Section 3 — Point Source Nutrient Reduction Technology Assessment and Implementation Plan

Section 3.1 Technology Assessment and Implementation Plan

Establishing Effluent Limits

The following describes the applicable federal and state laws and regulations pertaining to the establishment of effluent limits in NPDES permits. There are two bases for establishing effluent limits: technology and water quality. Technology-based limits establish the floor or minimum level of treatment a facility must provide. More stringent water quality-based limits must be imposed in permits when the technology-based limits will not assure compliance with state water quality standards.

Technology-Based Limits for POTWs

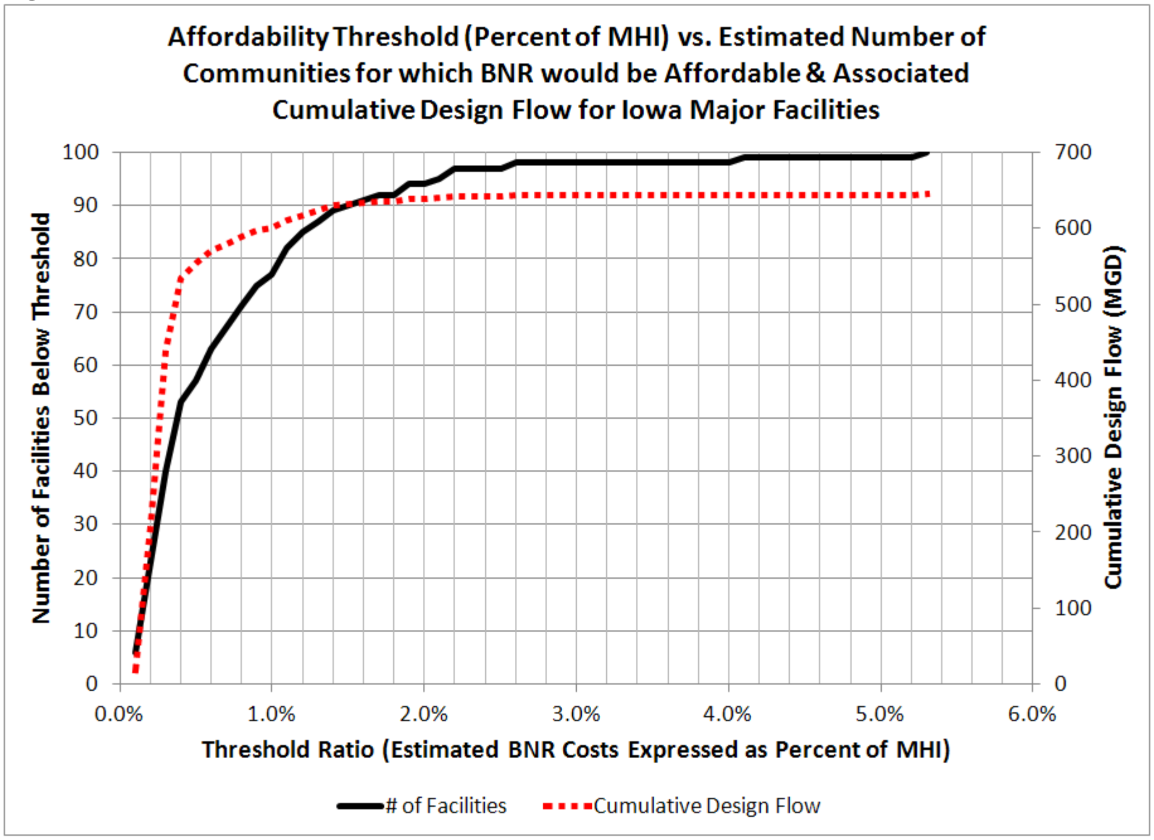
Technology-based limits for POTWs have been established by EPA in 40 §CFR 133 under authority of Section 304(d) of the Clean Water Act and represent the degree of reduction attainable through the application of secondary wastewater treatment technology. Technology-based effluent limits for a pollutant not covered by federal effluent standards may be imposed on a case-by-case basis (IAC 567-62.8(5)). Such limitation must be based on the effect of the pollutant in water and the feasibility and reasonableness of treating such pollutant.

Although continuously evolving, many nutrient removal technologies in wastewater treatment are already proven and well-established. Thus, nutrient removal for Iowa's wastewater treatment facilities is technologically feasible. The primary mechanism IDNR will use in assessing the "reasonableness" of nutrient removal for individual facilities is the estimated costs for improvements and the ability of end users to afford those costs.

Affordability of wastewater treatment improvements is dependent upon a number of factors including capital costs, existing and projected debt service, and operation and maintenance costs. Without detailed financial information from a facility it is not possible to determine affordability. Screening criteria are available to indicate the likelihood that a project will be affordable with minimal information. EPA economic guidance (U.S. EPA 1995) and proposed rules to implement the new disadvantaged communities' law (455B.199B) suggest that if the ratio of projected total wastewater costs to a community's Median Household Income (MHI) is less than one percent, then a project is affordable barring very weak community economic indicators. If the ratio is greater than two percent then a project is not affordable unless economic indicators are strong. Projects resulting in a ratio between one and two percent may or may not be considered affordable dependent upon the strength of secondary economic indicators such as comparison of county MHI to statewide MHI, bond rating, etc.

Section 3.2 shows that nutrient reduction costs are generally affordable for most of Iowa's major municipal facilities based on the ratio of estimated project cost to Median Household Income (MHI). These same facilities also have the largest design flows and, in general, the greatest point source nutrient contribution. If the communities served by major municipal facilities can afford a project cost/MHI ratio of 0.5%, the design flow treated by those facilities for which nutrient reduction is affordable is over 550 MGD, or roughly 86% of the total design flow for all major municipal facilities. This relationship is shown in Figure 3-1 below.

