity is only calculated on a weekly average basis. DNR policy has been to only include a 30 mg/L monthly average BOD5 limit if the weekly average is 30 mg/L or greater.
Ammonia limits in current permit = 5.2 mg/L weekly average, 2.2 mg/L monthly average
Full capacity-based limits = 15 mg/L weekly average, 8.8 mg/L monthly average after rounding
SLOWQ limit, weekly average = [(15 – 5.2)/3] + 5.2 = 8.5 mg/L after rounding
SLOWQ limit, monthly average = [(8.8 – 2.2)/3] + 2.2 = 4.4 mg/L after rounding

Again, note that SLOWQ limits are only given when the calculated limits are greater than existing limits in the current WPDES permit, meaning limits in the permit applied over the same averaging period.

One thing I noticed based on these tables is that there may have been a typo or calculation error in the September 30, 2013 evaluation for ammonia at the current flows. I used the above information and tried to reproduce the current limits and couldn't do it for monthly ammonia limits in some of the months. It doesn't affect anything in this evaluation, but it may warrant some re-evaluation of ammonia limits in the event Kiel goes with none of these options and remains with limits based on 0.862 MGD.

Finally, it should be noted that based on the new design flows, it is likely that the Kiel discharge would be considered a major municipal discharge in the future when actual flows exceed 1 MGD annual average. Although this might not affect planning limits at this time, the major municipal discharge designation means Kiel would need to test for all of the substances on the EPA priority pollutant list. Since mercury is included in that list, there is a chance that a mercury variance may be needed in the future, depending on future effluent mercury results, because many large treatment plans are unable to comply with mercury limits.

If you have any questions on this evaluation, please contact me at (608) 267-7658 or via e-mail at jamesw.schmidt@wisconsin.gov.

Sincerely,

James W. Schmidt
Wisconsin Department of Natural Resources
Bureau of Water Quality - Water District East

Cc: Dick Sachs – Water District East / Green Bay
David Gerdman - Water District East / Green Bay (e-copy only)
Steve Smith – WY/3, Madison

- Chapter III -
CURRENT SITUATION & NEEDS ASSESSMENT

A. PLANNING AREA DESCRIPTION

The City of Kiel is located mostly in the far southwest corner of Manitowoc County; the western portion of the City is located in Calumet County. The City is located at the intersection of STH 32/57 and STH 67. The Sheboygan River flows through the southeastern one-third of the City. The 20-Year Comprehensive Plan, prepared by Bay-Lake Regional Planning Commission, was adopted by the City on December 10, 2002. Relevant planning area description information provided in the Comprehensive Plan is included in this Facility Plan document.

1. Topography

The topography of the area surrounding the City of Kiel was molded by the last two sub-stages of the Wisconsin Stage of Glaciation. The till left by the glaciers gives the area a Kettle Moraine type topography with gravely hills, kettle shaped holes and coarse, sandy soils. The northwestern area of the City is relatively flat, and there is more relief in the areas closer to the Sheboygan River and especially on the south side of the River. The elevation within the City ranges between approximately 860 to 950-feet about sea level.

2. Geology, Soil Conditions & Hydrology

As described in the Comprehensive Plan, the two different glacial drifts that covered the area formed the landscape and distribution of the soils of the Kiel area. The glacial geology is characterized by glacial debris that was pushed or deposited by each glacial sub-stage to form plains, depressions, valleys and hills.

The following information is provided in the 20-Year Comprehensive Plan regarding the bedrock geology of the area:

> *"A layer of undifferentiated dolomite bedrock from the Silurian age underlies the entire planning area. This series of sedimentary rocks, approximately 75-feet thick, is underlain by a formation known as Maquoketa Shale. Below the Maquoketa Shale area is a group of rock units consisting of sandstone, shale and dolomite, known collectively as the sandstone aquifer. The Maquoketa formation is estimated to be 400 to 450-feet thick. The sandstone aquifer is estimated to be 800 to 850-feet thick."*

The soils in the area consist of the Hochheim-Theresa-Pella Series. These soils are generally well drained and are well suited to building site development. These soils are susceptible to moderate frost action.

3. Hydrology/Surface Water/Wetlands/Floodplains

a. Watersheds:

A significant majority of the City of Kiel drains to the Sheboygan River Watershed. A small area in the northwest corner of the Village drains to the South Branch of the Manitowoc River.

b. Surface Water:

The Sheboygan River bi-sects the City, and the Wastewater Treatment Facility discharges to the River. There are no other surface waters of note within the City limits.

c. Wetlands & Floodplains:

Mapped wetland areas and floodplains within the City are primarily adjacent to the Sheboygan River, as illustrated on Figure III-1. The wetland areas serve an important function by providing flood control during significant precipitation events and spring runoff, they filter pollutants out of water, offer habitat for a variety of plant and animal life and recharge groundwater systems. Wetlands are designated by the State and Federal governments as environmentally sensitive areas that should be protected from development.

As stated in the Comprehensive Plan, floodplains are often viewed as valuable recreational and environmental resources. These areas provide for storm water retention, groundwater recharge and habitat for various kinds of wildlife unique to the water. The 100-year floodplain in the Kiel area is outlined on Figure III-2.

4. Endangered Resources

Information provided on the Wisconsin Department Of Natural Resources (DNR) website, 'Endangered Resources Preliminary Assessment', indicates that no endangered resources have been recorded in the vicinity of the Wastewater Treatment Facility site. No further action is required or recommended with regard to Endangered Resources. A copy of the information obtained from the DNR website is provided in Appendix III-1.

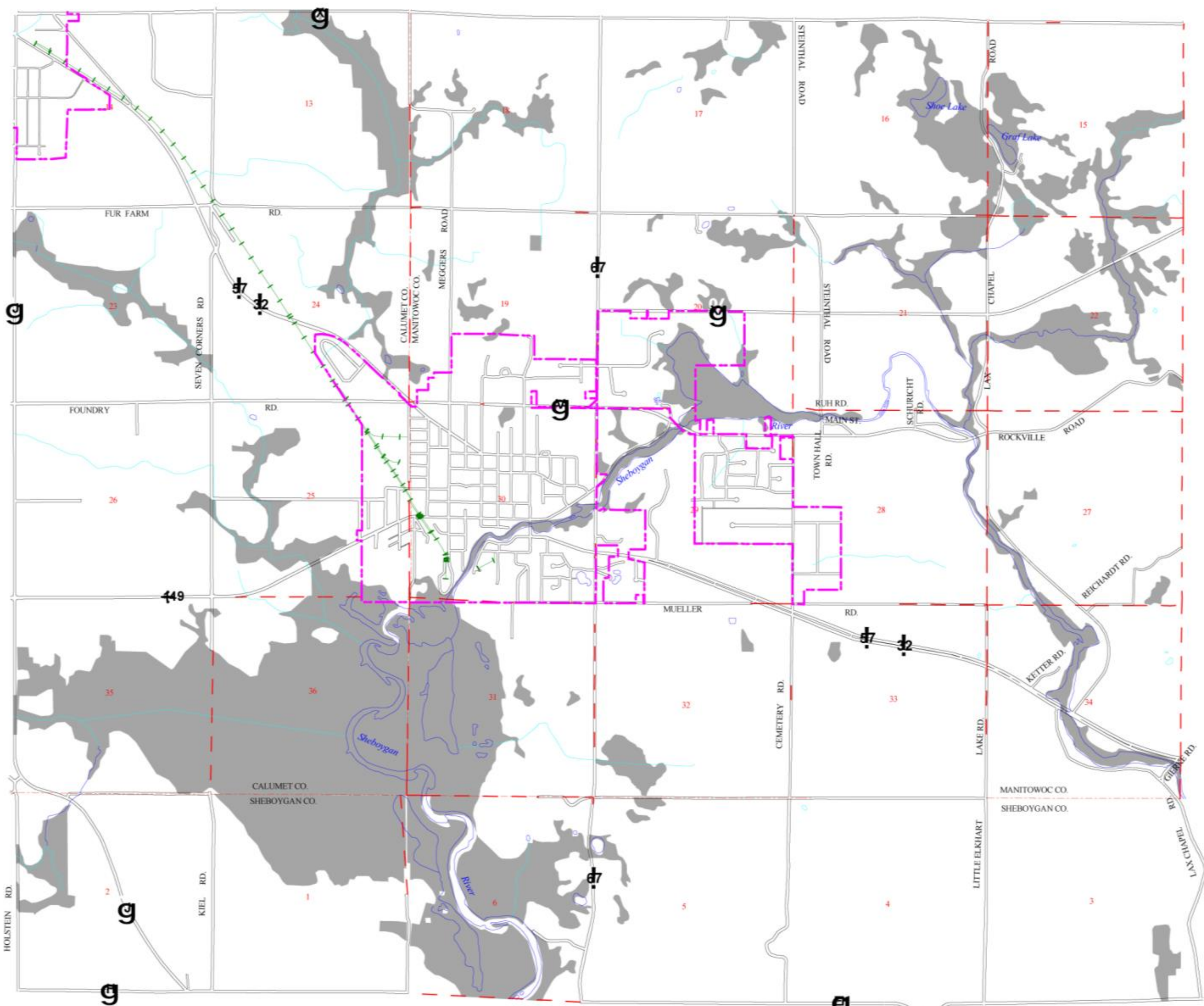
5. Archaeological/Historical/Cultural Resources

A request was made of the DNR Archaeologist to determine if any archaeological sites or historic structures/sites are present in the vicinity of the Kiel Wastewater Treatment Facility. The response received was that there are no recorded historic properties reported to occur within the project location. A copy of the response letter from the DNR is provided in Appendix III-2.

Wetlands

City of Kiel Planning Area

Calumet, Manitowoc & Sheboygan Counties



WDNR Wetlands

Map Features

- State Highway
- County Highway
- City Limits
- County Boundary
- Local Road
- Surface Water Features
- Railroad Corridor
- Section Line
- 36 Section Number

1 0 1

Miles

N

Source: WDNR, 1991; Bay-Lake Regional Planning Commission, 2002.

McMAHON
ENGINEERS ARCHITECTS

FIGURE III-1

WETLANDS

FACILITIES PLANNING

CITY OF KIEL, WI

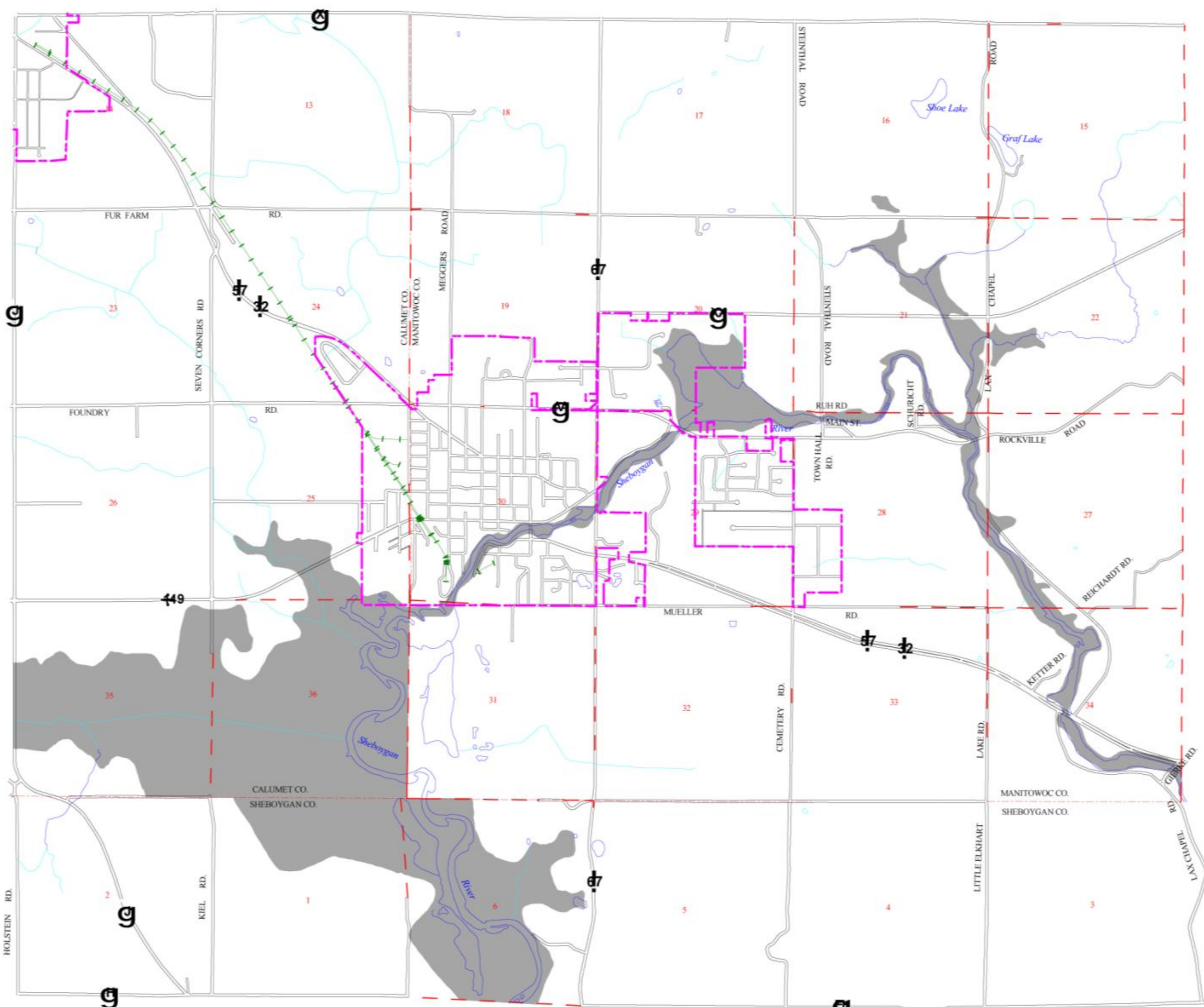
McM #K0015-950262.00 4/29/2015

ID: PPT\2015\MCM WI\KIEL-FACILITIES PLANNING FIGS.PPTX AJV:jmk

Floodplains

City of Kiel Planning Area

Calumet, Manitowoc & Sheboygan Counties



1 0 1

Miles

N

100 - Year Floodplain*

*Kiel Marsh Wildlife Area is not included in Manitowoc County's Floodplain.

Map Features

- State Highway
- County Highway
- City Limits
- County Boundary
- Local Road
- Surface Water Features
- Railroad Corridor
- Section Line
- 36 Section Number

Source: FEMA FIRM, 1982; Bay-Lake Regional Planning Commission, 2002.

McMAHON
ENGINEERS ARCHITECTS

FIGURE III-2

FLOODPLAINS

FACILITIES PLANNING

CITY OF KIEL, WI

McM #K0015-950262.00 4/29/2015

ID: PPT\2015\MCM WI\KIEL-FACILITIES PLANNING FIGS.PPTX AJV:jmk

6. Land Use & Demographics

Existing land use within the City of Kiel was identified during the development of the 20-Year Comprehensive Plan in 2001. A map of the existing land use was developed from a field survey conducted in September 2001 by Bay-Lake Regional Planning Commission, and is included as Figure III-3.

A Sewer Service Area Plan has not been developed for the City. Due to the City being under a population of 10,000, the City is not required to develop a Sewer Service Area Plan, as described in NR 121.

The Wisconsin Department of Administration (DOA) annually produces population estimates for Wisconsin municipalities based on prior Census, and analysis of contemporary data including housing units, automobile registrations, residential electric meters and other indicators of population change. The DOA also develops population projections for Wisconsin municipalities. The estimates and projections provided by the DOA are presented in Table III-1, and as illustrated graphically in Figure III-4. The projected population for 2035 is 4,260. The population projections were submitted to the Bay-Lake Regional Planning Commission for review and comment. The Commission indicated these are the same projections they would use for planning purposes. (Angela Pierce, Natural Resources Planner, Email May 1, 2015)

Table III-1

Population Projection - City Of Kiel	
1990 Census	2,910
1995 DOA Estimate	3,047
2000 Census	3,450
2005 DOA Estimate	3,570
2010 Census	3,738
2014 DOA Estimate	3,773
2020 DOA Projection	3,935
2025 DOA Projection	4,075
2030 DOA Projection	4,195
2035 DOA Projection	4,260
2040 DOA Projection	4,235

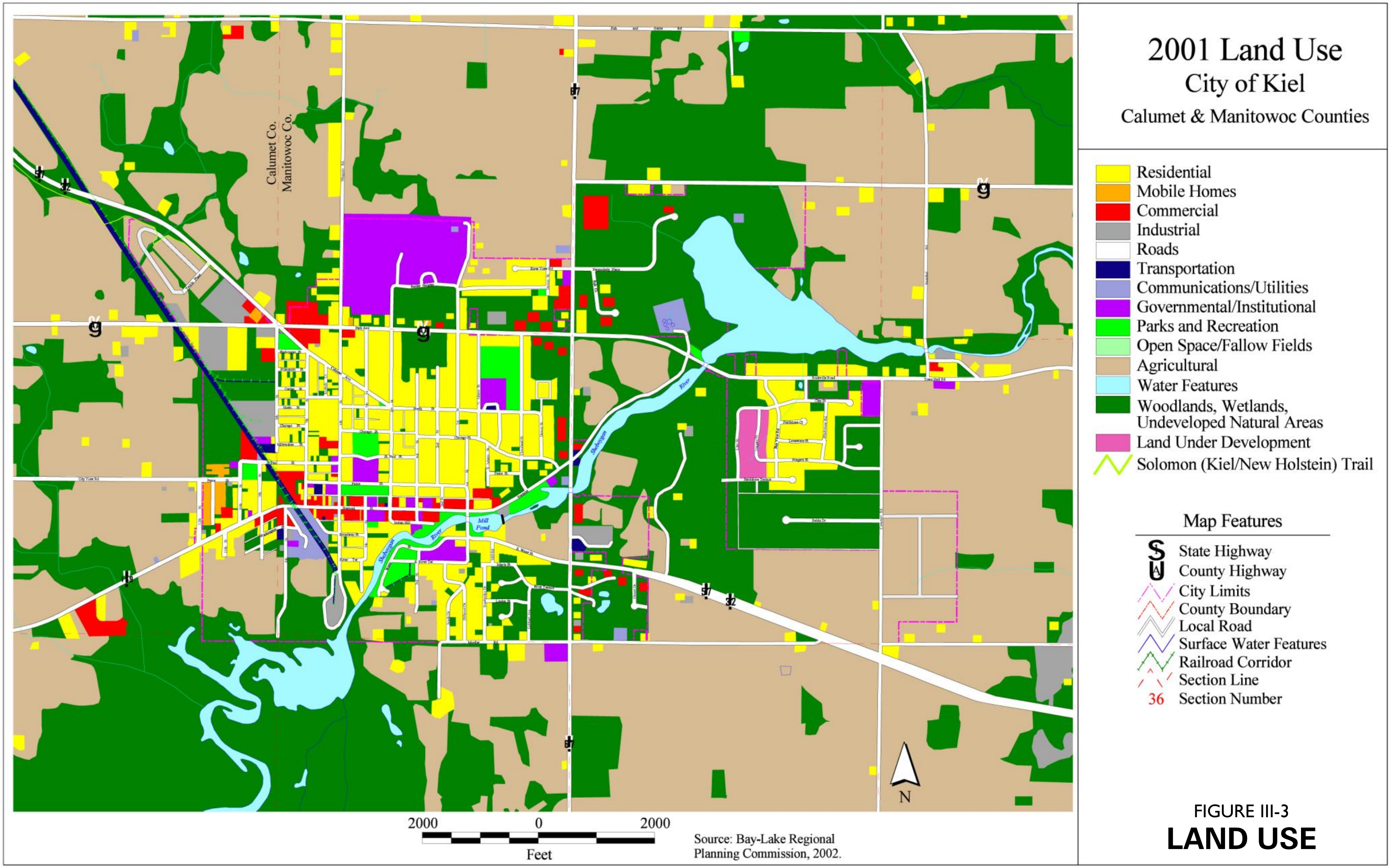


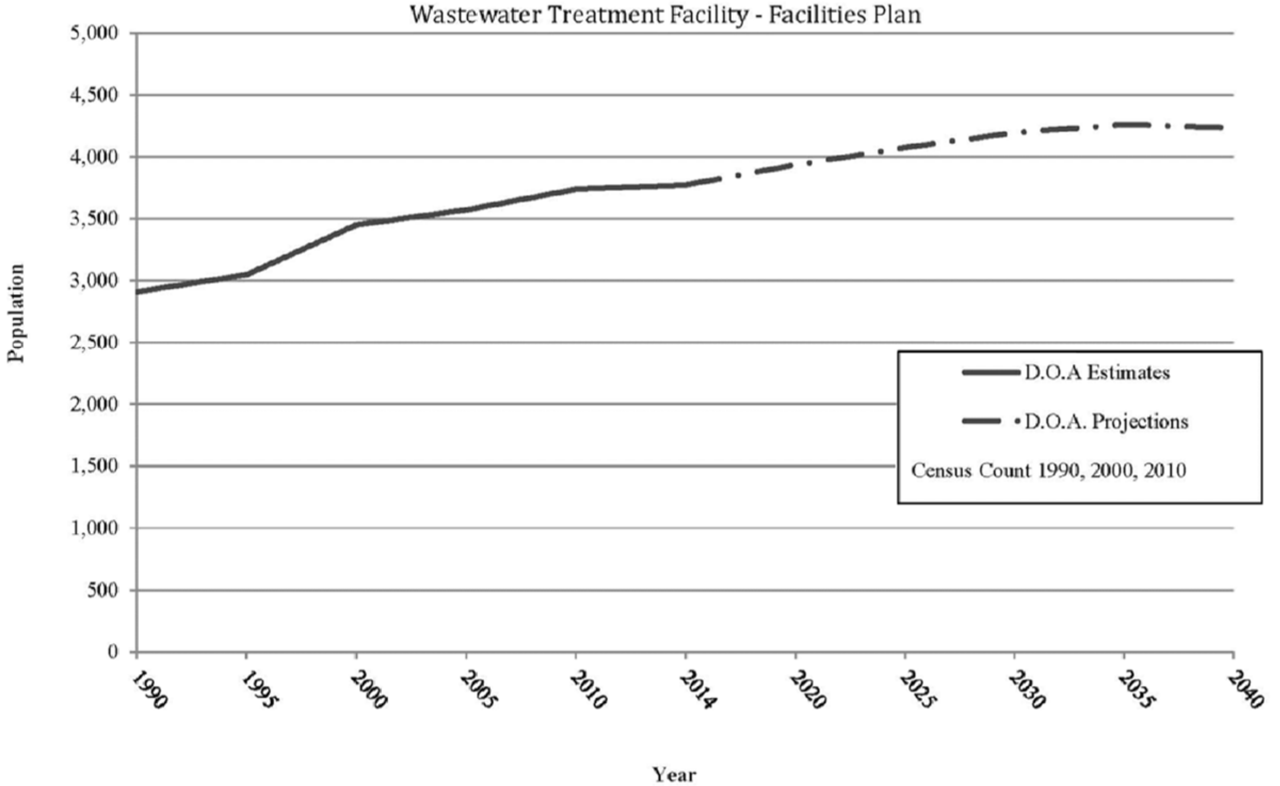
FIGURE III-3
LAND USE

McMAHON
ENGINEERS | ARCHITECTS

FACILITIES PLANNING
CITY OF KIEL, WI
McM #K0015-950262.00 4/29/2015
ID: PPT\2015\MCM WI\KIEL-FACILITIES PLANNING FIGS.PPTX

Figure III-4

POPULATION PROJECTIONS
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facilities Plan



B. INFRASTRUCTURE DESCRIPTION

1. <u>Public Water System</u>

The City of Kiel owns and operates a public water system that serves the properties in the City. Below is a brief summary of various features of the system:

Number Of Customers & Sales Of Water 2014

Type	Number	Gallons Sold
Residential	1,550	64,547,000
Commercial	142	9,797,000
Industrial	16	92,328,000
Public Authority	19	3,292,000
Multifamily Residential	10	2,100,000
Totals	1,737	172,064,000

Water Usage

Total Pumpage Into The System	
Average Day	659,050 gpd
Maximum Day	952,000 gpd
Total GPCD	175 gpcd based on total pumpage to system
Residential GPCD	47 gpcd based on residential metered sales

Water System Infrastructure

Supply - Four Wells	
Well #1	Washington Street
Well #3	North First Street
Well #4	STH 'XX'
Well #5	Clay Street

Storage - Elevated Tanks	
North Tank	200,000-gallons / Constructed 1971
South Tank	200,000-gallons / Constructed 1986

Water Main	Approximately 29-miles, ranging in size from 4-inch diameter to 18-inch diameter

2. Sanitary Sewer Collection System

The City of Kiel owns and operates the sanitary sewer collection system that collects and transports wastewater to the Wastewater Treatment Facility. A map of the system is provided on Figure III-5. The City provides sewer service to the residential, commercial, industrial and public authority properties within the City limits. Sewer service has been provided since the early 1900's. Generally, flow in the system drains from the west to the east to the Wastewater Treatment Facility. There is also an area of the City located south and east of the Facility that is served.

The sanitary sewer system consists of vitrified clay, truss, concrete and PVC pipe, ranging in size from 6-inches to 24-inches in diameter. Generally speaking, from the mid 1970's to present, sanitary sewers were constructed of PVC pipe. Sewers constructed from the mid-1950's to the mid-1970's were constructed of concrete pipe or truss pipe. Prior to the 1950's, sanitary sewers and laterals were constructed of 3-foot long sections of vitrified clay or concrete pipe.

There are six Lift Stations in the system; the largest of which is the River Road Lift Station, which pumps wastewater from the western three-fourths of the City. The locations of the Lift Stations are identified on Figure III-5.

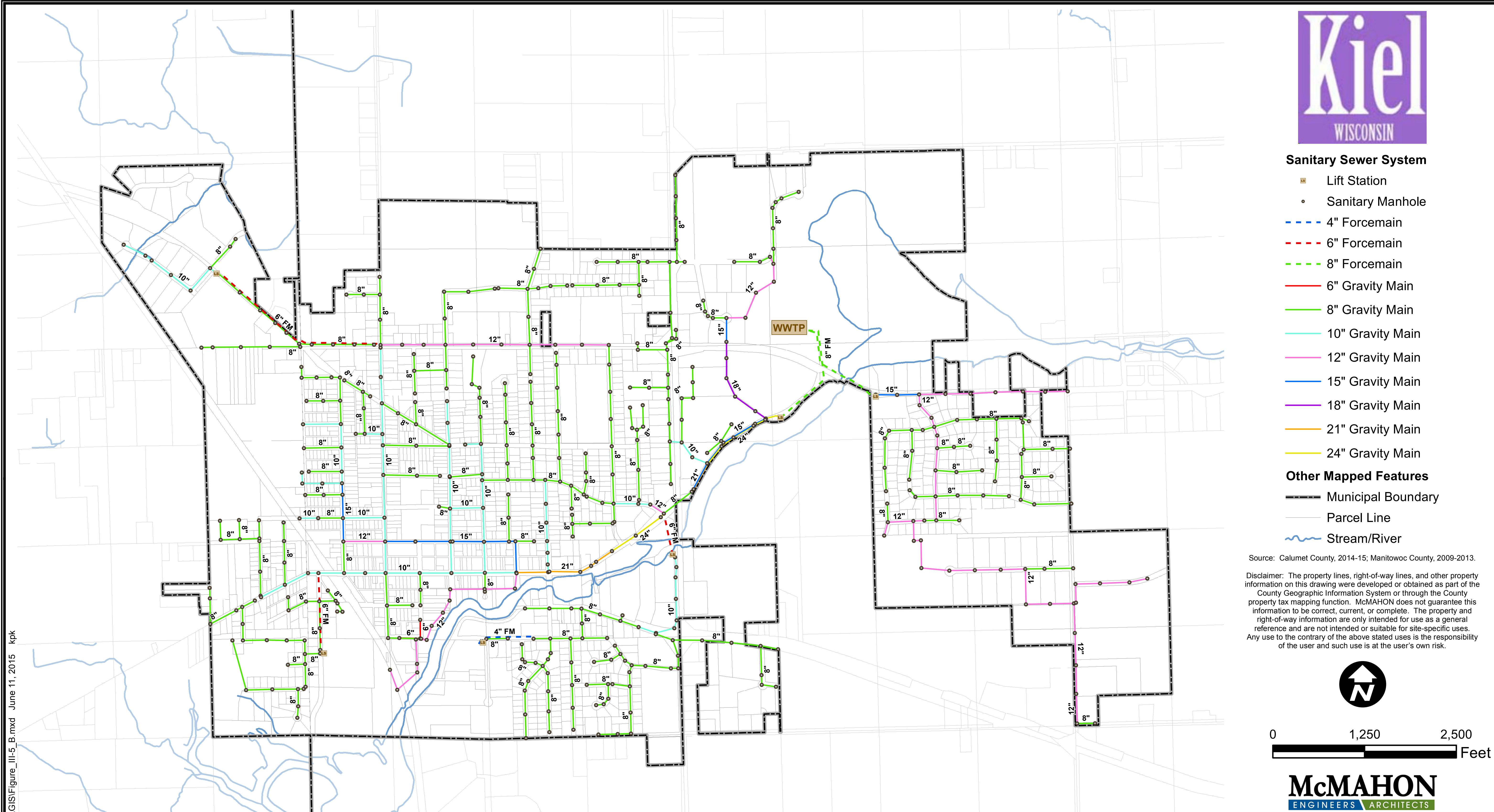


FIGURE III-5
SANITARY SEWER SYSTEM
CITY OF KIEL
CALUMET AND MANITOWOC
COUNTIES, WISCONSIN

3. Description Of Wastewater Treatment Facility

a. Liquid Train:

Flow arrives at the Wastewater Treatment Facility via force mains; an 8-inch and 12-inch force main from the River Road Lift Station transports wastewater generated from the majority of the service area, while the smaller Rockville Road Lift Station has a 4-inch force main and serves a residential area southeast of the Treatment Facility.

The River Road Lift Station and force mains are equipped with magnetic flow meters, which are utilized for influent flow recording. The Rockville Road Lift Station has no flow meter, and utilizes a wet well calculation to add the flow volume pumped, to the Wastewater Treatment Facility influent flow.

The force mains discharge upstream of two (2) parallel fine screens. The incoming flows are split between two (2) channels, each equipped with a spiral type fine screen utilizing a perforated basket with ¼-inch openings. Each screen is rated at 4.3 mgd, which is the firm capacity of the screening system. One (1) ultrasonic level sensor provides liquid level control of the screens. Flows combine after the fine screens are sampled flow proportionally.

A 12'x 12'x 12' Sidewater Depth (SWD) aerated grit chamber follows the sampling point. At maximum day design flow, the hydraulic detention time is 6.0-minutes, which is double the time allowable per NR 110. The grit chamber equipment dates back to 1979, while the remainder of the pretreatment facilities were constructed in 1996.

Settled grit is removed via air lift, and is transported via a 4-inch pipe to a grit classifier located in the adjacent Service Building. There is no grit washer to separate organic and inorganic materials. Originally built in 1965, the Service Building previously provided the pretreatment functions. A more detailed discussion of the Service Building will follow. A bypass channel provided around the grit chamber.

Downstream of the aerated grit chamber, a 16-inch pipe transports forward flows to a primary clarifier splitter box. The primary splitter box does not use any weirs to split the flow evenly, rather there are two (2) 16-inch pipes exiting the splitter box. One (1) pipe discharges into the stilling well of the north clarifier, which was originally constructed in 1965, and modified in 1979. The 1979 modifications included additional concrete wall height and mechanisms, along with construction of the south primary clarifier and splitter box / sludge / scum handling systems. Uneven flow splitting between the two (2) clarifiers can lead to operational inefficiencies and difficulties.

The primary clarifiers are each 28-feet in diameter with a SWD of 12.31-feet. Maximum hourly flows in excess of 1.847 mgd exceed the allowable surface setting basin rate of 1,500-gal/sq.ft./day per NR 110.

The 16-inch primary effluent piping from the north and south clarifiers is combined into a single 16-inch diameter pipe that extends to the aeration system splitter box, located at the southwest corner of the north aeration basins. Normally, secondary influent is split between three (3) aeration trains: the original 1965 'south' aeration train, and two (2) 'north' aeration trains constructed in 1985. When flows exceed 2.0 mgd, some forward flow is diverted away from the splitter box and directed to the south aeration train, which is at a lower elevation, alleviating a hydraulic limitation.

The aeration systems are designed to provide biological phosphorus removal. Hyperbolic mixers in anoxic zones provide mixing energy to keep the process active. Fine bubble ceramic diffusers provide air within the aerobic zones for mixing and oxygen transfer. The south aeration system consists of Aeration Basins #7, #8 and #9. Basin #7 is divided in two (2) parts by a curtain baffle wall; one (1) side equipped with a hyperbolic mixer, and one (1) side with fine bubble diffusers. Similarly, the north aeration trains are set up with three (3) basins each. The westerly train consists of Aeration Basins #1, #3 and #5; and the easterly train consists of Aeration Basins #2, #4 and #6. Basins #1 and #2 are equipped with hyperbolic mixers and curtain baffle walls, similar to the south train.

The north aeration basin trains have dimensions of 65'L x 32'W x 14'SWD, and include a 30'L anoxic zone at the influent end of Basins #1 and #2. The south aeration train has dimensions of 64'L x 28'W x 14'SWD, and contains a 30'L anoxic zone at the influent end of Basin #7. Each north train has approximately 90,500-gallons more than the south train.

The four (4) aeration blowers are located in the Solids Handling Building, and the 24-inch air main is buried en route to the aeration basins. Two (2) blowers date back to the 1997 project, while two (2) were included in the 2008 project. The older blowers are 100-HP, each, and rated for 1,680 scfm @ 8 psig, while the two (2) newer blowers are 150-HP with a 2,520 scfm, 8 psig capacity. Only the two (2) newer 150-HP positive displacement blowers are on Variable Frequency Drives (VFD's) and modulate in response to Dissolved Oxygen (D.O.) setpoints within the basins. The firm capacity of the blower system is 5,880 scfm, with one (1) of the new blowers out of service. The older 100-HP blowers have difficulty coming on-line when the dynamic backpressure increases due to diffuser fouling, and they experience motor overloading. Air splitting between the north and south basins is difficult to control, and the buried air main has leaking joints.

Mixed Liquor Suspended Solids (MLSS) from the three (3) trains is combined in a splitter box adjacent to the east side of the south aeration tanks. A single 10-foot wide weir is provided and, as such, does not evenly split flows between the two (2) final clarifiers; rather, the hydraulics of the 16-inch influent pipe to each clarifier is controlling the flow to each.

Two (2) final clarifiers, each 40-feet diameter with a SWD of 14.25-feet, provide clarified effluent and a thickened sludge for return or wasting from the process. The December 2014 Master Plan notes that the maximum hour solids loading rate is 55.7 lbs./sq.ft./day, which exceeds the NR 110 limit of 48.0. Settled sludge is removed from each clarifier via an organ pipe style mechanism, and transferred to a sludge well via a telescopic valve. Two (2) Return Activated Sludge (RAS) pumps, each rated at 1,400 gpm @ 22-feet Total Dynamic Head (TDH), are provided. There is no common section header for the RAS pumps, rather they are each connected to an individual clarifier's sludge well. While there is a normally open gate separating the two (2) sludge wells, there is no other means of pump backup.

Waste sludge is drawn through a 2-inch line tapped into each pump's suction pipe. A single rotary lobe pump provides Waste Activated Sludge (WAS) pumping. At 60-Hz, the WAS pump is rated for 60 gpm @ 10 psig, and there is no backup pump. The pump can be run up to 90-Hz and discharge 90 gpm. In the event the 2-inch WAS pump is out of service, the RAS pumps can discharge WAS to the aerated sludge holding tanks. Flow metering of RAS and WAS is provided by magnetic flow meters dated back to 1979.

Scum removed from the final clarifiers is collected in a common wet well, adjacent to the north clarifier. Two (2) centrifugal pumps, each rated at 150 gpm @ 30-feet TDH, discharge scum to the aerated sludge tanks.

Clarified final effluent leaves each clarifier via a 16-inch diameter pipe, and is combined in a single pipe of the same diameter prior to entering the sand filter influent wet well. The sand filter is divided into four (4) cells, each 12'x 12', with 30-inches of mono-media. Three (3) dry pit centrifugal feed pumps with extended motor shafts and VFD's are each rated for 1,300 gpm @ 35-feet TDH. Backwash is provided by two (2) vertical turbine pumps, each rated for 2,900 gpm @ 16.5-feet TDH. Backwash air scour is provided by a single 25-HP rotary lobe blower.

Filtered effluent flows by gravity from a filter effluent wet well to a chlorine contact chamber for disinfection. Flows drop over a weir into a chlorine mix chamber, where chlorine solution is diffused into the flow stream. Two (2) submerged 36"x 36" cast iron gates are utilized to split flows between two (2) chlorine contact chambers. These gates are in need of repair or replacement to provide a tight seal. Each contact chamber consists of five (5) passes, each with a L/W ratio of 26:2.5, which exceeds 40:1 required by NR 110. Upon exiting the contact chambers, an effluent structure combines the two (2) flow streams and dechlorination is provided with sulfur dioxide. 150 lb. cylinders are utilized for both chlorine and sulfur dioxide gas.

Downstream of the disinfection system, a 16-inch pipe conveys flow to a post-aeration tank to ensure adequate Dissolved Oxygen (DO) levels prior to discharge. The 32-foot diameter tank has a SWD of 8-feet, and utilizes EPDM membrane fine pore diffusers to aerate the effluent prior to discharge.

The Service Building was originally constructed in 1965, and functioned as the Headworks and provided space for the Office/Laboratory, as well as equipment. Currently, the blowers for the sludge holding tanks are housed in the Service Building, along with the grit system, post-aeration and channel aeration blowers. Non-potable water pumps are housed in the lower level, and a grit classifier is installed in former garage space.

High strength waste is received at the Wastewater Treatment Facility via local haulers. A manually cleaned bar rack precedes a converted aeration basin, which serves as a storage tank. Located at the north end of the south aeration train, the tank has a total volume of nearly 188,000-gallons at a 14-foot SWD. The high strength wastes are equalized in the tank, and fed upstream of the two (2) fine screens, un-metered, but sampled with the influent flow stream. Later this year, a dividing wall will be constructed in the high strength waste tank to segregate septage, and high strength wastes from dairy facilities. The Treatment Facility is also in the process of adding a 280 kW engine/generator to utilize the digester gas to create electricity and hot water for digester/supplemental heating.

b. Solids Train:

WAS from the final clarifiers is co-thickened in the primary clarifiers. Primary scum flows by gravity into a scum wet well, which can also receive primary sludge via telescopic valves. Typical operation utilizes a direct connection between the clarifier center sludge pit and the sludge pump; once per day the telescopic valve is utilized to check the sludge thickness and to clear the suction piping.

Two (2) air driven diaphragm pumps, located in the digester complex, are used to transfer primary sludge/scum to the primary digester. The east pump (SP6) is the principle pump for transferring primary sludge into the primary digester. The west pump (SP5) is on a common suction header with SP6, but is utilized primarily as a sludge transfer pump to send sludge to the aerated sludge holding tanks.

The anaerobic digestion system consists of two (2) 45-foot diameter tanks; one (1) designated as a primary, and one (1) designated as a secondary digester. The primary digester has an operating SWD of 21-feet, while the secondary digester has an operating SWD of 26-feet. Total volumetric capacities of the primary and secondary digesters is 269,652-gallons and 342,537-gallons, respectively. The primary digester is heated via a single boiler/heat exchanger and mixed via a gas mixing system. The secondary digester is unheated and unmixed, and functions as a storage vessel prior to dewatering. The primary digester has a fixed cover, while the secondary has a floating cover; both covers are in need of replacement.

A single 150 gpm centrifugal pump is utilized for recirculation of the primary digester contents. The combination boiler/heat exchanger has a boiler capacity of 825,000 btu/hour and a heat exchanger capacity of 375,000 btu/hour. Sludge transfer from the primary to the secondary may be accomplished with the recirculation pump, but is typically a gravity flow operation via an overflow box. Supernatant is decanted and flows by gravity to a submersible pump station, which transfers the flows to the effluent end of the grit removal system via two (2) separate force mains.

Stabilized sludge is transferred with one (1) of the air driven diaphragm pumps to a pair of aerated sludge holding tanks. The holding tanks are 62'x 25'x 16'SWD, each, and provide a combined total aerated storage capacity of 371,000-gallons. The sludge holding tanks can be decanted to the recycle wet well in order to maximize the storage volume and minimize the volume of sludge to be dewatered. The recycle wet well has two (2) dry pit centrifugal pumps, each rated for 560 gpm @ 36-feet TDH, which transfer flows to the effluent end of the grit removal system or to the aeration basin splitter box.

The storage tanks are mixed via coarse bubble diffused aeration. Six (6) drop legs per storage tank provide a spiral roll aeration pattern. A separate 8-inch air main extends from the Service Building blowers to each sludge storage tank. Three (3) positive displacement blowers are provided; two (2) duty blowers, and one (1) swing blower for backup. The capacities of the duty and backup blowers are different, as are the manufacturers and age. This may lead to operational problems when one (1) blower cannot overcome the operating pressure of the other in the event supplemental air is required.

Sludge dewatering is accomplished with a single 2.0 m belt press. There is no redundancy or backup unit. Two (2) belt press feed pumps transfer sludge from the sludge holding tanks to the belt press; one (1) pump is a progressive cavity type, while the other is a rotary lobe style. Each belt press feed pump is rated for a 150 gpm flow rate, while the press is limited to a 125 gpm/1,000 lbs./hour capacity. Filtrate is discharged to the effluent end of the grit removal system via gravity.

Dewatered sludge ranges from 14% to 17% solids. A conveyor system transfers the cake from the press to a lime pasteurization system. The pasteurization system is rated for 800 lbs./hour, and produces a Class A biosolids product. A lime storage silo provides 10 to 12-days of lime storage. However, the Operations Staff has been utilizing fly ash to reduce costs. The fly ash substitution requires approximately twice as much when compared to lime and the available storage in the silo is approximately 4 to 7-days.

The pasteurized biosolids are loaded into a 5 cubic yard dump truck. 3 to 4-times each day, the truck transports the biosolids from the load-out garage bay to the Cake Storage Building. The Cake Storage Building is approximately 80'W x 140'L and has 9,260 square feet of available floor space to store biosolids. A front-end loader is utilized to stack and load-out biosolids; a stack height of 12-feet is achievable, but can vary depending on the solids content.

c. Electrical:

1) Utility Service

The Wastewater Treatment Facility receives electrical service from the City of Kiel Electric Utility. High voltage (24.9 kV) is routed to the site, and to a pad-mounted transformer on the east side of the Treatment Facility. That transformer steps the voltage down from 24.9 kV to 4160V. From there, an underground service lateral extends westward to a transclosure / transformer located near the Solids Handling Building (Building #700). The transclosure contains three (3) single-phase transformers, 250 kVA each, which step the voltage down from 4160V to 480V. Metering takes place on the secondary (480V) side of the single-phase transformers.

a) Electric Utility Service, Summary Information:

(1) Serving Utility: City of Kiel, Electric Utility
(2) Primary Voltage: 4160V
(3) Secondary Voltage: 480V
(4) Service Transformer Capacity: 750 kVA
(5) Service Amp Rating: 1,600-amp plug with ampere setting of 0.7; or 1,120-amps
(6) Maximum available Fault Current at Utility Service Point: 50,119-amps.

b) Assessment:

The Electric Utility has stated that the existing service configuration to the Wastewater Treatment Facility is undesirable, and they desire to change it. The Electric Utility does not wish to sustain having two (2) transformer settings, nor do they wish to maintain the existing transclosure and single-phase transformers. The Electric Utility's long-term intention is to remove both existing transformer settings, and replace them with one (1) new pad-mounted transformer in place of the existing transclosure.

Of particular concern regarding the utility service is the existing maximum available fault current. The 'maximum available fault current' is the amount of electric current that would be expected to flow in the event of an accidental 3-phase short circuit. According to the Electric Utility, the available fault current at the point of utility service from the Kiel Electric Utility is 50,119-amps. At the location of the main service equipment (MCC-7), the available fault current drops to approximately 48,000-amps. Unfortunately, the main service equipment MCC-7 is rated for a maximum short circuit current of only 42,000-amps. The existing main electrical equipment is, therefore, underrated, when compared to the 48,000-amps of available fault current. In the worst-case scenario, if a 3-phase short circuit were to occur within the electrical service gear, the electrical equipment might be subjected to levels of electrical energy beyond its ability to sustain it, and possible violent destruction of equipment could occur. In addition, such an incident would represent a safety hazard to personnel, and the Treatment Facility could be rendered without power for an indefinite period of time. The electrical equipment short circuit rating should be addressed in the near future.

