Iowa Department of Natural Resources
Environmental Protection Commission

ITEM **11** **DECISION**

TOPIC **Notice of Intended Action – Chapter 61 Water Quality Standards-Chloride, Sulfate and Total Dissolved Solids**

Background
In 2004, the DNR moved forward with a proposed chloride standard. Concerns were raised that the proposed chloride standard was not scientifically defensible for use in Iowa. The result was that a chloride standard was not approved and an interim strategy using Total Dissolved Solids as an indicator regarding water quality was put in place while the Department worked through the issues surrounding the chloride standard.

Recently the research and analysis related to toxicity of total dissolved solids, chloride and sulfate has been completed by the Department in conjunction with the Environmental Protection Agency. The purpose was to update and develop criteria for these parameters to better protect aquatic life based on new scientific information.

The DNR worked with the U.S. Environmental Protection Agency to ensure that the research compiled met certain scientific standards. Gaps were identified in the research and resulted in new toxicity tests being performed in 2008 and 2009.

With the availability of new research and toxicity data, the information is now available to propose numeric criteria for chloride and sulfate to better protect river, stream and lake aquatic life uses and remove the current interim approach for total dissolved solids criteria.

Proposed chloride criteria
To calculate the applicable acute and chronic criteria for chloride, use the equations below. Statewide default values for hardness and sulfate will be used unless site specific data is available.

Acute Chloride Criteria Equation
$287.8(\text{Hardness})^{0.205797}(\text{Sulfate})^{-0.07452}$ = Acute Criteria Value (mg/L)

Chronic Chloride Criteria Equation
$177.87(\text{Hardness})^{0.205797}(\text{Sulfate})^{-0.07452}$ = Chronic Criteria Value (mg/L)

Proposed Sulfate Criteria

Chloride / Hardness mg/L as $CaCO_3$	$Cl^- < 5$ mg/L	5 < = Cl^- < 25	25 ≤ Cl^- < =500
H < 100 mg/L	**500**	**500**	500
100<=H<= 500	**500**	**[-57.478 + 5.79 (hardness) + 54.163 (chloride)] * 0.65**	[1276.7 + 5.508 (hardness) – 1.457 (chloride)] * 0.65
H > 500	500	2,000	2,000

Statewide Background Values

The following statewide background values were determined by analyzing DNR ambient water monitoring data from 2000 to 2007:

Hardness: 200 mg/L as CaCO3
Sulfate: 63 mg/L
Chloride: 34 mg/L

Total Dissolved Solids

The current interim approach for total dissolved solids levels through Whole Effluent Toxicity Testing will be replaced by the proposed numerical criteria for chloride and sulfate.

This revision is based on scientific review that demonstrates individual ions cause toxicity to aquatic life. This review revealed that in Iowa, chloride and sulfate are the specific ions of concern. As a result, ion criteria for chloride and sulfate are better indicators than integrative parameters such as TDS, conductivity and salinity for water quality protection.

Charles C. Corell, Chief
Water Quality Bureau
Environmental Services Division

April 27, 2009

ENVIRONMENTAL PROTECTION COMMISSION [567]

Notice of Intended Action

Pursuant to the authority of Iowa Code sections 455B.105 and 455B.173, the Environmental Protection Commission gives Notice of Intended Action to amend Chapter 61, "Water Quality Standards," Iowa Administrative Code.

The proposed amendments will:

- Establish numerical water quality criteria for chloride for the protection of aquatic life uses.
- Establish numerical water quality criteria for sulfate for the protection of aquatic life uses.
- Remove TDS criteria and implementation approach

Iowa Code (Sections 455B.171 – 455B.183) establishes requirements for the protection and management of surface water quality. The Environmental Protection Commission, through the assistance of the department, promulgates administrative regulations on water quality. Iowa's Water Quality Standards (WQS) are written into regulation at 567 IAC Chapter 61 – Water Quality Standards.

In 2004, the DNR moved forward with a proposed chloride standard. Concerns were raised that the proposed chloride standard was not scientifically defensible for use in Iowa. The result was that a chloride standard was not approved and an interim strategy using Total Dissolved Solids as an indicator regarding water quality was put in place while the Department worked through the issues surrounding the chloride standard.