Figure 3-1:



Three Tiers of Nutrient Removal

The three most commonly cited "tiers" of nutrient removal are Biological Nutrient Removal (BNR), Enhanced Nutrient Removal (ENR) and the Limit of Technology (LOT).

Biological Nutrient Removal is commonly associated with sequenced combinations of aerobic, anoxic and anaerobic processes which facilitate biological denitrification via conversion of nitrate to nitrogen gas and "luxury" uptake of phosphorus by biomass with subsequent removal through wasting of sludge (biomass). Effluent limits achievable using BNR at wastewater treatment facilities that treat primarily domestic wastewater are 10 mg/L of total nitrogen (TN) and 1.0 mg/L of total phosphorus (TP).

Enhanced Nutrient Removal typically uses BNR with chemical precipitation and granular media filtration to achieve lower effluent nitrogen and phosphorus concentrations than can be achieved through BNR alone. ENR systems are capable of producing effluent with nitrogen and phosphorus values of about 6 mg/L of total nitrogen and 0.2 mg/L of total phosphorus (Falk et al. 2011).

The term "Limit of Technology" (LOT) is generally associated with the lowest effluent concentrations that can be achieved using any treatment technology or suite of technologies. It is commonly referenced as an upper bound in nutrient removal performance. However, there is no consensus or regulatory definition establishing specific treatment requirements for the LOT. As such, effluent values associated with the LOT are debatable. Some have proposed statistical approaches that define the LOT as the minimum effluent concentrations that can be expected to be reliably met over a specific averaging period using widely available and proven treatment processes (Neethling et al. 2009, Bott et al. 2009). Commonly referenced thresholds for the LOT for BNR are 3 mg/L for total nitrogen and 0.1 mg/L for total phosphorus (U.S. EPA 2007, Jeyanayagam 2005). Lower effluent values are possible using tertiary chemical addition & filtration, advanced effluent membrane filtration, ion exchange and/or adsorption processes but may not be practical.

Technology Based Limits for Industries

Technology-based limits for industrial discharges are established by federal effluent guidelines adopted in 40 CFR subchapter N, under the authority of CWA Sections 304 and 306, and are adopted in the state of Iowa by reference in IAC 567-62.4. Where EPA has not promulgated a federal standard for a particular industrial category, technology-based limits must be developed on a case-by-case basis at the time of permit issuance (CWA section 402(a)(1)(B) and IAC 567-62.6(3)(a)). In developing case-by-case technology-based limits for industries, the limits must conform to 40 CFR Part 125 Subpart A – Criteria and Standards for Imposing Technology-Based Treatment Requirements.

EPA has promulgated federal effluent guidelines for 57 classes of industries but, with few exceptions, such effluent standards do not establish technology-based requirements for total nitrogen or total phosphorus. Where there are promulgated federal guidelines for TN or TP, the NPDES permit will contain effluent limits consistent with those guidelines.

Data on the amounts of nitrogen and phosphorus discharged by industries is not readily available but likely varies significantly based on the type of industry. For example, process wastewater discharged by a meat processing facility will likely contain significantly higher nutrient concentrations than the discharge from a steam electric power plant. Most industries do not operate biological wastewater treatment plants because the characteristics of their wastewater makes biological treatment unnecessary so requiring all industries to install BNR is not reasonable. All major industries and minor industries with existing biological treatment systems will be required to collect data on the source, concentration and mass of total nitrogen and total phosphorus in their effluent and to evaluate alternatives for reducing the amounts of both pollutants in their discharge. IDNR will use the results of these evaluations to establish case-by-case technology-based effluent limits in NPDES permits except in cases where the industry is subject to a federal effluent standard for total nitrogen or total phosphorus. The nitrogen and phosphorus effluent limits for industries and for POTWs with significant industrial loads will be determined consistent with 40 CFR Part 125 Subpart A and IAC 567-62.8(5).

Water Quality-Based Limits

The second basis for establishing NPDES permit limits is through state water quality standards; this is the "water quality-based" process. NPDES permits must contain requirements as needed for discharges to meet water quality standards (IAC 567-62.8(2)). Where implementation of technology-based limits for a wastewater discharge will not assure compliance with the water quality standards, permits must specify more stringent water quality-based effluent limits. While Iowa has not yet adopted numeric standards for total nitrogen or total phosphorus from which water quality-based effluent limits can be derived, permits must still contain necessary requirements to assure compliance with (1) narrative "free-from" water quality criteria in the Iowa Water Quality Standards that are applicable to all surface waters at all places and at all times (IAC 567-61.3(2)) and with (2) Iowa's antidegradation policy (IAC 567-61.2(2)).

When a facility proposes to discharge a new or increased amount of any pollutant, an antidegradation "alternatives analysis" must be performed. The alternatives analysis must consider non-degrading and less degrading alternatives to the increased discharge, and the facility must implement the least-degrading alternative that is practicable, affordable and cost efficient. Iowa's antidegradation policy applies on a pollutant-by-pollutant basis, meaning that the alternatives analysis must consider each pollutant that will be discharged in an increased amount. These pollutants would include any new or increased discharge of total nitrogen or total phosphorus.

Total Maximum Daily Loads

A total maximum daily load (TMDL) is a calculation that determines the maximum amount of a pollutant that can enter a stream or lake from different sources and still allow the stream or lake to meet the Iowa water quality standards. The IDNR is required by the CWA to determine the TMDL for all waters identified on the state's CWA Section 303(d) impaired waters list. These TMDL calculations must be reviewed and approved by EPA. One part of the TMDL calculation is the point source wasteload allocation (WLA), which may be used to calculate water quality-based effluent limitations to include in an NPDES permit. When determining the appropriate point source WLA to be used in the TMDL calculation, the IDNR will consider this point source nutrient strategy as the basis for setting the WLA for point sources. The IDNR will not impose effluent limitations in NPDES permits that require load reductions beyond the reductions achieved by implementation of this strategy unless it is determined necessary to allow the stream or lake to meet Iowa water quality standards.