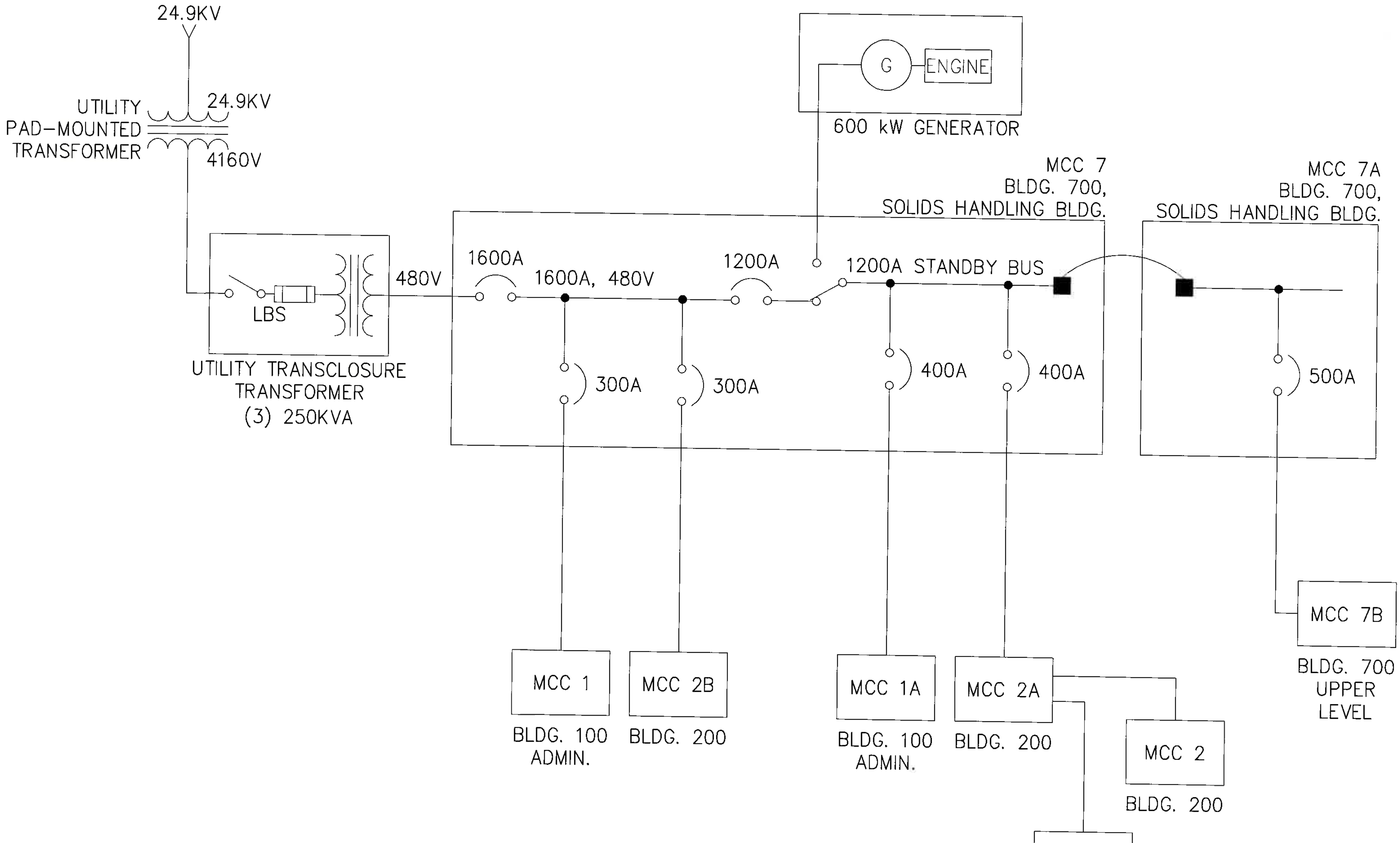
2) Electrical Distribution Equipment

The existing Wastewater Treatment Facility power distribution system is depicted in single-line diagram form in Figure III-6. Power distribution, as well as motor control, is accomplished with Motor Control Centers (MCC's) distributed throughout the Treatment Facility campus. Existing Wastewater Treatment Facility MCC's are listed in Table III-2.

Table III-2

EXISTING TREATMENT FACILTY MOTOR CONTROL CENTERS (MCC's)
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facilities Plan

MCC No.	Location	Installed	Manufacturer	Model	Amp Rating
1	Administration Building	1985	Square D	Model 4	300A
1A	Administration Building	1985	Square D	Model 4	400A
2	Service Building	1982	Cutler Hammer	Unitrol	300A
2A	Service Building	1985	Square D	Model 4	400A
2B	Service Building	1985	Square D	Model 4	300A
3	Digester Building	1985	Square D	Model 4	300A
7	Solids Handling Building	1985	Square D	Model 4	1,600A
7A	Solids Handling Building	1985	Square D	Model 4	1,200A
7B	Solids Handling Building	1997	Allen Bradley	Centerline	500A



EXISTING ONE-LINE DIAGRAM

FIGURE III-6

With the exception of MCC-7B, the MCC's are more than 30-years old. They are Square D, Model 4, MCC's, which have long been obsolete. Some parts are available for Model 4 MCC's, but new structures are not available. Adding VFD's to an existing Model 4 MCC is not practical. MCC-2, located in the Service Building, is an older Cutler Hammer - Unitrol MCC, and predates even the Square D, Model 4's. Like the Model 4's, the Unitrol MCC is also obsolete. Replacing the existing obsolete MCC's with new structures should be considered.

The existing circuit breaker panelboards are mostly of the same vintage as the MCC's. Several of them were manufactured as integral to the MCC's themselves, thus necessitating their replacement if the MCC's are replaced. The existing dry type transformers are also of the same age as the majority of the Treatment Facility electrical equipment; that is, over 30-years of service. In general, dry type transformers have a life expectancy of 25 to 30-years. Expected life increases if the transformer is operating in a cool and dry location; expected life drops if the transformer is operating in warm and humid location. While the indoor environmental conditions vary from building to building, the Wastewater Treatment Facility generally has conditions that are less than ideal for transformer longevity. Replacement of the older dry type power transformers should be considered.

3) Standby Power

Standby power is provided at the Wastewater Treatment Facility by means of an on-site diesel generator. The generator is 600 kW, 750 kVA, as manufactured by Marathon Electric. The generator connects to the Facility electrical distribution system at MCC 7 (in the Solids Handling Building). The connection is made at an Automatic Transfer Switch (ATS), located at a mid-point of the MCC 7 bus. With this configuration, MCC 7 is, therefore, comprised of a normal-power bus and a standby bus. Only equipment that is connected to the standby bus can operate on standby power.

The existing ATS is integrated into the existing MCC 7. As such, the transfer switch represents a single point of failure for the electrical distribution system. In the event of a 3-phase short circuit at the ATS, neither utility or generator power can be provided to the Treatment Facility load. In the event of a failure of the transfer switch, there are no existing bypass provisions to maintain power to the standby bus. A new ATS, which includes isolation and bypass provisions, should be considered.

4) Hazardous Locations

The digester structure is an National Electric Code (NEC) Classified Hazardous location. As such, all electrical equipment within the hazardous space must comply with NEC requirements for such locations. No electrical switching is permitted within the hazardous space, junction boxes must be approved for the application, and seal fittings must be provided in conduit runs to prevent migration of explosive gases to spaces outside of the hazardous area.

The existing electrical equipment in the Digester Building is not compliant with the NEC requirements for classified hazardous locations. The MCC, which contains electrical switching components, must not be located in the hazardous area. An existing pump control panel in the room is non-compliant with hazardous location requirements. Light switches are not to be located in the hazardous area. Existing lights and exit signs are not compliant for hazardous locations. In general, the entire Digester Facility should be electrically reconfigured, and rewired, for full compliance with the hazardous location requirements of NEC Article 500.

d. Controls:

The existing controls consist of Programmable Logic Controllers (PLC's) in various parts of the Wastewater Treatment Facility. The PLC's are from various manufacturers: Allen-Bradley, Siemens and Automation Direct (Koyo). Of these, some are obsolete, in that they are no longer manufactured and there is no Manufacturer's support. Others are classified as 'active mature' by the Manufacturer, which is defined as the product being fully supported, but a newer replacement product or family exists and the mature product will soon start to be phased-out.

Some controls are provided by vendors with their equipment and contain either stand-alone controllers (not a PLC) or consist of hardwired relays.

On the front of the Main Control Panel (MCP) are mounted approximately 50 indicator lights, a lighted graphic of the Wastewater Treatment Facility, an alarm annunciator light box and some selector switches. Several sections have plates covering holes from devices that were removed. Most of the items mentioned in the preceding paragraphs are obsolete; either the devices themselves or the technology currently employed.

A MCP is located in the Operator Control Room (OCR) in the Administration and Filtration Building. The MCP covers most of one wall, and is both front and rear accessible.

Internally, the MCP contains two (2) PLC's; a Siemens Simatic TI405 PLC, and an Automation Direct 405 PLC with an expansion rack. The output points from these PLC's drive indicator lights and graphic-mounted indicators, all of which are mounted on the front of the MCP. It also has eight (8) outputs for triggering inputs to the alarm autodialer.

The Wastewater Treatment Facility has an older Public Address (PA) system that annunciates critical alarms by means of a tone. A local telephone is located adjacent to each PA speaker. This system provides coverage for most internal areas of the Treatment Facility. In addition, each Operator carries a City-provided cellular telephone, but there are some areas of the Treatment Facility in which these telephones do not have sufficient signal to receive calls.

The PLC's input some analog process signals; mostly signals that had been used to drive circular chart recorders. Some MCP-mounted selector switches are input to these PLC's, but the MCP is mostly used as a process monitoring tool and collection point for data that is read by the Supervisory Control and Data Acquisition (SCADA) Personal Computer (PC).

The MCP also acts as a central communication hub. There is some inter-building Ethernet communication over Category 5 copper cable. An Ethernet switch is mounted in the MCP. The switch has eight (8) ports available for connecting copper Ethernet cables. Currently, six (6) of the eight (8) ports are used:

1) Blower Panel PLC
2) Effluent Pumps PLC
3) Automation Direct 405 PLC
4) Siemens Simatic TI405 PLC
5) SCADA PC
6) Hach PC

Two (2) PC's are located in the OCR. One (1) PC runs Wonderware SCADA software, which was purchased in 2008. The other PC runs Hach Water Information Management Solutions (WIMS) software.

The Wonderware SCADA software can only monitor processes that it can communicate with; the Blower Control Panel and the Effluent Pumps Control Panel. The only supervisory control the current SCADA has is partial control of the RAS.

Five (5) of the six (6) remote Lift Stations utilize copper telephone lines to communicate with the Wastewater Treatment Facility. This type of line is being phased-out by telephone companies, and usually is no longer available for a new communication service. Consideration should be given to upgrading the communication media, as well as the controls for each Lift Station.

C. WPDES PERMIT

The Wisconsin Pollutant Discharge Elimination System (WPDES) Permit limits for Kiel are described in Chapter II – Water Quality Objectives. Key limits include:

BOD	10 mg/L	May thru October
BOD	15 mg/L	November thru April
TSS	10 mg/L	May thru October
TSS	15 mg/L	November thru April
NH_3N	5.3 mg/L	October thru March
NH_3N	2.2 mg/L	April thru May
NH_3N	1.7 mg/L	June thru September
P	1.0 mg/L	

Other effluent limits for conventional parameters, such as pH, fecal coliform, chlorine residual, copper and chlorides, match up with conventional limits seen throughout the State.

D. WASTEWATER TREATMENT FACILITY FLOWS & LOADINGS

Influent flows and loadings for 2012 through 2014 are summarized in Table III-3. Comparing current Wastewater Treatment Facility design criteria to the actual flows and loadings received in 2012, 2013 and 2014, the Facility is overloaded on a regular basis.

Table III-3

WASTEWATER TREATMENT FACILITY HISTORICAL INFLUENT FLOWS & LOADINGS
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facilities Plan

Parameter	2012	2013	2014	Current Design Criteria
Influent Flow, mgd				
Average	0.850	1.014	1.019	0.862
Maximum Month	1.248	2.025	1.728	1.214
Maximum Day	2.333	3.115	3.088	3.095
BOD, mg/L (Average)	830	878	864	
BOD, lbs./day				
Average	5,968	6,999	6,741	6,000
Maximum Month	7,863	9,309	8,915	6,280
Maximum Day	12,358	21,337	17,631	9,250
TSS, mg/L (Average)	566	598	522	
TSS, lbs./day				
Average	4,042	5,026	4,185	2,842
Maximum Month	5,408	9,224	5,521	4,480
Maximum Day	10,058	48,746	9,518	7,420
Total P, mg/L (Average)	17	17	17	
Total P, lbs./day				
Average	121	139	132	145
Maximum Month	131	209	153	184
Maximum Day	262	826	275	247

Table III-4 illustrates the number of times the design criteria has been exceeded each year.

Table III-4

NUMBER OF DAYS EXCEEDING DESIGN CRITERIA
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facilities Plan

Parameter	No. Days Exceed	No. Sampling Days	No. Days Exceed	No. Sampling Days	No. Days Exceed	No. Sampling Days
Flow						
Average	135	366	188	363	226	363
Maximum Month	1	12	2	12	3	12
Maximum Day	0	366	1	363	0	363
BOD						
Average	46	103	64	104	60	103
Maximum Month	4	12	10	12	8	12
Maximum Day	7	103	10	104	15	103
TSS						
Average	86	102	94	103	81	104
Maximum Month	2	12	7	12	2	12
Maximum Day	5	102	8	103	5	104
Total P						
Average	18	101	32	104	31	104
Maximum Month	0	12	1	12	0	12
Maximum Day	1	101	2	104	2	104

Historic Wastewater Treatment Facility influent and industrial flows and loadings are summarized on Table III -5.

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Table III-5

WASTEWATER TREATMENT FACILITY HISTORICAL INFLUENT & INDUSTRIAL LOADINGS

CITY OF KIEL | WISCONSIN

Wastewater Treatment Facility - Facilities Plan

	2012			2013			2014		
Parameter	**WWTF Total**	**Land O'Lakes**	**Sargento**	**WWTF Total**	**Land O'Lakes**	**Sargento**	**WWTF Total**	**Land O'Lakes**	**Sargento**
Influent Flow, mgd									
Average	0.850	0.306	0.063	1.014	0.301	0.066	1.019	0.300	0.073
Maximum Month	1.248	0.330	0.083	2.025	0.355	0.084	1.728	0.333	0.106
Maximum Day	2.333	0.393	0.105	3.115	0.426	0.123	3.088	0.381	0.140
BOD, mg/L (Average)	830	1,241	2,404	878	1,357	2,209	864	1,119	2,058
BOD, lbs./day									
Average	5,968	3,163	1,454	6,999	3,434	1,351	6,741	2,800	1,393
Maximum Month	7,863	3,571	2,229	9,309	4,151	2,094	8,915	3,652	2,344
Maximum Day	12,358	8,205	6,235	21,337	13,994	6,107	17,631	8,896	7,708
TSS, mg/L (Average)	566	318	2,428	598	323	1,859	522	254	1,352
TSS, lbs./day									
Average	4,042	817	1,533	5,026	813	1,170	4,185	637	924
Maximum Month	5,408	971	4,190	9,224	926	2,023	5,521	744	2,259
Maximum Day	10,058	4,237	20,168	48,746	2,365	8,256	9,518	2,919	10,089
Total P, mg/L (Average)	17	37	23	17	41	19	17	34	18
Total P, lbs./day									
Average	121	95	13	139	104	11	132	85	12
Maximum Month	131	104	17	209	118	18	153	95	19
Maximum Day	262	352	35	826	275	45	275	178	36

E. WASTEWATER TREATMENT FACILITY PERFORMANCE

The City of Kiel Wastewater Treatment Facility performance for 2012 through 2014 is summarized in Table III-6.

The Compliance Maintenance Annual Report (CMAR) for 2014 is contained in Appendix III-3. The report is intended to be a report card for the Wastewater Treatment Facility to highlight specific areas of concern and those concerns that require action to correct. Overall, the City of Kiel Wastewater Treatment Facility scored an 'A' and is in the 'voluntary range', in which a response is optional. However, based on influent flows and loadings compared to design criteria, the Facility scored an 'F', as flows and loadings routinely exceeded the design values. Relative to flows and loadings, the Facility is in the 'Action Range', which requires a response to the DNR; this Facilities Plan satisfies that requirement.

While flows and loadings exceeded the design values on a regular basis in 2014, effluent quality was well within the permit limits. This is indicative of a highly motivated Staff with the knowledge and expertise to maximize the efficiency of the individual unit processes.

Figures III-7, III-8, III-9 and III-10 graphically illustrate the influent flows and loadings, and compare them to available design parameters. Figure III-11 through Figure III-20 illustrate effluent concentrations and loadings of the various discharge permit parameters, and compare them to the permit limits.

F. NEEDS ASSESSMENT

1. General

There are three (3) categories of needs at the City of Kiel Wastewater Treatment Facility, which may be broken down as follows:

a. Capacity
b. Plant Condition
c. Permit Requirements

Each category and the corresponding needs are described as follows.

2. Capacity

Current flows and loadings have been documented in this Chapter. The capacity of the Wastewater Treatment Facility is limited by the capacity of the individual unit processes. Appendix III-4 contains each unit process and its rated capacity, as described in the December 2014 Master Plan, prepared by Donohue & Associates, Inc. A discussion of each unit process and the limitations follows.

Table III-6

WASTEWATER TREATMENT FACILITY PERFORMANCE
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facilities Plan

MONTHLY AVERAGE

	Effluent BOD, mg/L			Effluent TSS, mg/L			Effluent P, mg/L			Effluent Ammonia, mg/L			Effluent Copper, µg/L			Effluent Chloride, mg/L		
Month	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**
January	2.11	2.87	3.30	2.64	2.07	3.82	0.66	0.41	0.58	0.37	0.60	0.07	18	8	23	390	370	540
February	2.13	3.53	4.64	3.02	2.98	4.63	0.65	0.36	0.43	0.16	0.24	0.10	16	10	9	450	460	570
March	3.80	2.84	2.73	2.98	1.70	1.78	0.34	0.31	0.28	0.11	0.04	0.04	11	11	10	350	397	480
April	2.06	5.83	4.50	1.73	5.16	3.73	0.53	0.46	0.25	0.05	0.34	0.07	12	-	8	360	410	470
May	3.11	3.11	3.76	3.44	2.42	1.93	0.56	0.42	0.51	0.11	0.27	0.06	10	9	11	270	350	350
June	2.89	3.17	4.44	2.29	1.55	3.16	0.62	0.58	0.58	0.08	0.06	0.07	9	-	11	400	440	420
July	1.73	3.06	3.33	1.62	2.29	2.49	0.50	0.70	0.54	0.06	0.07	0.12	15	18	13	450	540	330
August	1.23	2.47	1.78	1.33	2.31	2.38	0.60	0.64	0.59	0.07	0.07	0.87	14	15	9	460	520	400
September	2.15	2.59	2.54	1.10	2.31	1.98	0.51	0.52	0.69	0.07	0.07	0.03	14	21	13	440	510	430
October	1.70	2.20	1.91	2.16	3.98	1.75	0.65	0.42	0.63	0.06	0.10	0.02	11	21	11	470	510	510
November	1.98	3.20	6.13	1.80	2.23	2.13	0.59	0.79	0.51	0.07	0.10	1.94	8	19	6	440	480	430
December	2.20	3.00	4.83	1.46	3.11	3.20	0.55	0.43	0.43	0.04	0.09	0.07	7	45	24	500	560	430
Annual Avg.	2.26	3.15	3.66	2.13	2.67	2.75	0.56	0.50	0.50	0.10	0.17	0.29	12	18	12	415	462	447
Max. Month	3.80	5.83	6.13	3.44	5.16	4.63	0.66	0.79	0.69	0.37	0.60	1.94	18	45	24	500	560	570
# of Violations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

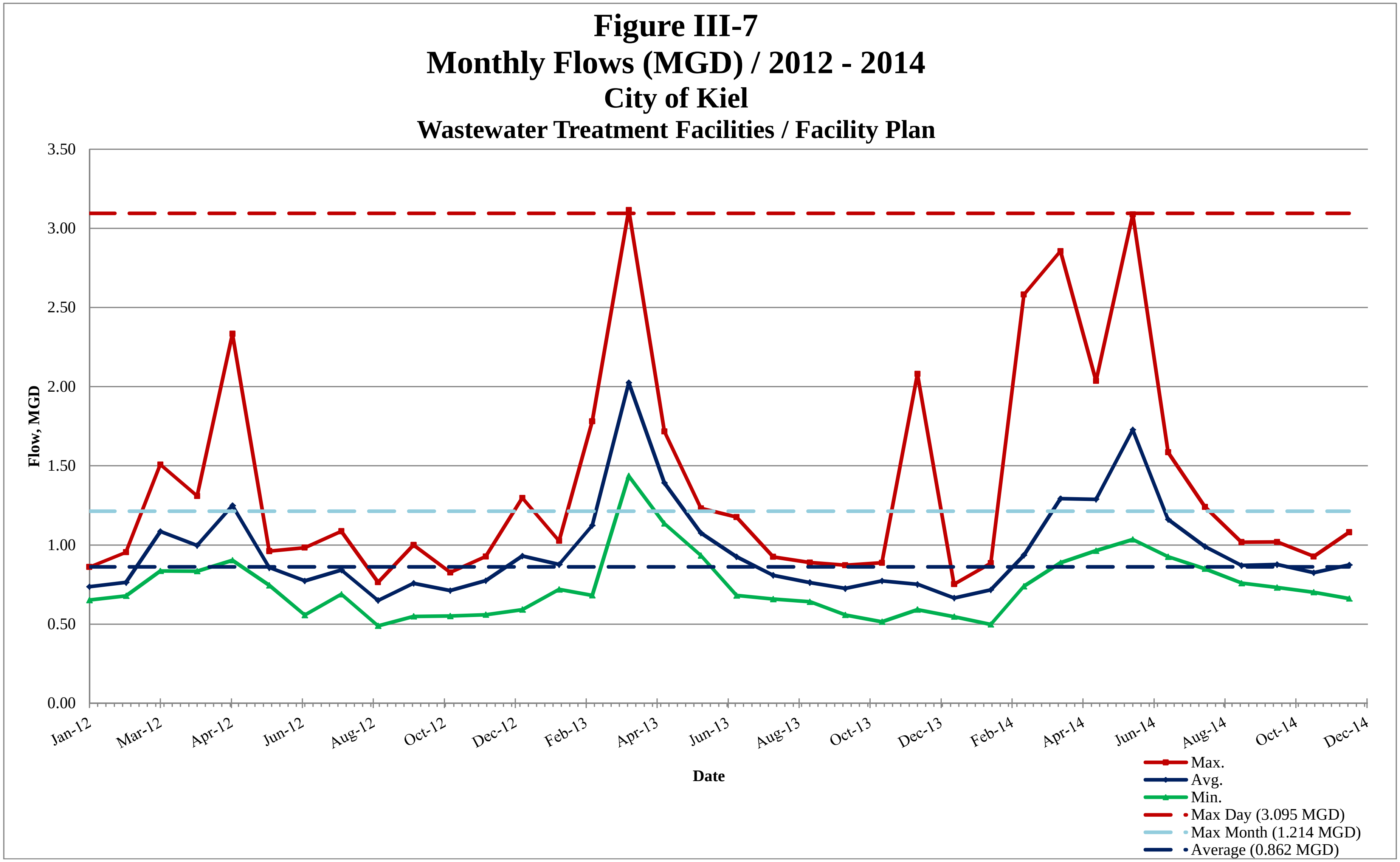
Monthly Average Limits

Effluent BOD
10 mg/L May thru October
15 mg/L November thru April

Effluent TSS
10 mg/L May thru October
15 mg/L November thru April

Effluent Total P
1 mg/L

Effluent NH_3N
2.2 mg/L April thru May
1.7 mg/L June thru September
5.3 mg/L October thru March



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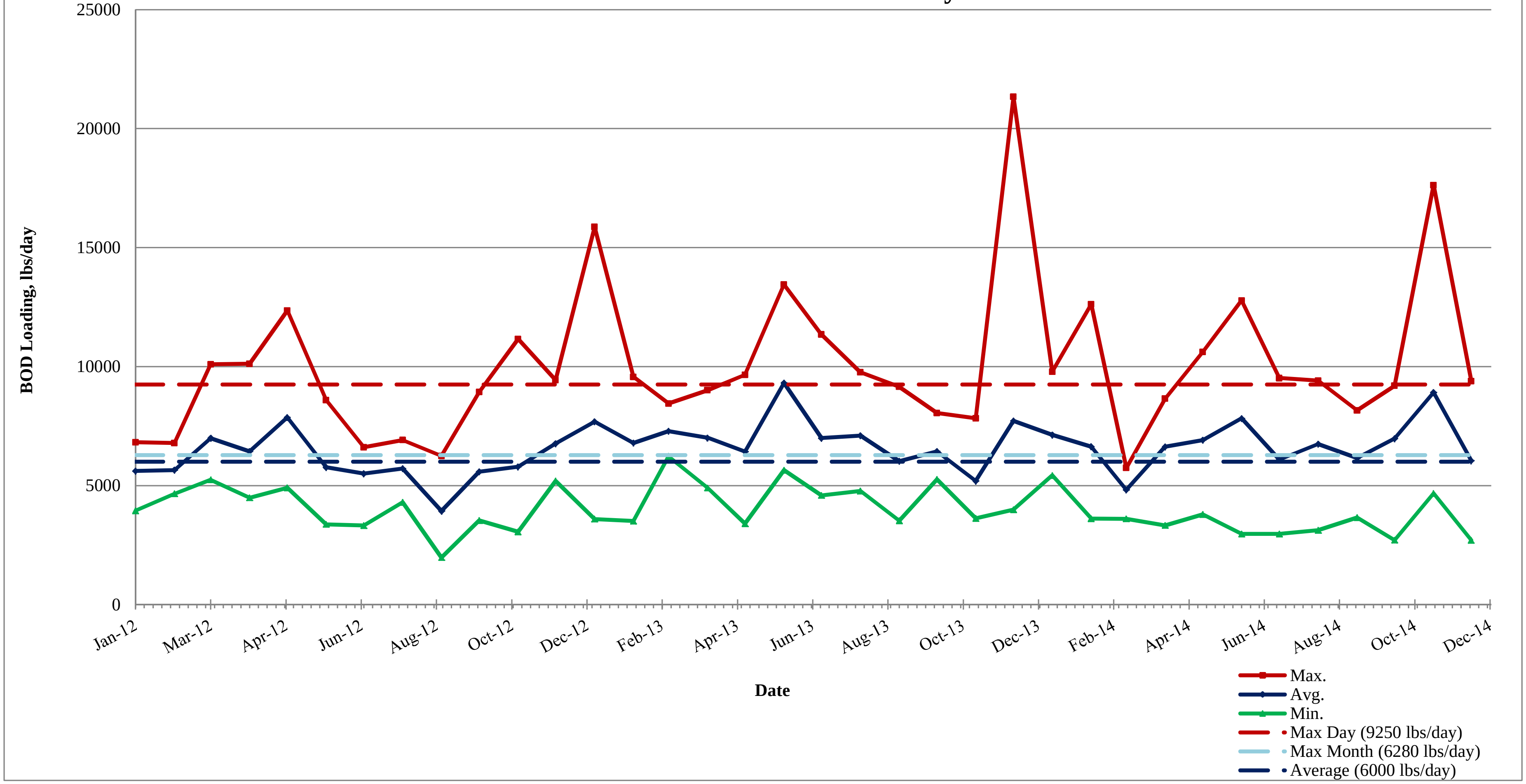
10/29/2015

Figure III-8
Monthly BOD (lbs/day) / 2012 - 2014
City of Kiel
Wastewater Treatment Facilities / Facility Plan



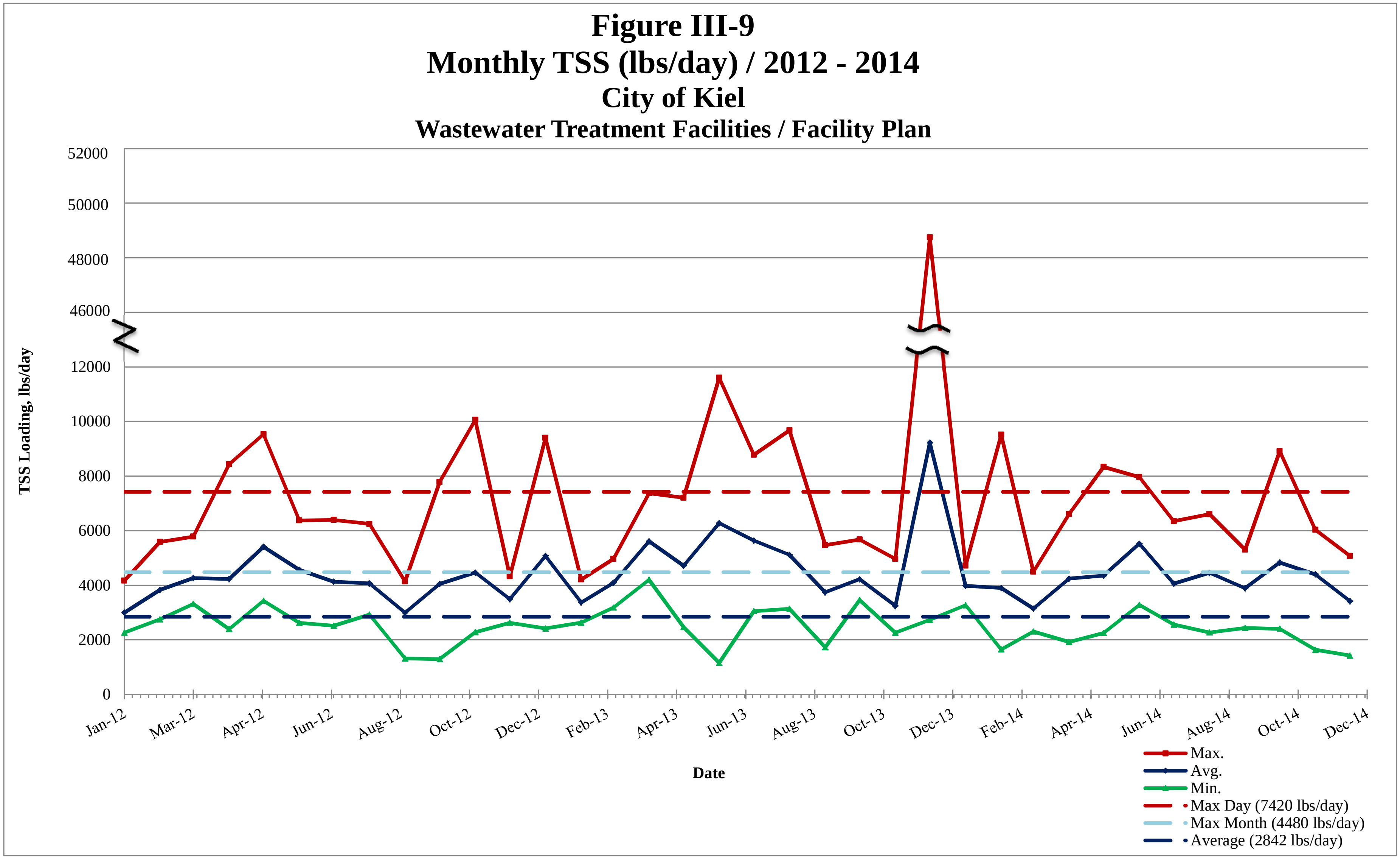
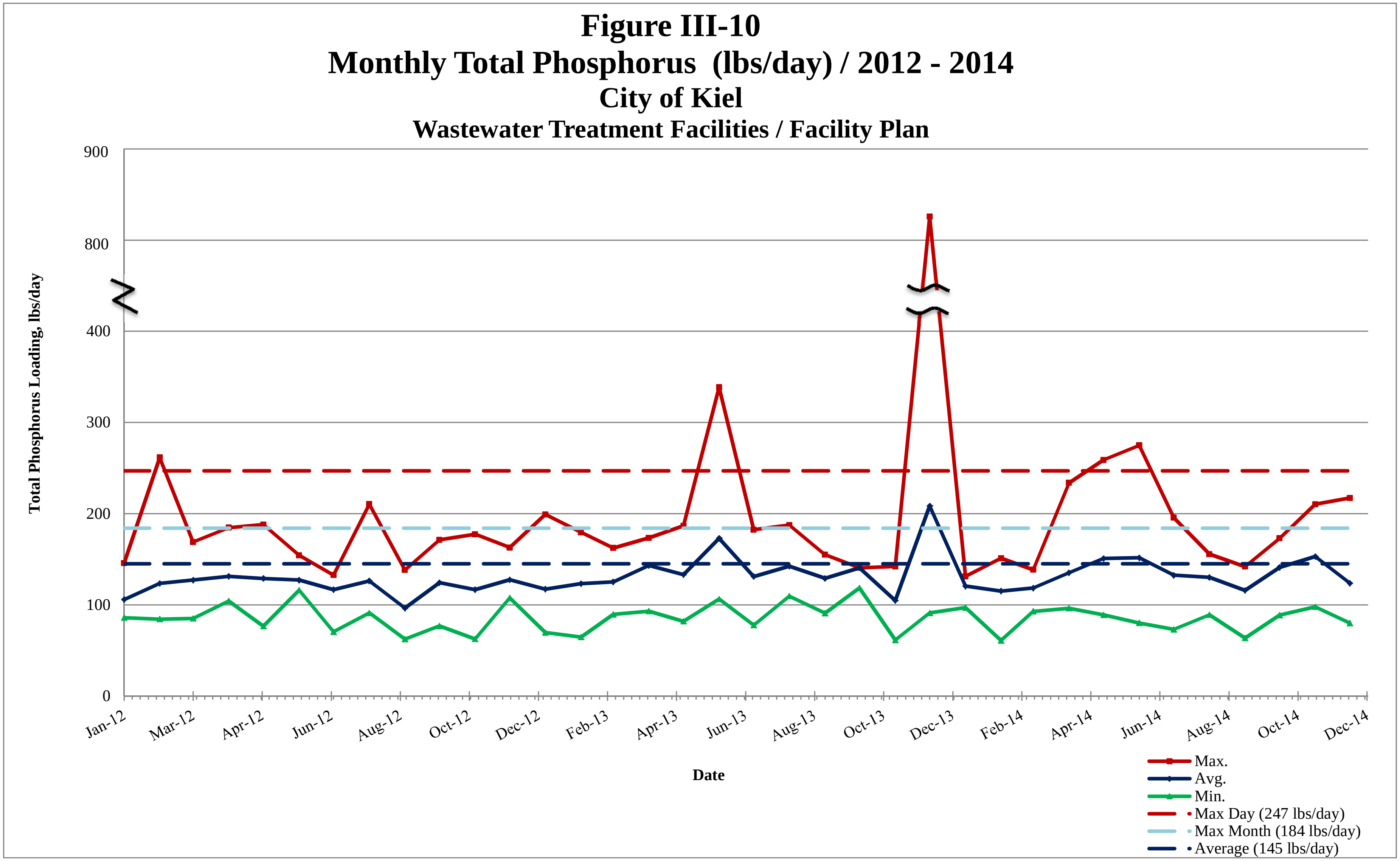


Figure III-9
Monthly TSS (lbs/day) / 2012 - 2014
City of Kiel
Wastewater Treatment Facilities / Facility Plan
TSS Loading, lbs/day
52000
50000
48000
46000
12000
10000
8000
6000
4000
2000
0
Jan-12
Mar-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
Aug-14
Oct-14
Dec-14
Date
Max.
Avg.
Min.
Max Day (7420 lbs/day)
Max Month (4480 lbs/day)
Average (2842 lbs/day)



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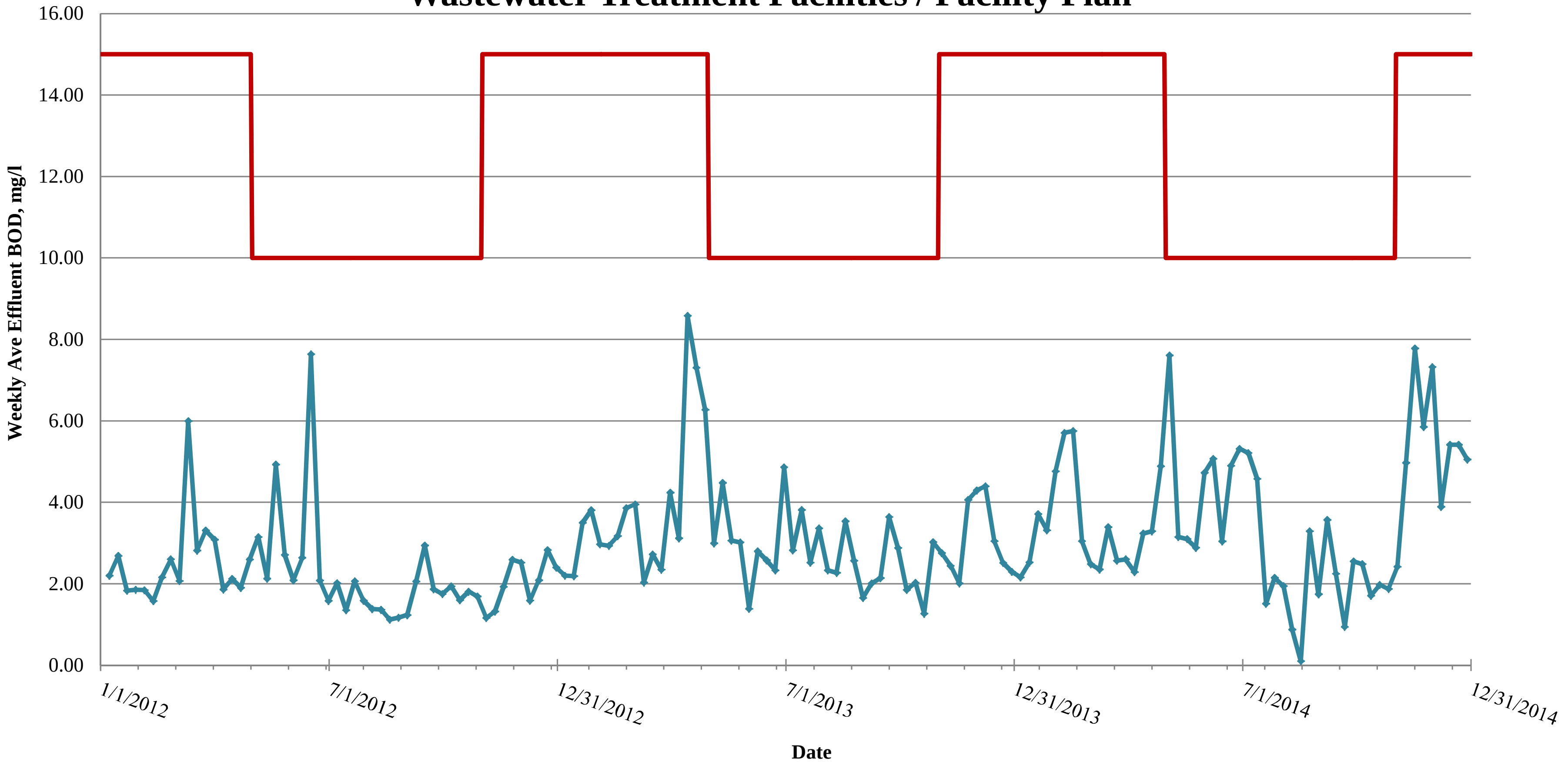
10/29/2015

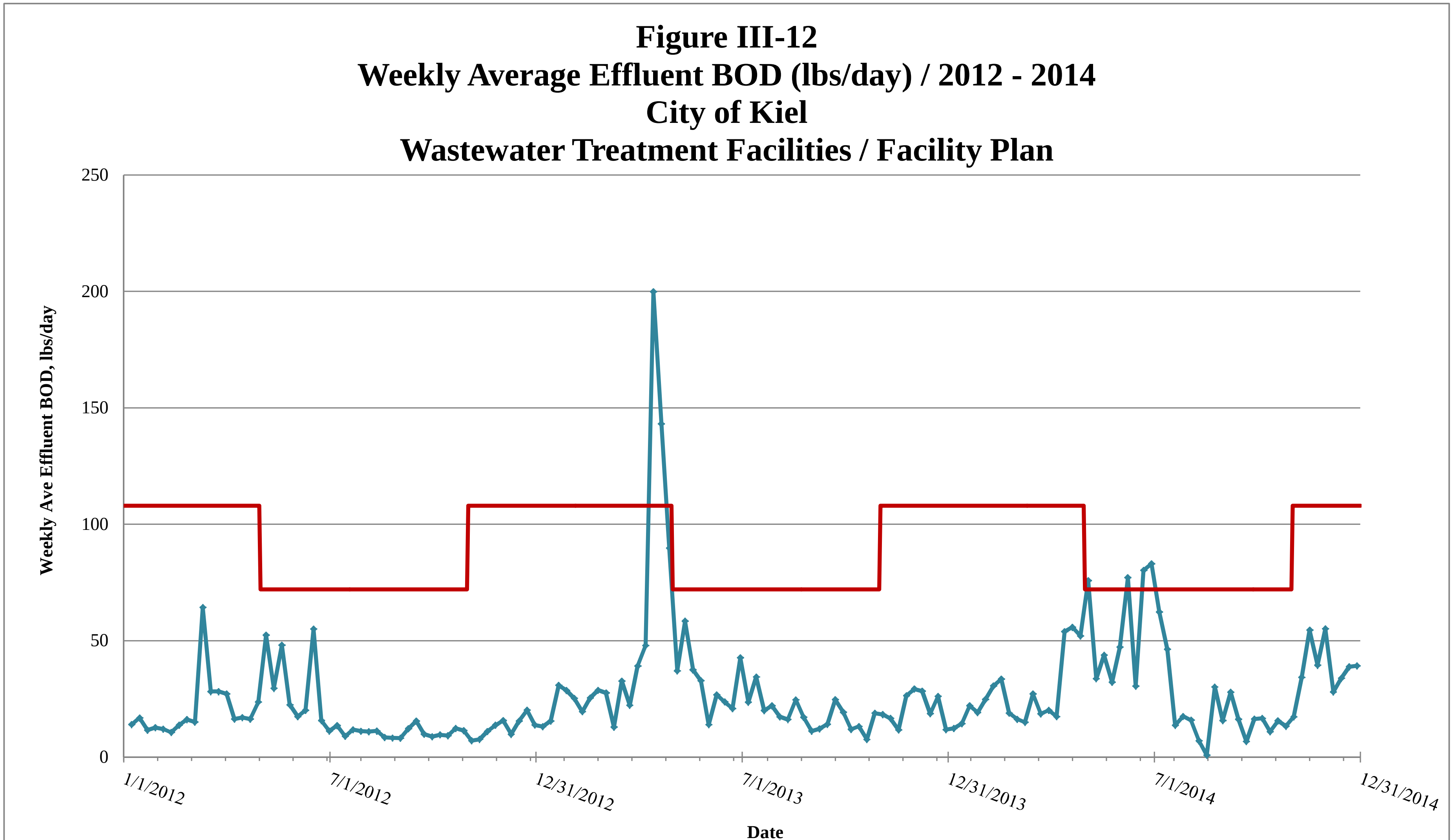
Figure III-11
Weekly Average Effluent BOD (mg/l) / 2012 - 2014
City of Kiel
Wastewater Treatment Facilities / Facility Plan



NOTE: Weekly Average Effluent BOD Limits:

May through October = 10 mg/l

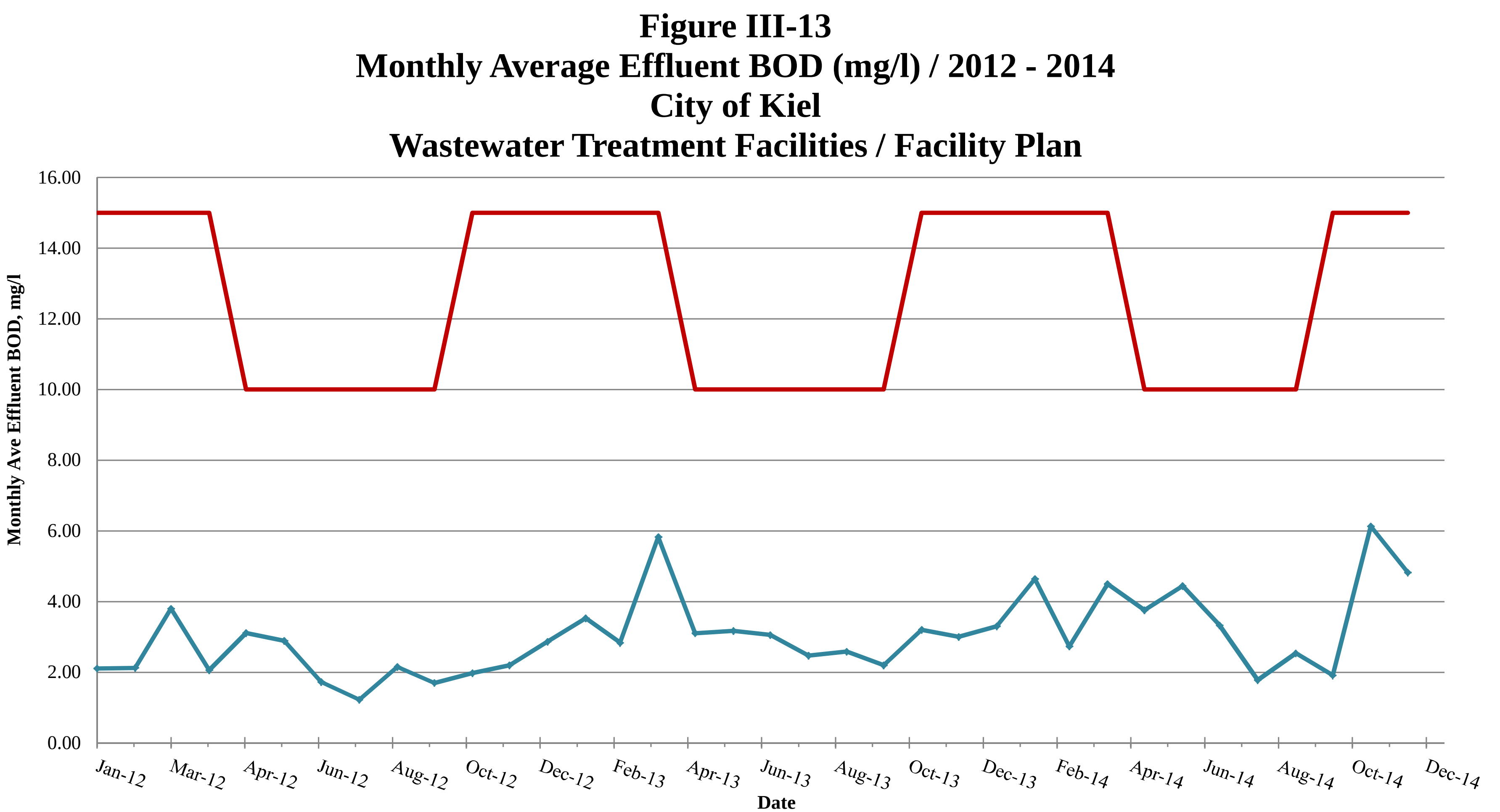
November through April = 15 mg/l



NOTE: Weekly Average Effluent BOD Limits:

May through October = 72 lbs/day

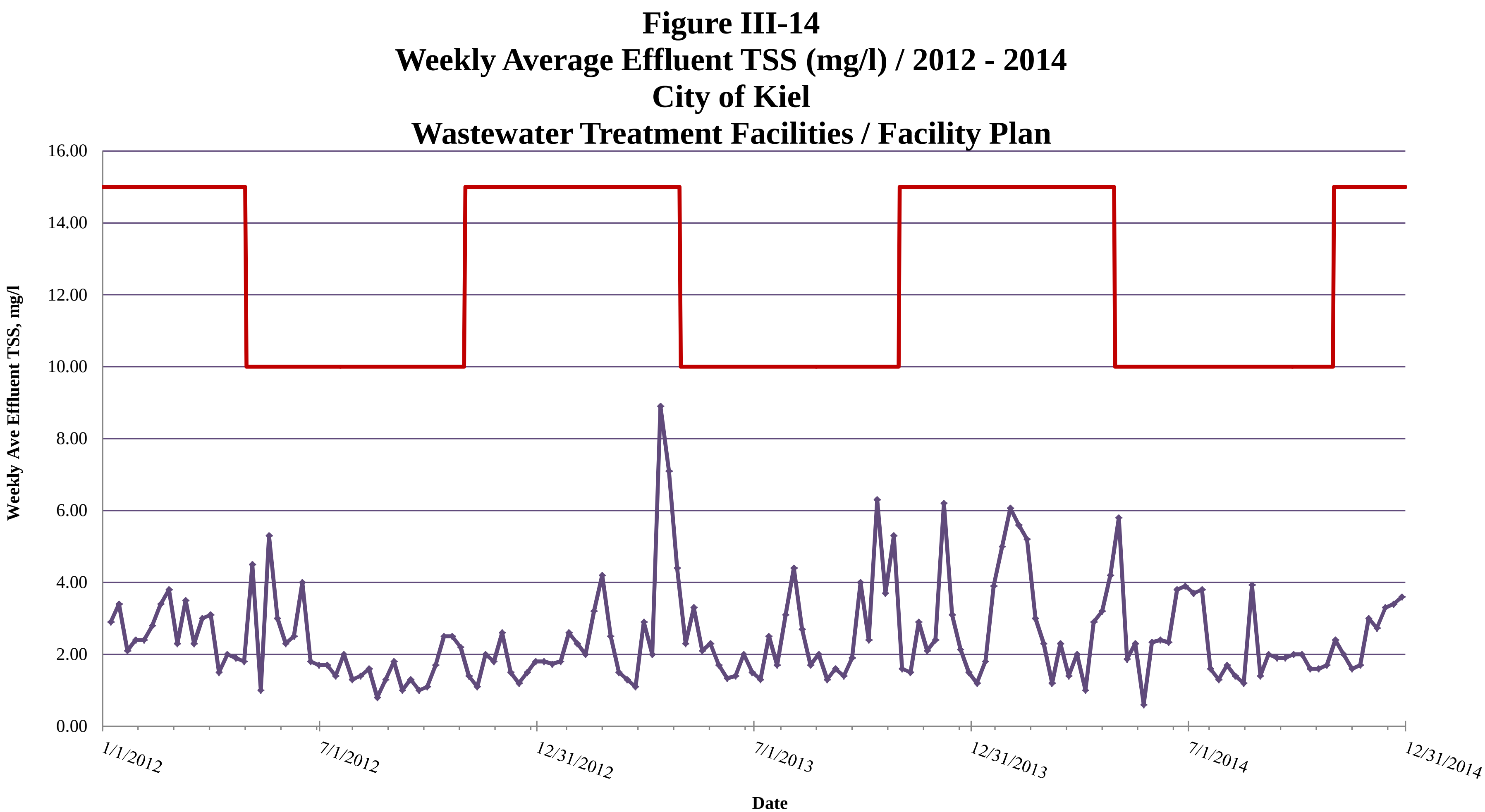
November through April = 108 lbs/day



NOTE: Monthly Average Effluent BOD Limits:

May through October = 10 mg/l

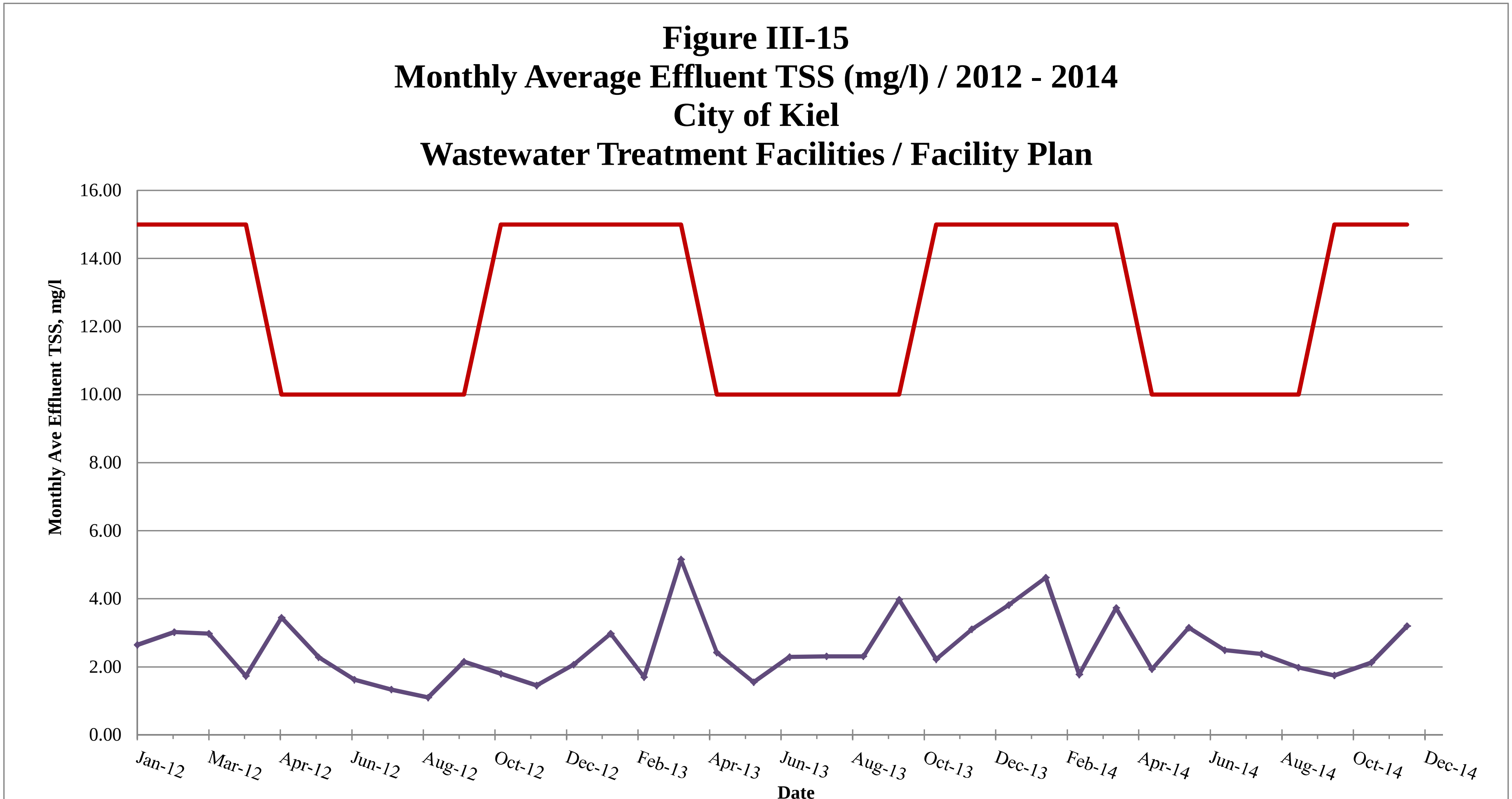
November through April = 15 mg/l



NOTE: Weekly Average Effluent TSS Limits:

May through October = 10 mg/l

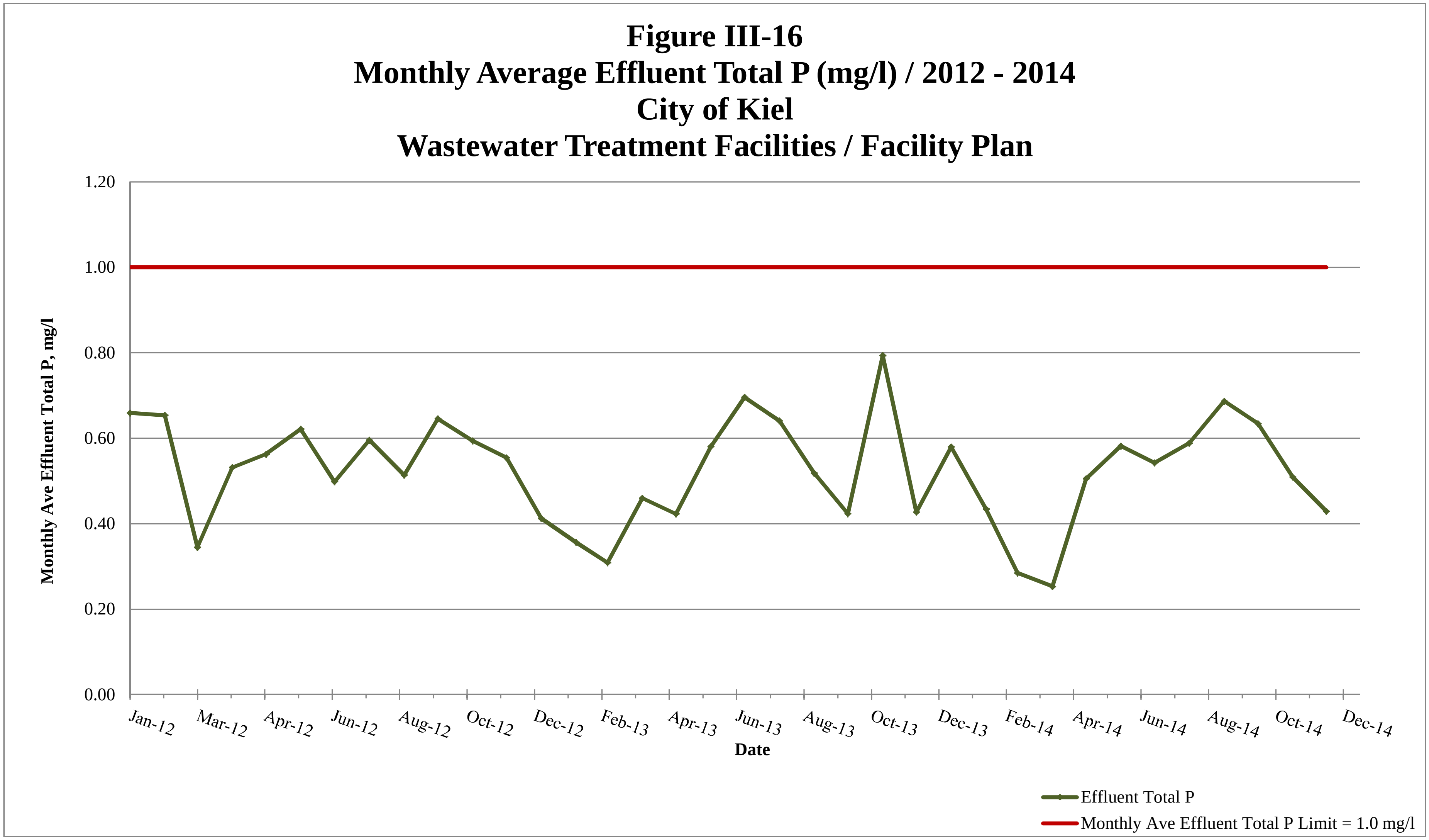
November through April = 15 mg/l



NOTE: Monthly Average Effluent TSS Limits:

May through October = 10 mg/l

November through April = 15 mg/l



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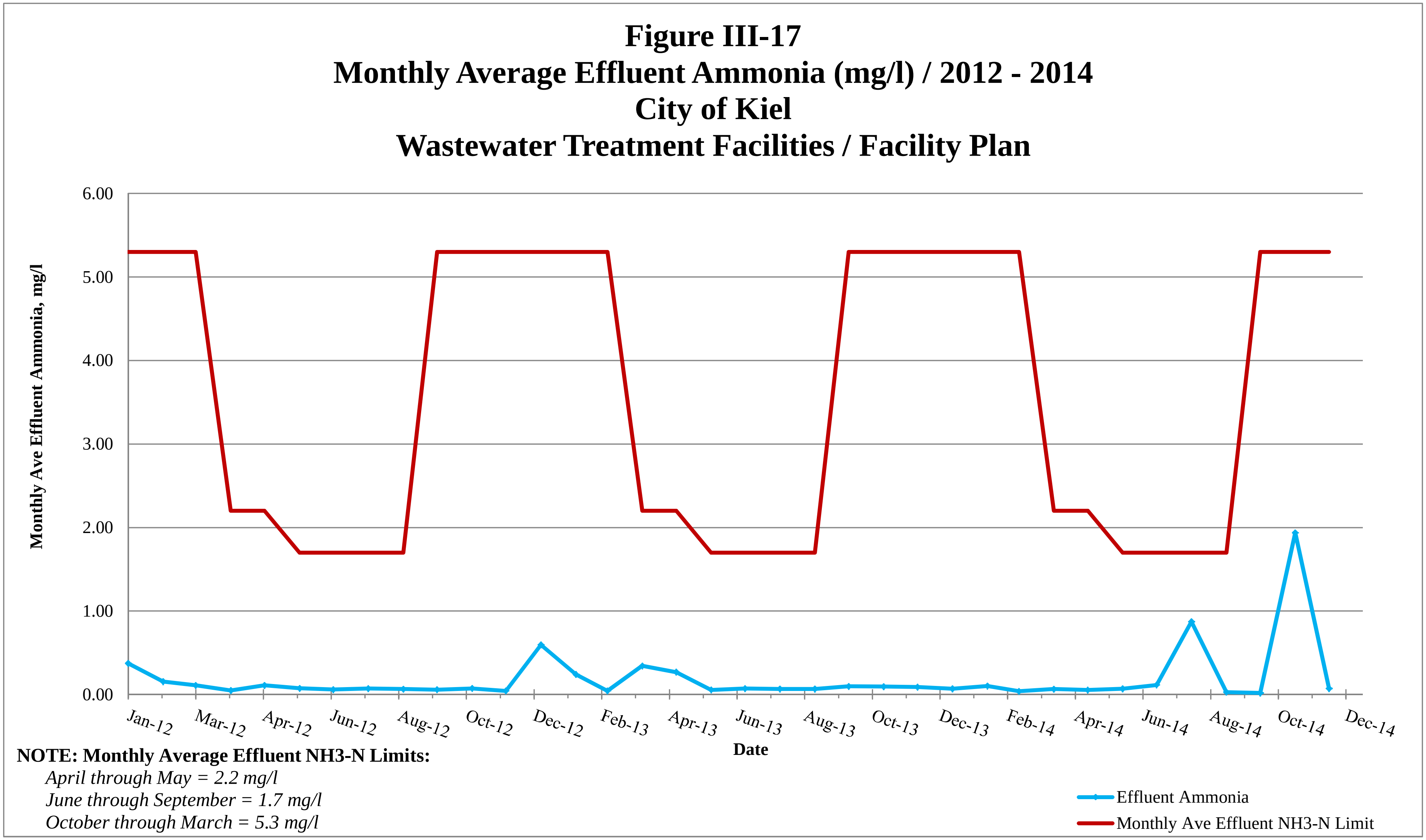
10/29/2015



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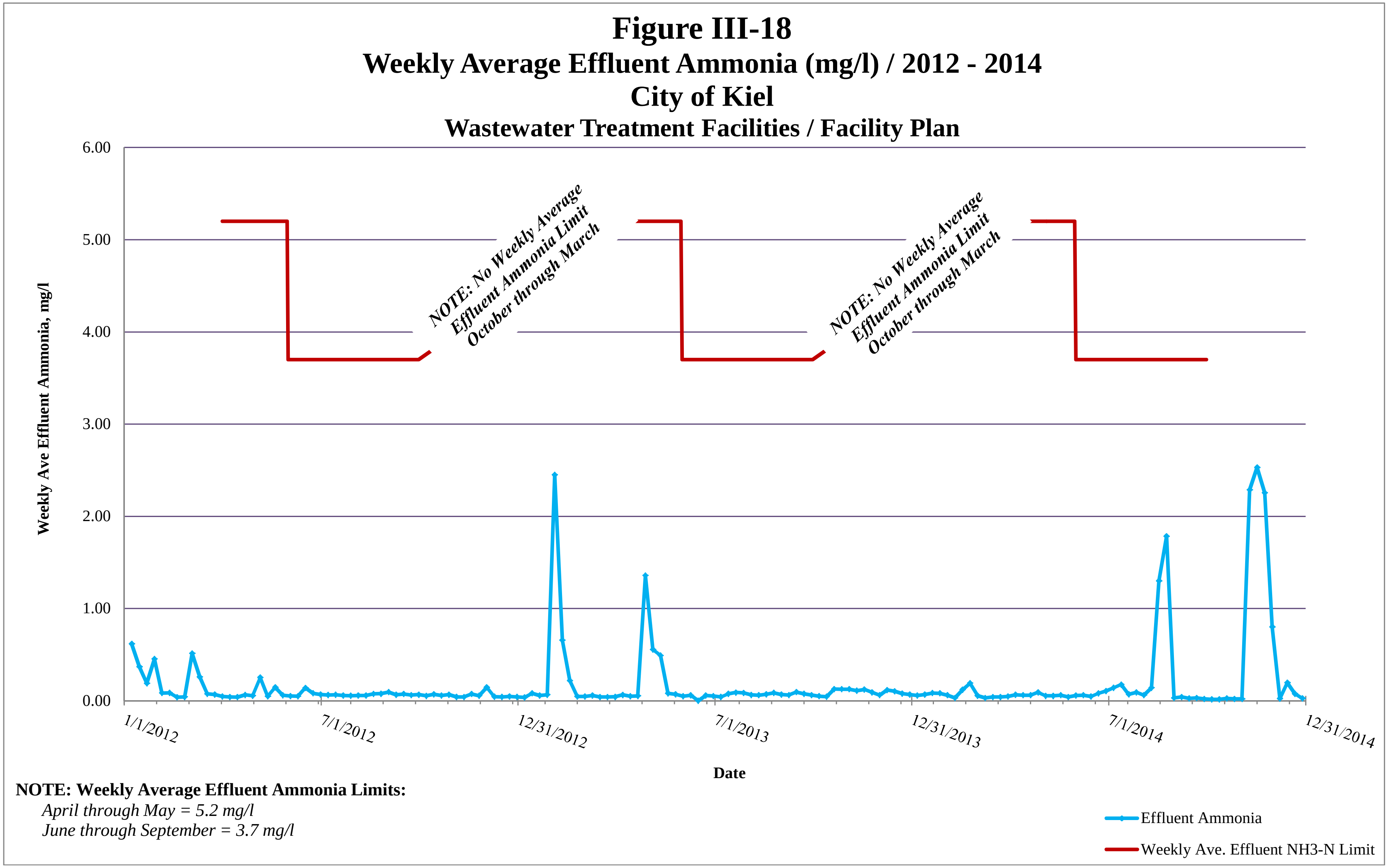
10/29/2015



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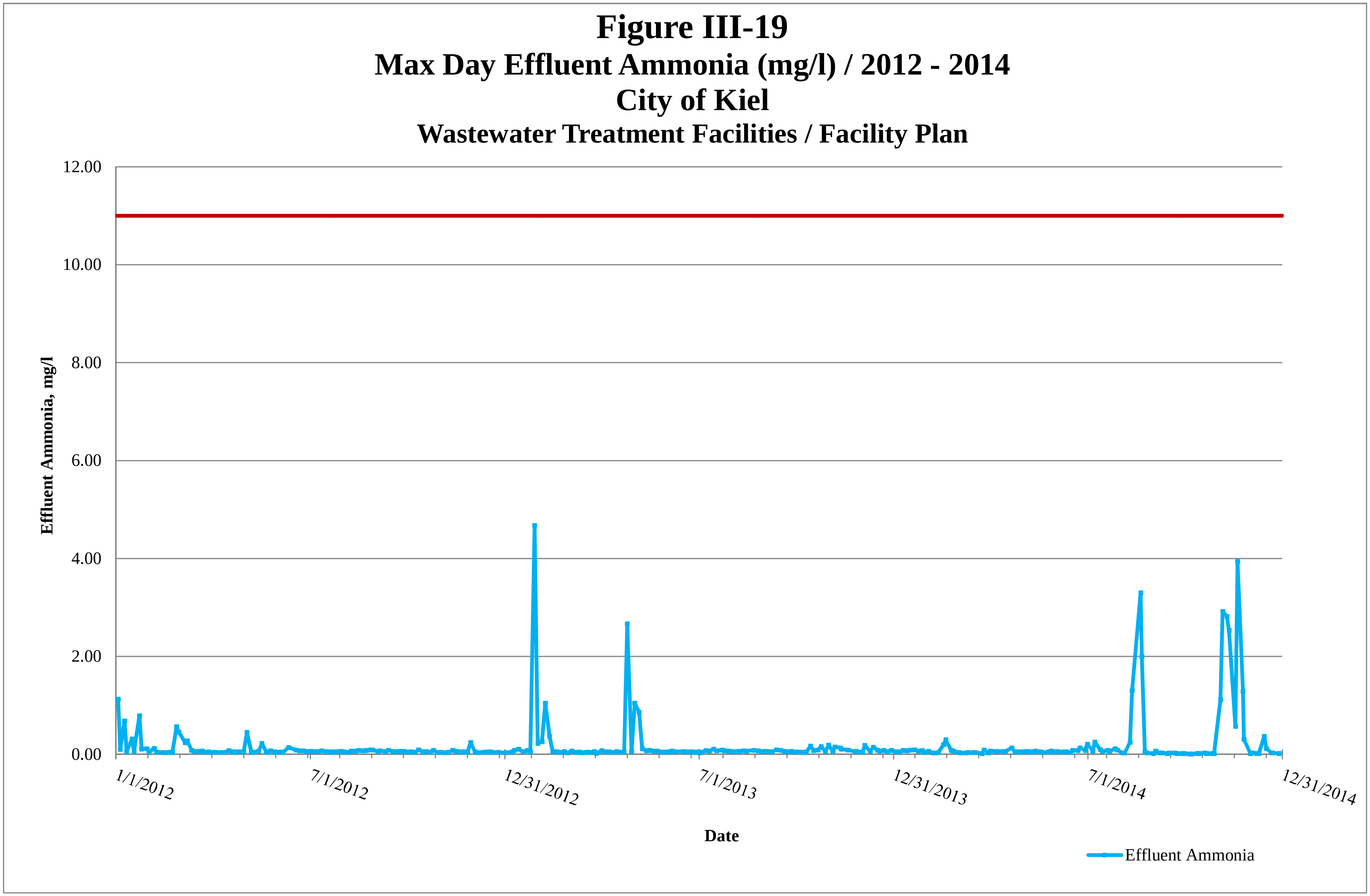


Figure III-19
Max Day Effluent Ammonia (mg/l) / 2012 - 2014
City of Kiel
Wastewater Treatment Facilities / Facility Plan
Effluent Ammonia, mg/l
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1/1/2012
7/1/2012
12/31/2012
7/1/2013
12/31/2013
7/1/2014
12/31/2014
Date
Effluent Ammonia

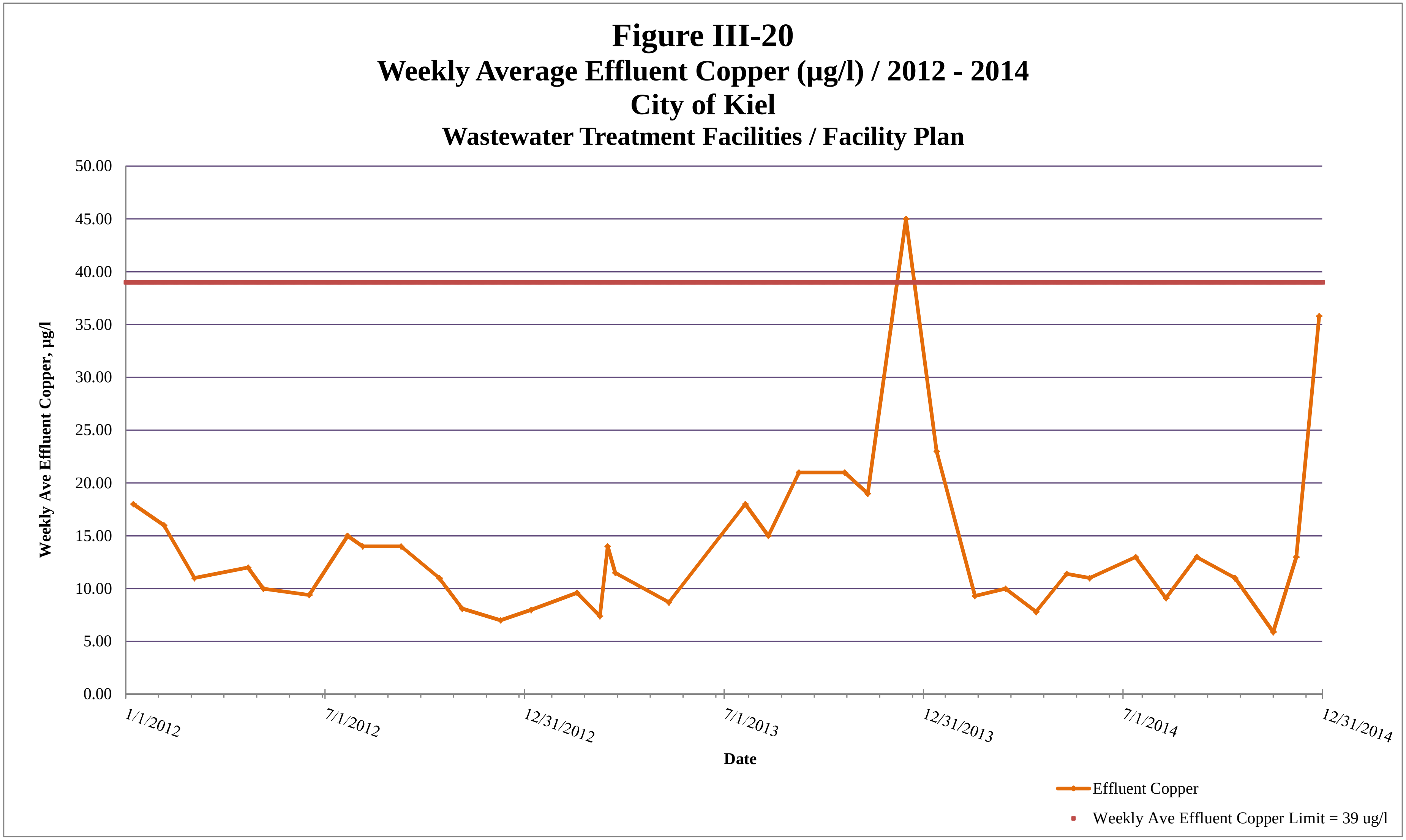


Figure III-20
Weekly Average Effluent Copper (µg/l) / 2012 - 2014
City of Kiel
Wastewater Treatment Facilities / Facility Plan
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Weekly Ave Effluent Copper, µg/l
1/1/2012
7/1/2012
12/31/2012
7/1/2013
12/31/2013
7/1/2014
12/31/2014
Date
Effluent Copper
Weekly Ave Effluent Copper Limit = 39 ug/l

The River Road Pump Station has a firm capacity of 2.42 mgd, with one (1) pump out of service. The peak hour design value is 4.26 mgd, which exceeds the firm capacity of the Pump Station. NR 110 of the Administrative Code requires a firm capacity of 4.26 mgd. Therefore, additional capacity is required.

The screening system has a firm capacity of 4.30 mgd, which exceeds the peak hour design flow of 4.26.

The aerated grit system has a peak hour design flow rate of 6.2 mgd, which results in a Hydraulic Retention Time (HRT) of 3.0-minutes. NR 110 requires an HRT of 3-minutes or less, at the design peak hour flow rate.

NR 110 requires primary clarifiers to have a surface overflow rate of 1,000 gpd/sq.ft. at the design average flow rate. This results in an average design flow capacity of 1.23 mgd for the primary clarifiers.

The 16-inch piping from the primary clarifiers to the aeration system splitter box is a hydraulic bottleneck, which limits forward flow to approximately 2 mgd. Additional capacity should be provided to eliminate the restriction.

During periods of high Biochemical Oxygen Demand (BOD) loadings, the aeration system experiences episodes of low Dissolved Oxygen (DO). The aeration system has been re-rated to allow a loading rate of 23.5 lbs. BOD/1,000 cu.ft. of basin volume, yielding a capacity of 4,970 lbs. BOD/day. Typical loadings exceed this value on a regular basis. In addition to requiring more tank volume, upgrading the blower system and/or air diffuser system to provide more oxygen will be necessary to achieve desired DO levels. The aeration blowers have a firm capacity of 5,880 scfm with one (1) large blower out of service. 4,227 scfm is required for mixing, per NR 110, and does not govern the air requirement when compared to the oxygen demand.

The piping between the aeration system and the final clarifiers is 16-inch diameter, and is hydraulic limiting during periods of high flows. Additional capacity is required to remove this restriction.

NR 110 limits the peak hour design surface settling rate to 1,000 gpd/sq.ft., which results in a final clarifier capacity of 2.51 mgd. This flow rate is exceeded during periods of high flows. Additionally, NR 110 limits the average design and peak hour solids loading rate to 1.2 and 2.0 lbs./sq.ft./hour, respectively. The resultant capacities of the final clarifiers are, therefore, 28.8 and 48.0 lbs./sq.ft./hour (average design and peak hour, respectively). The current loading rates are 25.4 lbs./sq.ft./hour (average) and 55.7 lbs./sq.ft./hour. The peak hour loading rate is in excess of the allowable 48.0 value, per NR 110. Although two (2) final clarifiers are utilized, the redundancy is ineffective, as the effluent quality deteriorates significantly with one (1) clarifier out of service. Additional clarifier capacity is required.

The firm capacity of the RAS pumping system is 2.016 mgd, with one (1) of two (2) pumps out of service. The NR 110 requirement is 1.72 mgd.

NR 110 requires a peak hour design filtration rate of 5 gpm/sq.ft., or less, with one (1) cell out of service. This results in a firm capacity of 3.095 mgd. However, the capacity of the filters with all cells in use is 2.0 mgd, based on actual operating experience. Maximum day flows exceed this value. The filters are in need of maintenance/repairs and are not suited to achieve low phosphorus limits; consideration should be given to upgrading to higher capacity cloth/mesh type filters.

The chlorine contact chamber has an average design capacity of 1.26 mgd, based on an HRT of 60-minutes; the peak hour design capacity is 2.53 mgd based on an NR 110 requirement of an HRT of 30-minutes.

With only one (1) primary digester that is heated and mixed, on a volumetric basis the anaerobic digestion system has a capacity of 17,977 gpd per the NR 110 requirement of a 15-day HRT. From a solids loading perspective, the capacity is 2,884 lbs. Volatile Suspended Solids (VSS)/day, based on the NR 110 loading rate of 80 lbs. VSS/1,000 cu.ft.

The sludge dewatering system is limited to the throughput capacity of the sole belt press, which is 125 gpm and 1,000 lbs. TSS/hour.

The Class A pasteurization system has a capacity of 800 lbs. TSS/hour.

The Cake Storage Facility has a capacity of 111,120 cu.ft. with a stack height of 12-feet, which exceeds the Administrative Code requirement of 180-days of storage (29,160 cu.ft.).

3. Wastewater Treatment Facility Condition

Originally built in 1965, the Wastewater Treatment Facility has been upgraded numerous times. 1979 and 1985 Phase I and Phase II upgrades resulted in the major treatment systems currently in use today. These upgrades were followed by Headworks additions in 1996, and aeration and sludge handling modifications in 1997. Lastly, aeration system upgrades in 2008 and conversion to enhanced Bio-P in 2012 resulted in the current treatment works. As such, there are buildings, pipes, tanks and treatment systems that date back 50-years.

In general terms, the following needs have been identified:

a. General

1) Instrumentation and controls (flow meters, etc.)
2) SCADA, control systems
3) Administration Building HVAC system

4) Laboratory countertops
5) Storage, maintenance space, vehicle storage

b. Headworks (Preliminary Treatment)

1) Address Class I, Division 1 compliance
2) Replace aerated grit system
3) Replace grit classifier

c. Primary Clarifiers

1) Repair structural cracks
2) Replace mechanisms and drives
3) Replace weirs and baffles
4) Address influent flow splitting
5) Provide dedicated / redundant positive displacement sludge pumps

d. Aeration System

1) Consider tying RAS pipe into the primary effluent line to facilitate mixing
2) Replace buried air main with new overhead air main
3) Provide new DO / pH ORP monitoring
4) Structural repair of spalled / cracked concrete, railings
5) Replace weir gates
6) Address flow splitting at splitter box

e. Final Clarifiers

1) Address flow splitting at splitter box
2) Provide redundant RAS and WAS pumps
3) Consider replacing Fiberglass-Reinforced Plastic (FRP) domes
4) Replace mechanisms and drives
5) Replace weirs and baffles

f. Tertiary Sand Filters

1) Repair steel components
2) Upgrade controls
3) Replace valves

g. Disinfection System

1) Repair / replace two (2) leaking gates

h. Post-Aeration System

1) Repair / modify step at walkway

i. High Strength Waste Tank

1) Provide screening system
2) Consider addition of an automated card reader for high strength waste / septage / grease
3) Provide a separate grease tank and pump system to feed directly to digester

j. Digesters

1) Consider thickening WAS
2) Optimize use of biogas
3) Replace covers on both digesters
4) Replace mixing system and add mixing to secondary digester
5) Replace pumps and provide redundancy
6) Replace boiler / heat exchanger
7) Address Class I, Division 1 compliance
8) Relocate flare
9) Relocate condensate drain in Service Building
10) Address structural cracks and brick maintenance; consider insulated metal panels
11) Replace instrumentation

k. Sludge Dewatering

1) Replace belt press with new redundant dewatering system
2) Consider alternatives to pasteurization to achieve Class A biosolids
3) Provide additional lime / fly ash storage
4) Replace dump truck utilized to transport sludge with larger capacity vehicle

l. Electrical

1) Implement electrical utility service improvements.
2) Provide new main electrical service equipment with a short circuiting rating of 65 kA.
3) Demolish and replace existing, obsolete MCC's.
4) Resolve non-compliance in Classified Hazardous Locations:
   a) Remove electrical equipment from the Digester Building that is not Underwriters Laboratories (UL)-approved for hazardous locations.

b) Provide new electrical equipment in hazardous locations that is UL-approved for hazardous locations.

c) Locate new electrical equipment intended for ordinary locations, so it is outside of classified hazardous atmosphere.

d) Provide new MCC-3, to replace existing MCC-3, in the Digester Building. Locate new MCC-3 in a new, non-hazardous location in the digester complex.

5) Provide new electrical distribution equipment, as required, to support the Wastewater Treatment Facility process improvements.

m. Controls Needs

Parts of the existing controls are old technology, and should be upgraded to take advantage of the operational tools available with new controllers and SCADA. Some of the existing PLC's are no longer manufactured, and support for them is becoming less and less available. In view of this, the following needs have been identified:

1) Communications:

a) Install a redundant fiber optic cable between all Treatment Facility buildings.

b) Install a secure firewall with remote access capability via a VPN (Virtual Private Network).

c) Allow vendors limited remote access for equipment support via a VPN.

d) Install Ethernet switches to connect fiber optic control network to individual building control networks.

2) Programmable Logic Controllers (PLC's):

a) Standardize on a PLC from a specific Manufacturer.

b) Replace obsolete PLC's with current-technology PLC's.

c) Formulate plan to replace 'mature active' PLC's.

d) Require new equipment vendors whose equipment needs a PLC for control to provide a PLC from the selected standard Manufacturer.

e) Each control panel with a PLC to have an Operator Interface Terminal (OIT) and an Ethernet managed switch.

3) Alarming:

a) Control panels containing a PLC to have an alarm horn for annunciating alarms occurring in its area. Alarm horn is silenced when the local Alarm Silence pushbutton is pressed or the alarm is acknowledged at the SCADA.

b) OIT's to display alarms generated by the PLC in its control panel and allows the Operator to acknowledge the alarm locally.

c) SCADA also annunciates alarms and retains alarm status. If the alarm is acknowledged at the local OIT, the SCADA alarm is also acknowledged. All alarms logged to its Historian.

d) Alarms detected by the SCADA are also annunciated via WIN911 alarm notification software. SCADA shall have a screen that allows the Operator to inhibit individual alarms from being annunciated by WIN911.

4) Supervisory Control & Data Acquisition (SCADA):

a) Two (2) PC's; one (1) designated as the Primary, and one (1) designated as the Secondary.

(1) Secondary PC acts as a 'hot backup' to the Primary PC, directly connected via a cross-over Ethernet cable.

(2) WIN911 alarm notification software and the Historian reside on the Primary PC.

(3) Both PC's to have two (2) solid-state drives with RAID 1 mirrored-array configuration.

(4) Large screen monitor that can display screens from either PC.

In addition to the above items, the existing MCP in the Operator Control Room should be demolished and a wall put in its place. Any required communication equipment or PLC that would be required to support Wastewater Treatment Facility control functions in the OCR would be housed in a considerably smaller panel. The space gained could be put to other uses. Putting a window in this wall and mounting the large screen monitor on the opposite wall will allow the Operator to assess Treatment Facility operation during a walk-by.

4. Permit Requirements

The City of Kiel Wastewater Treatment Facility operates under Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-0020141. This permit, like many others throughout the State of Wisconsin, is expired. The Wisconsin Department of Natural Resources (DNR) anticipates issuing new permits on a watershed-wide basis in the near future. A copy of the expired permit, which regulates the Kiel Wastewater Treatment Facility, was located in Chapter II - Appendix II-1.

In anticipation of permit issuance, the DNR has issued a Memorandum regarding Water Quality Based Effluent Limitations (WQBEL) for the Kiel Wastewater Treatment Facility, dated September 30, 2013. A copy of the Memorandum was located in Chapter II - Appendix II-2. The purpose of the Memorandum is to provide calculated water quality based effluent limitations for the Kiel Wastewater Treatment Facility discharge into the Sheboygan River.

Key changes to the Kiel discharge permit being considered by the DNR include:

a. Temperature Limits (September - April)
b. Total Phosphorus Limits
   1) 0.1 mg/L (May - October)
   2) 0.3 mg/L (November - April)
c. Chlorides, 460 mg/L
d. Ammonia, 6.7 mg/L daily maximum
e. Dissolved Oxygen (DO), 7.0 mg/L (July - September)
f. Biochemical Oxygen Demand (BOD)
   1) 8.9 mg/L (June)
   2) 9.5 mg/L (July)
   3) 8.7 mg/L (August)
   4) 9.9 mg/L (September)
   5) 9.3 mg/L (October)
g. Total Suspended Solids (TSS)
   1) 8.9 mg/L (June)
   2) 9.5 mg/L (July)
   3) 8.7 mg/L (August)
   4) 9.9 mg/L (September)
   5) 9.3 mg/L (October)

APPENDIX III-1

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR)
ENDANGERED RESOURCES PRELIMINARY ASSESSMENT

WISCONSIN DEPT. OF NATURAL RESOURCES

Endangered Resources Preliminary Assessment

Created on **Monday, April 27, 2015**. This report is good for one year after the created date.

Results

No actions required/recommended. No endangered resources have been recorded in this area. For additional information on Endangered Resources (ER) Reviews, please visit: http://dnr.wi.gov/topic/ERReview/Review.html

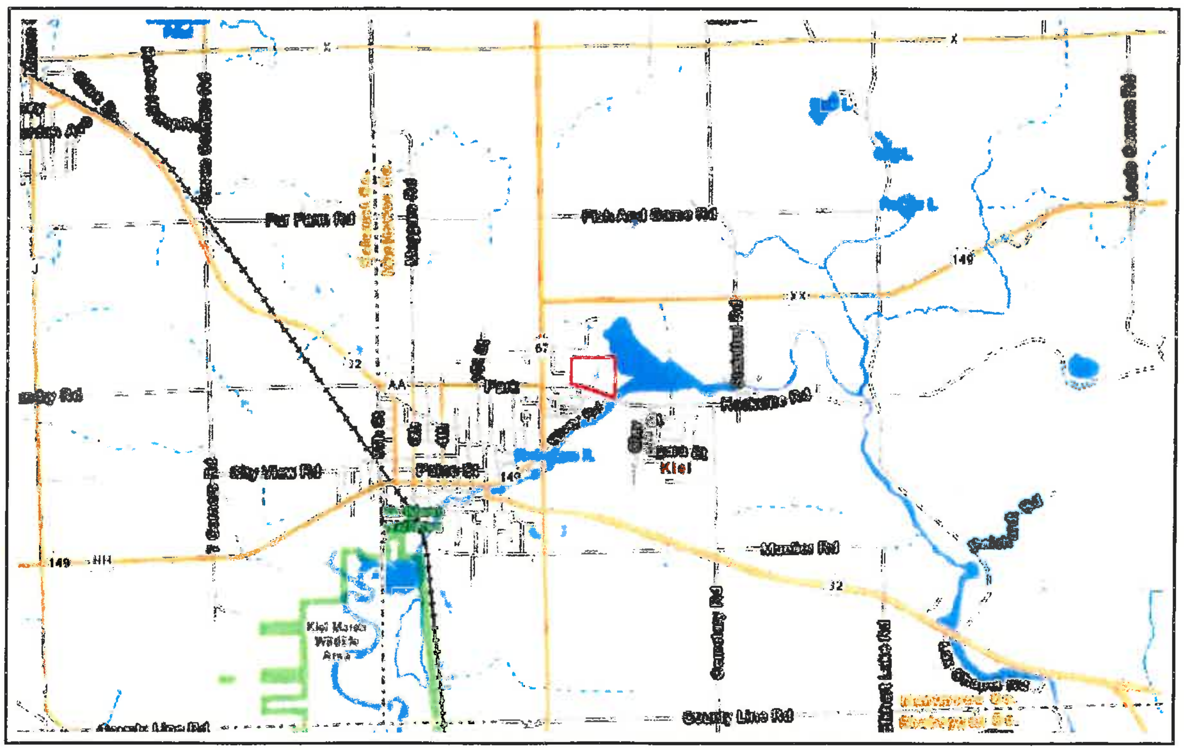
Project Information

Landowner name	City of Kiel
Project address	100 E. Park Avenue, Kiel, WI
Project description	Kiel Wastewater Treatment Plant

Project Questions

Does the project involve a public property?	Yes
Is the project on a federal property?	No
Is the project federally funded?	Yes
Is the project a utility, agricultural, forestry or bulk sampling (associated with mining) project?	Yes
Is the project property in Managed Forest Law or Managed Forest Tax Law?	No

Project Area Maps



https://dnrx.wisconsin.gov/nhiportal/public

101 S. Webster Street . PO Box 7921 . Madison, Wisconsin 53707-7921

APPENDIX III-2

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR)
ARCHAEOLOGICAL / HISTORICAL SIGNIFICANCE RESPONSE

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 S. Webster St.
Madison, Wisconsin 53707-7921
Phone/voicemail: 608.266.3462
E-mail: mark.dudzik@wisconsin.gov
FAX 608.267.2750

March 31, 2015

Amy Vaclavik, PE
McMahon Associates
1445 McMahon Drive
Neenah, WI 54956

Subject: *City of Kiel – WWTP Improvements, Manitowoc County (T17N/R21E/S20)*

Dear Ms. Vaclavik,

DNR has completed a review of the above project.

For cultural resource (per WI stats) issues only, the project is cleared to proceed (i.e., no *recorded* historic properties reported to occur within target parcels/locations).

Please forward this letter to other parties, as needed, and retain a copy for project files.

Do not hesitate to get in touch for additional information or clarification.

Sincerely,

Mark J. Dudzik
Departmental Archaeologist

McMAHON
ENGINEERS \ ARCHITECTS

March 26, 2015

Mr. Mark Dudzik
Department Archaeologist
Wisconsin Department Of Natural Resources
101 South Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Re: City Of Kiel, Wisconsin
Wastewater Facilities Planning
McM. No. KK0015-950262.00

Dear Mark:

We are preparing a Wastewater Facilities Plan for the City Of Kiel, Wisconsin. We request a review of the site be conducted to determine if there are potential archaeological or historic sites in the area. Figures showing the location of the Wastewater Treatment Facility are provided. The site is located as follows:

City Of Kiel
Township Seventeen (17) North, Range Twenty-One (21) East
Southwest Quarter (1/4) Of Section Twenty (20)
Manitowoc County, Wisconsin

Thank you for your consideration of this request. Please call if there are questions or if additional information is needed.

Very truly yours,

McMAHON

Amy J. Vaclavik

Amy J. Vaclavik, P.E., BCEE
Associate / Senior Project Engineer

AJV:smdt
Enclosure

APPENDIX III-3

COMPLIANCE MAINTENANCE ANNUAL REPORT (CMAR)
2014

Compliance Maintenance Annual Report

Kiel Wastewater Treatment Facility

Last Updated: 7/23/2015 | Reporting For: 2014

Influent Flow and Loading

1. Monthly Average Flows and (C)BOD Loadings

1.1 Verify the following monthly flows and (C)BOD loadings to your facility.

Outfall No. 701	Influent Monthly Average Flow, MGD	x	Influent Monthly Average (C)BOD Concentration mg/L	x	8.34	=	Influent Monthly Average (C)BOD Loading, lbs/day
January	0.6645	x	1,244	x	8.34	=	6,895
February	0.7161	x	1,128	x	8.34	=	6,736
March	0.8732	x	707	x	8.34	=	5,146
April	1.2928	x	655	x	8.34	=	7,066
May	1.2887	x	642	x	8.34	=	6,897
June	1.7283	x	582	x	8.34	=	8,384
July	1.1615	x	631	x	8.34	=	6,111
August	0.9901	x	810	x	8.34	=	6,688
September	0.8705	x	868	x	8.34	=	6,300
October	0.8764	x	988	x	8.34	=	7,223
November	0.8246	x	1,253	x	8.34	=	8,615
December	0.8740	x	861	x	8.34	=	6,275

2. Maximum Month Design Flow and Design (C)BOD Loading

2.1 Verify the design flow and loading for your facility.

Design	Design Factor	x	%	=	% of Design
Max Month Design Flow, MGD	1.214	x	90	=	1.0926
		x	100	=	1.214
Design (C)BOD, lbs/day	6000	x	90	=	5400
		x	100	=	6000

2.2 Verify the number of times the flow and (C)BOD exceeded 90% or 100% of design, points earned, and score:

	Months of Influent	Number of times flow was greater than 90% of	Number of times flow was greater than 100% of	Number of times (C)BOD was greater than 90% of design	Number of times (C)BOD was greater than 100% of design
January	1	0	0	1	1
February	1	0	0	1	1
March	1	0	0	0	0
April	1	1	1	1	1
May	1	1	1	1	1
June	1	1	1	1	1
July	1	1	0	1	1
August	1	0	0	1	1
September	1	0	0	1	1
October	1	0	0	1	1
November	1	0	0	1	1
December	1	0	0	1	1
Points per each		2	1	3	2
Exceedances		4	3	11	11
Points		8	3	33	22
Total Number of Points					66

66

3. Flow Meter

3.1 Was the influent flow meter calibrated in the last year?

● Yes Enter last calibration date (MM/DD/YYYY) 2014-08-25

○ No

If No, please explain:

4. Sewer Use Ordinance

4.1 Did your community have a sewer use ordinance that limited or prohibited the discharge of excessive conventional pollutants ((C)BOD, SS, or pH) or toxic substances to the sewer from industries, commercial users, hauled waste, or residences?