Recently the research and analysis related to toxicity of total dissolved solids, chloride and sulfate has been completed by the Department in conjunction with the Environmental Protection Agency. The purpose was to update and develop criteria for these parameters to better protect aquatic life based on new scientific information.

The DNR worked with the U.S. Environmental Protection Agency to ensure that the research compiled met certain scientific standards. Gaps were identified in the research and resulted in new toxicity tests being performed in 2008 and 2009.

With the availability of new research and toxicity data, the information is now available to propose numeric criteria for chloride and sulfate to better protect river, stream and lake aquatic life uses and remove the current interim approach for total dissolved solids criteria.

Additional information on Iowa's Water Quality Standards and the Department's rules can be found on the Department's Web site at http://www.iowadnr.com/water/standards/index.html.

Any person may submit written suggestions or comments on the proposed amendments through August 14, 2009. Such written material should be submitted to Adam Schnieders, Iowa Department of Natural Resources, Wallace State Office Building, 502 East 9th Street, Des Moines, Iowa 50319-0034, fax (515)281-8895 or by E-mail to adam.schnieders@dnr.iowa.gov. Persons who have questions may contact Adam Schnieders at (515)281-7409.

Persons are invited to present oral or written comments at public hearings which will be held:

July 7, 2009	11 a.m.	Orange City Public Library 112 Albany Avenue SE Orange City, IA
July 7, 2009	6 p.m.	Spencer Public Library 21 E. 3rd St. Spencer, IA
July 9, 2009	1 p.m.	Wallace State Office Building

		Fifth Floor Conference Rooms 502 East 9th Street Des Moines, Iowa
July 13, 2009	11 a.m.	Dubuque Public Library 360 W. 11th Street Dubuque, Iowa
July 13, 2009	6 p.m.	Iowa City Public Library 123 S. Linn Street Iowa City, Iowa
July 15, 2009	10 a.m.	Atlantic Public Library 507 Poplar Street Atlantic, Iowa
July 16, 2009	11 a.m.	Clear Lake Public Library 200 N. 4th Street Clear Lake, Iowa

These amendments may have an impact upon small businesses.

These amendments are intended to implement Iowa Code chapter 455B, division III, part 1.

The following amendments are proposed.

ITEM 1. Amend chloride portion of subrule 61.3(3), Table 1, Criteria for Chemical Constituents, as follows:

TABLE 1: Criteria for Chemical Constituents

Parameter		Use Designations B(CW1)	B(CW2)	B(WW-1)	B(WW-2)	B(WW-3)	B(LW)	C	HH
Chloride	**Chronic**	**389 (m)***	**389 (m)***	**389 (m)***	**389 (m)***	**389 (m)***	**389 (m)***	**--**	**--**
	Acute	**629(m)***	**629(m)***	**629(m)***	**629(m)***	**629(m)***	**629(m)***	**--**	**--**
	MCL	--	--	--	--	--	--	250*	--
Cadmium	Chronic	1	--	**0.45** ~~0.27~~(h)	**0.45** ~~0.27~~(h)	**0.45** ~~0.27~~(h)	1	--	--
	Acute	4	--	**4.32** ~~2.13~~(h)	**4.32** ~~2.13~~(h)	**4.32** ~~2.13~~(h)	4	--	--
	Human Health + -- Fish	--	--	--	--	--	--	--	168(e)
	MCL	--	--	--	--	--	--	5	--
Copper	Chronic	20	--	**16.9** ~~9.3~~(i)	**16.9** ~~9.3~~(i)	**16.9** ~~9.3~~(i)	10	--	--
	Acute	30	--	**26.9** ~~14~~(i)	**26.9** ~~14~~(i)	**26.9** ~~14~~(i)	20	--	--
	Human Health + -- Fish	--	--	--	--	--	--	--	1000(e)
	Human Health + -- F & W	--	--	--	--	--	--	--	1300(f)
Lead	Chronic	3	--	**7.7** ~~3.2~~(j)	**7.7** ~~3.2~~(j)	**7.7** ~~3.2~~(j)	3	--	--
	Acute	80	--	**197** ~~81.7~~(j)	**197** ~~81.7~~(j)	**197** ~~81.7~~(j)	80	--	--
	MCL	--	--	--	--	--	--	50	--
Nickel	Chronic	350	--	**93** ~~52~~(k)	**93** ~~52~~(k)	**93** ~~52~~(k)	150	--	--
	Acute	3250	--	**843** ~~470~~(k)	**843** ~~470~~(k)	**843** ~~470~~(k)	1400	--	--
	Human Health + -- Fish	--	--	--	--	--	--	--	4600 4584(e)
	Human Health + -- F & W	--	--	--	--	--	--	--	610(f)
Zinc	Chronic	200	--	**215** ~~120~~(l)	**215** ~~120~~(l)	**215** ~~120~~(l)	100	--	--
	Acute	220	--	**215** ~~120~~(l)	**215** ~~120~~(l)	**215** ~~120~~(l)	110	--	--
	Human Health + -- Fish	--	--	--	--	--	--	--	26* 5000(e)
	Human Health + -- F & W	--	--	--	--	--	--	--	7.4* 9100(f)