Monitoring in NPDES Permits

The IDNR will specify weekly total nitrogen and total phosphorus monitoring in permits issued to Nutrient Strategy facilities. A permit can be amended to include reduced monitoring if a facility has adequately demonstrated that their effluent contains concentrations of total nitrogen and total phosphorus that are consistently below treatable levels. Facilities are strongly encouraged to begin monitoring programs for TP and TN prior to NPDES permit reissuance to better assess current nutrient loading and removal capabilities that are possible with their existing treatment systems. Before starting a monitoring program, a facility should consult with IDNR and develop a sampling plan to ensure that a sufficient amount of good quality data is collected at appropriate locations and that samples will be analyzed for the correct parameters using appropriate methods.

IDNR will identify the appropriate total nitrogen and total phosphorus lab testing methods for wastewater and ambient stream water quality to ensure consistent data and allow for accurate accounting of removal of nutrients from wastewater treatment plants. These lab methods may be specified in NPDES permits with total nitrogen and total phosphorus testing requirements.

Construction Schedules

NPDES regulations allow permits to include schedules of compliance to provide facilities additional time to achieve compliance with Clean Water Act regulations. Such schedules must require compliance as soon as possible but may not extend a final compliance date specified in the Clean Water Act. Because all Clean Water Act deadlines for meeting technology-based effluent limits have passed, permits cannot include a schedule of compliance for meeting new technology-based limits for TN or TP that will be established in accordance with this strategy.

In order to comply with federal regulations yet still provide facilities with time to modify operations or treatment systems to reduce nutrient discharges, permits will establish construction schedules for installing or modifying facilities to remove nutrients. Nutrient limits will not be specified in permits until after facilities have been constructed, optimized and monitored to demonstrate nutrient reduction capabilities. In other words, nutrient limits will not be added to the NPDES permit until a facility has already shown that it complies with the final limits for TN and TP.

Two options exist for specifying technology-based limits and construction schedules: (1) a construction schedule for installing or modifying facilities to reduce nutrients will be established in the NPDES permit. Following construction completion, facility optimization, and a performance evaluation period, effluent limits will be added to the NPDES permit; or, (2) effluent limits will be included in the NPDES permit and a consent administrative order will be issued concurrently that would establish a construction schedule for installing or modifying facilities to remove nutrients. Permittees will be allowed to select which option they prefer.

Implementation Plan

All major municipal and industrial facilities, and minor industrial facilities that treat process wastewater using biological treatment, will be required to evaluate the economic and technical feasibility for reducing nutrient discharges. This evaluation, or "Feasibility Study," will be based on a goal of achieving annual average mass limits equivalent to effluent concentrations of 10 mg/L TN and 1 mg/L TP. These concentrations are consistent with the minimum levels considered achievable using biological nutrient removal at a wastewater treatment facility that treats primarily domestic sewage.

Technology-based effluent limits for nutrients for facilities addressed in this strategy must be developed on a case-by-case basis consistent with IAC 567-62.8(5) and will be developed using the procedures specified in 40 CFR Part 125 Subpart A. Such limits will be based on the effect of the pollutant in water and the feasibility and reasonableness of treating the pollutant. Based on information available to IDNR today it is anticipated that permits will not specify limits more stringent than 10 mg/L TN and 1 mg/L TP where biological treatment is the primary means of achieving the nutrient reduction goals.

Biological treatment processes are more efficient at reducing nutrients at higher water temperatures and higher quality wastewater effluent is typically produced in the spring, summer, and fall than in the winter. Thus, while properly designed and operated biological treatment systems may not achieve levels of 10 mg/L TN and 1 mg/L TP at all times, monitoring results averaged over the entire year should result in effluent concentrations at or below these levels {See page 2}. The IDNR realizes that some treatment facilities may not be able to achieve these limits due to higher concentrations of TN or TP in the raw wastewater than are typically found in domestic sewage. In these cases the goal is to achieve equivalent annual percentage reductions in raw wastewater of 66% TN and 75% TP.

If a permitted discharger installs nutrient reduction processes and technology-based TN and TP limits are included in the NPDES permit, then it is the position of the IDNR that the TN and TP discharge limits will not be made more restrictive for a period of at least 10 years after the completion of the nutrient reduction process construction unless it is determined that more restrictive limits are necessary to ensure the stream or lake will meet Iowa water quality standards. Iowa Code section 455B.173(3C) establishes the moratorium on more restrictive limits for municipal dischargers. For non-municipal discharges, this prohibition can be enforced through the permitting process or as a part of the adoption of any future nutrient limitation. A report of nutrient removal performance will be submitted to IDNR once facilities are constructed and have operated for a period of five years.

Implementation Plan Details

Requirements for evaluating nutrient removal will be specified in the next NPDES permit issued following the finalization of this strategy for all major municipal and industrial permits and for minor industrial facilities with biological treatment plants (see Section 3.3). The requirements to be included in the permit will vary according to the following: 1) Treatment already installed; 2) Treatment not installed and no capacity increases are planned; 3) Treatment not installed and capacity increases are planned; 4) Treatment impracticable; 5) New dischargers; and 6) Power Plants. In the case of a new major facility or a new minor industrial facility with biological treatment for process wastewater, requirements for evaluating nutrient reductions will be specified in the first permit issued to the new facility. The term "treatment" as used in the context of this strategy means treatment to reduce TN and/or TP. It is expected that most facilities will install and operate biological nutrient removal processes but nothing in this strategy precludes the use of other processes and techniques to achieve nutrient reductions similar to biological nutrient removal.