● Yes

○ No

If No, please explain:

4.2 Was it necessary to enforce the ordinance?

○ Yes

● No

If Yes, please explain:

5. Septage Receiving

5.1 Did you have requests to receive septage at your facility?

Septic Tanks	Holding Tanks	Grease Traps
● Yes	● Yes	● Yes
○ No	○ No	○ No

5.2 Did you receive septage at your faclity? If yes, indicate volume in gallons.

Septic Tanks

● Yes 1,126,916 gallons

○ No

Holding Tanks

● Yes 30,080,550 gallons

○ No

Grease Traps

● Yes 230,695 gallons

○ No

5.2.1 If yes to any of the above, please explain if plant performance is affected when receiving any of these wastes.

No plant issues recieving the above mentioned wastes.

6. Pretreatment

6.1 Did your facility experience operational problems, permit violations, biosolids quality concerns, or hazardous situations in the sewer system or treatment plant that were attributable to commercial or industrial discharges in the last year?

○ Yes

● No

If yes, describe the situation and your community's response.

6.2 Did your facility accept hauled industrial wastes, landfill leachate, etc.?

● Yes

○ No

If yes, describe the types of wastes received and any procedures or other restrictions that were in place to protect the facility from the discharge of hauled industrial wastes.

Dairy wash water waste from cheese plant. Waste placed in recieving basin and time paced into head works.

Total Points Generated	66
Score (100 - Total Points Generated)	34
Section Grade	F

Compliance Maintenance Annual Report

Kiel Wastewater Treatment Facility

Last Updated: 7/23/2015 Reporting For: 2014

Effluent Quality and Plant Performance (BOD/CBOD)

1. Effluent (C)BOD Results

1.1 Verify the following monthly average effluent values, exceedances, and points for BOD or CBOD

Outfall No. 001	Monthly Average Limit (mg/L)	90% of Permit Limit > 10 (mg/L)	Effluent Monthly Average (mg/L)	Months of Discharge with a Limit	Permit Limit Exceedance	90% Permit Limit Exceedance
January	15	13.5	3	1	0	0
February	15	13.5	5	1	0	0
March	15	13.5	3	1	0	0
April	15	13.5	4	1	0	0
May	10	10	4	1	0	0
June	10	10	4	1	0	0
July	10	10	3	1	0	0
August	10	10	1	1	0	0
September	10	10	2	1	0	0
October	10	10	1	1	0	0
November	15	13.5	6	1	0	0
December	15	13.5	5	1	0	0
* Equals limit if limit is <= 10						
Months of discharge/yr				12		
Points per each exceedance with 12 months of discharge					7	3
Exceedances					0	0
Points					0	0
Total number of points						0

NOTE: For systems that discharge intermittently to state waters, the points per monthly exceedance for this section shall be based upon a multiplication factor of 12 months divided by the number of months of discharge. Example: For a wastewater facility discharging only 6 months of the year, the multiplication factor is 12/6 = 2.0

1.2 If any violations occurred, what action was taken to regain compliance?

0

2. Flow Meter Calibration

2.1 Was the effluent flow meter calibrated in the last year?

● Yes Enter last calibration date (MM/DD/YYYY) 2014-08-25

○ No

If No, please explain:

3. Treatment Problems

3.1 What problems, if any, were experienced over the last year that threatened treatment?

No problems experienced with treatment.

4. Other Monitoring and Limits

4.1 At any time in the past year was there an exceedance of a permit limit for any other pollutants such as chlorides, pH, residual chlorine, fecal coliform, or metals?

○ Yes

● No

If Yes, please explain:

4.2 At any time in the past year was there a failure of an effluent acute or chronic whole effluent toxicity (WET) test?

- ○ Yes
- ● No

If Yes, please explain:

4.3 If the biomonitoring (WET) test did not pass, were steps taken to identify and/or reduce source(s) of toxicity?

- ○ Yes
- ○ No
- ● N/A

Please explain unless not applicable:

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

Compliance Maintenance Annual Report

Kiel Wastewater Treatment Facility

Last Updated: 7/23/2015 Reporting For: 2014

Effluent Quality and Plant Performance (Total Suspended Solids)

1. Effluent Total Suspended Solids Results

1.1 Verify the following monthly average effluent values, exceedances, and points for TSS:

Outfall No. 001	Monthly Average Limit (mg/L)	90% of Permit Limit >10 (mg/L)	Effluent Monthly Average (mg/L)	Months of Discharge with a Limit	Permit Limit Exceedance	90% Permit Limit Exceedance
January	15	13.5	3	1	0	0
February	15	13.5	5	1	0	0
March	15	13.5	1	1	0	0
April	15	13.5	3	1	0	0
May	10	10	2	1	0	0
June	10	10	3	1	0	0
July	10	10	2	1	0	0
August	10	10	1	1	0	0
September	10	10	2	1	0	0
October	10	10	0	1	0	0
November	15	13.5	1	1	0	0
December	15	13.5	3	1	0	0
* Equals limit if limit is <= 10						
Months of Discharge/yr				12		
Points per each exceedance with 12 months of discharge:					7	3
Exceedances					0	0
Points					0	0
Total Number of Points						0

0

NOTE: For systems that discharge intermittently to state waters, the points per monthly exceedance for this section shall be based upon a multiplication factor of 12 months divided by the number of months of discharge.

Example: For a wastewater facility discharging only 6 months of the year, the multiplication factor is 12/6 = 2.0

1.2 If any violations occurred, what action was taken to regain compliance?

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

Compliance Maintenance Annual Report

Kiel Wastewater Treatment Facility

Last Updated: 7/23/2015 | Reporting For: 2014

Effluent Quality and Plant Performance (Ammonia - NH3)

1. Effluent Ammonia Results

1.1 Verify the following monthly and weekly average effluent values, exceedances and points for NH3

Outfall No. 001	Monthly Average NH3 Limit (mg/L)	Weekly Average NH3 Limit (mg/L)	Effluent Monthly Average NH3 (mg/L)	Monthly Permit Limit Exceedance	Effluent Weekly Average for Week 1	Effluent Weekly Average for Week 2	Effluent Weekly Average for Week 3	Effluent Weekly Average for Week 4	Weekly Permit Limit Exceedance
January	5.3		.071111111	0					
February	5.3		.10125	0					
March	5.3		.039888889	0					
April	2.2		.063666667	0					
May	2.2		.055555556	0					
June	1.7		.068888889	0					
July	1.7		.115555556	0					
August	1.7		.87375	0					
September	1.7		.029	0					
October	5.3		.01875	0					
November	5.3		1.9375	0					
December	5.3		.073333333	0					

Points per each exceedance of Monthly average:	10
Exceedances, Monthly:	0
Points:	0
Points per each exceedance of weekly average (when there is no monthly averge):	2.5
Exceedances, Weekly:	0
Points:	0
Total Number of Points	0

0

NOTE: Limit exceedances are considered for mothly OR weekly averages but not both. When a monthly average limit exists it will be used to detect exceedances and generate points. This will be true even if a weekly limit also exists. When a weekly average limit exists and a monthly limit does not exist, the weekly limit will be used to detect exceedances and gernate points.

1.2 If any violations occurred, what action was taken to regain compliance?

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

Compliance Maintenance Annual Report

Kiel Wastewater Treatment Facility

Last Updated: 7/23/2015 Reporting For: 2014

Effluent Quality and Plant Performance (Phosphorus)

1. Effluent Phosphorus Results

1.1 Verify the following monthly average effluent values, exceedances, and points for Phosphorus

Outfall No. 001	Monthly Average phosphorus Limit (mg/L)	Effluent Monthly Average phosphorus (mg/L)	Months of Discharge with a Limit	Permit Limit Exceedance
January	1	0.6	1	0
February	1	0.4	1	0
March	1	0.3	1	0
April	1	0.3	1	0
May	1	0.5	1	0
June	1	0.6	1	0
July	1	0.5	1	0
August	1	0.6	1	0
September	1	0.7	1	0
October	1	0.6	1	0
November	1	0.5	1	0
December	1	0.4	1	0
Months of Discharge/yr			12	
Points per each exceedance with 12 months of discharge:				10
Exceedances				0
Total Number of Points				0

0

NOTE: For systems that discharge intermittently to waters of the state, the points per monthly exceedance for this section shall be based upon a multiplication factor of 12 months divided by the number of months of discharge.
Example: For a wastewater facility discharging only 6 months of the year, the multiplication factor is 12/6 = 2.0

1.2 If any violations occurred, what action was taken to regain compliance?

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

Compliance Maintenance Annual Report

Kiel Wastewater Treatment Facility

Last Updated: 7/23/2015 Reporting For: 2014

Biosolids Quality and Management

1. Biosolids Use/Disposal

1.1 How did you use or dispose of your biosolids? (Check all that apply)

- ☐ Land applied under your permit
- ☒ Publicly Distributed Exceptional Quality Biosolids
- ☐ Hauled to another permitted facility
- ☐ Landfilled
- ☐ Incinerated
- ☐ Other

NOTE: If you did not remove biosolids from your system, please describe your system type such as lagoons, reed beds, recirculating sand filters, etc.

1.1.1 If you checked Other, please describe:

3. Biosolids Metals

Number of biosolids outfalls in your WPDES permit:

3.1 For each outfall tested, verify the biosolids metal quality values for your facility during the last calendar year.

Outfall No. 004 - Cake Sludge

Parameter	80% of Limit	H.Q. Limit	Ceiling Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	80% Value	High Quality	Ceiling
Arsenic		41	75			2.8	.78					5.6	6.3				0	0
Cadmium		39	85			.42	.51					.27	.46				0	0
Copper		1500	4300			92	78					150	160				0	0
Lead		300	840			6.4	6.1					6.3	13				0	0
Mercury		17	57			0	0					0	.19				0	0
Molybdenum	60		75			32	35					37	30			0		0
Nickel	336		420			300	290					230	230			0		0
Selenium	80		100			0	0					3.8	0			0		0
Zinc		2800	7500			200	140					180	210				0	0

3.1.1 Number of times any of the metals exceeded the high quality limits OR 80% of the limit for molybdenum, nickel, or selenium = 0

Exceedence Points

- ● 0 (0 Points)
- ○ 1-2 (10 Points)
- ○ > 2 (15 Points)

3.1.2 If you exceeded the high quality limits, did you cumulatively track the metals loading at each land application site? (check applicable box)

- ○ Yes
- ○ No (10 points)
- ● N/A - Did not exceed limits or no HQ limit applies (0 points)
- ○ N/A - Did not land apply biosolids until limit was met (0 points)

3.1.3 Number of times any of the metals exceeded the ceiling limits = 0

Exceedence Points

- ● 0 (0 Points)
- ○ 1 (10 Points)
- ○ > 1 (15 Points)

3.1.4 Were biosolids land applied which exceeded the ceiling limit?

- ○ Yes (20 Points)
- ● No (0 Points)

Compliance Maintenance Annual Report

3.1.5 If any metal limit (high quality or ceiling) was exceeded at any time, what action was taken? Has the source of the metals been identified?

0

4. Pathogen Control (per outfall):

4.1 Verify the following information. If any information is incorrect, Contact Us.

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	01/01/2014 - 03/31/2014
Density:	4
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	No
Process:	PSTZN
Process Description:	Sludge Truck

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	01/01/2014 - 03/31/2014
Density:	4
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	No
Process:	PSTZN
Process Description:	Sludge Storage Building

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	04/01/2014 - 06/30/2014
Density:	3
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	Yes
Process:	PSTZN
Process Description:	Sludge Storage Building

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Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	04/01/2014 - 06/30/2014
Density:	4
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	Yes
Process:	PSTZN
Process Description:	Sludge Truck

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	07/01/2014 - 09/30/2014
Density:	5
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	No
Process:	PSTZN
Process Description:	Sludge Truck

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	07/01/2014 - 09/30/2014
Density:	5
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	No
Process:	PSTZN
Process Description:	Sludge Storage Building

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	10/01/2014 - 12/31/2014
Density:	5
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	Yes
Process:	PSTZN
Process Description:	Sludge Storage Building

Outfall Number:	004
Biosolids Class:	A
Bacteria Type and Limit:	F
Sample Dates:	10/01/2014 - 12/31/2014
Density:	5
Sample Concentration Amount:	MPN/G TS
Requirement Met:	Yes
Land Applied:	Yes
Process:	PSTZN
Process Description:	Sludge Truck

0

4.2 If exceeded Class B limit or did not meet the process criteria at the time of land application.

4.2.1 Was the limit exceeded or the process criteria not met at the time of land application?

○ Yes (40 Points)

● No

If yes, what action was taken?

5. Vector Attraction Reduction (per outfall):

5.1 Verify the following information. If any of the information is incorrect, Contact Us.

Outfall Number:	004
Method Date:	03/31/2014
Option Used To Satisfy Requirement:	PHADJ
Requirement Met:	Yes
Land Applied:	No
Limit (if applicable):	
Results (if applicable):	

Outfall Number:	004
Method Date:	06/30/2014
Option Used To Satisfy Requirement:	PHADJ
Requirement Met:	Yes
Land Applied:	Yes
Limit (if applicable):	
Results (if applicable):	

Outfall Number:	004
Method Date:	09/30/2014
Option Used To Satisfy Requirement:	PHADJ
Requirement Met:	Yes
Land Applied:	No
Limit (if applicable):	
Results (if applicable):	

Outfall Number:	004
Method Date:	12/31/2014
Option Used To Satisfy Requirement:	PHADJ
Requirement Met:	Yes
Land Applied:	Yes
Limit (if applicable):	
Results (if applicable):	

5.2 Was the limit exceeded or the process criteria not met at the time of land application?

- ○ Yes (40 Points)
- ● No

If yes, what action was taken?

0

6. Biosolids Storage

6.1 How many days of actual, current biosolids storage capacity did your wastewater treatment facility have either on-site or off-site?

- ● >= 180 days (0 Points)
- ○ 150 - 179 days (10 Points)
- ○ 120 - 149 days (20 Points)
- ○ 90 - 119 days (30 Points)
- ○ < 90 days (40 Points)
- ○ N/A (0 Points)

6.2 If you checked N/A above, explain why.

0

7. Issues

7.1 Describe any outstanding biosolids issues with treatment, use or overall management:

BNR sludge harder to dewater causing longer run times on biosolids process.

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

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Staffing and Preventative Maintenance (All Treatment Plants)

1. Plant Staffing 1.1 Was your wastewater treatment plant adequately staffed last year? ● Yes ○ No If No, please explain: Could use more help/staff for: 1.2 Did your wastewater staff have adequate time to properly operate and maintain the plant and fulfill all wastewater management tasks including recordkeeping? ● Yes ○ No If No, please explain:	
2. Preventative Maintenance 2.1 Did your plant have a documented AND implemented plan for preventative maintenance on major equipment items? ● Yes (Continue with question 2) ○ No (40 points) If No, please explain, then go to question 3: 2.2 Did this preventative maintenance program depict frequency of intervals, types of lubrication, and other tasks necessary for each piece of equipment? ● Yes ○ No (10 points) 2.3 Were these preventative maintenance tasks, as well as major equipment repairs, recorded and filed so future maintenance problems can be assessed properly? ● Yes ○ Paper file system ○ Computer system ● Both paper and computer system ○ No (10 points)	0
3. O&M Manual 3.1 Does your plant have a detailed O&M Manual that can be used as a reference when needed? ● Yes ○ No	
4. Overall Maintenance /Repairs 4.1 Rate the overall maintenance of your wastewater plant. ○ Excellent ● Very good ○ Good ○ Fair ○ Poor Describe your rating: The rating is very good. We are always busy preforming maintenance and that is due to age of plant so at this time excellent maintenance can not be met.	

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

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Operator Certification and Education

1. Operator-In-Charge 1.1 Did you have a designated operator-in-charge during the report year? ● Yes (0 points) ○ No (20 points) Name: KRIS A AUGUST Certification No: 18354	0
2. Certification Requirements 2.1 In accordance with Chapter NR 114.08 and 114.09, Wisconsin Administrative Code, what grade and subclass(es) were required for the operator-in-charge to operate the wastewater treatment plant and what grade and subclass(es) were held by the operator-in-charge? Required: 4 - ACEFGHIJ; A - PRIMARY SETTLING; C - ACTIVATED SLUDGE; E - DISINFECTION; F - ANAEROBIC DIGESTION; G - MECHANICAL SLUDGE; H - FILTRATION; I - PHOSPHORUS REMOVAL; J - LABORATORY Held: 4 - ACEFGHIJ; 4 - A=PRIMARY SETTLING GRADE 4; C=ACTIVATED SLUDGE GRADE 4; E=DISINFECTION GRADE 4; F=ANAEROBIC DIGESTION GRADE 4; G=MECHANICAL SLUDGE GRADE 4; H=FILTRATION GRADE 4; I=PHOSPHORUS REMOVAL GRADE 4; J=LABORATORY GRADE 4 2.2 Was the operator-in-charge certified at the appropriate level to operate this plant? ● Yes (0 points) ○ No (20 points)	0
3. Succession Planning 3.1 In the event of the loss of your designated operator-in-charge, did you have a contingency plan to ensure the continued proper operation and maintenance of the plant that includes one or more of the following options (check all that apply)? ☒ One or more additional certified operators on staff ☐ An arrangement with another certified operator ☐ An arrangement with another community with a certified operator ☐ An operator on staff who has an operator-in-training certificate for your plant and is expected to be certified within one year ☐ A consultant to serve as your certified operator ☐ None of the above (20 points) If "None of the above" is selected, please explain:	0
4. Continuing Education Credits 4.1 If you had a designated operator-in-charge, was the operator-in-charge earning Continuing Education Credits at the following rates? Grades T, 1, and 2: ○ Averaging 6 or more CECs per year. ○ Averaging less than 6 CECs per year. Grades 3 and 4: ● Averaging 8 or more CECs per year. ○ Averaging less than 8 CECs per year.	

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

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Financial Management

1. Provider of Financial Information

Name: Kris August

Telephone: (920) 894-2133 (XXX) XXX-XXXX

E-Mail Address (optional): kielwwtp@yahoo.com

2. Treatment Works Operating Revenues

2.1 Are User Charges or other revenues sufficient to cover O&M expenses for your wastewater treatment plant AND/OR collection system ?

- ● Yes (0 points)
- ○ No (40 points)

If No, please explain:

2.2 When was the User Charge System or other revenue source(s) last reviewed and/or revised?

Year: 2014

- ● 0-2 years ago (0 points)
- ○ 3 or more years ago (20 points)
- ○ N/A (private facility)

0

2.3 Did you have a special account (e.g., CWFP required segregated Replacement Fund, etc.) or financial resources available for repairing or replacing equipment for your wastewater treatment plant and/or collection system?

- ● Yes (0 points)
- ○ No (40 points)

REPLACEMENT FUNDS [PUBLIC MUNICIPAL FACILITIES SHALL COMPLETE QUESTION 3]

3. Equipment Replacement Funds

3.1 When was the Equipment Replacement Fund last reviewed and/or revised?

Year: 2014

- ● 1-2 years ago (0 points)
- ○ 3 or more years ago (20 points)
- ○ N/A

If N/A, please explain:

3.2 Equipment Replacement Fund Activity

3.2.1 Ending Balance Reported on Last Year's CMAR		$	634,678.00
3.2.2 Adjustments - if necessary (e.g. earned interest, audit correction, withdrawal of excess funds, increase making up previous shortfall, etc.)	+	$	82.13
3.2.3 Adjusted January 1st Beginning Balance		$	634,760.13
3.2.4 Additions to Fund (e.g. portion of User Fee, earned interest, etc.)	+	$	80,000.00
3.2.5 Subtractions from Fund (e.g., equipment replacement, major repairs - use description box 3.2.6.1 below*)	-	$	69,420.07
3.2.6 Ending Balance as of December 31st for CMAR Reporting Year		$	645,340.06

All Sources: This ending balance should include all Equipment Replacement Funds whether held in a bank account(s), certificate(s) of deposit, etc.

3.2.6.1 Indicate adjustments, equipment purchases, and/or major repairs from 3.2.5 above.

Electro Tech - Blower Motor $7,886.07, Asc Pumping - F.E. Reuse $7,278.38, Dorner - Final Clarifier valves $11,357.49, Furey Filter - FE booster pump $4,034.63, Xylem - DO Meter Aeration Basin 6 $ $11,700.00, Vogel Chevy - Vehicle $27,163.50.

3.3 What amount should be in your Replacement Fund? $ 487,298.75

Please note: If you had a CWFP loan, this amount was originally based on the Financial Assistance Agreement (FAA) and should be regularly updated as needed. Further calculation instructions and an example can be found by clicking the HELP link under Info in the left-side menu.

0

3.3.1 Is the December 31 Ending Balance in your Replacement Fund above, (#3.2.6) equal to, or greater than the amount that should be in it (#3.3)?

- ● Yes
- ○ No

If No, please explain.

4. Future Planning

4.1 During the next ten years, will you be involved in formal planning for upgrading, rehabilitating, or new construction of your treatment facility or collection system?

- ● Yes - If Yes, please provide major project information, if not already listed below.
- ○ No

Project #	Project Description	Estimated Cost	Approximate Construction Year
1	Anaerobic Digester Rehab.	2353000	2022
2	I/I Reduction based on SSES Study. New Data per study.	342892	2014
3	Tertiary Filter Upgrade for Phosphorus.	1705800	2020
4	New sewer North Street 700 block to include private laterals	32000	2014
5	Primary Clarifier rebuild	444475	2016
6	Final Clarifier Rebuild	989000	2018
7	Sewer 6th Street & River Terrace, 200-500 Blocks	168000	2017
8	9th Street, 800 block Washington, 400 & 500 Block North Ave.	45000	2016
9	Sludge Process Replacement	5400000	2021
10	Rehab concrete structures plant	210000	2018
11	Increase Capacity Main Pump Station (100 River Road)	243000	2017
12	SCADA Upgrade Plant	736000	2019
13	400 & 500 Block Calumet Street, 300 block North Street	145000	2019
14	Phosphorus Removal Improvements	384000	2023
15	Hydraulic Pipe Improvements Aeration Basins to Final Clarifier.	85000	2024
16	Rehab and increase capacity of 400 - 600 blocks	135000	2015

5. Financial Management General Comments

The utility is in good financial shape with progressive rate increases planned to meet future plant and system planned projects.

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

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Sanitary Sewer Collection Systems

1. CMOM Program

1.1 Do you have a Capacity, Management, Operation & Maintenance (CMOM) requirement in your WPDES permit?

- ○ Yes
- ● No

1.2 Did you have a documented (written records/files, computer files, video tapes, etc.) sanitary sewer collection system operation & maintenance (O&M) or CMOM program last calendar year?

- ● Yes (Continue with question 1)
- ○ No (30 points) (Go to question 2)

1.3 Check the elements listed below that are included in your O&M or CMOM program.

☒ Goals

Describe the specific goals you have for your collection system:

> 2.0 Goals
> The City of Kiel has developed this Capacity, Management, Operation and Maintenance Program (CMOM) to put in place the ideals, concepts and procedures to be used to prevent sewer overflows to the extent possible and practicable. The goals of the plan are
>
> Prevent overflows from the sanitary sewer to the extent possible and practicable.
> Manage the assets of the Kiel Wastewater Utility inclusive of personnel and equipment to affect a regular maintenance program and to be able to respond to emergency overflows of the system.
> Through the use of analytical and engineering methods, develop a system to assess and prioritize maintenance, rehabilitation and replacement activities for the portions of the collection system under operational control of the Kiel Wastewater Utility.
> Through effective management, develop and enforce appropriate ordinances that will help to better manage the performance of the collection system.
>
> 2014 Goals
> Clean 25% and known trouble areas yearly.
> Reevaluate FOG and Sand Trap Program.
> Update mapping to include new sewer and video options.

☒ Organization

Do you have the following written organizational elements (check only those that apply)?

- ☒ Ownership and governing body description
- ☒ Organizational chart
- ☒ Personnel and position descriptions
- ☒ Internal communication procedures
- ☒ Public information and education program

☒ Legal Authority

Do you have the legal authority for the following (check only those that apply)?

- ☒ Sewer use ordinance Last Revised Date (MM/DD/YYYY) 2014-12-09
- ☒ Pretreatment/industrial control Programs
- ☒ Fat, oil and grease control
- ☒ Illicit discharges (commercial, industrial)
- ☒ Private property clear water (sump pumps, roof or foundation drains, etc.)
- ☒ Private lateral inspections/repairs
- ☒ Service and management agreements

☒ Maintenance Activities (provide details in question 2)

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☒ Design and Performance Provisions

How do you ensure that your sewer system is designed and constructed properly?

- ☒ State plumbing code
- ☒ DNR NR 110 standards
- ☒ Local municipal code requirements
- ☒ Construction, inspection, and testing
- ☐ Others:

☒ Overflow Emergency Response Plan:

Does your emergency response capability include (check only those that apply)?

- ☒ Alarm system and routine testing
- ☒ Emergency equipment
- ☒ Emergency procedures
- ☒ Communications/notifications (DNR, internal, public, media, etc.)

☒ Capacity Assurance:

How well do you know your sewer system? Do you have the following?

- ☒ Current and up-to-date sewer map
- ☒ Sewer system plans and specifications
- ☒ Manhole location map
- ☒ Lift station pump and wet well capacity information
- ☒ Lift station O&M manuals

Within your sewer system have you identified the following?

- ☒ Areas with flat sewers
- ☒ Areas with surcharging
- ☒ Areas with bottlenecks or constrictions
- ☒ Areas with chronic basement backups or SSOs
- ☒ Areas with excess debris, solids, or grease accumulation
- ☒ Areas with heavy root growth
- ☒ Areas with excessive infiltration/inflow (I/I)
- ☒ Sewers with severe defects that affect flow capacity
- ☒ Adequacy of capacity for new connections
- ☒ Lift station capacity and/or pumping problems

☒ Annual Self-Auditing of your O&M/CMOM Program to ensure above components are being implemented, evaluated, and re-prioritized as needed

☐ Special Studies Last Year (check only those that apply):

- ☐ Infiltration/Inflow (I/I) Analysis
- ☐ Sewer System Evaluation Survey (SSES)
- ☐ Sewer Evaluation and Capacity Managment Plan (SECAP)
- ☐ Lift Station Evaluation Report
- ☐ Others:

0

2. Operation and Maintenance

2.1 Did your sanitary sewer collection system maintenance program include the following maintenance activities? Complete all that apply and indicate the amount maintained.

Cleaning	10	% of system/year
Root removal	1	% of system/year
Flow monitoring	0	% of system/year
Smoke testing	0	% of system/year

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Sewer line televising	7	% of system/year
Manhole inspections	10	% of system/year
Lift station O&M	52	# per L.S./year
Manhole rehabilitation	.05	% of manholes rehabbed
Mainline rehabilitation	.05	% of sewer lines rehabbed
Private sewer inspections	.05	% of system/year
Private sewer I/I removal	.05	% of private services

Please include additional comments about your sanitary sewer collection system below:

Sanitary system is performing at moderate efficiency with continue removal of problems I/I areas.

3. Performance Indicators

3.1 Provide the following collection system and flow information for the past year.

40.68	Total actual amount of precipitation last year in inches
31.30	Annual average precipitation (for your location)
17.5	Miles of sanitary sewer
6	Number of lift stations
0	Number of lift station failures
0	Number of sewer pipe failures
0	Number of basement backup occurrences
2	Number of complaints
0.850	Average daily flow in MGD (if available)
51.849	Peak monthly flow in MGD (if available)
	Peak hourly flow in MGD (if available)

3.2 Performance ratios for the past year:

0.00	Lift station failures (failures/year)
0.00	Sewer pipe failures (pipe failures/sewer mile/yr)
0.00	Sanitary sewer overflows (number/sewer mile/yr)
0.00	Basement backups (number/sewer mile)
0.11	Complaints (number/sewer mile)
61.0	Peaking factor ratio (Peak Monthly:Annual Daily Avg)
0.0	Peaking factor ratio (Peak Hourly:Annual Daily Avg)

4. Overflows

LIST OF SANITARY SEWER (SSO) AND TREATMENT FACILITY (TFO) OFERFLOWS REPORTED **

	Date	Location	Cause	Estimated Volume (MG)
		None reported		

** If there were any SSOs or TFOs that are not listed above, please contact the DNR and stop work on this section until corrected.

5. Infiltration / Inflow (I/I)

5.1 Was infiltration/inflow (I/I) significant in your community last year?

- ● Yes
- ○ No

If Yes, please describe:

Based on I/I Study and SSES Study areas of high I/I are known.

5.2 Has infiltration/inflow and resultant high flows affected performance or created problems in your collection system, lift stations, or treatment plant at any time in the past year?

- ○ Yes
- ● No

If Yes, please describe:

5.3 Explain any infiltration/inflow (I/I) changes this year from previous years:

Correction of I/I identified area on North and 7th Street.
Lower rainfall events occured.

5.4 What is being done to address infiltration/inflow in your collection system?

Replacing planned areas of the sanitary system I/I. During replacement main lines and laterals both public and private are replaced.

Total Points Generated	0
Score (100 - Total Points Generated)	100
Section Grade	A

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Grading Summary

WPDES No: 0020141

SECTIONS	LETTER GRADE	GRADE POINTS	WEIGHTING FACTORS	SECTION POINTS
Influent	F	0	3	0
BOD/CBOD	A	4	10	40
TSS	A	4	5	20
Ammonia	A	4	5	20
Phosphorus	A	4	3	12
Biosolids	A	4	5	20
Staffing/PM	A	4	1	4
OpCert	A	4	1	4
Financial	A	4	1	4
Collection	A	4	3	12
TOTALS			37	136
GRADE POINT AVERAGE (GPA) = 3.68				

Notes:
A = Voluntary Range (Response Optional)
B = Voluntary Range (Response Optional)
C = Recommendation Range (Response Required)
D = Action Range (Response Required)
F = Action Range (Response Required)

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Resolution or Owner's Statement

Name of Governing Body or Owner: City of Kiel

Date of Resolution or Action Taken:

Resolution Number: 2015-8

ACTIONS SET FORTH BY THE GOVERNING BODY OR OWNER RELATING TO SPECIFIC CMAR SECTIONS (Optional for grade A or B. Required for grade C, D, or F. Regardless of grade, required for Collection Systems if SSOs were reported):

Influent Flow and Loadings: Grade = F

Facility Plan to be completed in 2015 by McMahon Engineering followed by related construction and rehabilitation of current plant processes design started to meet influent flow and loading requirements.

Effluent Quality: BOD: Grade = A

Effluent Quality: TSS: Grade = A

Effluent Quality: Ammonia: Grade = A

Effluent Quality: Phosphorus: Grade = A

Biosolids Quality and Management: Grade = A

Staffing: Grade = A

Operator Certification: Grade = A

Financial Management: Grade = A

Collection Systems: Grade = A

ACTIONS SET FORTH BY THE GOVERNING BODY OR OWNER RELATING TO THE OVERALL GRADE POINT AVERAGE AND ANY GENERAL COMMENTS (Optional for G.P.A. greater than or equal to 3.00, required for G.P.A. less than 3.00)

G.P.A. = 3.68

APPENDIX III-4

UNIT PROCESS DESCRIPTIONS
December 2014 Master Plan

Appendix C: Unit Process Description

Existing Unit Processes
WWTP Capacity Evaluation
City of Kiel, WI

Raw Wastewater Pumping

Number of Pumps (River Road PS)	3	
Type	KSB Dry-Pit Submersible - Non-clog centrifugal	
Motor	33	HP
Drive	Variable-Frequency	
One Pump Capacity w/ 8" FM	1.84	mgd
Two Pump Capacity w/ 12" FM	2.42	mgd
Three Pump Capacity w/ 8" and 12" FM	4.27	mgd
Firm Pumping Capacity	2.42	mgd

Raw Wastewater Screening

Screen Type	Fine Screens - Hycor HLS500 Helisieve Spiral Screen	
Total Number of Screens	2	
Opening Size	0.25	inch
Each Screen Peak Capacity	2,986	gpm
Firm Screen Capacity	4.3	mgd

Aerated Grit Removal Basins

Number of Basins	1	
Dimensions		
Length	12.0	ft
Width	12.0	ft
Sidewater Depth	12.0	ft
Volume per Basin	12,925	gal
Total Volume	12,925	gal
Hydraulic Capacity @ 3 min DT	6.20	mgd
Grit Pump		
Number	1	
Type	Air Lift	
Grit Handling		
Number	1	
Type	Classifier	

Primary Clarifiers

Total Number of Basins	2	
Type	Circular	
Dimensions		
Diameter	28.0	ft
Weir Length	324	ft
Sidewater Depth	12.0	ft
Surface Area per Unit	616	sf
Total Surface Area	1,232	sf
Hydraulic Capacity @ 1000 gpd/sf	1.2	mgd

Aeration Basins

Number of Parallel Trains	3.0	
Dimensions		
Train 1 (Basins 1-4)		
Anoxic Zone		
Length (Total of 1 Zones)	30.0	ft
Width	28.0	ft
Sidewater Depth	14.0	ft
Volume	87,965	gal
Percent of Train 1 Volume	19%	
Aerobic Zone		
Length (Total of 3 Zones)	162.0	ft
Width	28.0	ft
Sidewater Depth	14.0	ft
Volume	475,010	gal
Tank 4 HSW Aerobic Zone		
Length	64.0	ft
Width	28.0	ft
Sidewater Depth	14.0	ft
Volume	187,658	gal
Train 2 (Basins 5,7,9)		
Anoxic Zone		
Length (Total of 1 Zones)	30.0	ft
Width	32.0	ft
Sidewater Depth	14.0	ft

Volume	100,531	gal
Percent of Train 1 Volume	18%	
Aerobic Zone		
Length (Total of 3 Zones)	165.0	ft
Width	32.0	ft
Sidewater Depth	14.0	ft
Volume	552,922	gal
Train 3 (Basins 6,8,10)		
Anoxic Zone		
Length (Total of 1 Zones)	30.0	ft
Width	32.0	ft
Sidewater Depth	14.0	ft
Volume	100,531	gal
Percent of Train 1 Volume	18%	
Aerobic Zone		
Length (Total of 3 Zones)	165.0	ft
Width	32.0	ft
Sidewater Depth	14.0	ft
Volume	552,922	gal
Anoxic Zone Mixing		
Type	Hyperbolic Mixer	
Number	3 (one per zone)	
Motor	3	HP
Disk Diameter	98	in
Aeration Type	Fine Bubble - Ceramic	
Type	Tapered Diffuser Density	
Total Number of Diffusers		3242 diffusers
Aeration Control		
Blower Control	Proportional to D.O. Setpoint	
Zone Control	Manually Adjusted Valves	

Aeration Blowers

Total Number of Blowers	4	
Total Number of "New" Blowers	2	
Blower Type	Positive Displacement	
Capacity Each	2,520	scfm @ 8 psi
Motor	150	hp
Drive	Variable-Frequency	
Total Number of "Old" Blowers	2	
Capacity Each	1,680	scfm @ 8 psi
Motor	100	hp
Drive	Variable-Frequency	
Total Capacity	8,400	scfm
Capacity (Measured with one 100 hp out of service)	6,356	scfm
Total Firm Rated Capacity	5,880	scfm

Final Clarifiers

Total Number of Basins	2	
Type	Circular	
Dimensions		
Diameter	40.0	
Sidewater Depth	14.0	ft
Weir Length	474.4	ft
Surface Area per Unit	1,257	sf
Total Surface Area	2,513	sf

Return Activated Sludge Pumping

Number of Pumps	2	
Type	Dry-pit centrifugal	
One Pump Capacity	1400	gpm @ 22 ft TDH
Motor	15	HP
Drive	Variable-Frequency	
Total Pumping Capacity	2,800	gpm

Final Clarifier Scum Pumping

Number of Pumps	2	
Type	Dry-pit centrifugal	
One Pump Capacity	150	gpm @ 30 ft TDH
Motor	5	HP

Tertiary Filtration

Type	Rapid, Mono media Sand	

Number of Cells	4	
Dimensions		
Length	12.0	ft
Width	12.0	ft
Area per Cell	144	sq ft
Total Area	576	sq ft
Media Depth	2.5	ft
TSS Removal	70	%
Backwash % of Forward Flow	3	%

Filter Feed Pumps

Number of Pumps	3	
Type	Extended Shaft Dry-pit centrifugal	
One Pump Capacity	1300	gpm @ 35 ft TDH
Motor	20	HP
Drive	Variable-Frequency	
Firm Pumping Capacity	3.74	mgd

Filter Backwash Supply Pumps

Number of Pumps	2	
Type	Vertical Turbine	
One Pump Capacity	2900	gpm @ 16.5 ft TDH
Motor	20	HP
Backwash Capacity	20	gpm/sq ft of one cell

Filter Backwash Waste Pumps

Number of Pumps	2	
Type	Dry-Pit Centrifugal	
One Pump Capacity	150	gpm @ 36 ft TDH
Motor	10	HP

Filter Backwash Air Scour Blower

Number of Blowers	1	
Type	Positive Displacement - Rotary Lobe	
Motor	25	HP

Disinfection

Type	Chlorine	
Number of Basins	2	
Total Volume	72,000	gal
Chemical Feed		
Type	100 lb Chlorine Gas Cylinders	
Dechlorination		
Type	100 lb Sulfur Dioxide Cylinders	

Anaerobic Solids Digestion

Number of Digesters	2	
Number of Primary Digesters	1	
Number of Secondary Digesters	1	
Digester No. 1		
Diameter	45.0	ft
Sidewater Depth	21.0	ft
Cone Volume	2.7	kcf
Volume	36.0	kcf
Volume	269,652	gal
Cover Type	Fixed Steel with Insulation	
Mixing	Gas Mixing - Perth	
Motor	7.1	HP
Digester No. 2		
Diameter	45.0	ft
Sidewater Depth	26.0	ft
Cone Volume	4.4	kcf
Volume	45.8	kcf
Volume	342,537	gal
Cover Type	Vertically Guided Floating Gas Holder	

Digester Heating

Number	1	
Type	Combination Boiler/Heat Exchanger	
Boiler Capacity	825,000	BTU/hr
Max Digester Gas Flow	1,720	cf/hr
Heating Control	Manual	
Heat Exchanger Capacity	375,000	BTU/hr
Sludge Tube Area	27	sq ft

Sludge Recirculation Pumping	Primary Digester	
Number	1	
Type	Non-Clog Dry-Pit Centrifugal	
Capacity	150	gpm

Primary Sludge and Digester Sludge Transfer Pumping

Number	2
Type	Air Operated Diaphragm

Digester Supernatant Recycle Pump

Type	Submersible Centrifugal
Discharge Location	Grit Basin Effluent

Sludge Holding Tank

Type	Aerated	
Number of Units	2	
Dimensions		
Length	62	ft
Width	25	ft
Sidewater Depth	16	ft
Total Volume	50,000	cf
	374,000	gal

Sludge Dewatering

Type	Belt Filter Press	
Number	1	
Size	2	m
Capacity	125	gpm
	1,000	lb/hr

Sludge Dewatering Feed Pumps

Number		2
Pump 1 Type	Progressive Cavity	
Capacity		150 gpm
Motor		10 HP
Drive	Variable-Frequency	
Pump 2 Type	Rotary Lobe	
Capacity		150 gpm
Motor		10 HP
Drive	Variable-Frequency	

Sludge Dewatering Polymer System

Number	2
Polymer Type	Liquid Emulsion in 55 gal drums
Number of Injection Locations	3

Sludge Dewatering Filtrate Recycle Pumps

Number		2
Type	Dry-pit Centrifugal	
Capacity		560 gpm @ 36 ft TDH
Motor		10 HP
Discharge Location	Grit Basin Effluent	

Biosolids Treatment

Type	RDP	
Size	800	lb/hr in winter
Number	1	
Class A Technique	Pasteurization with Lime & Heat for 30 min.	

Biosolids Storage

Type	Covered Shed	
Size		
Width	80.5	ft
Length	139.5	ft
Length of Free Space	20.0	ft
Total Area for Biosolids	9,600	sq ft
Stacking Height (35-40% TS), when adding $FeSO_4$	9.0	ft
Stacking Height (30-35% TS), no $FeSO_4$	4.0 to 5.0	ft
Storage Volume	86,400	cf

- Chapter IV -
INFILTRATION / INFLOW ANALYSIS

A. BACKGROUND

An Infiltration / Inflow (I/I) Analysis is an integral part of Facility Planning, and is required per Wisconsin Administrative Code NR 110. The I/I Analysis shall demonstrate whether or not excess I/I exists in the sewer system. The analysis shall identify the presence, flow rate and type of I/I conditions that exist in the sewer system.

Per NR 110, the definition of infiltration and inflow are:

> *"'Infiltration' means water other than wastewater that enters a sewerage system (including sewer service connections) from the ground through such sources as defective pipes, pipe joints, connections or manholes. Infiltration does not include, and is distinguished from, inflow."*

> *"'Inflow' means water other than wastewater that enters a sewerage system (including sewer service connections) from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross-connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash water, or drainage. Inflow does not include, and is distinguished from, infiltration."*

By Memorandum from the Wisconsin Department of Natural Resources (DNR), dated December 5, 1991, a simplistic I/I Analysis can be used to determine whether or not excessive I/I exists in a sewer system. Two methods are suggested:

The first method is from *Facilities Planning;* 1981, EPA *430/9-81-002.* Figure 2 (page 22) gives criteria for judging when infiltration is non-excessive.

Figure 2
Non-Excessive Infiltration Rate

Length of Sewer Pipe	Non-Excessive Infiltration Rate
> 100,000 feet	2,000 to 3,000 gpd / in / mi
10,000 to 100,000 feet	3,000 to 6,000 gpd / in / mi
< 10,000 feet	6,000 to 10,000 gpd / in / mi

The quantity of infiltration is based upon the highest 7-day to 14-day average infiltration within a 12-month period. The infiltration allowance determined above applies to both I/I Analysis and Sewer System Evaluation Surveys (SSES).

A second method is provided in *I /I Analysis* & *Project Certification;* May, 1985, EPA:

Infiltration is non-excessive if DWF $\leq$ 120 gpcd

Inflow is non-excessive if WWF $\leq$ 275 gpcd and the treatment plant does not experience hydraulic overloads during storm events.

Inflow is excessive if WWF $\geq$ 275 gpcd or the treatment plant does experience hydraulic overloads during storm events.

DWF = Dry Weather Flow - Highest average daily flow recorded over a 7 to 14-day period without precipitation during a period of seasonal high groundwater (March through July).

WWF = Wet Weather Flow - Highest daily flow recorded during a storm event.

When calculating the various flows used to evaluate the I/I for the Kiel sanitary sewer system, the industrial flows from Land 'O Lakes, Inc., Sargento and Polar Ware were deducted from the Wastewater Treatment Facility influent flows. In the remaining sections of this Chapter, these calculated flows are referred to as the adjusted flows. A similar methodology was used in previous I/I investigations in the City of Kiel. The flows from Land 'O Lakes, Inc. are recorded on a daily basis. The wastewater flows from Sargento are metered for 1-week each month and were then averaged over each month. It was estimated that Polar Ware discharges approximately 50,000 gpd to the wastewater system based on water usage. Land 'O Lakes, Inc. and Sargento are both cheese manufacturing facilities, and Polar Ware is a metal finishing plant.

B. INFILTRATION / INFLOW ANALYSIS

1. Infiltration

For communities with 10,000 to 100,000 linear feet of sewer (Kiel has approximately 135,600 LF or 25.7-miles), infiltration is non-excessive if the infiltration rate is between 2,000 to 3,000 gpd/inch-mile. An alternate method for determining whether infiltration is excessive indicates it is not excessive if the Dry Weather Flow (DWF) is less than 120-gallons per capita per day (gpcd). Infiltration is computed during a high groundwater period using 7 to 14-days consecutive flow data after rain, but not during rain events. Appendix IV-1 contains the I/I Analysis for Kiel. Influent flow versus precipitation for 2012 through 2014 is charted on Figures IV-1, IV-2 and IV-3.

In the Kiel collection system, infiltration rates range from 4,519 to 5,932 gpd/inch-mile and from 299 to 390 gpcd, in 2012 through 2014. **Therefore, infiltration in the Kiel system is excessive.**

Overall Total Gravity Pipe Lengths
For The City Of Kiel

Dia. Of Sewer Line	Length Of Sewer Line
6-inch	549
8-inch	85,360
10-inch	20,031
12-inch	19,074
15-inch	5,398
18-inch	1,288
21-inch	1,832
24-inch	2,104
Gravity TOTAL	135,636
	25.7-miles

2. Inflow

The Inflow Analysis is also summarized in the Appendix IV-1. The maximum day flows resulting from rainfall events were analyzed from 2012 through 2014. Maximum day (adjusted) wet weather flows per capita ranged from 505 gpcd to 700 gpcd. The greatest maximum day (adjusted) wet weather flow to the Wastewater Treatment Facility was 700 gpcd in 2013.

Inflow is considered excessive if the maximum day wet weather flow exceeds 275 gpcd. **Based on this analysis, inflow to the Kiel system is excessive**.

3. Peak Flow Analysis

Wastewater Treatment Facility influent flow data was reviewed for 2012 through 2014. Maximum daily flows are tabulated below:

Year	Total WWTF Flows	Adjusted WWTF Flows
2012	2.33 mgd	1.89 mgd
2013	3.12 mgd	2.64 mgd
2014	2.86 mgd	2.70 mgd

4. Inflow Quantity / Calculation

Peak inflow is projected by taking the peak flow to the Wastewater Treatment Facility and subtracting from it the peak dry weather base flow. Peak base flow is calculated as 2.5-times the base flow (per Ten State Standards). The calculations for peak inflow are presented below. These calculations are based on Wastewater Treatment Facility flows that have been adjusted to deduct the industrial flows as previously described.

Year	Base Flow mgd	Base Flow gpm	Peak Base Flow gpm
2012	0.33	229	573
2013	0.35	243	608
2014	0.42	292	729

Year	Peak Flow gpm	Peak Base Flow gpm	Estimated I/I gpm	Annual Rainfall inches
2012	1,313	573	740	35.4
2013	1,833	608	1,225	36.7
2014	1,875	729	1,146	56.4

5. I/I Reduction Efforts

A Sewer System Evaluation Survey (SSES) was prepared for the City of Kiel by McMAHON, dated January 5, 2011, as required by the Wisconsin Department of Natural Resources (DNR) (Case I.D. 2008-NEEE-074). Flow monitoring was conducted throughout the City to identify general areas contributing higher flows during peak flow events and to help determine if the clear water flow was caused by infiltration or inflow. Identifying the type of clear water inflow assists with the investigative techniques to be used to locate the sources of the I/I. The result of the sewer system flow monitoring was summarized in the SSES. The analysis of the flow monitoring results showed that Basins #1, #2 and #8 exhibited the greatest peak flows. These basins, located primarily in the western and northern areas of the City, encompass a large portion of the City. The collection system in these basins is primarily constructed of clay pipe and a majority of the pipe was constructed prior to the 1930's.