Category 1) Treatment already installed

a) Installed and Operating: If treatment is installed and has been operated at a given plant and the IDNR determines that a sufficient amount of data is available with which to establish plant performance, then the NPDES permit will specify technology-based limits. These limits will be determined on a case-by-case basis using actual plant performance data and the permit will require influent and effluent monitoring for both TN and TP.
b) Installed and NOT Operating: If treatment is installed at a given plant and has not been operated, then the NPDES permit will require the treatment facilities to be operated. Technology-based effluent limits for TN and TP will be determined on a case-by-case basis using actual plant performance data. The limits will be added to the NPDES permit by amendment at the end of a six-month process optimization period and a 12-month performance evaluation period. The NPDES permit will require influent and effluent monitoring for both parameters.

Category 2) Treatment not installed and no capacity increases are planned

If treatment is not installed and no increases in treatment facility design capacity are planned, then the reissued NPDES permit will include requirements for the facility within two years of reissuance of the NPDES permit to submit a report with the results of a study that evaluates the feasibility, reasonableness and costs of installing treatment to remove nutrients. The Feasibility Study will also include a proposed schedule for when treatment will be installed if it is found to be feasible and reasonable. The negotiated schedule will be incorporated into either the NPDES permit or an administrative consent order (See **Construction Schedules** above). Technology-based TN and TP discharge limits will be determined at the end of a six-month process optimization period and a 12-month performance evaluation period following the treatment process startup. The performance evaluation will include a determination of technologically achievable TN and TP concentrations. The NPDES permit will be amended to include TN and TP limits as determined from the performance evaluation. The NPDES permit will require influent and effluent monitoring for both parameters.

Category 3) Treatment not installed and capacity increases are planned

If treatment is not installed and increases in treatment plant design capacity are planned, then the evaluation of nutrient removal feasibility will be conducted as part of the construction permitting process through current antidegradation rules and procedures. Nutrient removal will be encouraged anytime construction is proposed. If nutrient removal is included in the plant expansion, then the NPDES permit will be amended to include effluent limits for TN and TP after a six-month optimization period and 12-month performance evaluation period following treatment process startup, the same as the Category 2 procedures. The NPDES permit will require influent and effluent monitoring for both TN and TP. If nutrient removal is not included with the plant expansion, then the NPDES permit will be written using the procedure in Category 2 above.

Category 4) Treatment impracticable

A facility with one or more nutrient discharges that are higher than 10 mg/L TN or 1 mg/L TP (or annual percentage reductions in raw wastewater that are lower than 66% TN and 75% TP) but where operational changes or treatment are not feasible or reasonable will be required to submit another Feasibility Study five years from the approval of the first Feasibility Study.

Category 5) New Dischargers

For new major municipal or industrial facilities or new minor industrial facilities that have biological treatment for process wastewater the procedures in Category 3 will be followed. Construction of a treatment plant by a new discharger subject to this strategy is considered to be a capacity increase in the context of these requirements.

Category 6) Power Plants

The permit for a power plant listed in the Strategy that demonstrates that it can consistently meet the goals of 10 mg/L TN and 1 mg/L TP will be amended to remove the Nutrient Reduction Requirements language and to remove or reduce TN and TP monitoring.

An industry that uses river water for cooling and other purposes that demonstrates that it does not cause a net increase of more than 10 mg/L TN or 1 mg/L TP can request that its permit be amended to remove the Nutrient Reduction Requirements language and remove or reduce TN and TP monitoring.

Calculation of Annual Average Effluent Limitations

Effluent limits for TN and TP will be expressed as annual average mass limits. The following procedure will be used to establish annual average effluent limitations for total nitrogen and total phosphorus in NPDES permits resulting from the implementation of this Strategy. This procedure is patterned after the approach developed by EPA and discussed in Appendix E of the *Technical Support Document For Water Quality-based Toxics Control*, EPA/5050/2-90-001, USEPA, March 1991.

The procedure assumes that the daily values used in the calculations are lognormally distributed and that more than ten (10) data points are available to derive the limitations. The mean and standard deviation of the data (in mg/L) are calculated and the 99th percentile of the daily values is determined. This 99th percentile value is multiplied by the treatment facility design average wet weather flow and a conversion factor of 8.34 and the result will be specified as the annual average effluent limitation in lbs/day. For industries that do not have a design flow, the 99th percentile value is multiplied by the maximum daily flow from the previous five years.

$X_{.99}$ = 99th percentile of daily values

$=E(X_n)+2.326[V(X_n)]^{1/2}$

where:

x_i	=	daily pollutant measurement i
y_i	=	$\ln(x_i)$
k	=	size of data set
μ_y	=	$(y_i) / k$
$ŏ_y^2$	=	$[y_i - \mu_y^2] / (k-1)$
E(x)	=	$\exp(\mu_y + 0.5ŏ_y^2)$
V(x)	=	$\exp(2\mu_y + ŏ_y^2)[\exp(ŏ_y^2) - 1]$
$E(x_n)$	=	E(x)
$V(x_n)$	=	V(x)/n
$cv(x_n)$	=	$V(x_n)^{1/2} / (x_n)$

The department will use this procedure to recalculate TN and TP limitations each time the permit is reissued. Higher TN and TP limits may be possible if facilities can justify degradation through an approved alternatives analysis.

The annual average discharge will be the sum of all measurements for a given pollutant collected during a 12-month period beginning on the date the permit limit is effective divided by the number of measurements made. For example, assume that TN mass measurements are made once per week. The annual average is determined by adding the 52 weekly measurements from the year of reporting and dividing by 52.

Revisions to Section 3.3 – List of Affected Facilities

If a new facility is constructed, or a facility is expanded, causing it to be designated a major facility it will be added to the list of affected facilities in Section 3.3 and will become subject to the requirements of this strategy. When a minor industry constructs a new biological wastewater treatment facility for treating process wastewater it will be added to the list of affected facilities and will be subject to the requirements of this strategy. If the circumstances that resulted in a facility being subject to this strategy change, and the facility is no longer designated a major facility, or if a minor industry no longer operates a biological treatment plant, it will no longer be subject to the requirements of this strategy. Furthermore, if a facility that does not have biological treatment for process wastewater can adequately demonstrate that their effluent (or contribution) is consistently below 10 mg/L TN and 1 mg/L TP, the permit can be amended to remove or reduce nutrient monitoring requirements and remove the Nutrient Strategy provisions. The Nutrient Strategy Annual Report will then reflect that the facility has met their obligations under the Strategy.