For several years, the City of Kiel has implemented annual I/I Reduction Programs, which focus on replacing clay pipe sewer mains with PVC main, and replacing laterals from the main to the home or building. In addition, approximately ten manholes are rehabilitated annually. The Sewer Utility inspects and televises sanitary sewers and manholes on streets that are scheduled for replacement or re-pavement. The televising efforts focus on determining the location of I/I sources, and the City focuses on infrastructure replacement instead of repair to provide a long-term solution to reduce clearwater inflow. The City has developed a 5-Year I/I Reduction Plan that is used as a guide for planning annual projects. The projects that are implemented each year may change based on current needs and budget. A copy of the 5-Year I/I Reduction Plan is provided in Appendix IV-2.

6. Handling I/I Flows

The City of Kiel will continue to diligently seek out and remove clearwater inflow sources to the sanitary sewer system, but a large amount of clearwater will be conveyed to the Wastewater Treatment Facility for treatment. This will be addressed in a later chapter of this Facility Plan.

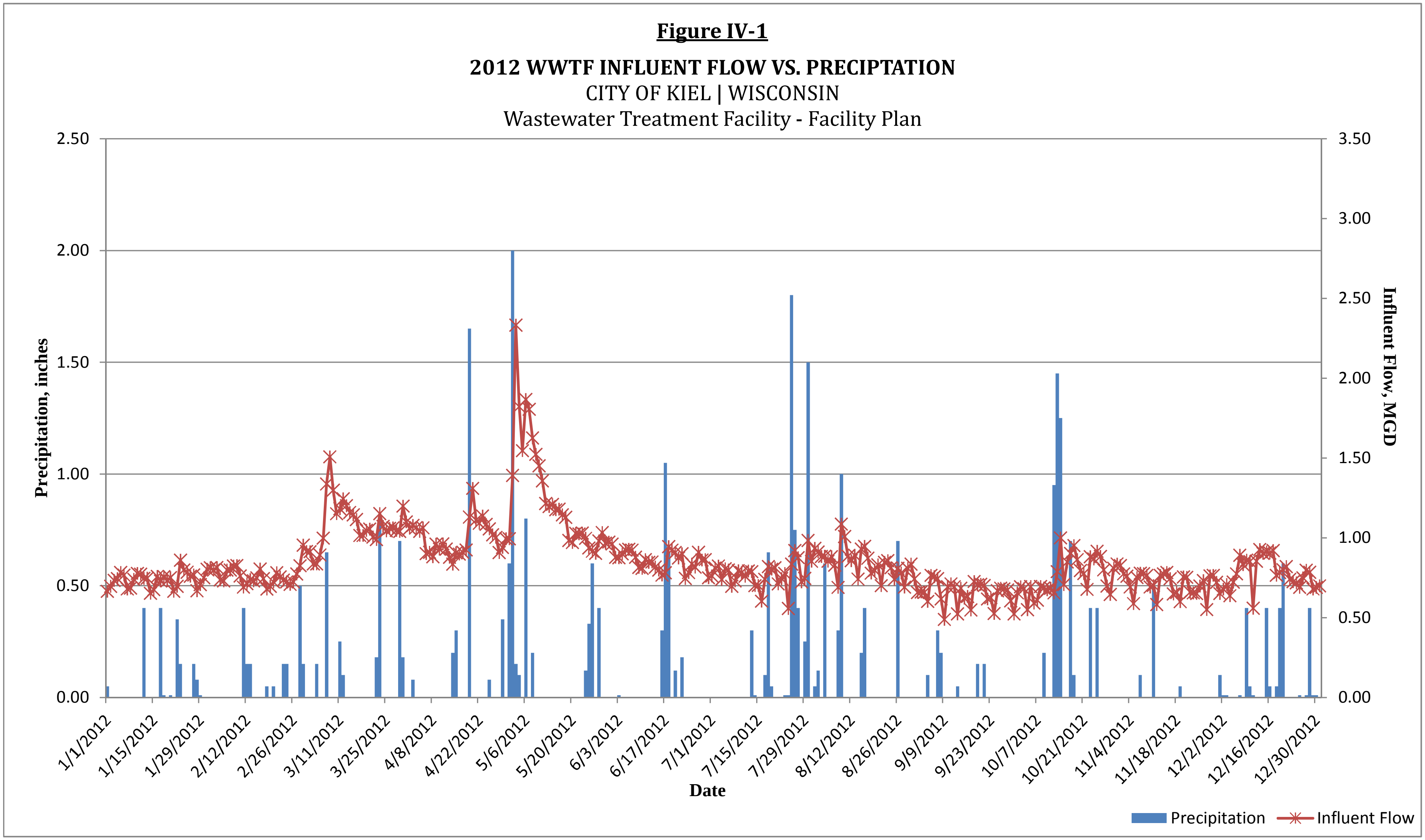
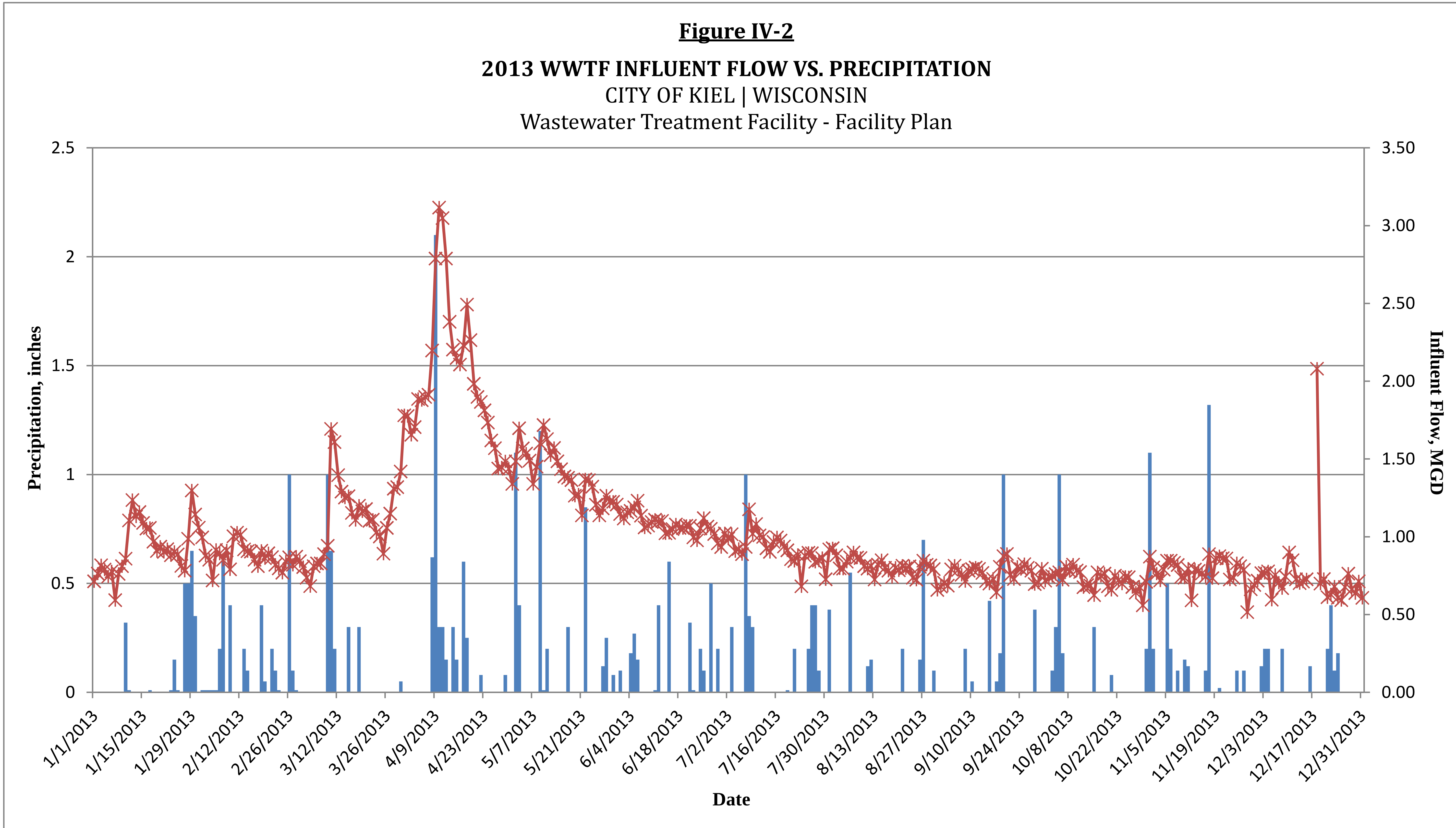


Figure IV-1
2012 WWTF INFLUENT FLOW VS. PRECIPTATION
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facility Plan
Precipitation, inches
Influent Flow, MGD
2.50
2.00
1.50
1.00
0.50
0.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1/1/2012
1/15/2012
1/29/2012
2/12/2012
2/26/2012
3/11/2012
3/25/2012
4/8/2012
4/22/2012
5/6/2012
5/20/2012
6/3/2012
6/17/2012
7/1/2012
7/15/2012
7/29/2012
8/12/2012
8/26/2012
9/9/2012
9/23/2012
10/7/2012
10/21/2012
11/4/2012
11/18/2012
12/2/2012
12/16/2012
12/30/2012
Date
Precipitation
Influent Flow



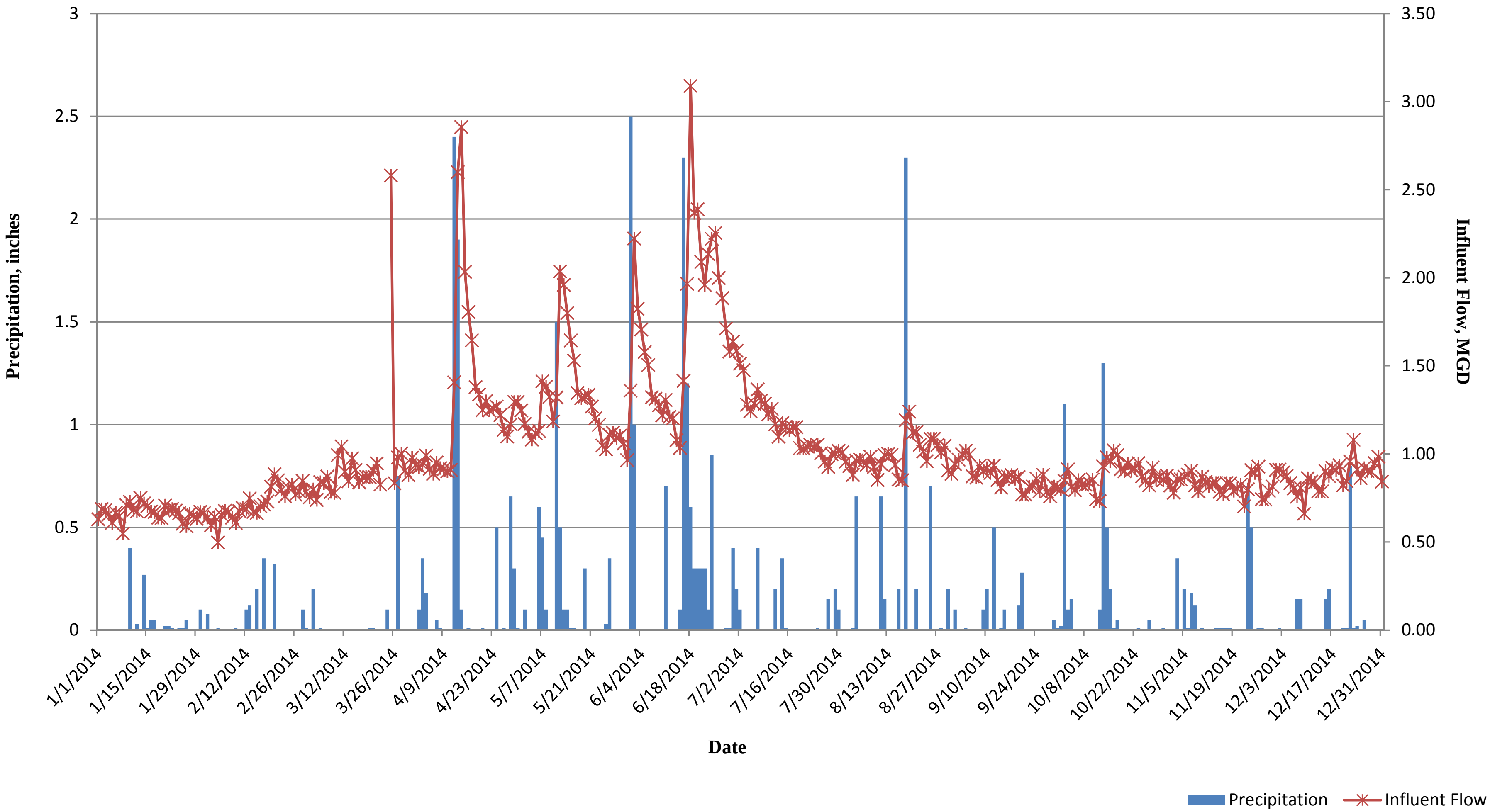
NOTE: Sanitary Sewer Overflow (SSO) occurred on April 10, 2013

Figure IV-3

2014 WWTF INFLUENT FLOW VS. PRECIPITATION

CITY OF KIEL | WISCONSIN

Wastewater Treatment Facility - Facilty Plan



APPENDIX IV-1

INFILTRATION / INFLOW (I/I) ANALYSIS

Table IV-A1-1

SUMMARY OF GRAVITY PIPE LENGTHS
& INCH-DIAMETER - MILE CALCULATIONS
CITY OF KIEL | WISCONSIN
Wastewater Treatment Facility - Facility Plan

	TOTAL IN CITY	
Diameter (inches)	**Length** (feet)	**Inch-Miles**
6	549	0.62
8	85,360	129.33
10	20,031	37.94
12	19,074	43.35
15	5,398	15.34
18	1,288	4.39
21	1,832	7.29
24	2,104	9.56
Total	**135,637**	**247.82**

Table IV-A1-2

SUMMARY OF EPA SYSTEM FOR DETERMINING CITY-WIDE INFILTRATION/INFLOW SEVERITY BASED ON POPULATION

CITY OF KIEL | WISCONSIN

Wastewater Treatment Facility - Facility Plan

		SEVERITY OF INFILTRATION				SEVERITY OF INFLOW			
Year	Estimated Population	Maximum Dry Weather Flow (mgd)	Dry Weather Flow (gpcd)	Excessive Criteria	Excessive? (Yes/No)	Maximum Wet Weather Flow (mgd)	Wet Weather Flow (gpcd)	Excessive Criteria	Excessive? (Yes/No)
2012	3,742	1.12	299	>120 gpcd	Yes	1.89	505	> 275 gpcd	Yes
2013	3,769	1.47	390	>120 gpcd	Yes	2.64	700	> 275 gpcd	Yes
2014	3,773	1.41	374	>120 gpcd	Yes	2.7	716	> 275 gpcd	Yes

1. Dry Weather Flow = Highest average daily flow recorded over a 7 to 14-day period without precipitation.
2. Wet Weather Flow = Highest daily flow recorded during a storm event.
3. All flows were adjusted to remove the Land 'O Lakes, Sargento and Polar Ware industrial flows.
4. Source of Population Estimates - Wisconsin Department of Administration

Table IV-A1-3

SUMMARY OF EPA SYSTEM FOR DETERMINING CITY-WIDE INFILTRATION SEVERITY BASED ON INCH-DIAMETER-MILES OF PIPE

CITY OF KIEL | WISCONSIN

Wastewater Treatment Facility - Facility Plan

		SEVERITY OF INFILTRATION				
Year	**Estimated Population**	**Maximum Dry Weather Flow** (mgd)	**Total City Inch-Miles**	**gpd Inch-Miles**	**Excessive Criteria**	**Excessive? (Yes/No)**
2012	3,742	1.12	247.82	4,519.36	< 2,000 gpd/inch-mile	Yes
2013	3,769	1.47	247.82	5,931.66	< 2,000 gpd/inch-mile	Yes
2014	3,773	1.41	247.82	5,689.55	< 2,000 gpd/inch-mile	Yes

1. Dry Weather Flow = Highest average daily flow recorded over a 7 to 14-day period without precipitation.
2. All flows were adjusted to remove the Land 'O Lakes, Sargento and Polar Ware industrial flows.
3. Inch-Miles are based on 2015 GIS mapping.
4. DNR Criteria: Infiltration is considered non-excessive if Dry Weather Flow (DWF) is less than or equal to 120 gpdc, or DWF is < 2,000 to 3,000 gpd/inch-mile.

DATE 5-19-15
CLIENT Kiel
PROJECT Facility Plan I/I
PROJECT NO. K0015-950262.00
BY AJV PAGE 1 OF

Population

2012 - 3,742
2013 - 3,769
2014 - 3,773

Wet Weather Flow, MGD

Adjusted to deduct Industrial Flows

2012 - 1.89 MGD May 3 Total Plant Flow 2.33 MGD
Rainfall: 5/1: 0.6"
5/2: 2.0"
5/3: 0.15"
5/4: 0.10"

2013 - 2.64 MGD April 10 Total Plant Flow 3.12 MGD SSO
Rainfall 4/8: 0.62" 4/11: 0.30"
4/9: 2.10" 4/12: 0.15"
4/10: 0.30"

2014 - 2.70 MGD April 14 Total Plant Flow 2.86 MGD
4/12: 2.40"
4/13: 1.90"
4/14: 0.10"

DATE 5-20-15
CLIENT Kiel
PROJECT Facility Plan I/I
PROJECT NO.
BY AJV PAGE ___ OF ___

Inflow Quantity / Calculation

Estimated Base Flow

	Total Plant Flow MGD		Adjusted Plant Flow MGD	
2012 Population: 3,742				
Jan.	0.74	198 gpcd	0.30	80 gpcd
Feb.	0.76	203 gpcd	0.34	91 gpcd
Sept.	0.65	174 gpcd	0.27	72 gpcd
Nov.	0.71	190 gpcd	0.33	88 gpcd
		191 gpcd	Avg	83 gpcd
2013 Population: 3,749				
Sept.	0.76	203 gpcd	0.35	93 gpcd
Oct.	0.73	195 gpcd	0.33	88 gpcd
Nov.	0.77	205 gpcd	0.38	101 gpcd
Dec.	0.75	200 gpcd	0.35	93 gpcd
		201 gpcd	Avg	94 gpcd
2014 Population: 3,773				
Jan.	0.66	175 gpcd	0.25	66 gpcd
Sept.	0.87	231 gpcd	0.44	117 gpcd
Nov.	0.82	271 gpcd	0.38	101 gpcd
Dec.	0.87	231 gpcd	0.42	111 gpcd
		227 gpcd		99 gpcd

Peak Adjusted Flow

	MGD	GPM
2012	1.89	1,313
2013	2.64	1,833
2014	2.70	1,875

Peak base flow is 2.5 times Base Flow (per Ten State Standards)

	Base Flow MGD	Base Flow GPM	Peak Base Flow GPM
2012	0.33	229	573
2013	0.35	243	608
2014	0.42	292	729

I/I: Peak flow less Peak base flow

	Peak Flow		Peak Base Flow		Estimated I/I	Annual Rainfall
2012:	1,313	-	573	=	740 gpm	35.4"
2013:	1,833	-	608	=	1,225 gpm	36.7"
2014:	1,875	-	729	=	1,146 gpm	56.4"

APPENDIX IV-2

5-YEAR INFILTRATION/INFLOW (I/I) REDUCTION PLAN

Table IV-A2-1

2015 WASTEWATER UTILITY 5-YEAR PLAN - COLLECTION SYSTEM

CITY OF KIEL | WISCONSIN

Wastewater Treatment Facility - Facility Plan

Year	Sewer	Individual Budget Estimate	Annual Budget Estimate
2015	Sewer - 600 Block of Paine & St Paul Street	$84,000	
	Manhole Rehab - 10 Structures	$12,730	
			$96,730
2016	Sewer - 9th Street	$101,110	
	Sewer - 800 Block Washington Street	$38,500	
	Sewer - 400 & 500 Blocks North Street	$38,500	
	Manhole Rehab - 10 Structures	$13,110	
			$191,220
2017	Sewer - 500 Block River Terrace	$58,000	
	Sewer - 200-500 Blocks of 6th Street	$110,000	
	Manhole Rehab - 10 Structures	$13,500	
			$181,500
2018	Sewer - 700-1100 Blocks of 6th Street	$500,000	
	Manhole Rehab - 10 Structures	$13,910	
			$513,910
2019	Sewer - 400 & 500 Blocks of Calumet	$110,000	
	Sewer - 300 Block of North Street	$35,000	
	Manhole Rehab - 10 Structures	$14,330	
			$159,330
2020	Sewer - 500 Block North Street	$58,140	
	Sewer - Kretsch Court	$25,000	
	Manhole Rehab - 10 Structures	$14,760	
			$97,900

Source: Prepared by The City Of Kiel

Sewer work includes sewer main replacement and sewer lateral replacement from the main to the home. The Property Owner is responsible for the lateral cost from the property line to the home.

- Chapter V -
FUTURE CONDITIONS

A. INTRODUCTION

To evaluate and size facilities for a Wastewater Management System, future population and wastewater flows and loadings must be estimated for the planning area. Wastewater flows and loadings are a function of the sewered population, per capita water use, commercial and industrial discharges, hauled-in wastes, and Infiltration/Inflow (I/I).

This Chapter defines the planning period, staging period, estimates future population, and estimates future flows and loadings anticipated within the planning area.

B. PLANNING PERIOD

The planning period is the time period over which the Wastewater Management System is evaluated for cost effectiveness. According to United States Environmental Protection Agency (USEPA) and Wisconsin Department Of Natural Resources (DNR) regulations, the planning period for a Facilities Plan shall be 20-years [NR 110.,09(1)]. For the purposes of this Facilities Plan, the planning period shall be to the year 2035.

C. POPULATION ESTIMATES

As previously noted in Chapter II, the Wisconsin Department Of Administration (DOA) population projections for the 10, 15 and 20-year staging period are as follows:

Year	Population Projection
2025	4,075
2030	4,195
2035	4,260

D. FUTURE FLOWS & LOADINGS

Projected future influent raw wastewater flows and loadings for the Kiel Wastewater Treatment Facility are provided in Table V-1. The flows and loadings projections were developed on the following basis:

1. Historical Wastewater Treatment Facility influent flows and loadings [Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), Total Phosphorus (P)] from 2012 through 2014 were used, as well as monitoring data from the two (2) significant industrial contributors, Land O'Lakes, Inc. and Sargento.

2. Average 'adjusted' or base residential / commercial Wastewater Treatment Facility flows and loadings were estimated using data from days during the period between January 1, 2012 and December 31, 2014, where total Wastewater Treatment Facility, Land O'Lakes, Inc. and Sargento monitoring data were all available. The Land O'Lakes, Inc. and Sargento flows and loadings, as well as hauled-in waste contributions, were subtracted from the total Wastewater Treatment Facility flows and loadings to establish a data set of 'adjusted' Wastewater Treatment Facility flows and loadings, representing the current average residential, commercial and light industrial contributions.

3. The projected increase in average residential / commercial flows and loadings was determined using an estimated population increase of 467 from 2013 to the Design Year 2035, and textbook per capita flows and loadings factors as follows:

   a. Average Flow = 100 gallons/capita/day
   b. Average BOD_5 = 0.18 lbs./capita/day
   c. Average TSS = 0.2 lbs./capita/day
   d. Average Total P = 0.007 lbs. capita/day

   Source: WEF MOP 8

4. Hauled-in waste contributions were determined based on current data and removing the portion contributed by Baker Cheese, which no longer hauls waste to the Kiel Wastewater Treatment Facility. It was assumed that the current hauled-in waste contribution (less Baker Cheese) is not expected to increase in the future, and will remain relatively stable.

5. Future average flows and loadings projections for the Land O'Lakes, Inc. facility were provided by Land O' Lakes, Inc. and are included in Table V-2.

6. Future flow projections for Sargento were initially calculated assuming a 50% increase in flow above the current average; however, this was later reduced to a 25% increase based on discussions with the City of Kiel and the current construction project initiated by Sargento. Average loadings were calculated based on current average concentrations at the future average flow. Refer to Table V-3.

7. Total projected future average flows and loadings were determined to be the sum of the adjusted Wastewater Treatment Facility flows and loadings, projected increases in average residential / commercial based on textbook value, current hauled-in waste contributions (less Baker Cheese), and future average projections for Land O'Lakes, Inc. and Sargento.

8. The future average Total Kjeldahl Nitrogen (TKN) loadings were projected based on future average flow and an average TKN concentration of 60 mg/L, which was determined based on influent TKN monitoring data from July 27 through August 6, 2015.

9. Future maximum month and maximum day flows and loadings were projected using peaking factors determined based on the current total Wastewater Treatment Facility influent data (years 2012 to 2014). Peaking factors for TKN were based on those used in

Kiel's Master Plan. It should be noted that the calculated peaking factor for maximum day TSS was 5.2; however, a more reasonable peaking factor of 2.5 was used for projecting future maximum day TSS, discounting the maximum day TSS value in 2013, which was considered an outlier and skewed the data.

Table V-1

PROJECTED 2035 FLOWS & LOADINGS

Parameter	Future
Influent Flow (mgd)	
▪ Average	1.24
▪ Maximum Month (PF = 1.75)	2.17
▪ Maximum Day (PF = 3.0)	3.75
▪ Peak (PF = 4.0)	4.96
BOD, lbs./day	
▪ Average	8,265
▪ Maximum Month (PF = 1.3)	10,745
▪ Maximum day (PF = 2.6)	21,489
TSS, lbs./day	
▪ Average	6,424
▪ Maximum Month (PF = 1.5)	9,636
▪ Maximum day (PF = 2.5)	16,060
Total P, lbs./day	
▪ Average	179
▪ Maximum Month (PF = 1.3)	233
▪ Maximum day (PF = 3.5)	627
TKN, lbs./day	
▪ Average	620
▪ Maximum Month (PF = 1.6)	993
▪ Maximum day (PF = 2.3)	1,427

Table V-2

LAND O'LAKES, INC. FUTURE FLOWS & LOADINGS

	Weekly Avg.	Daily Max.
Flow, gpd	436,364	523,636
BOD, lbs./day	4,000	8,000
TSS, lbs./day	2007	4,015
P, lbs./day	127	218

[*The remainder of this page was left blank intentionally*.]

Table V-3

SARGENTO FUTURE FLOWS & LOADINGS PROJECTIONS

	2012	2013	2014	Average	PF	Future
Influent Flow, mgd						
▪ Average	0.063	0.066	0.073	0.067		0.091
▪ Maximum Month	0.083	0.084	0.106	0.091	1.35	0.123
▪ Maximum Day	0.105	0.123	0.140	0.123	1.82	0.166
BOD, mg/L Average	2,404	2,209	2,058	2,224		
BOD, lbs./day						
▪ Average	1,454	1,351	1,393	1,399		1,692
▪ Maximum Month	2,229	2,094	2,344	2,222	1.59	2,688
▪ Maximum Day	6,235	6,107	7,708	6,683	4.78	8,082
TSS, mg/L (Average)	2,458	1,859	1,352	1,880		
TSS, lbs./day						
▪ Average	1,533	1,170	924	1,209		1,430
▪ Maximum Month	4,190	2,023	2,259	2,824	2.34	3,341
▪ Maximum Day	20,168	8,256	10,089	12,838	10.62	15,189
Total P, mg/L (Average)	23	19	18	20		
Total P, lb./day						
▪ Average	13	11	12	12		15
▪ Maximum Month	17	18	19	18	1.50	23
▪ Maximum Day	35	45	36	39	3.22	49

E. DESIGN PERIOD

The design period is the time period in which the Wastewater Management System is expected to reach design capacity. For Wastewater Treatment Facilities, NR 110.09(2)(j)4.b. recommends three (3) alternative staging periods of 10, 15 and 20-years be evaluated for cost effectiveness, based upon the following:

Table V-4

STAGING PERIODS

	Flow Growth Factor	Maximum Initial Staging Period
1.	Avg. Design Flow < 1.3-Times Initial Flow	20-years
2.	Avg. Design Flow 1.3 to 1.8 Times Initial Flow	15-years
3.	Avg. Design Flow > 1.8 Times Initial Flow	10-years

Utilizing a 20-year planning period results in a flow growth factor of 1.24/0.862 = 1.43.

When considering a 15-year staging period, the only flow related change is due to the reduction in population of 65 people, when compared to the 20-year period. The corresponding reduction in flow is equal to only 6,500 gpd, and results in the same flow growth factor of 1.2335/0.862 = 1.43.

Therefore, it can be concluded that the Wastewater Treatment Facility sizing is the same for both the 15-year and 20-year design periods, with only a 6,500 gpd (0.5%) difference in flow.

NR 110.09(2)j(4)a states '*The Owner shall analyze at least 3 alternative staging periods (10-years, 15-years and 20-years) and the least costly (i.e., total present worth or average annual cost) staging period shall be selected*.' When considering the size of unit treatment processes for the 15-year and 20-year design periods, they may be considered to be equal. When comparing the average annual cost of a project, a 20-year project has a lower annual cost, compared to a 15-year project.

Therefore, the 20-year staging period will be utilized for design purposes.

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F. DESIGN CAPACITY

The current and proposed future Wastewater Treatment Facility design criteria are summarized in Table V-5.

Table V-5

PROPOSED WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Current Design	2035
Population	N/A	4,260
Flow (mgd)		
▪ Average	0.862	1.24
▪ Maximum Month	1.214	2.17
▪ Maximum Day	3.095	3.75
▪ Peak Hour	4.26	4.96
Biochemical Oxygen Demand (BOD) (lbs./day)		
▪ Average	6,000	8,265
▪ Maximum Month	6,280	10,745
▪ Maximum Day	9,250	21,489
Total Suspended Solids (TSS)		
▪ Average	2,842	6,424
▪ Maximum Month	4,480	9,636
▪ Maximum Day	7,420	16,060
Total Kjehldahl Nitrogen (TKN)		
▪ Average	N/A	620
▪ Maximum Month	N/A	993
▪ Maximum Day	N/A	1,427
Phosphorus (P)		
▪ Average	145	179
▪ Maximum Month	184	233
▪ Maximum Day	247	627

Capacity limitations of existing unit processes are summarized in Table V-6.

Table V-6

CAPACITY LIMITATIONS

Item	Current Capacity	Current NR 110 Requirement	Future Capacity Requirement
River Road Pump Station	2.42 mgd	4.26 mgd	4.96 mgd
Screening	4.3 mgd	4.26 mgd	4.96 mgd
Primary Clarifiers	1.23 mgd Avg. 1.85 mgd Peak	0.862 mgd, Avg. 4.26 mgd, Peak	1.24 mgd Avg. 4.96 mgd Peak
16-inch PE Piping	2.0 mgd	---	4.96 mgd
Aeration Capacity	4,970 lbs./day	4,970 lbs./day	8,265 lbs./day
16-inch MLSS Piping	2.0 mgd	---	4.96 mgd
Final Clarifiers	2.513 mgd Peak	4.26 mgd Peak	4.96 mgd Peak
RAS Pumping	2.016 mgd	1.72 mgd	2.48 mgd
Tertiary Filters	2.0 mgd	4.26 mgd	4.96 mgd
Disinfection	2.53 mgd, Peak	4.26 mgd Peak	4.96 mgd Peak

- Chapter VI -
ALTERNATIVES EVALUATION & PRELIMINARY SCREENING

A. INTRODUCTION

Prior to evaluating specific wastewater treatment alternatives, wastewater management options require evaluation on the planning level. The options typically include the 'Regional Treatment' alternative and the 'No Action' alternative.

The City of Kiel has recently evaluated joint treatment with the City of New Holstein, and determined it was not cost effective. Therefore, Regional Treatment as an option will be dropped from further consideration, as there are no other suitable regional possibilities.

This Chapter evaluates and summarizes planning level alternatives. A preliminary screening is undertaken to identify those alternatives that are applicable to the Kiel facilities. Those alternatives surviving the screening process are evaluated for cost effectiveness in Chapter VII. Each unit process will be discussed, as well as the need or lack thereof for expansion or modification.

B. 'NO ACTION' ALTERNATIVE

The 'No Action' alternative consists of maintaining 'status quo' conditions at the Wastewater Treatment Facility. Under this alternative, no improvements or modifications would be recommended.

The current treatment facilities have reached or exceeded their design capacities for numerous unit processes. Hydraulic limitations exist, hampering the treatment process as flows increase. Many unit processes and equipment have reached or exceeded their service life, and are in need of repair or replacement.

Therefore, the 'No Action' alternative is impractical, and will be dropped from further consideration.

C. LIQUID TRAIN TREATMENT ALTERNATIVES

1. <u>General</u>

The Wisconsin Department Of Natural Resources (DNR) is considering changes to the City of Kiel's Wisconsin Pollutant Discharge Elimination System (WPDES) permit. Changes include Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Ammonia, Phosphorus (P) and Dissolved Oxygen (DO). Treatment system improvements will be evaluated to meet the new, changed limits being proposed. Potential restrictions regarding temperature and chlorides may need to be addressed with a variance, in the event they are not dropped from consideration by the DNR; data suggests a temperature limitation is not warranted, and chlorides are not removed by conventional technologies.

2. Pump Station

The River Road Pump Station utilizes three (3) dry pit pumps with a combined pumping capacity of 4.27 mgd. The firm capacity, with the largest pump out of service, is 2.42 mgd. In addition to the three (3) pumps in service, the Pump Station also has two (2) spare pumps stored in the Pump Room. This allows for a quick change out of a pump in the event of a failure.

Flow data from the past 4-years indicates the peak hour flow rate to the River Road Pump Station is 1.58 mgd (refer to Appendix VI-1 for data). This required pumping rate is less than the projected future peak hour flow rate of 4.96 mgd. The City of Kiel has an on-going Infiltration/Inflow (I/I) Reduction Program, as noted in Chapter IV. The City of Kiel intends to continue with I/I reductions within the collection system and, as such, believes the peak hour flows can be held to the current levels.

As the Pump Station has two (2) spare pumps available, and the City of Kiel has an I/I Reduction Program, and the current peak hour flows are less than the Pump Station capacity, the City of Kiel will forego any change in the pumping capacity at this time. Should conditions warrant at a future date, the City of Kiel may expand pumping capacity at that time.

3. Headworks

The building encompassing the fine screens is a Class I, Division 1, Classified Hazardous Area. The electrical systems, including controls, need to be upgraded to meet safety requirements. The City of Kiel intends to address the issue separately, and not include it in the treatment system upgrade project.

The firm capacity of the fine screens is close to the future peak hour flow rate. As such, it is not recommended to replace or upgrade the existing fine screens at this time. They are serviceable, and the combined capacity of both screens is sufficient for current peak hour events. The 4.30 mgd capacity of the screens exceeds the 4.27 mgd River Road Pump Station capacity. Additionally, the screens tilt out of the flow stream to provide an emergency bypass. In the event of a major equipment failure in the future, a larger capacity screen should be installed.

The ability of the grit chamber to effectively remove grit is unknown. A very small amount of grit is removed from the influent flow on a daily basis. Considering the surge in flows during rain events, one would expect a larger quantity. The grit classifier is serviceable at this time. When the digesters are taken out of service and cleaned out, the quantity of grit in the bottom of the vessels can be quantified and consideration of replacing the aerated grit system with a more efficient vortex type grit system may be evaluated. Upon failure of the current grit classifier, replacement with a grit washer should be considered at that time.

4. Primary Clarifiers

Continued use of the primary clarifiers will require repair of the structural cracks to extend the service life of the concrete. Mechanically, new mechanisms with rapid sludge removal headers and new drives will replace the existing equipment.

The weirs and baffles will be considered for replacement, as well. The projected weir overflow rate at average design conditions is 5,492 gpd/LF, which is below the NR 110 maximum value of 10,000 gpd/LF.

The projected surface settling rate at average conditions is 1,089 gpd/sq.ft., which is close to the NR 110 maximum value of 1,000 gpd/sq.ft.; the peak hour projected value is 4,114 gpd/sq.ft., which exceeds the NR 110 maximum value of 1,500 gpd/sq.ft. However, the activated sludge process, final clarifiers and tertiary filters follow the primary clarifiers, and any inefficiencies with the primaries may be accommodated in downstream processes. As such, primary clarifier removal efficiencies of 50% for TSS and 21% for BOD will be utilized for design of downstream processes. Additionally, 3% solids concentration will be assumed for primary sludge generated with the new sludge removal equipment.

Redundant, dedicated sludge pumps should be provided. Pumps should be positive displacement type for use with the 3% primary solids that may be expected with the future upgrades.

5. Activated Sludge

Expansion of the existing aeration system will be required to effectively treat the projected flows and loadings for the next 20-years. Influent / effluent piping to / from the aeration basins will need to have an increase in hydraulic capacity. Flow splitting at the existing splitter box will need to be addressed, as well. An additional aeration tank may be added to each of the three (3) trains.

Continued use of aeration tankage will require structural repairs to concrete, as necessary to extend their service life.

The buried air main, which leaks, should be replaced with an overhead, stainless steel air main. The old, 100-HP blowers are recommended to be replaced with more energy efficient units. Continued use of the 150-HP blowers is recommended, as they can provide on-line back-up to meet firm capacity requirements, while new energy efficient blowers provide duty service.

Retrofitting the aeration system with an Integrated Film Activated Sludge (IFAS) system should be considered as an alternative to increasing the existing conventional activated sludge system. An IFAS system combines both attached biological growth and suspended biological growth treatment in the same tank. Media is added to the aeration tankage, which provides a surface for growth of additional attached biomass. Advantages of IFAS include:

- Allows capacity expansion with same aerobic volume.
- Increases Biological Nutrient Removal (BNR).
- Improves solids settleability.
- Greater resistance to hydraulic washout.
- Increased resilience to slug loadings.
- Reduced solids loading to final clarifiers.

Consideration should be given to Membrane Bio-Reactor (MBR) systems. Factory-assembly of submerged units consisting of air diffusers assemblies, membrane cassettes, and common permeate manifolds provide simpler installation in the field.

MBR systems operate at a higher mixed liquor concentration, and require a significantly smaller footprint. Advantages of an MBR system include:

- Smaller footprint; fits in existing tankage.
- Multiple barriers; membranes and biofilm.
- Physical barrier to exclude viruses, bacteria and cysts; reducing need to expand disinfection system or existing filters.
- No need to rebuild or expand final clarifiers.

With the use of an expanded conventional activated sludge system, and with an IFAS system, the existing final clarifiers will be utilized. Replacement of the mechanisms and drives, weirs and baffles is required. In addition, two (2) new 40-foot diameter final clarifiers are required to handle the projected hydraulic capacity and solids loading. Consideration should be given to replacing the Fiberglass-Reinforced Plastic (FRP) domes, as well. Redundant Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) pumps are recommended. Final clarifiers are not required for the MBR alternative.

6. Tertiary Filtration

The capacity of the filter system must be increased, and efficiencies increased to allow removal of Phosphorus. The ability to remove Phosphorus down to 0.1 mg/L at 4.96 mgd in a retrofit of the existing sand filters is highly unlikely and impractical. Options utilizing ballasted high rate sedimentation (Actiflo and Co-Mag) do not allow for installation within the existing filter footprint while providing system redundancy, and are dropped from consideration. Instead, installation of disc type filters in the filter footprint will be evaluated with the expanded conventional activated sludge and IFAS options. Filters are not required with the MBR option.

7. Disinfection

The detention time in the chlorine contact tanks is 70-minutes at the 1.24 mgd average design flow, while it is only 17.5-minutes at the peak hour flow. NR 110.23(2)(e)2 notes that contact tanks shall "*…be sized to provide a detention time of 60-minutes at average design flow or 30-minutes at maximum hour design flow*."

The existing contact tanks comply with the 60-minute/average design flow requirement. Additionally, a filtration step precedes the disinfection system, which minimizes the solids reaching the contact tanks. Chlorine dosage (and de-chlorine dosage) can be adjusted as necessary to achieve adequate kill. The current facilities have a good record of compliance with disinfection requirements. Therefore, it is not recommended that the disinfection system be expanded due to the future peak hour flows.

Separation of the chlorine gas and sulfur dioxide gas systems should be provided, as they are not compatible.

8. High Strength Waste

The high strength waste system should be provided with an automated screening system to replace the manual bar rack. This would remove more undesirable trash and rocks, and improve Operator efficiency. The City of Kiel will evaluate screening alternatives as a separate maintenance project, and not part of the Wastewater Treatment Facility upgrade. Flow monitoring of incoming loads should be provided, along with consideration of an automated card reader to permit only authorized users to unload, quantify the amount / type of waste received, and facilitate billing. Dedicated pumps to feed high strength waste to the digester and/or Headworks, and septage/holding tank wastes to the Headworks, should also be considered.

D. SOLIDS TRAIN TREATMENT ALTERNATIVES

1. Anaerobic Digesters

Optimization of the biogas produced is currently underway via a project funded in part by the Focus On Energy program. A biogas conditioning system and a 280 kW engine / generator have been purchased utilizing a Focus On Energy grant. The resultant project will reduce electrical costs and heating costs associated with the digesters. The project is self-funded without the use of Clean Water Fund (CWF) financing, and is not increasing user rates charged to customers. The engine/generator can utilize up to 73 scfm of biogas. To produce this volume of biogas, additional sources of high strength waste will be received at the Wastewater Treatment Facility.

To produce sufficient volumes of biogas on a daily basis for operation of the engine / generator, the anaerobic digestion process will need to be optimized. With additional High Strength Waste (HSW) volume required in the future, limited space is available within the digesters. To maximize the space available, both digesters will be operated as primary digesters, and consideration should be given to pumping only primary sludge and high value waste streams to the process.

Current practice includes co-thickening WAS in the primary clarifiers. The resultant primary sludge is typically 1.5% to 2.5% total solids. Continuing to co-thicken WAS in the future results in a significant portion of the digester capacity unavailable for a more desirable HSW stream. The maximum month digester Hydraulic Retention Time (HRT) is projected to be less than 14-days with continued co-thickening WAS and no additional HSW added.

Mechanically thickening the WAS stream prior to digestion would reduce the volume and increase the digester HRT, leaving a small increase in volume available for HSW. However, mechanically thickening WAS and anaerobically digesting WAS has disadvantages:

- Only a small increase in digester volume is made available.
- Significant costs are associated with thickening equipment, pumps, polymer system, and tankage.
- A building enclosing the equipment is required for protection from the elements.
- Formation of struvite, which has previously caused pipe plugging, will continue.
- Phosphorus removed in the Enhanced Biological Phosphorus Removal (EBPR) process will be released, requiring removal again.

Completely removing the WAS stream from the anaerobic digestion process increases the HRT, maximizing room in the digesters for additional HSW streams for biogas production.

Therefore, the continuation of anaerobically digesting WAS will be dropped from further consideration. Treatment alternatives instead will consider thickening WAS while keeping it aerobic, and combining it with anaerobically digested primary sludge and HSW streams. The combined sludges will be thickened and sent to a dewatering step, followed by a Class A stabilization process.

Both digester covers are in need of replacement. Steel gas holding covers versus membrane type gas holding covers may be considered.

Due to limited room on the site, rooftop linear motion mixers will be provided on each digester cover. A new Digester Equipment Room will be constructed to enclose recirculation and transfer pumps and heat exchanger equipment. The existing flare will be relocated to provide the necessary setback distance. New instrumentation will be provided to optimize operation of the digestion and gas utilization systems.

Structural cracks and brick maintenance are required on the digester exterior walls. Insulated wall panels may be an option in lieu of brick maintenance for a long-term repair. The City of Kiel intends to address this issue separately, and not include it in the treatment system upgrade process.

2. Thickening

The existing sludge holding tanks provide a location to store WAS and anaerobically digested sludge prior to dewatering. To optimize the sludge handling systems downstream, thickening will be provided. Gravity Belt Thickeners (GBT's), drum thickeners, centrifuges and membranes could be considered for thickening. However, the sludge holding tanks are currently set-up for decanting. A solids concentration of 2% is achievable via the decanting option. The additional thickening of the sludge with a mechanical process does not provide significant benefit when coupled with a dewatering step. Therefore, until such point in time that additional storage volume is required, thickening will not be provided.

3. Dewatering

Space limitations in the area currently occupied by the 2-meter belt press preclude using the same technology in the future, when redundant units are provided. Screw press technology and centrifuges, which have a smaller footprint, will be considered for dewatering.

4. Class A Process

For as long as it is serviceable, continued use of the existing pasteurization process is recommended, as the basic infrastructure is in place, and a readily stackable and disposable biosolids product is produced. Presently, power plant bottom ash is added in excess of that required for stabilization in order to produce a stackable biosolids product. There is no cost to the City to acquire the bottom ash. When combined in the pasteurization process, the volume of cake produced is doubled. This results in a need to expand the Biosolids Storage Facility in the future should the RDP process be continued. In the event the pasteurization process becomes no longer serviceable, alternative technologies, such as dryers, should be considered, as they also can produce a stackable, readily disposable product. Belt dryers, which utilize hot air, will be considered, as they fit within the space limitations of the existing Solids Handling Building. The resultant Class A process with a dry solids content in excess of 90% will allow continued use of the existing Storage Facility without the need for expansion.

The December 2014 City of Kiel '*Wastewater Treatment Facility Master Plan'*, prepared by Donohue, evaluated dryers versus the current RDP system. Based on the Total Present Worth and other advantages of a dryer, compared to the lime stabilization systems, the dryer system was recommended for the future Class A process.

Additionally, continued use of systems utilizing lime or fly ash will likely result in premature equipment failures and corrosion due to lime/ash dust, which is air-borne. Treatment Facility Staff has experienced stand-by blowers that have the rotary lobes ‘locked’ in place due to corrosion, which is due to air-borne dust from the existing Class A system.

To avoid future issues related to dust control and the need to expand the Cake Storage Facility, systems utilizing lime or ash will be dropped from future consideration. Like the 2014 Master Plan, we concur with the recommendation of a dryer for the Class A process.

Optimization of the biosolids processing systems will include extending the hours of operation during a 3 or 4-day work week. By operating the systems beyond a typical 8-hour day, the size of the equipment can be reduced and start-up/shut-down inefficiencies minimized.