Section 3.2 - Cost Estimates

Estimated Costs for BNR Improvements for Muncipal Majors (Target Effluent TN = 10 mg/L, Target Effluent TP = 1 mg/L)										
Treatment Type	# of Facilities	Combined Design AWW Flow (MGD)	Combined Annual Average Flow[1] (MGD)	Total Capital Cost ($M)	Total Annual O&M Cost ($M)	Total Present Worth Cost ($M)[2]	Total Annual Cost ($M)	$/1,000 gallons Treated[3]	Weighted Monthly Cost/Household[4]	Weighted % of MHI[4]
Activated Sludge	56	533	355	348	25	686	51	0.39	7.75	0.18%
Fixed Film	37	101	67	430	7	524	39	1.59	25.83	0.73%
Aerated Lagoon	9	11	8	110	3	147	11	3.92	85.16	2.13%
Totals	102	645	430	887	35	1,358	101	0.64	11.85[5]	0.29%[5]

1. Average annual flow estimated as 2/3 of design AWW flow.
2. Present worth values calculated using discount rate of 4.125% and a 20-year design life.
3. Based on annual average flow.
4. % of MHI for BNR improvements only. Estimates weighted by number of households.
5. Aggregate value weighted by number of households.

Estimated Costs for BNR Improvements for all Industries with Biological Treatment (Target Effluent TN = 10 mg/L, Target Effluent TP = 1 mg/L)							
Treatment Type	# of Facilities	Combined Design Flow (MGD)	Total Capital Cost ($M)	Total Annual O&M Cost ($M)	Total Present Worth Cost ($M)[1]	Total Annual Cost ($M)	$/1,000 gallons Treated[2]
Activated Sludge	20	44.2	29.3	2.0	56.1	4.2	0.26
Fixed Film	1	0.6	2.7	0.04	3.3	0.2	1.06
Aerated Lagoon	7	5.8	86.5	2.20	116.0	8.6	4.05
Totals	28	50.7	118.5	4.2	175.5	13.1	0.71

1. Present worth values calculated using discount rate of 4.125% and a 20-year design life.
2. Based on design flow.

Estimated Costs for BNR Improvements for Major Municipals + all Industries with Biological Treatment (Target Effluent TN = 10 mg/L, Target Effluent TP = 1 mg/L)							
Treatment Type	# of Facilities	Combined Flow (MGD)[2]	Total Capital Cost ($M)	Total Annual O&M Cost ($M)	Total Present Worth Cost ($M)[1]	Total Annual Cost ($M)	$/1,000 gallons Treated[2]
Activated Sludge	76	399.5	377.3	27.2	742.5	55.2	0.38
Fixed Film	38	67.8	432.3	7.1	527.5	39.2	1.59
Aerated Lagoon	16	13.5	196.3	5.0	263.1	19.6	3.98
Totals	130	480.8	1,005.8	39.2	1,533.1	114.1	0.65

1. Present worth values calculated using discount rate of 4.125% and a 20-year design life.
2. Based on design flow for industries + estimated average annual flow for municipals.

Section 3.3 - List of Affected Facilities

Major Municipalities (> 1.0 MGD):

	NPDES NO.	FACILITY NAME	TREATMENT TYPE	2010 POPULATION
1	2503001	ADEL CITY OF STP	AERATED LAGOON	3,682
2	5502001	ALGONA CITY OF STP	TRICKLING FILTER	5,560
3	8503001	AMES WATER POLLUTION CONTROL FACILITY	TRICKLING FILTER	58,965
4	5307001	ANAMOSA CITY OF STP	TRICKLING FILTER	5,533
5	1509001	ATLANTIC CITY OF STP	SEQUENCING BATCH REACTOR	7,112
6	0819001	BOONE CITY OF STP	ACTIVATED SLUDGE	12,661
7	4103001	BRITT CITY OF STP	TRICKLING FILTER	2,069
8	2909001	BURLINGTON CITY OF STP	ACTIVATED SLUDGE	25,663
9	9113001	CARLISLE CITY OF STP	AERATED LAGOON	3,876
10	1415001	CARROLL, CITY OF STP	ACTIVATED SLUDGE	10,103
11	0709001	CEDAR FALLS CITY OF STP	TRICKLING FILTER	39,260
12	5715001	CEDAR RAPIDS CITY OF STP	ACTIVATED SLUDGE	126,326
13	0407003	CENTERVILLE CITY OF STP (EAST)	ROTATING BIOLOGICAL CONTACTOR	5,528
14	5903001	CHARITON CITY OF STP	OXIDATION DITCH	4,321
15	3405001	CHARLES CITY, CITY OF STP	TRICKLING FILTER	7,652
16	1811002	CHEROKEE CITY OF STP	ACTIVATED SLUDGE	5,253
17	7329001	CLARINDA CITY OF STP	TRICKLING FILTER	5,572
18	1716901	CLEAR LAKE SANITARY DISTRICT	SEQUENCING BATCH REACTOR	
19	2326001	CLINTON CITY OF STP	ACTIVATED SLUDGE	26,885
20	5208001	CORALVILLE CITY OF STP	SEQUENCING BATCH REACTOR	18,907
21	7820001	COUNCIL BLUFFS CITY OF STP	TRICKLING FILTER	62,230
22	4515001	CRESCO CITY OF STP	ACTIVATED SLUDGE	3,868
23	8816001	CRESTON CITY OF STP	TRICKLING FILTER	7,834
24	8222003	DAVENPORT CITY OF STP	ACTIVATED SLUDGE	99,685
25	9630001	DECORAH CITY OF STP	ACTIVATED SLUDGE	8,127
26	2424001	DENISON MUNICIPAL UTILITIES-STP	ACTIVATED SLUDGE	8,298
27	7727001	DES MOINES METROPOLITAN WRF	ACTIVATED SLUDGE	203,483
28	2330001	DEWITT CITY OF STP	OXIDATION DITCH	5,322
29	3126001	DUBUQUE CITY OF STP	ACTIVATED SLUDGE	57,637
30	9926001	EAGLE GROVE, CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	3,583
31	4236001	ELDORA CITY OF STP	SEQUENCING BATCH REACTOR	2,732
32	8230003	ELDRIDGE, CITY OF SOUTH SLOPE	SEQUENCING BATCH REACTOR	5,651
33	7428002	EMMETSBURG CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	3,904
34	3218002	ESTHERVILLE CITY OF STP	TRICKLING FILTER	6,360
35	0723001	EVANSDALE CITY OF STP	ACTIVATED SLUDGE	4,751
36	5131001	FAIRFIELD CITY OF STP	OXIDATION DITCH	9,464
37	9525001	FOREST CITY, CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	4,151
38	9433003	FORT DODGE CITY OF STP	ACTIVATED SLUDGE	25,206
39	5625001	FORT MADISON CITY OF STP	ACTIVATED SLUDGE	11,051
40	6525001	GMU WASTEWATER TREATMENT FACILITY	ROTATING BIOLOGICAL CONTACTOR	5,269
41	0140001	GREENFIELD CITY OF STP	TRICKLING FILTER	1,982
42	7736001	GRIMES, CITY OF STP	ACTIVATED SLUDGE	8,264