E. SUMMARY OF ALTERNATIVES

Primary clarifiers will be refurbished, including new mechanisms and drives. Weirs and baffles will be replaced, and new dedicated Positive Displacement (P.D.) sludge pumps will be provided for each clarifier.

Expanding the activated sludge process to include an additional treatment cell per each of the three (3) trains, and two (2) new 40-foot diameter final clarifiers is Option #1. Retrofitting the existing trains with IFAS and adding the two (2) final clarifiers is Option #2. Option #3 utilizes MBR technology installed in the last cell of the south train, along with modifications to the north trains; no clarifiers are required for Option #3. Increases in hydraulic capacity from the primary clarifiers to the activated sludge tanks, and from the activated sludge tanks to the downstream process, are included in all options. Air main replacement and new aeration blowers are also included in each option. New sludge pumps are required for each option, as well.

Replacement of the existing filters with disk type filters is required for activated sludge Options #1 and #2. MBR technology does not require filters.

Separation of the chlorine gas and sulfur dioxide gas systems is required for all options.

Dedicated pumping of HSW and septage will be provided to direct flow to the Headworks and/or anaerobic digesters.

Additional space will be added to the existing Administration Building garage area to accommodate a growing need for maintenance and storage of vehicles and equipment.

The anaerobic digesters will be upgraded with new covers and mixers, an additional boiler heat exchanger, dedicated sludge pumps, and optimized for use with the Combined Heat & Power (CHP) system.

The use of centrifuges or screw presses will be evaluated for dewatering biosolids. The existing RDP system will be utilized for the Class A process until such time it is no longer serviceable. At this time, replacement of the RDP pasteurization system with a belt dryer will be considered.

Electrical and control systems throughout the Wastewater Treatment Facility will be upgraded. The Supervisory Control & Data Acquisition (SCADA) system will also receive an upgrade to current technology.

F. PROPOSED DESIGN CRITERIA

Proposed criteria for individual unit processes are summarized in Table VI-1.

Table VI-1

PROPOSED WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	**Proposed Design 2035**
INFLUENT PUMPING (River Road Lift Station)	
▪ Number Of Pumps	3
▪ Capacity, each pump, gpm	1,150
▪ Station Firm Capacity, mgd	2.42
▪ Type Of Pump	Dry Pit-Immersible
INFLUENT SCREENING	
▪ Number Of Units	2
▪ Type	Spiral
▪ Capacity, each unit, mgd	4.30
▪ Clear Opening, inch	¼
GRIT REMOVAL	
▪ Type Of Unit	Aerated
▪ Number Of Units	1
▪ Capacity, each unit, mgd	6.2
PRIMARY CLARIFIERS	
▪ Number Of Units	2
▪ Diameter, each unit, feet	2@28
▪ Sidewater (SWD) Depth, each unit, feet	2@12.31
▪ Surface Overflow Rate, gpd/sq.ft.	
▪ Average Flow, 1.34 mgd	2@1,089
▪ Peak Hour Flow, 5.06 mgd	2@4,114
▪ Weir Loading Rate, gpd/ft.	
▪ Average Flow, 1.34 mgd	2@4,542
▪ Detention Time, hours	
▪ Average Flow, 1.34 mgd	2@2.0
▪ Maximum Day Flow, 3.85 mgd	2@0.7
▪ Removal Efficiencies	
▪ BOD, %	21
▪ SS, %	50
▪ TKN	10
▪ Primary Sludge, lbs./day	
▪ Average Day	3,482
▪ Maximum 30-Day	5,088

Table VI-1

PROPOSED WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
PRIMARY CLARIFIERS (continued)	
▪ Volatile Sludge, lbs./day	
▪ Average Day (78% VSS)	2,716
▪ Maximum 30-Day (78% VSS)	3,969
▪ Primary Sludge, gpd @ x% solids	3
▪ Average Day	13,917
▪ Maximum 30-Day	20,336
SECONDARY TREATMENT SYSTEM	
▪ Design Loadings To Secondary, lbs./day	
▪ Biochemical Oxygen Demand (BOD)	
▫ Average Day	6,806
▫ Maximum Day	17,253
▫ Maximum 30-Day	8,765
▪ Total Kjeldahl Nitrogen (TKN) (includes sidestreams), lbs./day	
▫ Average Day	775
▫ Maximum Day	1,783
▫ Maximum 30-Day	1,240
▪ Phosphorus (P), lbs./day	
▫ Average Day	183
▫ Maximum Day	595
▫ Maximum 30-Day	233
▪ Existing Aeration Tanks, size, ft.	6@65x32 + 3@64x28
▪ Proposed Aeration Tanks, size, ft.	2@65x32 + 1@64x28
▪ SWD, ft.	14
▪ Total Tank Volume, cu.ft.	333,312
▪ Anoxic Selector, ft.	2@40x32 + 1@48x28
▪ Anoxic Volume, cu.ft.	51,520
▪ Anoxic / Aerobic Ratio	0.1828
▪ Aerobic Volume, cu.ft.	281,792
▪ BOD Loading, lbs./1,000 cu.ft.	
▪ Average Day	24.1
▪ Maximum 30-Day	31.1
▪ Design MLSS, mg/L	
▪ Average	3,275
▪ Maximum Month	3,510
▪ Design F:M	
▪ Average	0.10
▪ Design Sludge Retention Time (SRT), Days	
▪ Average	20
▪ Volatile Solids, %	75%
▪ Total Sludge Production, lbs. SS/lb. BOD	0.67
▪ Secondary Sludge, lbs./day	
▪ Average	4,560
▪ Maximum 30-Day	5,873
▪ WAS To Dewatering, gpd @ 1%	
▪ Average	54,676
▪ Maximum Month	70,420
▪ Oxygen Requirements, lbs./day @ 1.1 lb. O2/lb.	

Table VI-1

PROPOSED WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
SECONDARY TREATMENT SYSTEM (continued)	
▪ BOD Applied & 4.6 lb. O2/lb. TKN Applied	
▪ Average Day	11,052
▪ Maximum Day	27,180
▪ Maximum Month	15,345
▪ Air Requirements, scfm	
▪ Average Day	4,075
▪ Maximum Day	11,348
▪ Maximum Month	5,921
▪ Blowers	
▪ Number of Existing PD Blowers	2
▪ Capacity, each existing unit, scfm	2,160
▪ Number Of New PD Blowers	3
▪ Capacity, each new unit, scfm	3,800
▪ Discharge Pressure, psig	8.0
▪ Firm Capacity, scfm	11,920
SECONDARY CLARIFIERS	
▪ Number Of Units	4
▪ Diameter, ft.	4@40
▪ SWD, ft.	14.25
▪ Surface Settling Rate, gpd/sq.ft.	
▪ Average Flow, 1.24 mgd	247
▪ Peak Hour Flow, 4.96 mgd	987
▪ Weir Loading, gpd/ft.	
▪ Average Flow, 1.24 mgd	1,396
▪ Peak Hour Flow, 4.96 mgd	5,586
▪ Detention Time, hours	
▪ Average Flow, 1.24 mgd	10.4
▪ Peak Hour Flow, 4.96 mgd	2.6
▪ Solids Loading, lbs./hour/sq.ft.	
▪ Average Flow, 1.24 mgd	0.28
▪ Peak Hour Flow, 4.96 mgd	1.20
FILTERS	
▪ Filtration Rate, gpm/sq.ft.	
▪ Average Flow, 1.24 mgd (firm)	0.92
▪ Peak Hour Flow, 4.96 mgd (firm)	3.66
DISINFECTION	
Number Of Tanks	2
Total Volume, gallons	60,250
Detention Time, minutes	
▪ Average Flow, 1.24 mgd	70.0
▪ Peak Hour Flow, 4.96 mgd	17.5
ANAEROBIC DIGESTION	
▪ Number Of Digesters	
▪ Primary	2
▪ Secondary	0
▪ Diameter, feet	2@45

Table VI-1

PROPOSED WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
ANAEROBIC DIGESTION (continued)	
▪ Maximum SWD, feet	
▫ North Digester	26
▫ South Digester	21
▪ Maximum Volume, gallons	
▫ North Digester	342,537
▫ South Digesters	269,652
Total	612,189
▪ Mixing System	Linear Motion
▪ Cover Type	
▫ North Digester	Gas Holder
▫ South Digester	Gas Holder
▪ Maximum Month HRT, days	
▫ North Digester	8.4
▫ South Digester	6.6
Total	15.0
▪ Digestion Capacity, gpd	40,812
▪ Maximum Month VSS Loading, lbs. VSS/KCF	49.7
▪ VSS Destruction, %	50
▪ Heat Exchanger Capacity, gpd	41,000
▪ Sludge To Dewatering, lbs./day	
▫ Average	2,396
▫ Maximum Month	3,329
▪ Anaerobic Sludge To Dewatering, gpd @ 1%	
▫ Average	29,717
▫ Maximum Month	33,436
SLUDGE HOLDING TANKS	
▪ Number Of Tanks	2
▪ Size, ft.	2 @ 62'x 25'x 16' SWD
▪ Volume, gallons, each	185,500
▪ Volume, gallons, total	371,000
▪ Solids, % After Decanting	2.0
▪ 2% Sludge From Outside Sources, gallons/week	10,000
▪ Sludge To Dewatering, lbs./day	
▫ Average	7,194
▫ Maximum Month	9,440
▪ Sludge To Dewatering, gpd @ 2%	
▫ Average	43,626
▫ Maximum Month	53,357
SLUDGE DEWATERING	
▪ Number Of Units	2
▪ Capacity, each	
▫ gpm	76
▫ lbs./hour	750
▪ Hours Of Operation/Day	24
▪ Average Days Of Operation/Week	<3
▪ Cake Solids, %, minimum	20

Table VI-1

PROPOSED WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
CLASS A DRYING PROCESS (Existing RDP System)	
▪ Number Of Units	1
▪ Minimum % Solids	49
▪ Hours Of Operation/Day	24
▪ Days Of Operation/Week	<3
▪ Dried Biosolids/Year, cu.yds.	9,147 cu.yds.
▪ Stack Height @ 180-Days, ft.	13'-2"
CLASS A DRYING PROCESS (New Dryer)	
▪ Number Of Units	1
▪ Minimum % Solids	92
▪ Hours Of Operation/Day	24
▪ Days Of Operation/Week	<3
▪ Dried Biosolids/Year, cu.yd.	1,617
▪ Stack Height @ 180-Days, ft.	2'-4"

APPENDIX VI-1

PEAK HOUR FLOW DATA

	A	B	C
1	Date	MGD	MGD
2		Influent Flow	Effluent Flow
3		2	114
4	4/10/2013	3.12	3.12
5	6/18/2014	3.09	3.09
6	4/11/2013	3.05	3.05
7	4/14/2014	2.86	2.86
8	4/12/2013	2.79	2.79
9	4/9/2013	2.79	2.79
10	4/13/2014	2.60	2.60
11	3/25/2014	2.58	2.58
12	4/26/2011	2.50	2.50
13	4/18/2013	2.49	2.49
14	6/20/2014	2.39	2.39
15	4/13/2013	2.38	2.38
16	4/22/2011	2.37	2.37
17	6/19/2014	2.37	2.37
18	5/3/2012	2.33	2.33
19	4/23/2011	2.30	2.30
20	4/19/2013	2.26	2.26
21	6/25/2014	2.26	2.26
22	4/17/2013	2.23	2.23
23	6/2/2014	2.22	2.22
24	6/24/2014	2.22	2.22
25	4/14/2013	2.20	2.20
26	4/8/2013	2.20	2.20
27	4/21/2011	2.19	2.19
28	4/27/2011	2.17	2.17
29	4/15/2013	2.15	2.15
30	6/23/2014	2.13	2.13
31	4/16/2013	2.11	2.11
32	6/21/2014	2.09	2.09
33	12/18/2013	2.08	2.08
34	5/12/2014	2.04	2.04
35	4/15/2014	2.03	2.03
36	4/28/2011	2.00	2.00
37	6/26/2014	2.00	2.00
38	4/20/2013	1.98	1.98
39	4/24/2011	1.97	1.97
40	6/17/2014	1.97	1.97
41	5/13/2014	1.96	1.96
42	6/22/2014	1.96	1.96
43	4/16/2011	1.96	1.96
44	4/3/2011	1.93	1.93
45	4/25/2011	1.92	1.92
46	4/7/2013	1.91	1.91
47	4/29/2011	1.90	1.90
48	4/6/2013	1.90	1.90
49	4/21/2013	1.90	1.90
50	4/4/2013	1.89	1.89
51	6/27/2014	1.88	1.88
52	4/5/2013	1.88	1.88
53	4/4/2011	1.87	1.87
54	4/22/2013	1.87	1.87
55	5/6/2012	1.87	1.87
56	4/20/2011	1.83	1.83

← MAX DAY (MGD)

Max Hour Flow

Date	Time	Raw Influent (GPM)
4/9/2013	0:03:00	1430
4/9/2013	0:18:00	1410
4/9/2013	0:33:00	1520
4/9/2013	0:48:00	1405
4/9/2013	1:03:00	1520
4/9/2013	1:18:01	1435
4/9/2013	1:33:00	1380
4/9/2013	1:48:00	1550
4/9/2013	2:03:00	1495
4/9/2013	2:18:00	1560
4/9/2013	2:33:00	1555
4/9/2013	2:48:00	1580
4/9/2013	3:03:01	1595
4/9/2013	3:18:00	1580
4/9/2013	3:33:00	1550
4/9/2013	3:48:00	1660
4/9/2013	4:03:00	1710
4/9/2013	4:18:00	1715
4/9/2013	4:33:00	1575
4/9/2013	4:48:01	1510
4/9/2013	5:03:00	1480
4/9/2013	5:18:00	1445
4/9/2013	5:33:00	1505
4/9/2013	5:48:00	1490
4/9/2013	6:03:00	1460
4/9/2013	6:18:00	1570
4/9/2013	6:33:01	1530
4/9/2013	6:48:00	1540
4/9/2013	7:03:00	1525
4/9/2013	7:18:00	1525
4/9/2013	7:33:00	1575
4/9/2013	7:48:00	1600
4/9/2013	8:03:00	1540
4/9/2013	8:18:01	1480
4/9/2013	8:33:00	1440
4/9/2013	8:48:00	1420
4/9/2013	9:03:00	1440
4/9/2013	9:18:00	1425
4/9/2013	9:33:00	1475
4/9/2013	9:48:00	1510
4/9/2013	10:03:01	1520
4/9/2013	10:18:00	1600
4/9/2013	10:33:00	1610

4/9/2013	10:48:00	1625
4/9/2013	11:03:00	1645
4/9/2013	11:18:00	1590
4/9/2013	11:33:00	1575
4/9/2013	11:48:01	1680
4/9/2013	12:03:00	1650
4/9/2013	12:18:00	1680
4/9/2013	12:33:00	1620
4/9/2013	12:48:00	1590
4/9/2013	13:03:00	1630
4/9/2013	13:18:00	1570
4/9/2013	13:33:01	1540
4/9/2013	13:48:00	1615
4/9/2013	14:03:00	1660
4/9/2013	14:18:00	1690
4/9/2013	14:33:00	1785
4/9/2013	14:48:00	1990
4/9/2013	15:03:00	2075
4/9/2013	15:18:01	2100
4/9/2013	15:33:00	2260
4/9/2013	15:48:00	1795
4/9/2013	16:03:00	1850
4/9/2013	16:18:00	2030
4/9/2013	16:33:00	2025
4/9/2013	16:48:00	2020
4/9/2013	17:03:01	2135
4/9/2013	17:18:00	2165
4/9/2013	17:33:00	2170
4/9/2013	17:48:00	2125
4/9/2013	18:03:00	2120
4/9/2013	18:18:00	2115
4/9/2013	18:33:00	2120
4/9/2013	18:48:01	2115
4/9/2013	19:03:00	2115
4/9/2013	19:18:00	2115
4/9/2013	19:33:00	2030
4/9/2013	19:48:00	2025
4/9/2013	20:03:00	2145
4/9/2013	20:18:00	2135
4/9/2013	20:33:01	2110
4/9/2013	20:48:00	2110
4/9/2013	21:03:00	2125
4/9/2013	21:18:00	2190
4/9/2013	21:33:00	2185
4/9/2013	21:48:00	2085

4/9/2013	22:03:00	2095
4/9/2013	22:18:01	2115
4/9/2013	22:33:00	2015
4/9/2013	22:48:00	2110
4/9/2013	23:03:00	2125
4/9/2013	23:18:00	2115
4/9/2013	23:33:00	2000
4/9/2013	23:48:00	2130

4/10/2013	0:03:01	2095	
4/10/2013	0:18:00	2065	
4/10/2013	0:33:00	0	
4/10/2013	0:48:00	2135	
4/10/2013	1:03:00	2125	
4/10/2013	1:18:00	2125	
4/10/2013	1:33:00	2040	
4/10/2013	1:48:01	2120	
4/10/2013	2:03:00	2140	
4/10/2013	2:18:00	2130	
4/10/2013	2:33:00	2115	
4/10/2013	2:48:00	2135	
4/10/2013	3:03:00	2145	
4/10/2013	3:18:00	2150	
4/10/2013	3:33:01	2165	
4/10/2013	3:48:00	2185	
4/10/2013	4:03:00	2210	
4/10/2013	4:18:00	2255	
4/10/2013	4:33:00	2250	
4/10/2013	4:48:00	2240	
4/10/2013	5:03:00	2225	
4/10/2013	5:18:01	2230	
4/10/2013	5:33:00	2240	
4/10/2013	5:48:00	2130	
4/10/2013	6:03:00	2230	
4/10/2013	6:18:00	2245	
4/10/2013	6:33:00	2240	
4/10/2013	6:48:00	2270	← 1.576 MGD PEAK HOUR
4/10/2013	7:03:01	2240	
4/10/2013	7:18:00	2140	
4/10/2013	7:33:00	2260	
4/10/2013	7:48:00	2180	
4/10/2013	8:03:00	2210	
4/10/2013	8:18:00	2205	

4/10/2013	8:33:00	2230
4/10/2013	8:48:01	2115
4/10/2013	9:03:00	2220
4/10/2013	9:18:00	2200
4/10/2013	9:33:00	2200
4/10/2013	9:48:00	2185
4/10/2013	10:03:00	2180
4/10/2013	10:18:00	2185
4/10/2013	10:33:01	2195
4/10/2013	10:48:00	2165
4/10/2013	11:03:00	2170
4/10/2013	11:18:00	2175
4/10/2013	11:33:00	2190
4/10/2013	11:48:00	2190
4/10/2013	12:03:00	2180
4/10/2013	12:18:01	2180
4/10/2013	12:33:00	2165
4/10/2013	12:48:00	2160
4/10/2013	13:03:00	2155
4/10/2013	13:18:00	2160
4/10/2013	13:33:00	2165
4/10/2013	13:48:00	2175
4/10/2013	14:03:01	2170
4/10/2013	14:18:00	2155
4/10/2013	14:33:00	2065
4/10/2013	14:48:00	2175
4/10/2013	15:03:00	2175
4/10/2013	15:18:00	2185
4/10/2013	15:33:00	2190
4/10/2013	15:48:01	2190
4/10/2013	16:03:00	2185
4/10/2013	16:18:00	2195
4/10/2013	16:33:00	2190
4/10/2013	16:48:00	2195
4/10/2013	17:03:00	2180
4/10/2013	17:18:00	2195
4/10/2013	17:33:01	2185
4/10/2013	17:48:00	2175
4/10/2013	18:03:00	2205
4/10/2013	18:18:00	2200
4/10/2013	18:33:00	2205
4/10/2013	18:48:00	2195
4/10/2013	19:03:00	2200
4/10/2013	19:18:01	2205

4/10/2013	19:33:00	2200
4/10/2013	19:48:00	2190
4/10/2013	20:03:00	2195
4/10/2013	20:18:00	2075
4/10/2013	20:33:00	2180
4/10/2013	20:48:00	2155
4/10/2013	21:03:01	2195
4/10/2013	21:18:00	2195
4/10/2013	21:33:00	2185
4/10/2013	21:48:00	2175
4/10/2013	22:03:00	2080
4/10/2013	22:18:00	2065
4/10/2013	22:33:00	2170
4/10/2013	22:48:01	2170
4/10/2013	23:03:00	2165
4/10/2013	23:18:00	2045
4/10/2013	23:33:00	2155
4/10/2013	23:48:00	2155

4/11/2013	0:03:00	2155
4/11/2013	0:18:00	2155
4/11/2013	0:33:01	2170
4/11/2013	0:48:00	2170
4/11/2013	1:03:00	2145
4/11/2013	1:18:00	2150
4/11/2013	1:33:00	2145
4/11/2013	1:48:00	2145
4/11/2013	2:03:00	2145
4/11/2013	2:18:01	2155
4/11/2013	2:33:00	2150
4/11/2013	2:48:00	2150
4/11/2013	3:03:00	2145
4/11/2013	3:18:00	2145
4/11/2013	3:33:00	2155
4/11/2013	3:48:00	2150
4/11/2013	4:03:01	2150
4/11/2013	4:18:00	2150
4/11/2013	4:33:00	2045
4/11/2013	4:48:00	2145
4/11/2013	5:03:00	2150
4/11/2013	5:18:00	2155
4/11/2013	5:33:00	2145
4/11/2013	5:48:01	2155

4/11/2013	6:03:00	2035
4/11/2013	6:18:00	2150
4/11/2013	6:33:00	2155
4/11/2013	6:48:00	2150
4/11/2013	7:03:00	2150
4/11/2013	7:18:00	2155
4/11/2013	7:33:01	2155
4/11/2013	7:48:00	2165
4/11/2013	8:03:00	2160
4/11/2013	8:18:00	2160
4/11/2013	8:33:00	2150
4/11/2013	8:48:00	2150
4/11/2013	9:03:00	2160
4/11/2013	9:18:01	2055
4/11/2013	9:33:00	2170
4/11/2013	9:48:00	2180
4/11/2013	10:03:00	2175
4/11/2013	10:18:00	2180
4/11/2013	10:33:00	2180
4/11/2013	10:48:00	2175
4/11/2013	11:03:01	2205
4/11/2013	11:18:00	2175
4/11/2013	11:33:00	2180
4/11/2013	11:48:00	2175
4/11/2013	12:03:00	2175
4/11/2013	12:18:00	2175
4/11/2013	12:33:00	2190
4/11/2013	12:48:01	2190
4/11/2013	13:03:00	2190
4/11/2013	13:18:00	2185
4/11/2013	13:33:00	2195
4/11/2013	13:48:00	2215
4/11/2013	14:03:00	2210
4/11/2013	14:18:00	2185
4/11/2013	14:33:01	2070
4/11/2013	14:48:00	2180
4/11/2013	15:03:00	2190
4/11/2013	15:18:00	2175
4/11/2013	15:33:00	2185
4/11/2013	15:48:00	2180
4/11/2013	16:03:00	2175
4/11/2013	16:18:01	2160
4/11/2013	16:33:00	2160
4/11/2013	16:48:00	2040
4/11/2013	17:03:00	2165

4/11/2013	17:18:00	2160
4/11/2013	17:33:00	0
4/11/2013	17:48:00	2195
4/11/2013	18:03:01	2160
4/11/2013	18:18:00	2150
4/11/2013	18:33:00	2180
4/11/2013	18:48:00	2150
4/11/2013	19:03:00	2150
4/11/2013	19:18:00	2155
4/11/2013	19:33:00	2155
4/11/2013	19:48:00	2155
4/11/2013	20:03:00	2150
4/11/2013	20:18:01	2145
4/11/2013	20:33:00	2145
4/11/2013	20:48:00	2150
4/11/2013	21:03:00	2150
4/11/2013	21:18:00	2145
4/11/2013	21:33:00	2155
4/11/2013	21:48:00	2040
4/11/2013	22:03:01	2155
4/11/2013	22:18:00	2145
4/11/2013	22:33:00	2145
4/11/2013	22:48:00	2170
4/11/2013	23:03:00	2145
4/11/2013	23:18:00	2150
4/11/2013	23:33:00	2140
4/11/2013	23:48:01	2140

- Chapter VII -
COST EFFECTIVE ANALYSIS

A. INTRODUCTION

Justification for selection of wastewater treatment alternatives is based upon a Cost Effective Analysis. Cost effectiveness takes into consideration both monetary and non-monetary factors. Monetary factors include capital (first costs) and operation and maintenance costs over the entire planning period. Non-monetary factors include such items as primary and secondary environmental effects, implementation capability (social and institutional), operability, performance, reliability and flexibility.

B. COST ESTIMATING PROCEDURES

Capital construction cost items used in the Cost Effective Analysis include the following:

- Equipment costs.
- Construction and installation costs, including Contractor's overhead and profit.
- Cost of engineering, design, field exploration, construction management, on-site field representative and start-up services.
- Cost of administration and legal services, including costs of bond sales.
- Interest during construction.

Prices of components and installation are estimated on the basis of market prices as of the third quarter of 2015, with no allowance for inflation of wages or prices.

Additional project costs (engineering, contingencies, legal, fiscal and administrative) are estimated at 30% of capital costs; which includes 15% contingencies, and 15% for engineering, legal, fiscal, administrative and interest costs.

Since the Cost Effective Analysis is computed on a present worth basis, the salvage value of structure and equipment are computed on a straight line depreciation basis, if there is a use for the structure at the end of the design period and it can be demonstrated that the item can be reused. The design period over which the Cost Effective Analysis occurs is 20-years. Future replacement costs for equipment with a life expectancy of less than 20-years is also included in the analysis.

The useful life of the various structures and equipment is estimated according to the following:

Item	Useful Life
■ Land	Permanent
■ Wastewater Conveyance Structures (i.e., pipes, interceptors)	40-years
■ Structures, Tankage, Basins	40-years
■ Process Equipment	10 to 20-years
■ Auxiliary Equipment	1 to 20-years

Operation & Maintenance (O&M) costs include all annual costs (operation and maintenance, labor, equipment parts, repairs and supply costs, chemical, power and fuel costs) necessary to operate and maintain the treatment facility. The costs utilized include:

- Labor:.. $55.00/Hour (includes fringe benefits)
- Electricity:.. $0.07/kWH
- Polymer .... $1.44/lb.
- Natural Gas:... $0.83/therm

O&M Costs are based upon the design criteria for each alternative and the personnel required to operate and maintain these facilities.

Annual O&M costs, future costs and salvage values are calculated to total present worth values using a discount rate of 4.625%.

C. ALTERNATIVE ANALYSIS

Based upon the Preliminary Screening Process, which is summarized in the previous chapter, the following alternatives will be subject to a Cost Effective Analysis:

- Activated Sludge Process
- Biosolids Dewatering

1. Activated Sludge Process

a. General:

The following viable alternatives for the Activated Sludge Process will be considered:

1) Expand Existing System
2) Integrated Film Activated Sludge (IFAS)
3) Membrane Bio-Reactor (MBR)

A diagram of each activated sludge alternative is shown on Figure VII-1, Figure VII-2 and Figure VII-3. The detailed description of each alternative was previously noted in Chapter VI.

b. Analysis:

Table VII-1, Table VII-2 and Table VII-3 contain the Present Worth Analysis of each of the alternatives. The potential capital construction costs are summarized as follows:

Option #1 - Expand Existing System $13,407,849
Option #2 - IFAS $15,297,523
Option #3 - MBR $13,412,022

The Present Worth Total of the potential capital construction costs are as follows:

Option #1 - Expand Existing System $13,723,290
Option #2 - IFAS $15,634,745
Option #3 - MBR $13,627,131

The potential annual O&M costs of each alternative were estimated for comparison purposes. The potential annual O&M costs are:

Option #1 - Expand Existing Facilities $617,916
Option #2 - IFAS $738,984
Option #3 - MBR $702,108

The present worth of each O&M cost is noted below:

Option #1 - Expand Existing Facilities $7,951,454
Option #2 - IFAS $9,509,379
Option #3 - MBR $9,034,852

A summary of the Present Worth Total of the potential capital construction and O&M costs is presented below:

<u>Total Present Worth</u>
Option #1 - Expand Existing Facilities $21,674,745
Option #2 - IFAS $25,144,124
Option #3 - MBR $22,661,983

On a 20-year Present Worth basis, taking into account capital construction, salvage and O&M potential costs, the MBR option is within 4.5% of the expansion of the existing Wastewater Treatment Facility option, and the IFAS option is 16% higher than the expansion option.

c. Conclusions:

1) The expansion of the existing system is essentially equal (-$4,173) to the MBR initial construction cost, although the MBR option may have the lowest Present Worth of the capital costs.
2) The expansion of the existing system may have the lowest annual O&M and lowest Present Worth of the O&M cost.
3) The Total Present Worth for the expansion of the existing system may be 4.5% less than the MBR option and 16% less than IFAS, over a 20-year period.
4) The Wisconsin Department Of Natural Resources (DNR) considers Present Worth Values that are within 10% of each other to be essentially equal in monetary value due to normal variability in costs at the planning level.

2. Biosolids Dewatering

a. General:

Centrifuges and screw presses will be evaluated to determine if one method of dewatering biosolids is more cost effective than the other. Each alterative will utilize the existing sludge pumps and polymer feed systems. Each alternative will be assumed to utilize an overhead monorail system for installation and long-term maintenance, and a conveyor system for transporting cake solids to the Class A process.

b. Loading Rate & Operation:

Both the centrifugal and screw press alternatives will be loaded at a rate of 750 lbs. /hour of solids (dry weight). Centrifuge polymer consumption is assumed to be 15 lbs./dry ton, while the screw press is assumed to utilize 20 lbs./dry ton. To process the predicted 750 lbs./hour loading rate, the required run time will be approximately 3-days while operating 24-hours/day.

c. Biosolids Dewatering:

A dewatered cake of 22% and 20% has been assumed for the centrifuge and screw press, respectively. The energy to remove the water and achieve 92% solids in a Class A dryer was also taken into consideration. Compared to the centrifuge, the screw press alternative will need to remove an additional 2% of water content in the Class A dryer.

d. Analysis:

The Present Worth Analysis of the centrifuge and screw press alternatives is summarized in Table VII-4 and Table VII-5.

The potential capital construction costs are summarized as follows:

Centrifuge $1,289,846
Screw Press $1,273,635

The Present Worth Total of the potential capital construction costs are as follows:

Centrifuge $1,283,589
Screw Press $1,267,335

The potential annual O&M costs of each alternative were estimated for comparison purposes. Costs to evaporate an additional 2% water content were added to the screw press alternative. The costs may be summarized as follows:

Centrifuge $109,638
Screw Press $114,275

The present worth of the potential O&M cost is noted below:

Centrifuge $1,410,842
Screw Press $1,470,511

A summary of the Present Worth Total of the potential capital construction and O&M costs is presented below:

<u>Total Present Worth</u>
Centrifuge $2,694,431
Screw Press $2,737,846

On a 20-year Present Worth basis, taking into account capital construction, salvage and O&M potential costs, the screw press option is within 1.6% of the centrifuge option.

e. Conclusions:

1) The screw press option may have a slight advantage in capital construction and Present Worth value of those costs.

2) The centrifuge, if it can consistently produce a dewatered biosolids product with 2% less water content compared to the screw press, may have a slight advantage over the screw press with respect to O&M costs.

3) The Total Present Worth for the centrifuge may be 1.6% less than the screw press option over a 20-year period.\

4) The DNR considers Present Worth Values that are within 10% of each other to be essentially equal in monetary value due to normal variability in costs at the planning level.

D. CAKE PROCESS

An Opinion Of Probable Construction Costs for the Class A process utilizing a dryer is presented in Table VII-6.

Table VII-1
OPTION #1 - AERATION BASIN EXPANSION
CITY OF KIEL
Wastewater Treatment System - Facilities Plan

Capital Construction Costs Item		**Service Life**	**Replacement Cost**	**Salvage Value**
Miscellaneous				
▪ Mechanical and Structural Demolition	$25,000	--	--	--
▪ Tank Cleaning (Pri. Clar., AB, Sec. Clar., Digesters)	$120,000	--	--	--
▪ Miscellaneous Metals (grating, railing, hatches, etc.)	$54,000	20	$0	$0
▪ Painting (Digesters, Digester Bldg. Expansion, HSW Tank)	$241,000	20	$0	$0
Site Work				
▪ Underground Piping (20" P.E., 18" AB, 18" FE, 8" RAS)	$149,000	40	$0	$74,500
▪ Air Main Replacement (24" Main, 20" to N, 14" to S)	$176,000	40	$0	$88,000
▪ Relocate Flare	$7,500	--	--	--
▪ Grading and Landscaping	$50,000	40	$0	$25,000
▪ Fencing	$11,000	40	$0	$5,500
▪ Paving	$197,000	20	$0	$0
Structures				
▪ Primary Clarifier Repairs	$27,000	20	$0	$0
▪ Aeration Basin Repairs	$5,000	20	$0	$0
▪ North Aeration Basins (65' x 32' x 14' swd x 2)	$526,000	40	$0	$263,000
▪ Tunnel Structure/Secondary Clarifiers (2 x 40' diameter)	$467,000	40	$0	$233,500
▪ South Aeration Basin (64' x 28' x 14' swd)	$291,000	40	$0	$145,500
▪ Chlor/Dechlor Gas Storage Room Modifications	$5,000	40	$0	$2,500
▪ Digester Building Expansion	$400,000	40	$0	$200,000
▪ High Strength Waste Tank Seperation	$24,000	40	$0	$12,000
▪ Admin. Bldg. Maintenance Addition	$165,000	40	$0	$82,500
Equipment				
▪ Pri. Clarifier Drives, Mechanisms, Weirs, Baffles (2)	$200,000	20	$0	$0
▪ Primary Sludge Pumps (3)	$75,000	10	$75,000	$0
▪ Aeration Splitter Box Gates (3)	$37,000	40	$0	$18,500
▪ Aeration Systems (3 Basins)	$135,000	20	$0	$0
▪ New Aeration Blowers (3 @200 hp)	$472,000	20	$0	$0
▪ Sec. Clarifier Drives, Mechanisms, Weirs, Baffles (Typ 4)	$449,000	20	$0	$0
▪ Sec. Clarifier Launder Covers	$80,000	20	$0	$0
▪ RAS Pumps (6)	$150,000	10	$150,000	$0
▪ WAS Pumps (2)	$50,000	10	$50,000	$0
▪ Scum Pump (1)	$13,000	10	$13,000	$0
▪ Disc Filters	$1,050,000	20	$0	$0
▪ High Strength Waste Pumps (2)	$26,000	10	$26,000	$0
▪ Digester Covers and Mixers	$557,000	20	$0	$0
▪ Digester Recirc Pumps (2)	$50,000	10	$50,000	$0
▪ Boiler/Heat Exchanger	$155,000	20	$0	$0
Equiment Installation (20% of Equipment)	$699,800	--	$72,800	$0
Mechanical (Process Piping, Plumbing, HVAC) (30% Equip.)	$1,049,700	40	$0	$524,850
Electrical	$850,000	40	$0	$425,000
Controls and SCADA	$600,000	10	$600,000	$0
Subtotal	$9,639,000	--	$1,036,800	$2,100,350
General Conditions, Bonds, Insurance,	$674,730	--	--	--
Total	$10,313,730	--	$1,036,800	$2,100,350
Contingencies (15% of Total)	$1,547,060	--	--	--
Engineering (15% of Total)	$1,547,060	--	--	--
Grand Total	$13,407,849	--	$1,036,800	$2,100,350
Present Worth of Total	$13,723,290	--	$659,691	$344,249

Present Worth (P) = Future (F) x $(1+i)^{-n}$

i = 4.625 %
n = 10 (Replacement)
n = 40 (Salvage)

$(1 + i)^{-n}$ = 0.636275631 (Replacement)
$(1 + i)^{-n}$ = 0.163900833 (Salvage)

Operation and Maintenance Costs	
Labor/Maintenance	$50,000
Power	$244,000
Chemical	$30,000
Replacement (5% Equipment)	$209,940
Parts & Supplies (2% Equipment)	$83,976
Total Annual	$617,916
O&M Present Worth	$7,951,454
Capital Present Worth	$13,723,290
Total Present Worth	**$21,674,745**

Present Worth (P) = Annual Cost (A) x $\frac{(1+n)^n-1}{i(1+i)^n}$

i= 4.625%
n= 20

$$\frac{(1+i)^n-1}{ix(1+i)^n} = \mathbf{12.86817994}$$

Table VII-2

OPTION #2 - IFAS

CITY OF KIEL

Wastewater Treatment System - Facilities Plan

Capital Construction Costs **Item**		**Service Life**	**Replacement Cost**	**Salvage Value**
Miscellaneous				
▪ Mechanical and Structural Demolition	$27,000	--	--	--
▪ Tank Cleaning (Pri. Clar., AB, Sec. Clar., Digesters)	$120,000	--	--	--
▪ Miscellaneous Metals (grating, railing, hatches, etc.)	$28,000	20	$0	$0
▪ Painting (Digesters, Digester Bldg. Expansion, HSW Tank)	$241,000	20	$0	$0
Site Work				
▪ Underground Piping (20" P.E., 18" AB, 18" FE, 8" RAS)	$149,000	40	$0	$74,500
▪ Air Main Replacement (24" Main, 20" to N, 14" to S)	$176,000	40	$0	$88,000
▪ Relocate Flare	$7,500	--	--	--
▪ Grading and Landscaping	$40,000	40	$0	$20,000
▪ Fencing	$8,000	40	$0	$4,000
▪ Paving	$194,000	20	$0	$0
Structures				
▪ Primary Clarifier Repairs	$27,000	20	$0	$0
▪ Aeration Basin Repairs	$5,000	20	$0	$0
▪ Tunnel Structure/Secondary Clarifiers (2 x 40' diameter)	$467,000	40	$0	$233,500
▪ Chlor/Dechlor Gas Storage Room Modifications	$5,000	40	$0	$2,500
▪ Digester Building Expansion	$400,000	40	$0	$200,000
▪ High Strength Waste Tank Seperation	$24,000	40	$0	$12,000
▪ Admin. Bldg. Maintenance Addition	$165,000	40	$0	$82,500
Equipment				
▪ Pri. Clarifier Drives, Mechanisms, Weirs, Baffles (Typ 2)	$200,000	20	$0	$0
▪ Primary Sludge Pumps (3)	$75,000	10	$75,000	$0
▪ Aeration Splitter Box Gates (3)	$37,000	40	$0	$18,500
▪ IFAS System	$1,625,000	20	$0	$0
▪ New Aeration Blowers (3 @ 200hp)	$472,000	20	$0	$0
▪ Sec. Clarifier Drives, Mechanisms, Weirs, Baffles (Typ 4)	$449,000	20	$0	$0
▪ Sec. Clarifier Launder Covers	$80,000	20	$0	$0
▪ RAS Pumps (6)	$150,000	10	$150,000	$0
▪ WAS Pumps (2)	$50,000	10	$50,000	$0
▪ Disc Filters	$1,050,000	20	$0	$0
▪ High Strength Waste Pumps (2)	$26,000	10	$26,000	$0
▪ Digester Covers and Mixers	$557,000	20	$0	$0
▪ Digester Recirc Pumps (2)	$50,000	10	$50,000	$0
▪ Boiler/Heat Exchanger	$155,000	20	$0	$0
Equiment Installation (20% of Equipment)	$995,200	--	$70,200	$0
Mechanical (Process Piping, Plumbing, HVAC) (30% Equip.)	$1,492,800	40	$0	$746,400
Electrical	$850,000	40	$0	$425,000
Controls and SCADA	$600,000	10	$600,000	$0
Subtotal	$10,997,500	--	$1,021,200	$1,906,900
General Conditions, Bonds, Insurance,	$769,825	--	--	--
Total	$11,767,325	--	$1,021,200	$1,906,900
Contingencies (15% of Total)	$1,765,099	--	--	--
Engineering (15% of Total)	$1,765,099	--	--	--
Grand Total	$15,297,523		$1,021,200	$1,906,900
Present Worth of Total	**$15,634,745**		$649,765	$312,542

Present Worth (P) = Future (F) x $(1+i)^{-n}$

i =	**4.625**	**%**
n =	**10**	**(Replacement)**
n =	**40**	**(Salvage)**
$(1 + i)^{-n}$ =	**0.636275631**	**(Replacement)**
$(1 + i)^{-n}$ =	**0.163900833**	**(Salvage)**

Operation and Maintenance Costs	
Labor/Maintenance	$50,000
Power	$241,000
Chemical	$30,000
Replacement (5% Equipment)	$298,560
Parts & Supplies (2% Equipment)	$119,424
Total Annual	$738,984
O&M Present Worth	$9,509,379
Capital Present Worth	$15,634,745
Total Present Worth	**$25,144,124**

Present Worth (P) = Annual Cost (A) x $\frac{(1+n)^n-1}{i(1+i)^n}$

i= **4.625%**

n= **20**

$\frac{(1+i)^n-1}{ix(1+i)^n}$ **12.86817994**

Table VII-3
OPTION #3 - MBR's
CITY OF KIEL
Wastewater Treatment System - Facilities Plan

Capital Construction Costs Item		Service Life	Replacement Cost	Salvage Value
Miscellaneous				
▪ Mechanical and Structural Demolition	$21,000	--	--	--
▪ Tank Cleaning (Pri. Clar., AB, Digesters)	$100,000	--	--	--
▪ Painting (Digesters, Digester Bldg. Expansion, HSW Tank)	$241,000	20	$0	$0
Site Work				
▪ Underground Piping (20" P.E., 20" FE, 16" RAS, 6" WAS)	$69,000	40	$0	$34,500
▪ Air Main Replacement (24" and 16" Main)	$40,000	40	$0	$20,000
▪ Relocate Flare	$7,500	--	--	--
▪ Grading and Landscaping	$40,000	40	$0	$20,000
▪ Paving	$187,000	20	$0	$0
Structures				
▪ Primary Clarifier Repairs	$27,000	20	$0	$0
▪ Aeration Basin Repairs	$5,000	20	$0	$0
▪ Aeration Basin Modifications	$20,000	40	$0	$10,000
▪ MBR Equipment Building	$150,000	40	$0	$75,000
▪ Chlor/Dechlor Gas Storage Room Modifications	$5,000	40	$0	$2,500
▪ Digester Building Expansion	$400,000	40	$0	$200,000
▪ High Strength Waste Tank Seperation	$24,000	40	$0	$12,000
▪ Admin. Bldg. Maintenance Addition	$165,000	40	$0	$82,500
Equipment				
▪ Replace Fine Screen Baskets	$15,000	20	$0	$0
▪ Pri. Clarifier Drives, Mechanisms, Weirs, Baffles (Typ 2)	$200,000	20	$0	$0
▪ Primary Sludge Pumps (3)	$75,000	10	$75,000	$0
▪ Aeration Splitter Box Gates (3)	$37,000	40	$0	$18,500
▪ MBR Equipment	$2,850,000	20	$0	$0
▪ Aeration Systems (2 Trains)	$100,000	20	$0	$0
▪ New Aeration Blowers (3 @ 200hp)	$472,000	20	$0	$0
▪ High Strength Waste Pumps (2)	$26,000	10	$26,000	$0
▪ Digester Covers and Mixers	$557,000	20	$0	$0
▪ Digester Recirc Pumps (2)	$50,000	10	$50,000	$0
▪ Boiler/Heat Exchanger	$155,000	20	$0	$0
Equiment Installation (20% of Equipment)	$907,400	--	$30,200	$0
Mechanical (Process Piping, Plumbing, HVAC) (30% Equip.)	$1,361,100	40	$0	$680,550
Electrical	$780,000	40	$0	$390,000
Controls and SCADA	$555,000	10	$555,000	$0
Subtotal	$9,642,000	--	$736,200	$1,545,550
General Conditions, Bonds, Insurance,	$674,940	--	--	--
Total	$10,316,940	--	$736,200	$1,545,550
Contingencies (15% of Total)	$1,547,541	--	--	--
Engineering (15% of Total)	$1,547,541	--	--	--
Grand Total	$13,412,022		$736,200	$1,545,550
Present Worth of Total	**$13,627,131**		$468,426.12	$253,316.93

Present Worth (P) = Future (F) x $(1+i)^{-n}$

i =	**4.625**	**%**
n =	**10**	**(Replacement)**
n =	**40**	**(Salvage)**
$(1+i)^{-n}$ =	**0.636275631**	**(Replacement)**
$(1+i)^{-n}$ =	**0.163900833**	**(Salvage)**

Operation and Maintenance Costs	
Labor/Maintenance	$50,000
Power	$238,000
Chemical	$33,000
Replacement (5% Equipment)	$272,220
Parts & Supplies (2% Equipment)	$108,888
Total Annual	$702,108
O&M Present Worth	$9,034,852
Capital Present Worth	$13,627,131
Total Present Worth	**$22,661,983**

Present Worth (P) = Annual Cost (A) x $\frac{(1+n)^n-1}{i(1+i)^n}$

i= 4.625%
n= 20

$\frac{(1+i)^n-1}{ix(1+i)^n}$ **12.86817994**

Table VII-4

OPTION #4 - CENTRIFUGE OPTION

CITY OF KIEL

Wastewater Treatment System - Facilities Plan

Capital Construction Costs **Item**	**Cost**	**Service Life**	**Replacement Cost**	**Salvage Value**
Miscellaneous				
▪ Demolition	$25,000	--	--	--
Equipment				
▪ Centrifuge Equipment (Including Polymer Feed)	$500,000	20	$0	$0
▪ Grinders	$28,000	20	$0	$0
▪ Conveyor Equipment	$60,000	20	$0	$0
▪ Monorails, Bridge Beam, and Hoist	$30,000	40	$0	$15,000
Equiment Installation (30% of Equipment)	$185,400	--	--	--
Mechanical (Process Piping and Valves) (7.5% of Equipment)	$46,350	40		$23,175
Electrical, Controls, and SCADA (8.5% of Equipment)	$52,530	20		
Subtotal	$927,280	--	$0	$38,175
General Conditions	$64,910	--	--	--
Total	$992,190	--	$0	$38,175
Contingencies (15% of Total)	$148,828	--	--	--
Engineering (15% of Total)	$148,828	--	--	--
Grand Total	$1,289,846		$0	$38,175
Present Worth of Total	**$1,283,589**		**$0**	**$6,257**

Present Worth (P) = Future (F) x $(1+i)^{-n}$

i = 4.625 %

n = 10 (Replacement)

n = 40 (Salvage)

$(1 + i)^{-n}$ = 0.636275631 (Replacement)

$(1 + i)^{-n}$ = 0.163900833 (Salvage)

Operation and Maintenance Costs	
Labor/Maintenance	$13,300
Power	$11,800
Chemical	$28,300
Replacement (5% of Equipment)	$40,170
Parts & Supplies (2% of Equipment)	$16,068
Additional Class 'A' Costs	$0
Total Annual	$109,638
O&M Present Worth	$1,410,842
Capital Present Worth	$1,283,589
Total Present Worth	**$2,694,431**

Present Worth (P) = Annual Cost (A) x $\frac{(1+n)^n-1}{i(1+i)^n}$

i= 4.625%

n= 20

$\frac{(1+i)^n-1}{ix(1+i)^n}$ **12.86817994**

Table VII-5
OPTION #5 - SCREW PRESS OPTION
CITY OF KIEL
Wastewater Treatment System - Facilities Plan

Capital Construction Costs **Item**	**Cost**	**Service Life**	**Replacement Cost**	**Salvage Value**
Miscellaneous				
▪ Demolition	$25,000	--	--	--
Equipment				
▪ Screw Press Equipment (Including Polymer Feed)	$570,000	20	$0	$0
▪ Conveyor Equipment	$25,000	20	$0	$0
▪ Monorails, Bridge Beam, and Hoist	$30,000	40	$0	$15,000
Equiment Installation (30% of Equipment)	$187,500	--	--	--
Mechanical (Process Piping, Plumbing and HVAC) (7.5% Eqnt)	$46,875	40	$0	$23,438
Electrical, Controls, and SCADA (5% of Equipment)	$31,250	20	$0	$0
Subtotal	$915,625	--	$0	$38,438
General Conditions	$64,094	--	--	--
Total	$979,719	--	$0	$38,438
Contingencies (15% of Total)	$146,958	--	--	--
Engineering (15% of Total)	$146,958	--	--	--
Grand Total	$1,273,635		$0	$38,438
Present Worth of Total	**$1,267,335**		**$0**	**$6,300**

Present Worth (P) = Future (F) x $(1+i)^{-n}$

i =	**4.625**	**%**
n =	**10**	**(Replacement)**
n =	**40**	**(Salvage)**
$(1 + i)^{-n}$ =	**0.636275631**	**(Replacement)**
$(1 + i)^{-n}$ =	**0.163900833**	**(Salvage)**

Operation and Maintenance Costs	
Labor/Maintenance	$6,900
Power	$900
Chemical	$37,700
Replacement (5% of Equipment)	$40,625
Parts & Supplies (2% of Equipment)	$16,250
Additional Class 'A' Costs	$11,900
Total Annual	$114,275
O&M Present Worth	$1,470,511
Capital Present Worth	$1,267,335
Total Present Worth	**$2,737,846**

Present Worth (P) = Annual Cost (A) x $\frac{(1+n)^n-1}{i(1+i)^n}$

i= **4.625%**
n= **20**

$$\frac{(1+i)^n-1}{ix(1+i)^n} \quad \mathbf{12.86817994}$$

Table VII-6
OPTION #6 - SLUDGE DRYER
CITY OF KIEL
Wastewater Treatment System - Facilities Plan

Capital Construction Costs

Item	Cost
Equipment	
▪ Sludge Drying Equipment	$2,900,000
Equiment Installation (25% of Equipment)	$725,000
Mechanical (Process Piping, Plumbing and HVAC) (15% Eqnt)	$435,000
Electrical, Controls, and SCADA (10% of Equipment)	$290,000
Subtotal	$4,350,000
General Conditions	$304,500
Total	$4,654,500
Contingencies (10% of Total)	$465,450
Engineering (10% of Total)	$465,450
Grand Total	$5,585,400

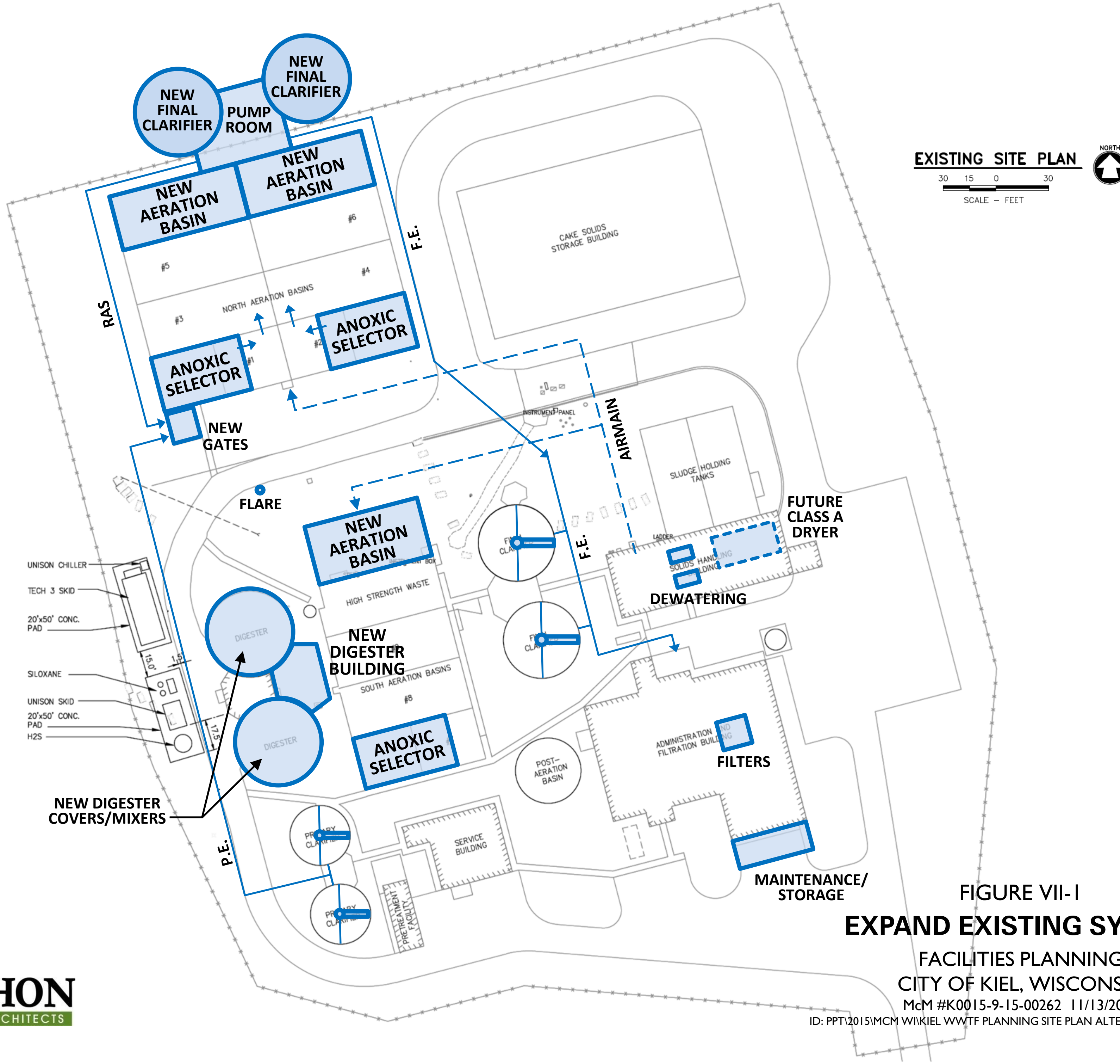

FIGURE VII-1

EXPAND EXISTING SYSTEM

FACILITIES PLANNING

CITY OF KIEL, WISCONSIN

McM #K0015-9-15-00262 11/13/2015

ID: PPT\2015\MCM WI\KIEL WWTF PLANNING SITE PLAN ALTERNATES.PPTX TJK:JMK

McMAHON
ENGINEERS ARCHITECTS

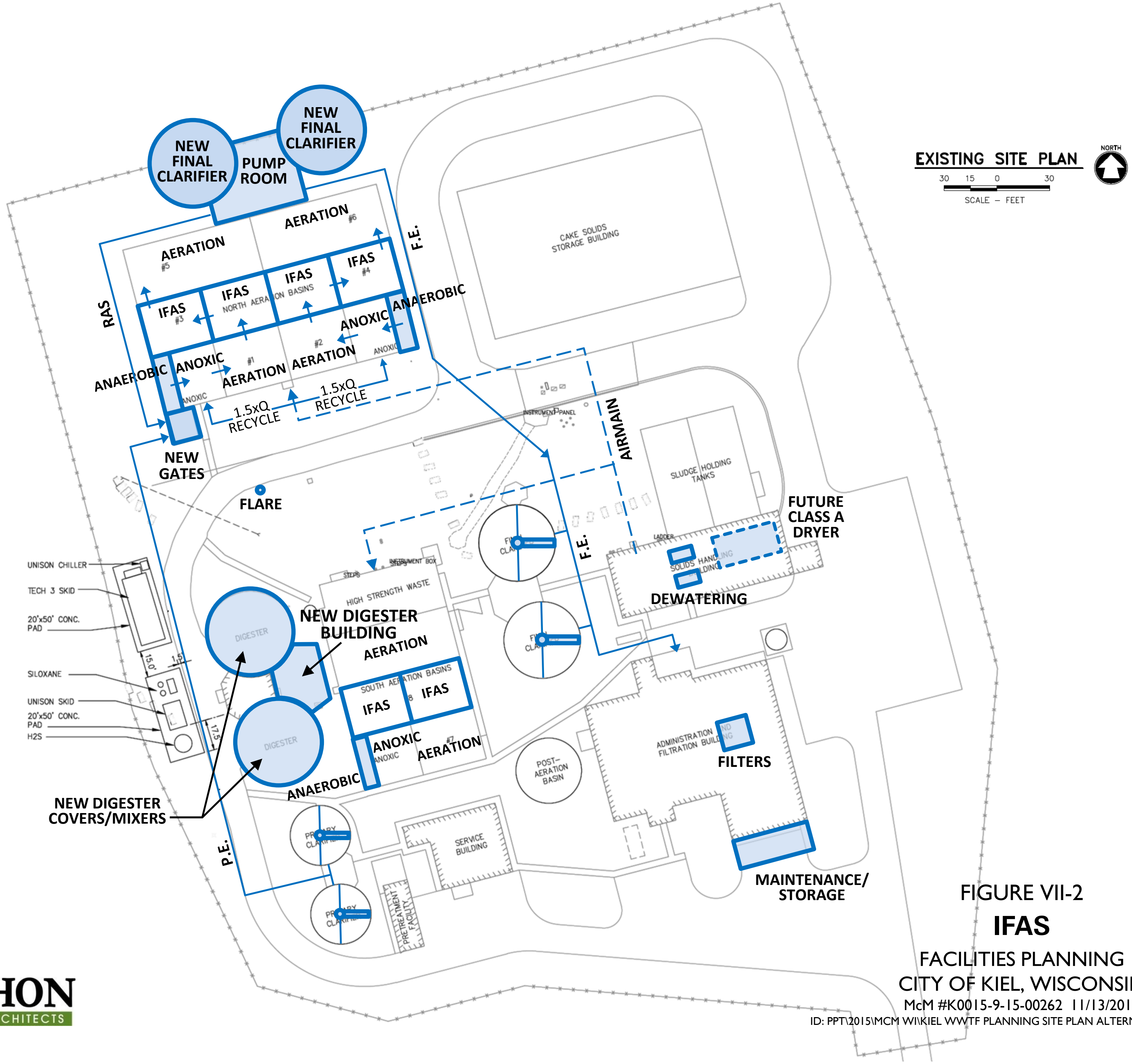

FIGURE VII-2

IFAS

FACILITIES PLANNING

CITY OF KIEL, WISCONSIN

McM #K0015-9-15-00262 11/13/2015

ID: PPT\2015\MCM WI\KIEL WWTF PLANNING SITE PLAN ALTERNATES.PPTX TJK:JMK

McMAHON ENGINEERS ARCHITECTS

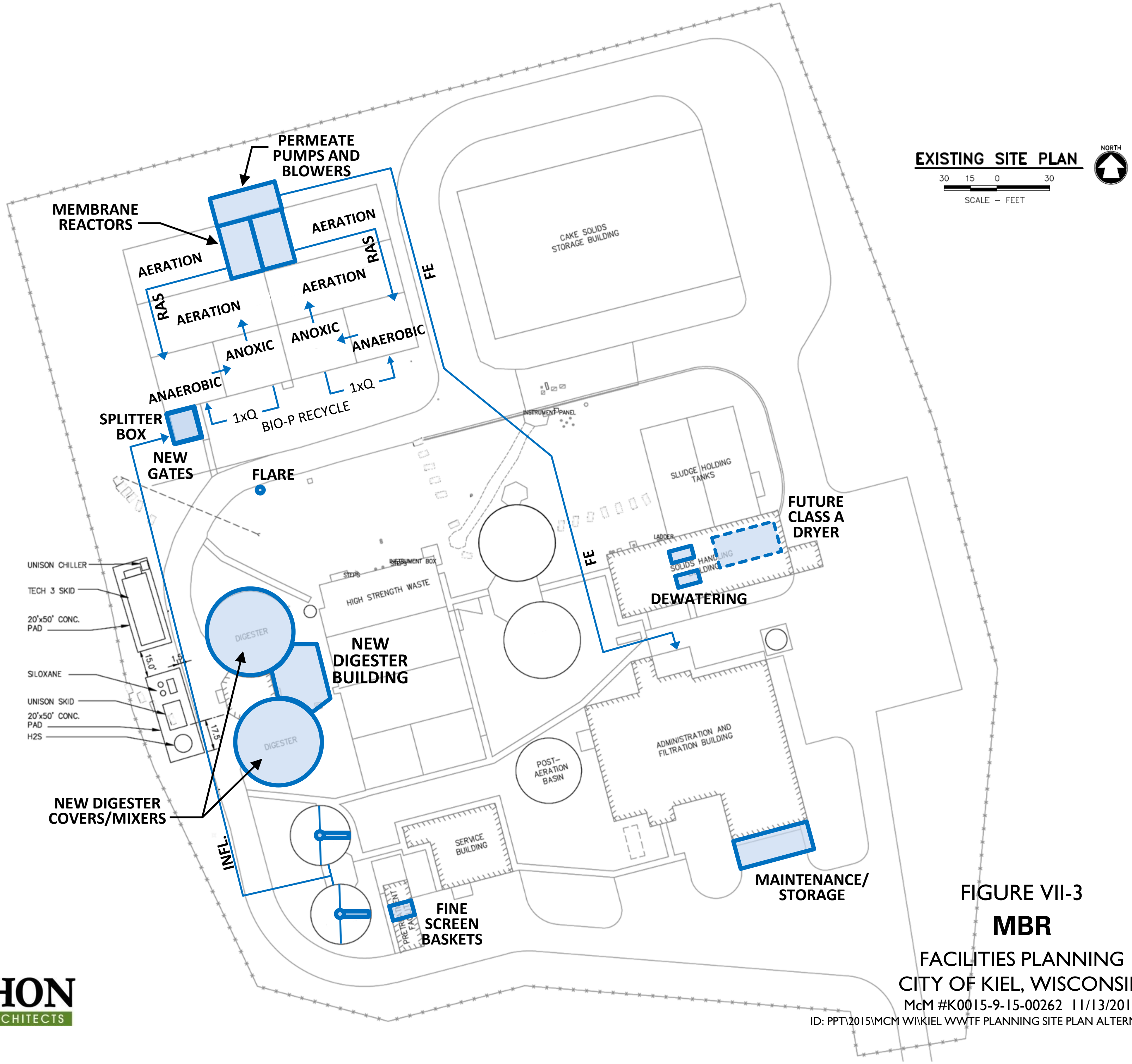

FIGURE VII-3

MBR

FACILITIES PLANNING

CITY OF KIEL, WISCONSIN

McM #K0015-9-15-00262 11/13/2015

ID: PPT\2015\MCM WI\KIEL WWTF PLANNING SITE PLAN ALTERNATES.PPTX TJK:JMK

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ENGINEERS ARCHITECTS

- Chapter VIII -
ENVIRONMENTAL SITE ASSESSMENT

A. INTRODUCTION

The potential impacts associated with the construction of Wastewater Treatment Facility Improvements for the City of Kiel Wastewater Treatment Facility are discussed in this chapter.

Environmental impacts are put into categories of primary and secondary impacts. Primary impacts result directly from construction activities and facility operations. Secondary impacts are indirect, and occur because the project causes changes that induce actions that would not occur without the project. A third category is that of unavoidable, adverse impacts.

The proposed Treatment Facility improvements project will be confined to the existing Wastewater Treatment Facility site, and public roads by which the facility is accessed.

1. Noise, Odor & Aesthetics

Construction of improvements at the City of Kiel Wastewater Treatment Facility will inevitably generate some dust. Fumes, dust and noise will be a short-term impact from truck travel and heavy machinery associated with construction activities. These short-term impacts may be a nuisance to residents living near the activities and along truck routes. Mitigation of these impacts will be discussed in the 'Mitigation of Impacts' section of this chapter. A short-term aesthetic impact will also be associated with construction of Treatment Facility improvements. It should be noted that there are no residential properties adjacent to the Treatment Facility site.

2. Erosion & Sedimentation

Soils exposed during construction will be subject to accelerated erosion until the surface is re-vegetated. Erosion will be mitigated by Best Management construction practices for erosion control, as appropriate for the Treatment Facility site.

3. Surface Water

Erosion control will be provided, as necessary, to protect nearby surface water from sedimentation due to runoff during construction at the Treatment Facility site.

Appendix VIII-1 contains the floodplain mapping indicating the Wastewater Treatment Facility site is outside the 100-year floodplain.

4. Groundwater

There is groundwater approximately 15-feet below grade at the Treatment Facility site. Dewatering may be required when excavating for new below-ground structures at the Treatment Facility site. However, no significant long-term impacts are expected as a result of construction.

5. Wetlands

Construction of improvements at the City of Kiel Wastewater Treatment Facility will be confined to the existing Treatment Facility site. Therefore, there are no anticipated impacts on wetland areas.

Appendix VIII-2 contains a wetlands map of the area surrounding the Wastewater Treatment Facility site, confirming there are no affected wetlands.

6. Fish & Wildlife

Information provided on the Wisconsin Department Of Natural Resources (DNR) website, '*Endangered Resources Preliminary Assessment*', indicates no endangered resources have been recorded in the vicinity of the Wastewater Treatment Facility site.

Appendix VIII-3 provides documentation from the website.

7. Agricultural Lands

The wastewater treatment improvements and their implementation are to be located at the site of the existing Wastewater Treatment Facility. As a result, there will be no immediate impact on agricultural lands. There may be secondary impacts associated with potential growth and development, as well as Class A biosolids disposal as a result of the project.

8. Land Use

The project is not expected to induce changes in previously identified land use. The City of Kiel has zoning controls in place, and has adopted a 20-year Comprehensive Plan. Development will continue within the Sewer Service Area. Mitigation of growth related impacts will be discussed in the 'Mitigation of Impacts' section of this chapter.

9. Transportation

Short-term impacts will include increased truck traffic from construction activities. Due to the Treatment Facility location, these activities are not expected to disrupt traffic flow in and around the City of Kiel or result in the use of short-term detours. Long-term transportation impacts are not expected.

10. Economics

Construction of the Wastewater Treatment Facility improvements will lead to short-term increases in employment, and purchased goods and services in the immediate area.

11. Cultural Resources

With regard to the existing Treatment Facility site, the Wisconsin Historical Society files would have previously been reviewed by the DNR Archeologist for potential impacts to archeological sites or historical structures during previous projects.

New correspondence with the DNR Archeologist regarding this review is provided in Appendix VIII-4. No impacts are anticipated.

12. Unavoidable Adverse Impacts

Some impacts associated with implementation of the Recommended Plan cannot be avoided. The construction of the Wastewater Treatment Facility improvements may have the following adverse impacts:

a. Short-term construction dust, noise and traffic.

b. Minor erosion during construction.

13. Irretrievable & Irreversible Resource Commitments

The proposed construction of the Wastewater Treatment Facility improvements would include the commitment of the following resources:

a. Fossil fuel, electrical energy and human labor for facilities construction and operation.

b. Increased user fees to cover construction and operation.

c. Some unsalvageable construction material.

B. MITIGATION OF IMPACTS

As previously discussed, various adverse impacts would be associated with the proposed alternative. Many of these adverse impacts could be reduced significantly by the application of mitigative measures. These mitigative measures consist of a variety of legal requirements, planning measures and design practices. The extent to which these measures are applied will determine the ultimate impact of the particular actions. Potential measures for alleviating construction, operation, and secondary effects are discussed in the following section.

1. Mitigation Of Construction Impacts

Construction related impacts are primarily short-term effects resulting from construction activities. Mitigation measures for these impacts are the responsibility of the Contractor, and are governed by requirements in the project Drawings and Specifications, and appropriate local, State and Federal regulations.

Erosion and sediment control measures are required by the project Specifications. The Specifications require the Contractor provide an Erosion and Sediment Control Program consisting of a schedule for land clearing and grading for each structure and trench excavation, along with a description of measures to be used during construction for erosion and sediment control. Adherence to the required Program will minimize adverse impacts from erosion and sedimentation.

If the area disturbed by construction activities is larger than 1-acre, the Contractor will also be required to obtain a DNR Storm Water Discharge Permit. The Permit requirements would be implemented and administered by the Contractor throughout the project.

The Specifications will require the Contractor to provide dust control measures. These measures generally consist of periodic watering of the construction area.

Traffic control during construction activities will adhere to appropriate requirements.

2. Mitigation Of Operation Impacts

Proper operation and maintenance of the Wastewater Treatment Facilities will improve the reliability of the system, leading to the discharge of high quality effluent. The new facilities will be constructed without disrupting existing level of treatment.

3. Mitigation Of Secondary Impacts

Secondary impacts are principally associated with induced development associated with the improvements to the wastewater treatment system. Induced growth can be controlled with proper planning and zoning controls. The City of Kiel has zoning controls in place at

- Chapter VIII -
ENVIRONMENTAL SITE ASSESSMENT

A. INTRODUCTION

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The proposed Treatment Facility improvements project will be confined to the existing Wastewater Treatment Facility site, and public roads by which the facility is accessed.

1. Noise, Odor & Aesthetics

Construction of improvements at the City of Kiel Wastewater Treatment Facility will inevitably generate some dust. Fumes, dust and noise will be a short-term impact from truck travel and heavy machinery associated with construction activities. These short-term impacts may be a nuisance to residents living near the activities and along truck routes. Mitigation of these impacts will be discussed in the 'Mitigation of Impacts' section of this chapter. A short-term aesthetic impact will also be associated with construction of Treatment Facility improvements. It should be noted that there are no residential properties adjacent to the Treatment Facility site.

2. Erosion & Sedimentation

Soils exposed during construction will be subject to accelerated erosion until the surface is re-vegetated. Erosion will be mitigated by Best Management construction practices for erosion control, as appropriate for the Treatment Facility site.

3. Surface Water

Erosion control will be provided, as necessary, to protect nearby surface water from sedimentation due to runoff during construction at the Treatment Facility site.

Appendix VIII-1 contains the floodplain mapping indicating the Wastewater Treatment Facility site is outside the 100-year floodplain.

4. Groundwater

There is groundwater approximately 15-feet below grade at the Treatment Facility site. Dewatering may be required when excavating for new below-ground structures at the Treatment Facility site. However, no significant long-term impacts are expected as a result of construction.

5. Wetlands

Construction of improvements at the City of Kiel Wastewater Treatment Facility will be confined to the existing Treatment Facility site. Therefore, there are no anticipated impacts on wetland areas.

Appendix VIII-2 contains a wetlands map of the area surrounding the Wastewater Treatment Facility site, confirming there are no affected wetlands.

6. Fish & Wildlife

Information provided on the Wisconsin Department Of Natural Resources (DNR) website, '*Endangered Resources Preliminary Assessment*', indicates no endangered resources have been recorded in the vicinity of the Wastewater Treatment Facility site.

Appendix VIII-3 provides documentation from the website.

7. Agricultural Lands

The wastewater treatment improvements and their implementation are to be located at the site of the existing Wastewater Treatment Facility. As a result, there will be no immediate impact on agricultural lands. There may be secondary impacts associated with potential growth and development, as well as Class A biosolids disposal as a result of the project.

8. Land Use

The project is not expected to induce changes in previously identified land use. The City of Kiel has zoning controls in place, and has adopted a 20-year Comprehensive Plan. Development will continue within the Sewer Service Area. Mitigation of growth related impacts will be discussed in the 'Mitigation of Impacts' section of this chapter.

9. Transportation

Short-term impacts will include increased truck traffic from construction activities. Due to the Treatment Facility location, these activities are not expected to disrupt traffic flow in and around the City of Kiel or result in the use of short-term detours. Long-term transportation impacts are not expected.

10. Economics

Construction of the Wastewater Treatment Facility improvements will lead to short-term increases in employment, and purchased goods and services in the immediate area.

11. Cultural Resources

With regard to the existing Treatment Facility site, the Wisconsin Historical Society files would have previously been reviewed by the DNR Archeologist for potential impacts to archeological sites or historical structures during previous projects.

New correspondence with the DNR Archeologist regarding this review is provided in Appendix VIII-4. No impacts are anticipated.

12. Unavoidable Adverse Impacts

Some impacts associated with implementation of the Recommended Plan cannot be avoided. The construction of the Wastewater Treatment Facility improvements may have the following adverse impacts:

a. Short-term construction dust, noise and traffic.

b. Minor erosion during construction.

13. Irretrievable & Irreversible Resource Commitments

The proposed construction of the Wastewater Treatment Facility improvements would include the commitment of the following resources:

a. Fossil fuel, electrical energy and human labor for facilities construction and operation.

b. Increased user fees to cover construction and operation.

c. Some unsalvageable construction material.

the present time. The City of Kiel also has adopted a 20-year Comprehensive Plan (December 2002), which provides guidance for potential growth on a regional basis.

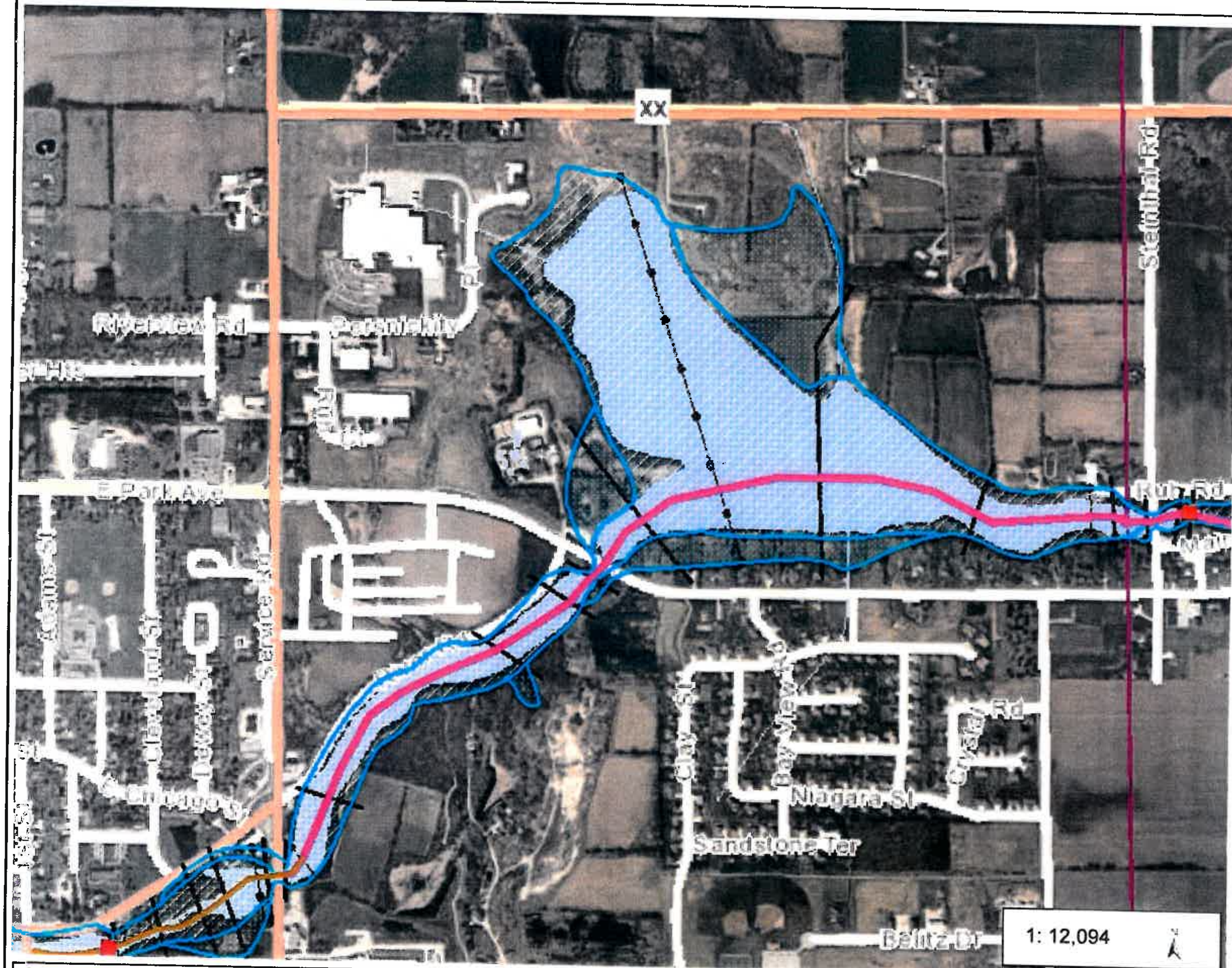
C. RESOURCES IMPACT SUMMARY

Appendix VIII-5 contains the 'Resources Impact Summary' for the City of Kiel proposed Recommended Plan. This document will be made available for public review and comment.

APPENDIX VIII-1

100-YEAR FLOODPLAIN MAPPING

Surface Water Data Viewer Map



1: 12,094

Legend

Dams
- Dams with FERC License
- Dams

Floodplain Analysis Lines
- Other
- Flood Insurance Study
- Letter of Map Revision
- Case By Case Analysis
- Bridge

Floodplain Analysis Points
- Other
- Flood Insurance Study
- Letter of Map Revision
- Case By Case Analysis
- Bridge

- 1% Annual Chance Flood Haz
- 0.2% Annual Chance Flood Ha
- Cross Sections
- Floodway
- Base Flood Elevations
- FIRM Panel Index
- Statewide Flood Insurance Rat Index
- Rivers and Streams
- Open Water
- 2010 Air Photos (WROC)

Notes

0.4 0 0.19 0.4 Miles

NAD_1983_HARN_Wisconsin_TM

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SHEBOYGAN RIVER									
A	215,179	251	919	5.2	0	845.3	845.3	845.3	0.0
B	215,878	258	1,168	4.1	0	846.7	846.7	846.7	0.0
C	216,025	237	1,141	4.0	0	846.9	846.9	846.9	0.0
D	216,302	290	2,260	1.4	0	855.6	855.6	855.6	0.0
E	216,445	376	2,689	1.6	0	855.6	855.6	855.6	0.0
F	219,442	380	3,248	1.2	0	855.8	855.8	855.8	0.0
G	219,886	78	778	4.9	0	856.5	856.5	856.5	0.0
H	220,014	75	837	4.5	0	857.3	857.3	857.3	0.0
I	220,232	448	3,755	1.2	0	857.7	857.7	857.7	0.0
J	223,908	496	3,503	1.7	88	857.9	857.9	857.9	0.0
K	226,907	434	3,124	1.7	0	858.1	858.1	858.1	0.0
L	228,763	283	1,499	3.8	0	858.3	858.3	858.3	0.0
M	229,214	91	672	5.7	0	858.6	858.6	858.6	0.0
N	229,335	240	1,351	4.5	0	859.0	859.0	859.0	0.0
O	229,887	125	144	3.3	140	859.5	859.5	859.5	0.0
P	232,401	135	528	6.6	0	861.6	861.6	861.6	0.0
Q	235,865	95	495	6.2	0	872.1	872.1	872.1	0.0
R	235,951	200	1,190	2.7	0	881.4	881.4	881.4	0.0
S	236,190	77	720	4.1	0	881.4	881.4	881.4	0.0
T	236,420	347	1,707	1.9	0	881.7	881.7	881.7	0.0
U	237,423	439	2,572	1.2	0	881.8	881.8	881.8	0.0
V	238,539	1,044	9,925	0.3	0	881.8	881.8	881.8	0.0
W	239,808	288	2,357	1.2	0	881.8	881.8	881.8	0.0
X	240,360	95	672	4.1	0	881.8	881.8	881.8	0.0
Y	240,605	328	2,063	1.4	0	882.0	882.0	882.0	0.0

[1]FEET ABOVE MOUTH

TABLE 12

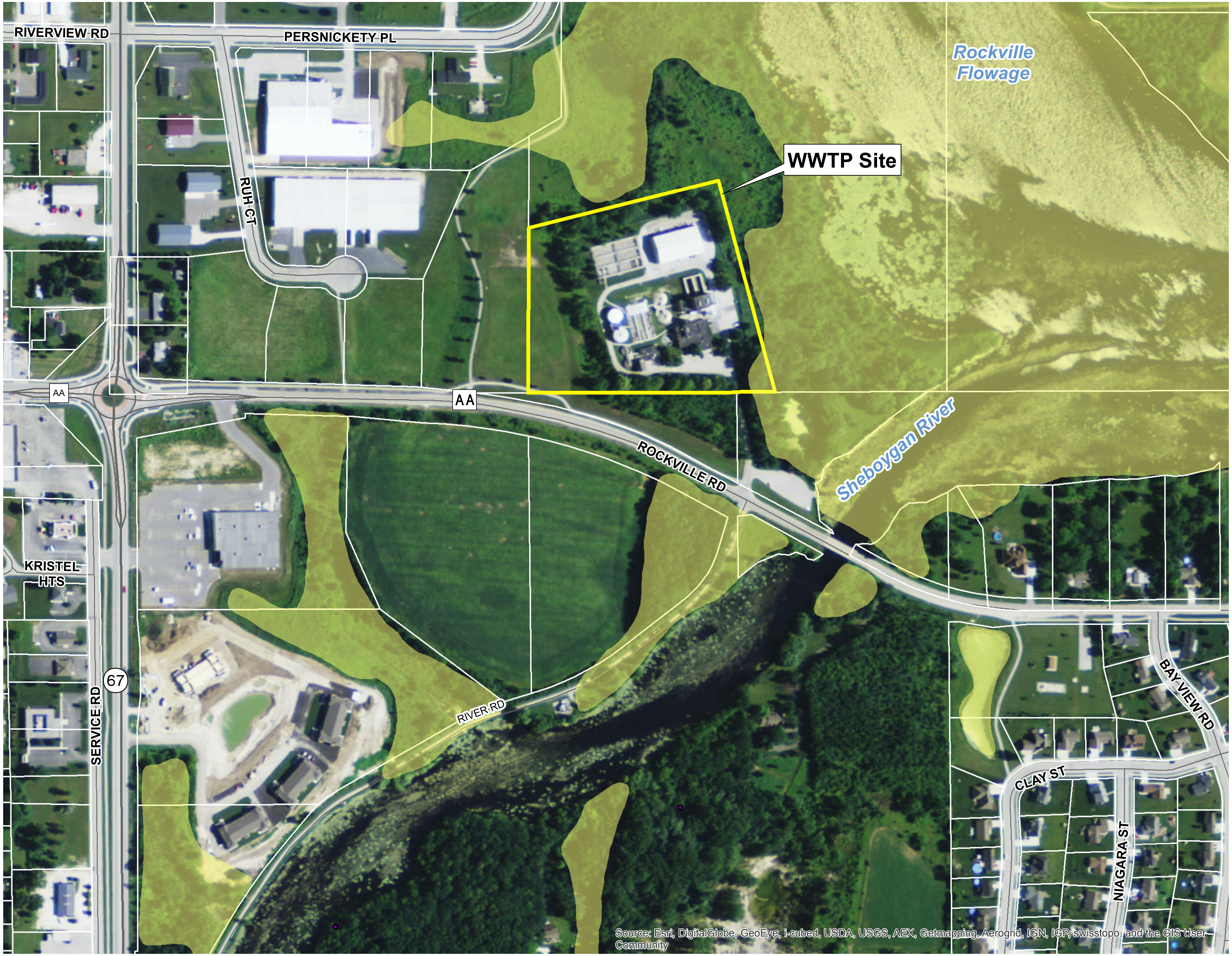
FEDERAL EMERGENCY MANAGEMENT AGENCY
MANITOWOC COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SHEBOYGAN RIVER

APPENDIX VIII-2

WETLANDS MAP



Kiel
WISCONSIN

Mapped Features

- WDNR Wetlands (2010)
- Parcel Line

Source: Manitowoc County, 2010-12.

Disclaimer: The property lines, right-of-way lines, and other property information on this drawing were developed or obtained as part of the County Geographic Information System or through the County property tax mapping function. McMAHON does not guarantee this information to be correct, current, or complete. The property and right-of-way information are only intended for use as a general reference and are not intended or suitable for site-specific uses. Any use to the contrary of the above stated uses is the responsibility of the user and such use is at the user's own risk.

N

0 300 600 Feet

McMAHON
ENGINEERS ARCHITECTS

AERIAL LOCATION & WETLANDS
KIEL WASTEWATER
TREATMENT PLANT
CITY OF KIEL
MANITOWOC COUNTy, WISCONSIN

W:\PROJECTS\K0015\950262\00\GIS\AerialWetlands_B.mxd SLH

APPENDIX VIII-3

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR)
'Endangered Resources Preliminary Assessment'

Endangered Resources Preliminary Assessment

Created on **Monday, April 27, 2015**. This report is good for one year after the created date.

Results

No actions required/recommended. No endangered resources have been recorded in this area. For additional information on Endangered Resources (ER) Reviews, please visit: http://dnr.wi.gov/topic/ERReview/Review.html

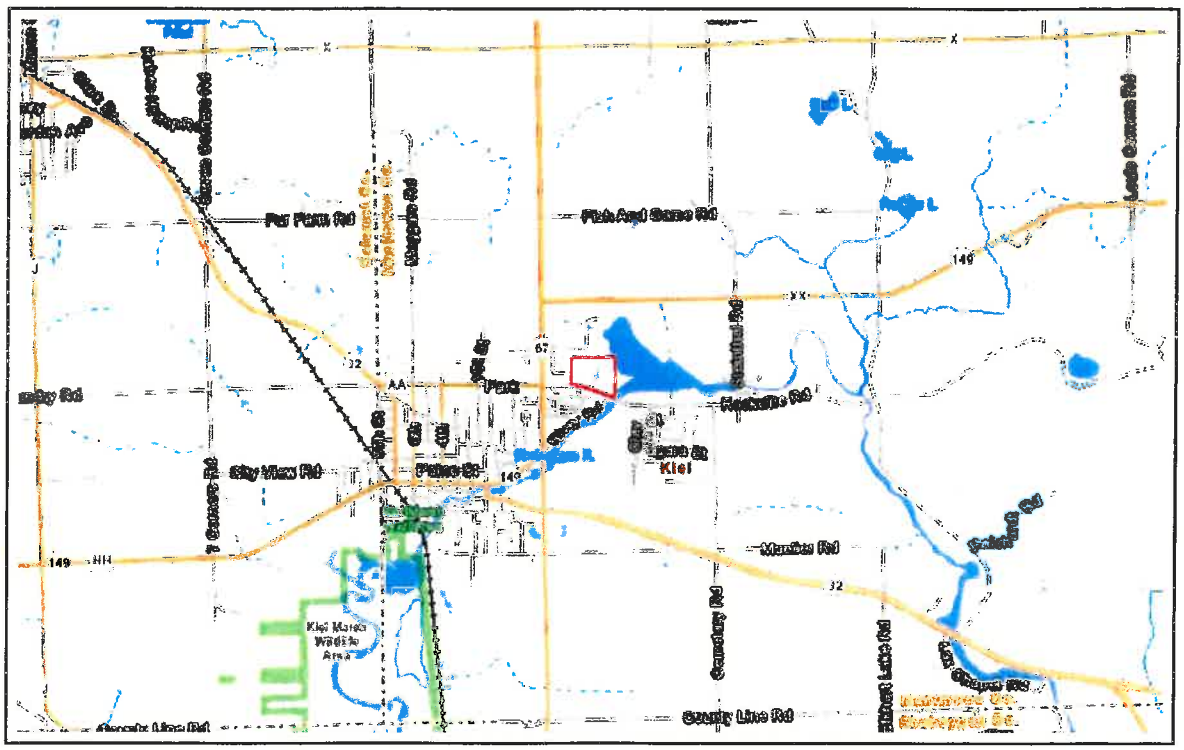
Project Information

Landowner name	City of Kiel
Project address	100 E. Park Avenue, Kiel, WI
Project description	Kiel Wastewater Treatment Plant

Project Questions

Does the project involve a public property?	Yes
Is the project on a federal property?	No
Is the project federally funded?	Yes
Is the project a utility, agricultural, forestry or bulk sampling (associated with mining) project?	Yes
Is the project property in Managed Forest Law or Managed Forest Tax Law?	No

Project Area Maps



https://dnrx.wisconsin.gov/nhiportal/public

101 S. Webster Street . PO Box 7921 . Madison, Wisconsin 53707-7921

APPENDIX VIII-4

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR)
Archaeological / Historical Significance Response

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 S. Webster St.
Madison, Wisconsin 53707-7921
Phone/voicemail: 608.266.3462
E-mail: mark.dudzik@wisconsin.gov
FAX 608.267.2750

March 31, 2015

Amy Vaclavik, PE
McMahon Associates
1445 McMahon Drive
Neenah, WI 54956

Subject: *City of Kiel – WWTP Improvements, Manitowoc County (T17N/R21E/S20)*

Dear Ms. Vaclavik,

DNR has completed a review of the above project.

For cultural resource (per WI stats) issues only, the project is cleared to proceed (i.e., no *recorded* historic properties reported to occur within target parcels/locations).

Please forward this letter to other parties, as needed, and retain a copy for project files.

Do not hesitate to get in touch for additional information or clarification.

Sincerely,

Mark J. Dudzik
Departmental Archaeologist

McMAHON
ENGINEERS ARCHITECTS

March 26, 2015

Mr. Mark Dudzik
Department Archaeologist
Wisconsin Department Of Natural Resources
101 South Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Re: City Of Kiel, Wisconsin
Wastewater Facilities Planning
McM. No. KK0015-950262.00

Dear Mark:

We are preparing a Wastewater Facilities Plan for the City Of Kiel, Wisconsin. We request a review of the site be conducted to determine if there are potential archaeological or historic sites in the area. Figures showing the location of the Wastewater Treatment Facility are provided. The site is located as follows:

City Of Kiel
Township Seventeen (17) North, Range Twenty-One (21) East
Southwest Quarter (1/4) Of Section Twenty (20)
Manitowoc County, Wisconsin

Thank you for your consideration of this request. Please call if there are questions or if additional information is needed.

Very truly yours,

McMAHON

Amy J. Vaclavik

Amy J. Vaclavik, P.E., BCEE
Associate / Senior Project Engineer

AJV:smdt
Enclosure

McMAHON ASSOCIATES, INC. | 1445 McMAHON DRIVE NEENAH, WI 54956 Mailing P.O. BOX 1025 NEENAH, WI 54957-1025
PH 920.751.4200 FAX 920.751.4284 MCM@MCMGRP.COM WWW.MCMGRP.COM

Project Solutions

APPENDIX VIII-5

RESOURCES IMPACT SUMMARY

- Appendix VIII-5
RESOURCES IMPACT SUMMARY

A. PROJECT IDENTIFICATION

CITY OF KIEL

- **Wastewater Treatment Facili**ties
  100 East Park Avenue
  Kiel, WI 53042
  Manitowoc County
  Township Seventeen (17) North, Range Twenty-One (21) East, Section Twenty (20)

B. PROJECT DESCRIPTION

1. Why Is This Project Required?

The current Wastewater Treatment Facility receives flows and loadings beyond its design capacity. The Facility is designed to treat an average flow of 0.862 mgd and 6,000 lbs. Biochemical Oxygen Demand (BOD) and 2,842 lbs. Suspended Solids (SS). Over the past 3-years, the actual average flows and loadings were 0.961 mgd, 6,569 lbs. BOD and 4,418 lbs. SS. The treatment capacity needs to be increased to accommodate current, as well as future, flows and loadings.

Some equipment utilized in the treatment processes has reached the end of its useful life. New technologies are available, which can replace old, worn out systems and improve efficiencies.

Changing effluent limits will require changes to the current treatment processes. The existing filters cannot treat the effluent to the necessary degree required by a Phosphorus limit of 0.1 mg/L.

2. Proposed Facility Improvements

The proposed improvements are summarized below:

a. Plant-Wide Improvements:

1) Heating, ventilation and temperature control systems.
2) Flow metering.
3) Supervisory Control & Data Acquisition (SCADA), control system upgrades.
4) Electrical gear upgrades.
5) Lighting system upgrades.
6) Site paving.

7) Primary effluent piping.
8) Final effluent piping.
9) Maintenance structure addition.

b. Headworks:

1) Fine screen basket replacement.

c. Primary Clarifiers:

1) Structural crack repair.
2) Replace drives.
3) Replace clarifier mechanism.
4) Replace weirs and baffles.
5) Positive Displacement (PD) sludge pumps.

d. Activated Sludge System:

1) Structural crack repair.
2) Splitter box gates.
3) Aeration tank modifications.
4) Aeration diffuser modifications.
5) Aeration blowers and piping.
6) Membrane Bio-Reactor (MBR) system.
7) MBR Equipment Building.

e. Disinfection:

1) Gas Storage Room modifications.

f. Digesters:

1) Building expansion.
2) Replace covers.
3) Mixing system.
4) Boiler / heat exchanger.
5) Recirculation pumps.
6) Relocate flare.
7) Coating system.

g. High Strength Waste Tank:

1) Separation wall and coating system.
2) Pumps and piping.

h. **Dewatering:**

1) Dewatering equipment.
2) Biosolids conveyors.
3) Hoisting equipment.

i. **Class A Process:**

1) Dryer system.

3. Sewer Service Area

The corporate boundaries of the City of Kiel are the limits of the area to be served by the sewer system. The Wastewater Treatment Facility is able to receive high strength wastes and septage from outside of the Kiel corporate limits via independent haulers.