43	7930001	GRINNELL, CITY OF STP	TRICKLING FILTER	9,218
44	3833001	GRUNDY CENTER CITY OF STP	SEQUENCING BATCH REACTOR	2,706
45	3544001	HAMPTON CITY OF STP	SEQUENCING BATCH REACTOR	11,790
46	8335002	HARLAN CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	5,106
47	4641001	HUMBOLDT CITY OF STP	ACTIVATED SLUDGE	4,690
48	1037001	INDEPENDENCE CITY OF STP	TRICKLING FILTER	5,966
49	9133001	INDIANOLA CITY OF STP (NORTH)	ACTIVATED SLUDGE	14,782
50	5225002	IOWA CITY, CITY OF (SOUTH) STP	ACTIVATED SLUDGE	67,862
51	4260001	IOWA FALLS CITY OF STP	TRICKLING FILTER	5,238
52	3050901	IOWA GREAT LAKES SANITARY DISTRICT STP	ACTIVATED SLUDGE	74,210
53	3742001	JEFFERSON CITY OF STP	ACTIVATED SLUDGE	8,982
54	1044002	JESUP, CITY OF STP (SOUTH)	AERATED LAGOON	2,520
55	5640001	KEOKUK CITY OF STP	ACTIVATED SLUDGE	10,780
56	6342001	KNOXVILLE CITY OF STP	TRICKLING FILTER	7,313
57	8254002	LECLAIRE CITY OF STP	SEQUENCING BATCH REACTOR	3,765
58	7540001	LEMARS CITY OF STP	ACTIVATED SLUDGE	9,826
59	4950001	MAQUOKETA CITY OF STP	ACTIVATED SLUDGE	6,141
60	6469001	MARSHALLTOWN CITY OF	SEQUENCING BATCH REACTOR	27,552
61	1750001	MASON CITY, CITY OF STP	ACTIVATED SLUDGE	28,079
62	6352001	MELCHER-DALLAS CITY OF STP	AERATED LAGOON	1,288
63	7751001	MITCHELLVILLE CITY OF STP	SEQUENCING BATCH REACTOR	2,254
64	7950001	MONTEZUMA CITY OF STP	AERATED LAGOON	1,462
65	5343001	MONTICELLO CITY OF STP	TRICKLING FILTER	3,796
66	4453001	MOUNT PLEASANT CITY OF STP (MAIN)	SEQUENCING BATCH REACTOR	8,668
67	5758001	MOUNT VERNON CITY OF STP	ACTIVATED SLUDGE	4,506
68	7048001	MUSCATINE CITY OF STP	ACTIVATED SLUDGE	22,886
69	8562001	NEVADA CITY OF STP	TRICKLING FILTER	6,798
70	1970001	NEW HAMPTON CITY OF STP	TRICKLING FILTER	3,571
71	5059002	NEWTON CITY OF STP	ACTIVATED SLUDGE	15,254
72	5252001	NORTH LIBERTY CITY OF STP	SEQUENCING BATCH REACTOR	13,374
73	3353001	OELWEIN CITY OF STP	ACTIVATED SLUDGE	6,415
74	8474001	ORANGE CITY CITY OF STP	AERATED LAGOON	6,004
75	2038002	OSCEOLA CITY OF STP	TRICKLING FILTER	4,929
76	6273001	OSKALOOSA CITY OF STP (NORTHEAST)	TRICKLING FILTER	
77	6273002	OSKALOOSA CITY OF STP (SOUTHWEST)	ACTIVATED SLUDGE	11,463
78	9083001	OTTUMWA CITY OF STP	ACTIVATED SLUDGE	25,023
79	6368006	PELLA CITY OF STP	ACTIVATED SLUDGE	10,352
80	2561001	PERRY CITY OF STP	ACTIVATED SLUDGE	7,702
81	6950001	RED OAK CITY OF STP	TRICKLING FILTER	5,742
82	1376001	ROCKWELL CITY, CITY OF STP	TRICKLING FILTER	1,709
83	7170001	SHELDON CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	5,188
84	3659001	SHENANDOAH CITY OF STP	TRICKLING FILTER	5,150
85	8486002	SIOUX CENTER CITY OF STP	TRICKLING FILTER	7,048
86	9778001	SIOUX CITY CITY OF STP	ACTIVATED SLUDGE	82,684
87	2171004	SPENCER, CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	11,233
88	1178001	STORM LAKE CITY OF STP	ACTIVATED SLUDGE	10,600
89	8670002	TAMA CITY OF STP	ACTIVATED SLUDGE	2,877
90	1689001	TIPTON CITY OF STP (WEST)	AERATED LAGOON	3,221
91	8676001	TOLEDO CITY OF STP	ACTIVATED SLUDGE	2,341