4. Design Flows & Loadings

PROPOSED WASTEWATER TREATMENT FACILITY
DESIGN CRITERIA

Design Year	2035
Population	4,260
Flow (mgd)	
▪ Average	1.24
▪ Maximum Month	2.17
▪ Maximum Day	3.75
▪ Peak Hour	4.96
Biochemical Oxygen Demand (BOD) (lbs./day)	
▪ Average	8,265
▪ Maximum Month	10,745
▪ Maximum Day	21,489
Total Suspended Solids (TSS)	
▪ Average	6,424
▪ Maximum Month	9,636
▪ Maximum Day	16,060
Total Kjehldahl Nitrogen (TKN)	
▪ Average	620
▪ Maximum Month	993
▪ Maximum Day	1,427
Phosphorus (P)	
▪ Average	179
▪ Maximum Month	233
▪ Maximum Day	627

5. Effluent Limits

Treated effluent is discharged to the Sheboygan River (water body identification Code Number 50700) at Rockville Flowage in the Sheboygan River Watershed (SH03) of the

Sheboygan River Drainage Basin in Manitowoc County. The discharge is authorized under Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-0020141-08-0. Key limits include:

BOD	10 mg/L	May thru October
BOD	15 mg/L	November thru April
TSS	10 mg/L	May thru October
TSS	15 mg/L	November thru April
NH_3N	5.3 mg/L	October thru March
NH_3N	2.2 mg/L	April thru May
NH_3N	1.7 mg/L	June thru September
P	1.0 mg/L	

Other effluent limits for conventional parameters, such as pH, fecal coliform, chlorine residual, copper and chlorides, match up with conventional limits seen throughout the State.

In anticipation of reissuance of the WPDES Permit, the DNR has issued a Memorandum regarding Water Quality Based Effluent Limitations (WQBEL) for the City of Kiel Wastewater Treatment Facility, dated September 30, 2013. The purpose of the Memorandum is to provide calculated water quality based effluent limits for discharge into the Sheboygan River.

Key changes to the Kiel discharge permit being considered by the DNR include:

a. Temperature Limits (September - April)

b. Total Phosphorus Limits
   1) 0.1 mg/L (May - October)
   2) 0.3 mg/L (November - April)

c. Chlorides, 460 mg/L

d. Ammonia, 6.7 mg/L daily maximum

e. Dissolved Oxygen (DO), 7.0 mg/L (July - September)

f. Biochemical Oxygen Demand (BOD)
   1) 8.9 mg/L (June)
   2) 9.5 mg/L (July)
   3) 8.7 mg/L (August)
   4) 9.9 mg/L (September)
   5) 9.3 mg/L (October)

g. Total Suspended Solids (TSS)
   1) 8.9 mg/L (June)
   2) 9.5 mg/L (July)
   3) 8.7 mg/L (August)
   4) 9.9 mg/L (September)
   5) 9.3 mg/L (October)

6. Implementation

Design of the proposed improvements is scheduled to occur in 2016, with construction commencing in 2017 and continuing through 2018. The project is anticipating financing via the Clean Water Fund (CWF) program.

C. AFFECTED ENVIRONMENT

1. Physical

The proposed Treatment Facility upgrade will occur on the existing Wastewater Treatment Facilities site. The site has been previously disturbed during the mid-1980's expansion projects, and subsequent improvement projects since. The proposed project will have no anticipated impacts on lakes, streams, shore lands, flood plains, wetlands, groundwater, soils or topography. Erosion control measures shall be required by project specifications.

2. Biological

Information provided by the DNR website '*Endangered Resources Preliminary Assessment'* indicates no endangered resources have been recorded in the vicinity of the Wastewater Treatment Facility site.

3. Cultural

The proposed Wastewater Treatment Facility improvements project will have no impact on zoning, land use, ethnic or cultural groups, or archaeological/historical resources.

4. Other Features

The proposed Wastewater Treatment Facility improvements project will have no impact on parks, waterways, natural areas or prime agricultural land.

D. PROJECT ENVIRONMENTAL IMPACTS

Environmental impacts are put into categories of primary and secondary impacts. Primary impacts result directly from construction activities and facility operations. Secondary impacts are indirect, and occur because the project causes changes that induce actions that would not occur without the project. A third category is that of unavoidable, adverse impacts.

1. Noise, Odor & Aesthetics

Construction of improvements at the City of Kiel Wastewater Treatment Facilities will inevitably generator some dust. Fumes, dust and noise will be a short-term impact from truck travel and heavy machinery associated with construction activities. These short-term impacts may be a nuisance to residents living near the activities and along truck routes. Mitigation of these impacts are discussed in Paragraph E - *Mitigation of Impacts*. A short-term aesthetic impact will also be associated with construction of Treatment Facility improvements.

2. Erosion & Sedimentation

Soils exposed during construction will be subject to accelerated erosion until the surface is re-vegetated. Erosion will be mitigated by Best Management construction practices for erosion control, as appropriate.

3. Surface Water

Erosion control will be provided, as necessary, to protect nearby surface water from sedimentation due to runoff during construction.

4. Groundwater

There is relatively high groundwater the Wastewater Treatment Facility site (approximately 15-feet below grade). Dewatering may be required when excavating for new below-ground structures at the Treatment Facility site. However, no significant long-term impacts are expected as a result of construction.

5. Wetlands

Construction of improvements at the City of Kiel Wastewater Treatment Facility will be confined to the existing Treatment Facility site. Therefore, there are no impacts on wetland areas.

6. Fish & Wildlife

Information provided on the DNR website '*Endangered Resources Preliminary Assessment*' indicated no endangered resources have been recorded in the vicinity of the Wastewater Treatment Facility site.

7. Agricultural Lands

The Wastewater Treatment Facility improvements will be located at the site of the existing Treatment Facility. As a result, there will be no immediate impact on agricultural lands. There may be secondary impacts associated with potential growth and development, as well as a Class A biosolids disposal as a result of the project.

8. Land Use

The project is not expected to induce changes in previously identified land use. Development will continue within the City of Kiel corporate limits. A 20-year Comprehensive Plan, prepared by Bay-Lake Regional Planning Commission, was adopted by the City of Kiel on December 10, 2002, which provides guidance for future development. Mitigation of growth related impacts will be discussed in Paragraph E - *Mitigation Of Impacts*.

9. Transportation

Short-term impacts will include increased truck traffic from construction activities. These activities are not expected to disrupt traffic flow in and around the City or result in the use of short-term detours. Long-term transportation impacts are not expected.

10. Economics

Construction of the Wastewater Treatment Facility improvements will lead to short-term increases in employment, and purchased goods and services in the immediate area.

11. Cultural Resources

A request was made of the DNR Archeologist to determine if any archeological sites or historic structures/sites are present within the vicinity of the City of Kiel Wastewater Treatment Facility site. The response from the DNR was that there are no recorded historic properties recorded to occur within the project location. There are no expected impacts for work at the existing Wastewater Treatment Facility site.

12. Unavoidable Adverse Impacts

Some impacts associated with implementation of the Recommended Plan cannot be avoided. The project may have the following adverse impacts:

a. Potential short-term construction dust, noise and traffic.

b. Potential minor erosion during construction.

13. Irretrievable & Irreversible Resource Commitments

The proposed project would include the commitment of the following resources:

a. Fossil fuel, electrical energy and human labor for facilities construction and operation.

b. Increased user fees to cover construction and operation.

c. Some unsalvageable construction material.

E. MITIGATION OF IMPACTS

As previously discussed, various potential adverse impacts would be associated with the proposed alternative. Many of these potential adverse impacts could be reduced significantly by the application of mitigative measures. These mitigative measures consist of a variety of legal requirements, planning measures and design practices. The extent to which these measures are applied will determine the ultimate impact of the particular actions. Potential measures for alleviating construction, operation and secondary effects are discussed in the following section.

1. Mitigation Of Construction Impacts

Construction related impacts are primarily short-term effects resulting from construction activities. Mitigation measures for these impacts are the responsibility of the Contractor, and are governed by requirements in the project Drawings and Specifications and appropriate regulations.

Erosion and sediment control measures are required by the project Specifications. The Specifications require the Contractor provide an Erosion and Sediment Control Program consisting of a schedule for land clearing and grading for each structure and trench excavation, along with a description of measures to be used during construction for erosion and sediment control. Adherence to the required Plan will minimize adverse impacts from erosion and sedimentation.

If the area disturbed by construction activities is larger than 1-acre, the Contractor will also be required to obtain a DNR Storm Water Discharge Permit. The permit requirements would be implemented and administered by the Contractor throughout the project.

The Specifications will require the Contractor to provide dust control measures. These measures generally consist of periodic watering of the construction area.

Traffic control during construction activities will adhere to appropriate requirements.

2. Mitigation Of Operation Impacts

Proper operation and maintenance of the Wastewater Treatment Facility will improve the reliability of the system, leading to the discharge of high quality effluent. The new facilities will be constructed utilizing temporary equipment and processes, as necessary, to minimize disruption of existing treatment.

3. Mitigation Of Secondary Impacts

Secondary impacts are principally associated with induced development associated with the improvements to the wastewater treatment system. Induced growth can be controlled with proper planning and zoning controls. The City of Kiel has zoning controls in place at the present time. Additionally, the City of Kiel has the 20-year Comprehensive Plan for guidance.

F. ALTERNATIVES CONSIDERED

The following alternatives were considered:

1. 'No Action' Alternative

The 'No Action' Alternative consists of maintaining 'status quo' conditions within the Treatment Facility. Under this Alternative, no Wastewater Treatment Facility improvements or modifications would be implemented.

The current facilities have reached or exceeded their design capacities. Hydraulic limitations exist, hampering the treatment process as flows increase. Many of the unit processes, control systems and infrastructure have been in service for more than 20-years. Age, environmental conditions and continued use have taken a toll on equipment, processes and controls throughout the Facility. Rather than taking a piecemeal approach to upgrades, and sacrificing cost savings and construction related synergy, the City of Kiel authorized a Wastewater Facilities Plan be undertaken to estimate future flows and loadings to the Year 2035. The rationale for a comprehensive approach to addressing the needs at the Treatment Facilities makes the 'No Action' Alternative impractical.

2. Regional Treatment

Regional treatment with the closest municipality, New Holstein, was previously considered. High costs for wastewater transmission rendered this alternative impractical.

3. Wastewater Treatment Alternatives

Three (3) alternatives were considered for the activated sludge process:

- Expand Existing System
- Integrated Film Activated Sludge (IFAS)
- Membrane Bio-Reactor (MBR)

a. Expand Existing System:

Expansion of the existing aeration system will be required to effectively treat the projected flows and loadings for the next 20-years. Influent / effluent piping to/from the aeration basins will need to have an increase in hydraulic capacity. Flow splitting at the existing splitter box will need to be addressed, as well. An additional aeration tank may be added to each of the three (3) trains.

Continued use of aeration tankage will require structural repairs to concrete, as necessary, to extend their service life.

The buried air main, which leaks, should be replaced with an overhead, stainless steel air main. The old, 100-HP blowers are recommended to be replaced with more energy efficient units. Continued use of the 150-HP blowers is recommended, as they can provide on-line back-up to meet firm capacity requirements, while new energy efficient blowers provide duty service.

b. Integrated Film Activated Sludge (IFAS):

Retrofitting the aeration system with an Integrated Film Activated Sludge (IFAS) system was considered as an alternative to increasing the existing treatment capacity of the conventional activated sludge system. An IFAS system combines both attached biological growth and suspended biological growth treatment in the same tank. Media is added to the aeration tankage, which provides a surface for growth of additional attached biomass. Advantages of IFAS include:

1) Allows capacity expansion with same aerobic volume.
2) Increases Biological Nutrient Removal (BNR).
3) Improves solids settleability.
4) Greater resistance to hydraulic washout.
5) Increased resilience to slug loadings.
6) Reduced solids loading to final clarifiers.

c. Membrane Bio-Reactor (MBR):

Consideration was also given to Membrane Bio-Reactor (MBR) systems. Factory-assembly of submerged units, consisting of air diffusers assemblies, membrane cassettes and common permeate manifolds, provide simpler installation in the field.

MBR systems operate at a higher mixed liquor concentration, and require a significantly smaller footprint. Advantages of an MBR system include:

1) Smaller footprint; fits in existing tankage.
2) Multiple barriers; membranes and biofilm.
3) Physical barrier to exclude viruses, bacteria and cysts; reducing need to expand disinfection system or existing filters.
4) No need to rebuild or expand final clarifiers.

With the use of an expanded conventional activated sludge system, and with an IFAS system, the existing final clarifiers will be utilized. Replacement of the mechanisms and drives, weirs and baffles is required. In addition, two (2) new 40-foot diameter final clarifiers are required to handle the projected hydraulic capacity and solids loading. Redundant Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) pumps are included. Final clarifiers are not required for the MBR alternative.

The capacity of the filter system must be increased, and efficiencies increased to allow removal of Phosphorus. The ability to remove Phosphorus down to 0.1 mg/L at 4.96 mgd in a retrofit of the existing sand filters is highly unlikely and impractical. Options utilizing ballasted high rate sedimentation (Actiflo and Co-Mag) do not allow for installation within the existing filter footprint while providing system redundancy, and were dropped from consideration. Instead, installation of disc type filters in the filter footprint were evaluated with the expanded conventional activated sludge and IFAS options. Filters are not required with the MBR option.

4. Biosolids Handling Alternatives

Space limitations in the area currently occupied by the 2-meter belt press preclude using the same technology in the future, when redundant units are provided. Screw press technology and centifuges, which have a smaller footprint, will be considered for dewatering.

For as long as it is serviceable, continued use of the existing pasteurization process is proposed, as the basic infrastructure is in place, and a readily stackable and disposable biosolids product is produced. Presently, power plant bottom ash is added in excess of that required for stabilization in order to produce a stackable biosolids product. There is no cost to the City to acquire the bottom ash. When combined in the pasteurization process, the volume of cake produced is doubled. This results in a need to expand the Biosolids Storage

Facility in the future should the RDP process be continued. In addition, continued use of systems with lime or fly ash will result in premature equipment failures due to lime /ash dust that becomes airborne. In the event the pasteurization process becomes no longer serviceable, alternative technology, such as dryers, are recommended, as they also can produce a stackable, readily disposable product. Belt dryers, which utilize hot air, fit within the space limitations of the existing Solids Handling Building. The resultant Class A process with a dry solids content in excess of 90% will allow continued use of the existing Storage Facility without the need for expansion.

5. Total Project Costs

An Opinion Of Probable Construction Costs[(1)] and Operation & Maintenance (O&M) Costs[(1)] is summarized below for each alternative considered.

Treatment Option	Capital Cost	Present Worth Capital	Annual O&M	Present Worth O&M	Total Present Worth
Expand Existing System	$13,407,849	$13,723,290	$617,916	$7,951,454	$21,674,745
IFAS	$15,297,523	$15,634,745	$738,984	$9,509,379	$25,144,124
MBR	$13,412,022	$13,627,131	$702,108	$9,034,852	$22,661,983

Biosolids Option	Capital Cost	Present Worth Capital	Annual O&M	Present Worth O&M	Total Present Worth
Centrifuge	$1,289,846	$1,283,589	$109,638	$1,410,842	$2,694,431
Screw Press	$1,273,635	$1,267,335	$114,275	$1,470,511	$2,737,846

Class A	Capital Cost
Dryer	$5,585,400

6. Environmental Impacts Of Non-Selected Alternatives

a. 'No Action' Alternative:

The environmental impacts of the 'No Action' Alternative include a continuation of the aging of equipment and additional stress on the treatment process, which could ultimately lead to violations of the WPDES permit. Equipment failures would be expected to occur, jeopardizing the wastewater treatment process. The ability to hydraulically treat incoming flows is questionable.

b. Non-Selected Alternatives:

The environmental impacts of non-selected alternatives are the same as the impacts of the selected alternatives. Impacts would be limited to the existing Wastewater Treatment Facility site, and chiefly consist of short-term construction related impacts.

(1) The Opinion Of Probable Cost was prepared for use by the Owner in planning for future costs of the project. In providing Opinions Of Probable Cost, the Owner understands that the Design Professional has no control over costs or the price of labor, equipment or materials, or over Construction Professionals' method of pricing, and that the Opinions Of Probable Cost provided herewith are made on the basis of the Design Professional's qualifications and experience. It is not intended to reflect actual costs, and is subject to change with the normal rise and fall of the local area's economy. This Opinion must be revised after every change made to the project or after every 30-day lapse in time from the original submittal by the Design Professional.

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- Chapter IX -
RECOMMENDED PLAN

A. INTRODUCTION

Based upon the 'Alternatives Evaluation & Preliminary Screening', 'Cost Effectiveness Analysis', and 'Environmental Assessment', the Recommended Plan for the City of Kiel Wastewater Treatment Facility improvements include:

- Upgrading the activated sludge process with Membrane Bio-Reactor (MBR) technology;
- Upgrading the anaerobic digestion process to utilize two (2) primary digesters;
- Utilizing primary sludge and high strength wastes in the digestion process, and diverting Waste Activated Sludge (WAS) to dewatering;
- Upgrading biosolids dewatering to screw press technology;
- Incorporating a dryer as the Class A biosolids process; and
- Continuing with on-going Infiltration/Inflow (I/I) reduction programs.

B. DESCRIPTION

Figure IX-1 is a graphic representation of the liquid flow train through the treatment process. Figure IX-2 is a graphic representation of the solids handling and biosolids management train. The biogas management train is depicted in Figure IX-3. The design criteria for the Recommended Plan is summarized in Table IX-1. A detailed description of the Recommended Plan follows.

1. Plant-Wide

a. Instrumentation & Controls
b. Supervisory Control & Data Acquisition (SCADA) System
c. Administration Building HVAC
d. Laboratory Countertops
e. Storage, Maintenance Space, Vehicle Storage
f. Tank Cleaning (primaries, aeration, digesters)
g. Tank Painting (digesters, HSW tank)
h. Grading & Landscaping
i. Site Paving
j. Primary Effluent Piping
k. Final Effluent Piping
l. Electrical Gear

2. Headworks

a. Replace Fine Screen Baskets With 3 mm.

3. Primary Clarifiers

a. Repair Structural Cracks.
b. Replace Clarifier Mechanisms & Drives.
c. Replace Weirs & Baffles.
d. Provide Three (3) New Positive Displacement (PD) Sludge Pumps.

4. Activated Sludge System

a. Replace Splitter Box Gates.
b. Repair Spalled Concrete.
c. MBR Equipment & Building.
d. Overhead Air Main.
e. Additional Aeration System Headers & Diffusers.
f. Aeration Blowers.
g. Aeration Basin Configuration Modifications.

5. Disinfection System

a. Gas Storage Room Modifications.

6. Digesters

a. Replace Covers.
b. Add Mixing Systems.
c. Address Class I, Division 1 Compliance.
d. Add Boiler / Heat Exchanger.
e. Recirculation Pumps.
f. Relocate Flare.
g. Relocate condensate Drain In Service Building.
h. Clean & Coat Interiors.

7. High Strength Waste Receiving

a. Separation Wall Addition & Coating.
b. Pumps & Piping To Digesters.

8. Dewatering

a. Redundant Screw Presses.
b. Biosolids Conveyor.
c. Hoisting Equipment.

9. Class A Process

a. Hot Air Dryer System.

10. 180-Day Biosolids Storage

a. Continued Use Of Existing Building.

Table IX-1

WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
INFLUENT PUMPING (River Road Lift Station)	
▪ Number Of Pumps	3
▪ Capacity, each pump, gpm	1,150
▪ Station Firm Capacity, mgd	2.42
▪ Type Of Pump	Dry Pit-Immersible
INFLUENT SCREENING	
▪ Number Of Units	2
▪ Type	Spiral
▪ Capacity, each unit, mgd	4.30
▪ Clear Opening, mm	3
GRIT REMOVAL	
▪ Type Of Unit	Aerated
▪ Number Of Units	1
▪ Capacity, each unit, mgd	6.2
PRIMARY CLARIFIERS	
▪ Number Of Units	2
▪ Diameter, each unit, feet	2@28
▪ Sidewater (SWD) Depth, each unit, feet	2@12.31
▪ Surface Overflow Rate, gpd/sq.ft.	
▪ Average Flow, 1.34 mgd	2@1,089
▪ Peak Hour Flow, 5.06 mgd	2@4,114
▪ Weir Loading Rate, gpd/ft.	
▪ Average Flow, 1.34 mgd	2@4,542
▪ Detention Time, hours	
▪ Average Flow, 1.34 mgd	2@2.0
▪ Maximum Day Flow, 3.85 mgd	2@0.7
▪ Removal Efficiencies	
▪ BOD, %	21
▪ SS, %	50
▪ TKN	10
▪ Primary Sludge, lbs./day	
▪ Average Day	3,482
▪ Maximum 30-Day	5,088

Table IX-1

WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
PRIMARY CLARIFIERS (continued)	
▪ Volatile Sludge, lbs./day	
▪ Average Day (78% VSS)	2,716
▪ Maximum 30-Day (78% VSS)	3,969
▪ Primary Sludge, gpd @ x% solids	3
▪ Average Day	13,917
▪ Maximum 30-Day	20,336
SECONDARY TREATMENT SYSTEM	
▪ Design Loadings To Secondary, lbs./day	
▪ Biochemical Oxygen Demand (BOD)	
▫ Average Day	6,806
▫ Maximum Day	17,253
▫ Maximum 30-Day	8,765
▪ Total Kjeldahl Nitrogen (TKN) (includes sidestreams), lbs./day	
▫ Average Day	775
▫ Maximum Day	1,783
▫ Maximum 30-Day	1,240
▪ Phosphorus (P), lbs./day	
▫ Average Day	183
▫ Maximum Day	595
▫ Maximum 30-Day	233
▪ Existing Aeration Tanks, size, ft.	6@65x32
▪ SWD, ft.	14
▪ Total Tank Volume, cu.ft.	174,720
▪ Anoxic Zone, size, ft.	2@30x32
▪ Anaerobic Zone, size, ft.	2@34x32
▪ Aerobic Zone, size, ft.	4@65x32
▪ BOD Loading, lbs./1,000 cu.ft.	
▪ Average Day	39.0
▪ Maximum 30-Day	50.1
▪ Design MLSS, mg/L	
▪ Average	10,500
▪ Maximum Month	10,500
▪ Design F:M	
▪ Average	0.06
▪ Design Sludge Retention Time (SRT), Days	
▪ Average	25
▪ Volatile Solids, %	75%
▪ Total Sludge Production, lbs. SS/lb. BOD	0.60
▪ Secondary Sludge, lbs./day	
▪ Average	4,084
▪ Maximum 30-Day	5,259
▪ WAS To Dewatering, gpd @ 1.4%	
▪ Average	34,978
▪ Maximum Month	45,041
▪ Oxygen Requirements, lbs./day @ 1.1 lb. O2/lb.	

Table IX-1

WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	Proposed Design 2035
SECONDARY TREATMENT SYSTEM (continued)	
▪ BOD Applied & 4.6 lb. O2/lb. TKN Applied	
▪ Average Day	11,052
▪ Maximum Day	27,180
▪ Maximum Month	15,345
▪ Air Requirements, scfm	
▪ Average Day	4,075
▪ Maximum Day	11,348
▪ Maximum Month	5,921
▪ Blowers	
▪ Number of Existing PD Blowers	2
▪ Capacity, each existing unit, scfm	2,160
▪ Number Of New PD Blowers	3
▪ Capacity, each new unit, scfm	3,800
▪ Discharge Pressure, psig	8.0
▪ Firm Capacity, scfm	11,920
▪ Membrane Zone	
▪ MLSS, mg/L	14,000
▪ Flux Rate, gfd	9.1
▪ Membrane Area, sq.ft.	252,000
DISINFECTION	
Number Of Tanks	2
Total Volume, gallons	60,250
Detention Time, minutes	
▪ Average Flow, 1.24 mgd	70.0
▪ Peak Hour Flow, 4.96 mgd	17.5
ANAEROBIC DIGESTION	
▪ Number Of Digesters	
▪ Primary	2
▪ Secondary	0
▪ Diameter, feet	2@45
▪ Maximum SWD, feet	
▪ North Digester	26
▪ South Digester	21
▪ Maximum Volume, gallons	
▪ North Digester	342,537
▪ South Digesters	269,652
Total	612,189
▪ Mixing System	Linear Motion
▪ Cover Type	
▪ North Digester	Gas Holder
▪ South Digester	Gas Holder
▪ Maximum Month HRT, days	
▪ North Digester	8.4
▪ South Digester	6.6
Total	15.0

Table IX-1

WASTEWATER TREATMENT FACILITY DESIGN CRITERIA

Design Year	**Proposed Design 2035**
ANAEROBIC DIGESTION (continued)	
▪ Digestion Capacity, gpd	40,812
▪ Maximum Month VSS Loading, lbs. VSS/KCF	49.7
▪ VSS Destruction, %	50
▪ Heat Exchanger Capacity, gpd	41,000
▪ Sludge To Dewatering, lbs./day	
▪ Average	2,396
▪ Maximum Month	3,329
▪ Anaerobic Sludge To Dewatering, gpd @ 1%	
▪ Average	29,717
▪ Maximum Month	33,436
SLUDGE HOLDING TANKS	
▪ Number Of Tanks	2
▪ Size, ft.	2 @ 62'x 25'x 16' SWD
▪ Volume, gallons, each	185,500
▪ Volume, gallons, total	371,000
▪ Solids, % After Decanting	2.0
▪ 2% Sludge From Outside Sources, gallons/week	10,000
▪ Sludge To Dewatering, lbs./day	
▪ Average	6,718
▪ Maximum Month	8,826
▪ Sludge To Dewatering, gpd @ 2%	
▪ Average	40,276
▪ Maximum Month	52,914
SLUDGE DEWATERING	
▪ Number Of Units	2
▪ Capacity, each	
▪ gpm	50
▪ lbs./hour	490
▪ Hours Of Operation/Day	24
▪ Average Days Of Operation/Week	4
▪ Cake Solids, %, minimum	20
CLASS A DRYING PROCESS (Existing RDP System)	
▪ Number Of Units	1
▪ Minimum % Solids	49
▪ Hours Of Operation/Day	24
▪ Days Of Operation/Week	4
▪ Dried Biosolids/Year, cu.yds.	9,147 cu.yds.
▪ Stack Height @ 180-Days, ft.	13'-2"
CLASS A DRYING PROCESS (New Dryer)	
▪ Number Of Units	1
▪ Minimum % Solids	92
▪ Hours Of Operation/Day	24
▪ Days Of Operation/Week	4
▪ Dried Biosolids/Year, cu.yd.	1,617
▪ Stack Height @ 180-Days, ft.	2'-4"

C. IMPLEMENTATION

The Recommended Plan includes three (3) phases of construction.

1. Phase I

Phase I of the Recommended Plan includes work related to the primary clarifiers and primary effluent piping and the anaerobic digestion process. Specifically, the following items are included in Phase I:

a. Miscellaneous:

1) Instrumentation and controls related to the primary clarifiers and anaerobic digestion system.
2) SCADA system related to the primary clarifiers and anaerobic digestion system.
3) Primary clarifier and anaerobic digester tank cleaning.
4) Digester and high strength tank painting.
5) Grading/landscaping/paving of areas affected by the Phase I improvements.
6) Primary effluent piping.
7) Electrical gear related to the primary clarifiers and anaerobic digester system.

b. Primary Clarifiers:

1) Repair structural cracks.
2) Replace clarifier mechanisms and drives.
3) Replace weirs and baffles.
4) Provide three (3) new Positive Displacement (PD) sludge pumps.

c. Digesters:

1) Replace covers.
2) Add mixing systems.
3) Address Class I, Division 1 compliance.
4) Add boiler/heat exchanger.
5) Transfer and recirculation pumps.
6) Relocate flare.
7) Relocate condensate drain in Service Building.
8) Clean and coat tank interiors.

d. **High Strength Waste Receiving:**

1) Separation wall addition and coating.
2) Pumps and piping to digesters.

e. **Disinfection System:**

1) Gas Storage Room modifications.

By including the above items into Phase I, the most pressing needs of the treatment works can be addressed first, while minimizing the initial project cost. To further minimize the Phase I costs, the City of Kiel proposes to undertake some of the tasks as part of their Capital Improvements project, and utilize Replace Fund monies and the Operations Budget to fund the work. Specifically, the Phase I tasks to be included in the Capital Improvements are:

- Primary clarifier structural crack repair.
- Replacement of primary clarifier mechanisms and drives.
- Replacement of the primary weirs and baffles.
- High strength waste tank separation wall and coating.
- Gas Storage Room modifications.

The work scope associated with the Capital Improvements will not affect the user rates, as no 'new money' is utilized for the cost of the work. Rather, existing monies in the Replacement Fund and Operating Budget cover the costs.

Additionally, the City of Kiel proposes to directly procure the following major equipment items related to Phase I:

- Primary clarifier mechanisms and drives.
- Primary weirs and baffles.
- Primary sludge pumps.
- Anaerobic digester covers.
- Anaerobic digester mixers.
- Anaerobic digester boiler/heat exchanger.
- Recirculation and transfer pumps.
- High strength waste/septage pumps.

2. <u>Phase II</u>

Phase II of the Recommended Plan includes the activated sludge system and sludge dewatering aspects. Specifically, the following items are included in Phase II:

a. Miscellaneous:

1) Instrumentation and Controls related to the activated sludge process and dewatering process.
2) SCADA system related to the activated sludge process and dewatering process.
3) Storage, maintenance space, vehicle storage.
4) Aeration basin cleaning.
5) Grading/landscaping areas affected by the Phase II improvements.
6) Final effluent piping.
7) Electrical gear related to the activated sludge and dewatering systems.
8) Administration Building HVAC.
9) Laboratory countertops.

b. Headworks:

1) Replace fine screen baskets with 3 mm.

c. Activated Sludge System:

1) Replace splitter box gates.
2) Repair spalled concrete.
3) MBR equipment and building.
4) Overhead air main.
5) Additional aeration system headers and diffusers.
6) Aeration blowers.
7) Aeration basin configuration modifications.

d. Dewatering:

1) Provide two (2) new screw presses.
2) Provide new biosolids conveyor.
3) Provide hoisting equipment.

Upon completion of the Phase I improvements, the Phase II upgrades address the most pressing needs of the treatment works. Similarly, Phase II will utilize an Operations Budget for Capital Improvement projects to address the Administration Building HVAC, Laboratory countertops, repair of spalled concrete related to the aeration tankage, and replacement of the fine screen baskets. The corresponding Phase II project costs are reduced by an amount equal to the Capital Improvement projects.

Additionally, the City of Kiel proposes to directly procure the following major equipment items related to Phase II:

- Splitter box gates.

- MBR equipment.
- Aeration system headers/diffusers.
- Aeration blowers.
- Screw presses.
- Biosolids conveyor.

3. Phase III

Phase III of the Recommended Plan includes the Class A system upgrades, utilizing a hot air dryer system. Specifically, the following items are included in Phase III:

a. Miscellaneous:

1) Instrumentation and Controls upgrades remaining from Phases I and II.
2) SCADA system remaining from Phases I and II.
3) Site paving remaining from Phases I and II.
4) Electrical gear remaining from Phases I and II.

b. Class A Process:

1) Hot air dryer system.

To maximize the service life of the existing Class A process, the Phase III improvements include replacement of the aging pasteurization system with a hot air dyer system. It is anticipated that the City of Kiel may be able to defer the Phase III improvements for approximately 5-years.

D. CAPITAL COST

The Opinion Of Probable Construction Costs [1] for the Recommended Plan, including engineering and contingencies, is summarized below for each of the three (3) phases. A detailed breakdown of these costs is provided for each phase in Table IX-2.

1. Phase I

Capital Cost	$2,925,400
Engineering, Legal, Administration, Contingencies	877,600
TOTAL	$3,803,000

2. Phase II

Capital Cost	$7,596,700
Engineering, Legal, Administration, Contingencies	2,279,000
TOTAL	$9,875,700

3. Phase III

Capital Cost $4,906,000
<u>Engineering, Legal, Administration, Contingencies .... 981,200</u>
TOTAL.. $5,887,200

Table IX-2

RECOMMENDED PLAN
Opinion Of Probable Construction Cost - Phase I

Miscellaneous	
▪ Mechanical & Structural Demolition	$21,000
▪ Tank Cleaning (Primary Clarifier, Digesters)	$50,000
▪ Painting (Digesters, Digester Building Expansion)	$147,000
Site Work	
▪ Underground Piping (20-inch P.E.)	$47,000
▪ Relocate Flare	$7,500
▪ Grading & Landscaping	$20,000
▪ Paving	$47,000
Structures	
▪ Digester Building Expansion	$400,000
Equipment	
▪ Primary Sludge Pumps (3)	$75,000
▪ High Strength Waste Pumps (2)	$26,000
▪ Digester Covers & Mixers	$557,000
▪ Digester Recirculation Pumps (2)	$50,000
▪ Boiler/Heat Exchanger	$155,000
Equipment Installation (20% of Equipment)	$172,600
Mechanical (Process Piping, Plumbing, HVAC) (30% of Equipment)	$258,900
Electrical	$400,000
Controls & SCADA	$300,000
Subtotal	**$2,734,000**
General Conditions, Bonds, Insurance	$191,400
Total	**$2,925,400**
Contingencies (15% of Total)	$438,800
Engineering (15% of Total)	$438,800
GRAND TOTAL	**$3,803,000**

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Table IX-2
(continued)

RECOMMENDED PLAN
Opinion Of Probable Construction Cost - Phase II

Miscellaneous	
▪ Mechanical & Structural Demolition	$25,000
▪ Tank Cleaning (Aeration Basins)	$50,000
Site Work	
▪ Underground Piping (FE)	$22,000
▪ Air Main Replacement	$40,000
▪ Grading & Landscaping	$20,000
Structures	
▪ Aeration Basin Modifications	$20,000
▪ MBR Equipment Building	$150,000
▪ Administration Building Maintenance Addition	$165,000
Equipment	
▪ Aeration Splitter Box Gates	$37,000
▪ MBR Equipment	$2,850,000
▪ Aeration Systems (2 Trains)	$100,000
▪ Aeration Blowers (3 @ 200-HP)	$472,000
▪ Screw Press Equipment (including polymer feed)	$570,000
▪ Conveyor Equipment	$25,000
▪ Hoisting Equipment	$30,000
Equipment Installation (22% of Equipment)	$898,500
Mechanical (Process Piping, Plumbing, HVAC) (30% of Equipment)	$1,225,200
Electrical	$200,000
Controls & SCADA	$200,000
Subtotal	**7,099,700**
General Conditions, Bonds, Insurance	$497,000
Total	**$7,596,700**
Contingencies (15% of Total)	$1,139,500
Engineering (15% of Total)	$1,139,500
GRAND TOTAL	**$9,875,700**

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Table IX-2
(continued)

RECOMMENDED PLAN
Opinion Of Probable Construction Cost - Phase III

Site Work	
▪ Paving	$140,000
Equipment	
▪ Sludge Drying Equipment System	$2,900,000
Equipment Installation (25% of Equipment)	$725,000
Mechanical (Process Piping, Plumbing and HVAC) (15% Eqnt)	$435,000
Electrical, Controls & SCADA (18% of Equipment)	$525,000
Subtotal	**$4,585,000**
General Conditions	$321,000
Total	**$4,906,000**
Contingencies (10% of Total)	$490,600
Engineering (10% of Total)	$490,600
GRAND TOTAL	**$5,887,200**

E. PARALLEL COST CALCULATIONS

1. Parallel Cost Percentage Definition

The Parallel Cost Percentage is the proportion of the project costs that are eligible for below-market rate financing relative to the total project cost eligible for Clean Water Fund (CWF) Program financing. Project costs related to septage receiving and treatment are eligible for a 0% rate financing.

2. Calculating The Parallel Cost Percentage

The design period for the Kiel Wastewater Treatment System is evaluated in Chapter V - Future Conditions, Section E., Design Period. Three (3) Staging Periods were considered: 20-years, 15-years and 10-years. The analysis presented in Chapter V demonstrates that facility sizing is the same for both the 15-year and 20-year design periods, and based upon the projected flows, the 20-year staging period will be used for design purposes and for developing the Parallel Cost Percentage.

As required by the CWF, project costs associated with conveying flows and providing treatment for flows from industrial customers are eligible for funding at the market rate. Project costs associated with septage receiving and treatment are eligible for 0% interest rate financing.

If the project is to be implemented in separate phases and financed with separate CWF loans, parallel costs are calculated for each project phase.

The calculations for the project costs related to septage receiving and treatment, and the parallel cost calculation, is provided in Appendix IX-1. All of the improvements associated with septage receiving and treatment are proposed to be completed in Phase I. Reduced project costs related to industrial flows and loadings are included in Phase II and Phase III.

The septage costs and parallel cost ratios are summarized as follows:

Project Costs Eligible For 0% Interest Rate Funding = $243,425
(Septage Receiving & Treatment)

	Parallel Cost Ratio
Phase I	100%
Phase II	81.42%
Phase III	87.47%

F. POTENTIAL COST IMPACT

The City Of Kiel has prepared a sewer user rate study utilizing the three (3) phase project approach. The results are summarized in Appendix IX-2.

G. SCHEDULE

A proposed Implementation Schedule is shown below:

- Public Hearing....................January 2016
- Submit Facility Plan To Wisconsin DNR....................January 2016
- Begin Equipment Procurement Process....................January 2016
- Wisconsin DNR Facility Plan Approval....................April 2016
- Phase I -
  - Equipment Procurement Bidding .... May 2016
  - Drawings & Specification Submittal.................... December 2016
  - Bidding ....January 2017
  - Secure Project Financing....................March 2017
  - Substantial Completion....................June 2018
  - Project Close-Out .... September 2018
- Phase II -
  - Equipment Procurement Process .... May 2018
  - Equipment Procurement Bidding .... September 2018
  - Drawings & Specification Submittal.................... December 2018
  - Bidding ....January 2019
  - Substantial Completion.................... November 2019
  - Project Close-Out ....January 2020

- Phase III -
  - Equipment Procurement Process .... July 2019
  - Equipment Procurement Bidding .... September 2019
  - Drawings & Specification Submittal...January 2020
  - Bidding ....February 2020
  - Substantial Completion.. December 2020
  - Project Close-Out ....January 2021

(1) The Opinion Of Probable Cost was prepared for use by the Owner in planning for future costs of the project. In providing Opinions Of Probable Cost, the Owner understands that the Design Professional has no control over costs or the price of labor, equipment or materials, or over Construction Professionals' method of pricing, and that the Opinions Of Probable Cost provided herewith are made on the basis of the Design Professional's qualifications and experience. It is not intended to reflect actual costs, and is subject to change with the normal rise and fall of the local area's economy. This Opinion must be revised after every change made to the project or after every 30-day lapse in time from the original submittal by the Design Professional.

APPENDIX IX-1

PARALLEL COST CALCULATIONS

Table IX-A1

RECOMMENDED PLAN - PHASE I

Identification of Septage Costs and Parallel Cost Ratio Calculation

		Septage Costs	Opinion of Probable Cost Less Septage Costs	Parallel Cost
Miscellaneous				
▪ Mechanical & Structural Demolition	$21,000		$21,000	$21,000
▪ Tank Cleaning (Primary Clarifier, Digesters)	$50,000		$50,000	$50,000
▪ Painting (Digesters, Digester Building Expansion)	$147,000	$94,000	$53,000	$53,000
Site Work				
▪ Underground Piping (20-inch P.E.)	$47,000		$47,000	$47,000
▪ Relocate Flare	$7,500		$7,500	$7,500
▪ Grading & Landscaping	$20,000		$20,000	$20,000
▪ Paving	$47,000		$47,000	$47,000
Structures				
▪ Digester Building Expansion	$400,000		$400,000	$400,000
Equipment				
▪ Primary Sludge Pumps (3)	$75,000		$75,000	$75,000
▪ High Strength Waste Pumps (2)	$26,000	$26,000	$0	$0
▪ Digester Covers & Mixers	$557,000		$557,000	$557,000
▪ Digester Recirculation Pumps (2)	$50,000		$50,000	$50,000
▪ Boiler/Heat Exchanger	$155,000		$155,000	$155,000
Equipment Installation (20% of Equipment)	$172,600	$10,000	$162,600	$162,600
Mechanical (Process Piping, Plumbing, HVAC) (30% of Equipment)	$258,900	$15,000	$243,900	$243,900
Electrical	$400,000	$10,000	$390,000	$390,000
Controls & SCADA	$300,000	$20,000	$280,000	$280,000
Subtotal	**$2,734,000**	**$175,000**	**$2,559,000**	**$2,559,000**
General Conditions, Bonds, Insurance	$191,400	$12,250	$179,150	$179,150
Total	**$2,925,400**	**$187,250**	**$2,738,150**	**$2,738,150**
Contingencies (15% of Total)	$438,810	$28,088	$410,723	$410,723
Engineering (15% of Total)	$438,810	$28,088	$410,723	$410,723
GRAND TOTAL	**$3,803,020**	**$243,425**	**$3,559,595**	**$3,559,595**

The Flows and Loadings from Industry do not have an impact on the improvements proposed in Phase I.

Parallel Cost Ratio = $\frac{\$3,559,595}{\$3,559,595}$ = 100%

Table IX-A2
RECOMMENDED PLAN - PHASE II
Identification of Septage Costs and Parallel Cost Ratio Calculation

		Parallel Cost	Comment
Miscellaneous			
▪ Mechanical & Structural Demolition	$25,000	$25,000	Industry has no impact on this task
▪ Tank Cleaning (Aeration Basins)	$50,000	$50,000	Industry has no impact on this task
Site Work			
▪ Underground Piping (FE)	$22,000	$22,000	Max Day Flows still exceed pipe capacity
▪ Air Main Replacement	$40,000	$30,000	Existing air main leaks, reduced diameter
▪ Grading & Landscaping	$20,000	$20,000	Industry has no impact on this task
Structures			
▪ Aeration Basin Modifications	$20,000	$20,000	Industry has no impact on this task
▪ MBR Equipment Building	$150,000	$150,000	Industry has no impact on this task
▪ Administration Building Maintenance Addition	$165,000	$165,000	Industry has no impact on this task
Equipment			
▪ Aeration Splitter Box Gates	$37,000	$37,000	Industry has no impact on this task
▪ MBR Equipment	$2,850,000	$2,500,000	Slightly smaller casettes and pumps
▪ Aeration Systems (2 Trains)	$100,000	$50,000	Fewer diffusers required
▪ Aeration Blowers (3 @ 200-HP)	$472,000	$236,000	Smaller blowers required
▪ Screw Press Equipment (including polymer feed)	$570,000	$450,000	Smaller units required
▪ Conveyor Equipment	$25,000	$25,000	Industry has no impact on this task
▪ Hoisting Equipment	$30,000	$30,000	Industry has no impact on this task
Equipment Installation (22% of Equipment)	$898,500	$732,160	Reduced scope
Mechanical (Process Piping, Plumbing, HVAC) (30% of Equipment)	$1,225,200	$998,400	Reduced scope
Electrical	$200,000	$40,000	Reduced scope
Controls & SCADA	$200,000	$200,000	Industry has no impact on this task
Subtotal	**$7,099,700**	**$5,780,560**	
General Conditions, Bonds, Insurance	$497,000	$404,639	
Total	**$7,596,700**	**$6,185,199**	
Contingencies (15% of Total)	$1,139,505	$927,780	
Engineering (15% of Total)	$1,139,505	$927,780	
GRAND TOTAL	**$9,875,710**	**$8,040,759**	

There are no septage costs in the Phase II Project

Parallel Cost = $\frac{\$8,040,759}{\$9,875,710}$ = 81.42%

Table IX-A3

RECOMMENDED PLAN - PHASE III

Identification of Septage Costs and Parallel Cost Ratio Calculation

		Parallel Cost	Comment
Site Work			
▪ Paving	$140,000	$140,000	Industry has no impact on this task
Equipment			
▪ Sludge Drying Equipment System	$2,900,000	$2,500,000	Smaller units required
Equipment Installation (25% of Equipment)	$725,000	$625,000	Reduced scope
Mechanical (Process Piping, Plumbing and HVAC) (15% Eqnt)	$435,000	$375,000	Reduced scope
Electrical, Controls & SCADA (18% of Equipment)	$525,000	$485,000	Reduced scope
Subtotal	**$4,725,000**	**$4,125,000**	
General Conditions	$321,000	$288,750	
Total	**$5,046,000**	**$4,413,750**	
Contingencies (10% of Total)	$504,600	$441,375	
Engineering (10% of Total)	$504,600	$441,375	
GRAND TOTAL	**$6,055,200**	**$5,296,500**	

Parallel Cost = $\frac{\$5,296,500}{\$6,055,200}$ = 87.47%

APPENDIX IX-2

CITY OF KIEL
PROJECTED SEWER RATES

Appendix IX-2

WASTEWATER UTILITY SEWER USER RATE STUDY
Summary of Results 2015 to 2022

CITY OF KIEL

Wastewater Treatment Facility - Facility Plan

Three (3) Clean Water Fund Loans Construction Complete 2018, 2020, 2022 @2.7%

Year	2015	2016	2017	2018	2019	2020	2021	2022
Capital Upgrades		$1,300,000		$3,500,000		$9,000,000		$6,000,000
O&M Expenses	$1,142,769	$1,099,811	$1,154,802	$1,251,305	$1,595,988	$1,591,250	$1,623,075	$1,655,537
Revenue Requirement	$1,682,830	$1,691,311	$1,750,224	$1,934,293	$2,182,817	$2,898,665	$2,897,595	$3,360,368
Annual Dept Payment on Capital Upgrades	$192,039	$243,477	$243,559	$281,070	$281,070	$878,358	$878,358	$1,270,550
Replacement Fund 5% of Total Active Loan	$80,000	$74,348	$74,356	$78,107	$78,107	$137,836	$137,836	$177,055
User Rate								
Fixed								
5/8	$12.88	$13.26	$13.78	$14.45	$16.40	$23.29	$24.40	$28.90
3/4	$12.88	$13.26	$13.78	$14.45	$16.40	$23.29	$24.40	$28.90
1	$15.28	$15.73	$16.40	$17.20	$19.51	$27.71	$29.04	$34.39
1 1/2	$17.46	$17.98	$18.75	$19.66	$22.30	$31.67	$33.18	$39.39
2	$19.65	$22.03	$20.95	$21.97	$24.93	$35.40	$37.09	$43.92
3	$26.19	$26.96	$27.98	$29.34	$33.29	$47.28	$49.53	$58.66
4	$36.02	$37.08	$38.60	$40.47	$45.92	$65.21	$68.32	$80.91
6	$58.04	$60.67	$62.99	$66.05	$74.94	$106.43	$111.51	$132.05
Volumetric Rate	$2.03	$2.10	$2.11	$2.20	$2.51	$3.42	$3.41	$3.95
BOD Rate/lb	$0.20	$0.24	$0.28	$0.35	$0.39	$0.54	$0.56	$0.68
TSS Rate/lb	$0.31	$0.37	$0.38	$0.47	$0.51	$0.66	$0.68	$0.95
Phos Rate/lb	$2.40	$3.09	$6.77	$7.37	$7.55	$8.66	$9.22	$12.40
Single Family Monthly Average with 600 cubic feet usage	$25.06	$25.86	$26.44	$27.65	$31.46	$43.81	$44.86	$52.60
Percentage Increase for Average Single Family Home		3.09%	2.19%	4.38%	12.11%	28.19%	2.34%	14.71%