92	0688001	VINTON CITY OF STP	ACTIVATED SLUDGE	5,257
93	7085001	WALCOTT CITY OF STP (SOUTH)	ACTIVATED SLUDGE	1,629
94	5879001	WAPELLO CITY OF STP	AERATED LAGOON	2,067
95	9271001	WASHINGTON CITY OF STP	SEQUENCING BATCH REACTOR	7,266
96	0790001	WATERLOO CITY OF STP	ACTIVATED SLUDGE	68,406
97	2573001	WAUKEE CITY OF STP	ACTIVATED SLUDGE	13,790
98	0398001	WAUKON CITY OF STP	TRICKLING FILTER	3,897
99	0990001	WAVERLY CITY OF STP	TRICKLING FILTER	9,874
100	4063001	WEBSTER CITY, CITY OF STP	ROTATING BIOLOGICAL CONTACTOR	8,070
101	2985001	WEST BURLINGTON CITY OF STP	ACTIVATED SLUDGE	2,968
102	7073001	WEST LIBERTY CITY OF STP	ACTIVATED SLUDGE	3,736
103	6171001	WINTERSET CITY OF STP	TRICKLING FILTER	5,190

Major Industries

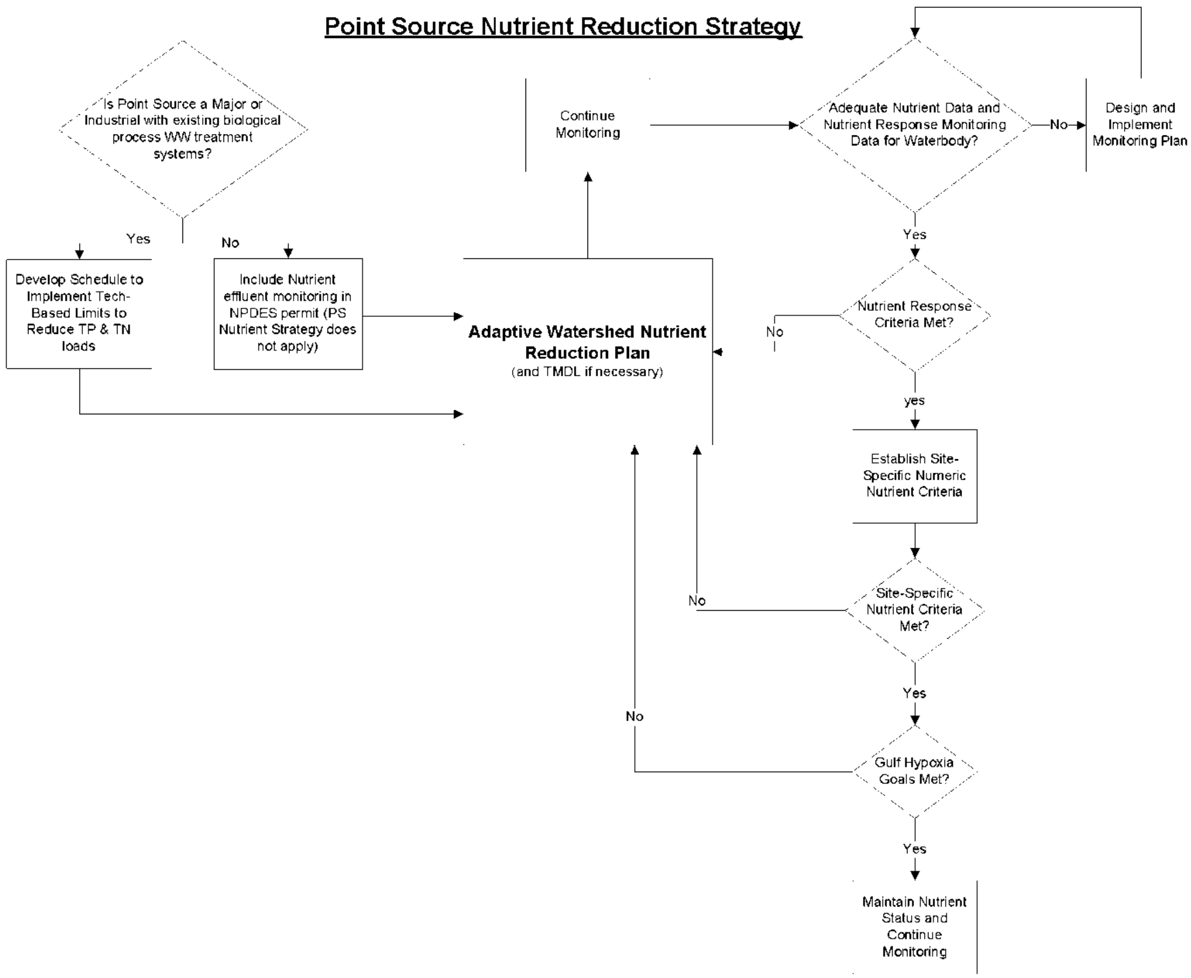
	NPDES NO.	FACILITY NAME	LOCATION	TREATMENT TYPE
1	2326101	ARCHER DANIELS MIDLAND CORN PROCESSING	CLINTON	ACTIVATED SLUDGE
2	6800100	CARGILL, INC.	EDDYVILLE	ACTIVATED SLUDGE
3	7048101	GRAIN PROCESSING CORP.	MUSCATINE	ACTIVATED SLUDGE
4	5800100	TYSON FRESH MEATS, INC.	COLUMBUS JUNCTION	ACTIVATED SLUDGE
5	2500100	TYSON FRESH MEATS, INC.	PERRY	ACTIVATED SLUDGE
6	2900900	IOWA ARMY AMMUNITION PLANT	WEST BURLINGTON	NO BIOLOGICAL TREATMENT
7	7000102	MONSANTO COMPANY	MUSCATINE	ACTIVATED SLUDGE
8	5640101	ROQUETTE AMERICA, INC.	KEOKUK	ACTIVATED SLUDGE
9	8670100	CARAUSTAR - TAMA PAPERBOARD	TAMA	ACTIVATED SLUDGE
10	2326112	EQUISTAR CHEMICALS, LP	CAMANCHE	ACTIVATED SLUDGE
11	8278100	ARCONIC INC. (ALCOA, INC. DAVENPORT WORKS)	RIVERDALE	NO BIOLOGICAL TREATMENT
12	5625106	CLIMAX MOLYBDENUM COMPANY	FORT MADISON	NO BIOLOGICAL TREATMENT
13	9700101	GELITA USA, INC.	SERGEANT BLUFF	AERATED LAGOON
14	7700119	GREATER DES MOINES ENERGY CENTER	PLEASANT HILL	NO BIOLOGICAL TREATMENT
15	2900101	IPL - BURLINGTON GENERATING STATION	BURLINGTON	NO BIOLOGICAL TREATMENT
16	0300100	IPL - LANSING STATION	LANSING	NO BIOLOGICAL TREATMENT
17	5715108	IPL - PRAIRIE CREEK GENERATING STATION	CEDAR RAPIDS	NO BIOLOGICAL TREATMENT
18	3126107	JOHN DEERE DUBUQUE WORKS	DUBUQUE	ACTIVATED SLUDGE
19	0790103	JOHN DEERE WATERLOO WORKS	WATERLOO	NO BIOLOGICAL TREATMENT
20	9700102	MIDAMERICAN ENERGY - NEAL NORTH ENERGY CENTER	SERGEANT BLUFF	NO BIOLOGICAL TREATMENT
21	9700106	MIDAMERICAN ENERGY - NEAL SOUTH ENERGY CTR	SERGEANT BLUFF	NO BIOLOGICAL TREATMENT
22	8278101	MIDAMERICAN ENERGY CO - RIVERSIDE STATION	RIVERDALE	NO BIOLOGICAL TREATMENT
23	5800105	MIDAMERICAN ENERGY CO. - LOUISA STATION	MUSCATINE	NO BIOLOGICAL TREATMENT
24	7048106	MUSCATINE POWER AND WATER	MUSCATINE	NO BIOLOGICAL TREATMENT
25	5700104	NEXTERA ENERGY DUANE ARNOLD, LLC	PALO	NO BIOLOGICAL TREATMENT
26	9700104	CF INDUSTRIES NITROGEN, LLC - PORT NEAL NITROGEN COMPLEX	SERGEANT BLUFF	NO BIOLOGICAL TREATMENT

27	7820101	WALTER SCOTT, JR. ENERGY CENTER	COUNCIL BLUFFS	NO BIOLOGICAL TREATMENT
28	4802102	WHIRLPOOL CORP - AMANA APPLIANCE DIVISION	AMANA	ACTIVATED SLUDGE
29	5600118	IOWA FERTILIZER COMPANY	WEVER	ACTIVATED SLUDGE
30	1178105	TYSON FRESH MEATS, INC.	STORM LAKE	ACTIVATED SLUDGE
31	9083101	JBS PORK	OTTUMWA	OXIDATION DITCH

Minor Industries with Biological Treatment for Process Wastewater:

	NPDES NO.	**FACILITY NAME**	**LOCATION**	**TREATMENT TYPE**
1	0375102	AGRI STAR MEAT AND POULTRY LLC	POSTVILLE	ACTIVATED SLUDGE
2	8670101	IOWA PREMIUM BEEF	TAMA	ACTIVATED SLUDGE
3	7856100	OSI INDUSTRIES, LLC	OAKLAND	SEQUENCING BATCH REACTOR
4	5600105	PINNACLE FOODS GROUP LLC	FORT MADISON	ACTIVATED SLUDGE
5	8748102	MICHAEL FOODS, INC.	LENOX	ACTIVATED SLUDGE
6	9500102	REMBRANDT ENTERPRISES, INC.	THOMPSON	AERATED LAGOON
7	8400120	AGROPUR INC.	HULL	SEQUENCING BATCH REACTOR
8	3621100	MANILDRA MILLING CORPORATION	HAMBURG	ACTIVATED SLUDGE
9	6800113	AJINOMOTO HEARTLAND LLC	EDDYVILLE	ACTIVATED SLUDGE
10	2200100	SWISS VALLEY FARMS	LUANA	ACTIVATED SLUDGE
11	2500103	NORTHERN NATURAL GAS CO	REDFIELD	AERATED LAGOON
12	3300100	ASSOCIATED MILK PRODUCERS	ARLINGTON	AERATED LAGOON
13	3405100	CAMBREX	CHARLES CITY	ACTIVATED SLUDGE
14	3900103	GUTHRIE CENTER EGG FARM	GUTHRIE CENTER	AERATED LAGOON
15	5200116	KALONA CREAMERY, LLC	KALONA	AERATED LAGOON
16	9300104	DAIRICONCEPTS	ALLERTON	ACTIVATED SLUDGE
17	4500802	LIME SPRINGS BEEF, LLC	LIME SPRINGS	ACTIVATED SLUDGE

Section 3.4 – Conceptual Flow Chart



3.5 References

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