* units expressed as milligrams/liter

h) Class B(WW-1), B(WW-2), & B(WW-3) criteria listed in main table based on a hardness of ~~100~~ **200** mg/l (as $CaCO_3$ (mg/l)). Numerical criteria (µg/l) for cadmium is a function of hardness (as $CaCO_3$ (mg/l)) using the equation for each use according to the following table:

	B(WW-1)	B(WW-2)	B(WW-3)
Acute	$e^{[1.0166\text{Ln(Hardness)} - 3.924]}$	$e^{[1.0166\text{Ln(Hardness)} - 3.924]}$	$e^{[1.0166\text{Ln(Hardness)} - 3.924]}$
Chronic	$e^{[0.7409\text{Ln(Hardness)} - 4.719]}$	$e^{[0.7409\text{Ln(Hardness)} - 4.719]}$	$e^{[0.7409\text{Ln(Hardness)} - 4.719]}$

(i) Class B(WW-1), B(WW-2), & B(WW-3) criteria listed in main table based on a hardness of ~~100~~ **200** mg/l (as $CaCO_3$ (mg/l)). Numerical criteria (µg/l) for copper is a function of hardness ($CaCO_3$ (mg/l)) using the equation for each use according to the following table:

	B(WW-1)	B(WW-2)	B(WW-3)
Acute	$e^{[0.9422\text{Ln(Hardness)} - 1.700]}$	$e^{[0.9422\text{Ln(Hardness)} - 1.700]}$	$e^{[0.9422\text{Ln(Hardness)} - 1.700]}$
Chronic	$e^{[0.8545\text{Ln(Hardness)} - 1.702]}$	$e^{[0.8545\text{Ln(Hardness)} - 1.702]}$	$e^{[0.8545\text{Ln(Hardness)} - 1.702]}$

(j) Class B(WW-1), B(WW-2), & B(WW-3) criteria listed in main table based on a hardness of ~~100~~ **200** mg/l (as $CaCO_3$ (mg/l)). Numerical criteria (µg/l) for lead is a function of hardness ($CaCO_3$ (mg/l)) using the equation for each use according to the following table:

	B(WW-1)	B(WW-2)	B(WW-3)
Acute	$e^{[1.2731\text{Ln(Hardness)} - 1.46]}$	$e^{[1.2731\text{Ln(Hardness)} - 1.46]}$	$e^{[1.2731\text{Ln(Hardness)} - 1.46]}$
Chronic	$e^{[1.2731\text{Ln(Hardness)} - 4.705]}$	$e^{[1.2731\text{Ln(Hardness)} - 4.705]}$	$e^{[1.2731\text{Ln(Hardness)} - 4.705]}$

(k) Class B(WW-1), B(WW-2), & B(WW-3) criteria listed in main table based on a hardness of ~~100~~ **200** mg/l (as $CaCO_3$ (mg/l)). Numerical criteria (µg/l) for nickel is a function of hardness ($CaCO_3$ (mg/l)) using the equation for each use according to the following table:

	B(WW-1)	B(WW-2)	B(WW-3)
Acute	$e^{[0.846\text{Ln(Hardness)} + 2.255]}$	$e^{[0.846\text{Ln(Hardness)} + 2.255]}$	$e^{[0.846\text{Ln(Hardness)} + 2.255]}$
Chronic	$e^{[0.846\text{Ln(Hardness)} + 0.0584]}$	$e^{[0.846\text{Ln(Hardness)} + 0.0584]}$	$e^{[0.846\text{Ln(Hardness)} + 0.0584]}$

(l) Class B(WW-1), B(WW-2), & B(WW-3) criteria listed in main table based on a hardness of ~~100~~ **200** mg/l (as $CaCO_3$ (mg/l)). Numerical criteria (µg/l) for zinc is a function of hardness ($CaCO_3$ (mg/l)) using the equation for each use according to the following table:

	B(WW-1)	B(WW-2)	B(WW-3)
Acute	$e^{[0.8473\text{Ln(Hardness)} + 0.884]}$	$e^{[0.8473\text{Ln(Hardness)} + 0.884]}$	$e^{[0.8473\text{Ln(Hardness)} + 0.884]}$
Chronic	$e^{[0.8473\text{Ln(Hardness)} + 0.884]}$	$e^{[0.8473\text{Ln(Hardness)} + 0.884]}$	$e^{[0.8473\text{Ln(Hardness)} + 0.884]}$

(m) Acute and chronic criteria listed in main table are based on a hardness of 200 mg/l (as $CaCO_3$ (mg/l)) and sulfate concentration of 63 mg/l. Numerical criteria (µg/l) for chloride is a function of hardness ($CaCO_3$ (mg/l)) and sulfate (mg/l)) using the equation for each use according to the following table:

	B(CW1), B(CW2), B(WW-1), B(WW-2), B(WW-3), B(LW)
Acute	$\mathbf{287.8(Hardness)^{0.205797}(Sulfate)^{-0.07452}}$
Chronic	$\mathbf{177.87(Hardness)^{0.205797}(Sulfate)^{-0.07452}}$

ITEM 2. Add the following <u>new</u> Table 4, Criteria for Sulfate, to subrule 61.3(3) as follows:

<u>TABLE 4: Aquatic Life Criteria for Sulfate for Class B waters</u>
<u>(all values expressed in milligrams per liter)</u>

Chloride / Hardness mg/L as $CaCO_3$	Cl^- < 5 mg/L	5 < = Cl^- < 25	25 <= Cl^- < =500
H < 100 mg/L	500	500	500
100<=H<= 500	500	[-57.478 + 5.79 (hardness) + 54.163 (chloride)] * 0.65	[1276.7 + 5.508 (hardness) – 1.457 (chloride)] * 0.65
H > 500	500	2,000	2,000

ITEM 3. Rescind subrule 61.3(2)g as follows:

g. ~~Acceptable levels of total dissolved solids (TDS) and constituent cations and anions will be established on a site-specific basis. The implementation approach for establishing the site-specific levels may be found in the "Supporting Document for Iowa Water Quality Management Plans," Chapter IV, July 1976, as revised on June 16, 2004.~~

ITEM 4. Amend "Supporting Document for Iowa Water Quality Management Plans," Chapter IV, July 1976, (insert new effective date)" to reflect the removal of the TDS site-specific approach and revision of the sulfate ion guideline value.

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Date

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Richard Leopold, Director

Fiscal Impact Statement

Associated with the

Notice of Intended Action

TDS, Chloride, and Sulfate Criteria Revisions – Water Quality Standards

(Chapter 61)

Prepared by the

Department of Natural Resources

April 10, 2009

Table of Contents

Fiscal Impact Statement

Introduction: This Fiscal Impact Statement (FIS) will provide the projected costs and potential benefits associated with the proposed rule changes being addressed in the Notice of Intended Action for Total Dissolved Solids (TDS), Chloride, and Sulfate Criteria Revisions – Water Quality Standards (Chapter 61). This rule-making effort is the most recent effort of the triennial review of Iowa's Water Quality Standards and is a part of the IDNR's Time Lines for Water Quality Standards Modifications that includes the following topic:

- Replace the current interim site-specific total dissolved solids general standard with specific ion numeric criteria for chloride and sulfate.

This evaluation will discuss the fiscal impacts for this topic and provide a summary of the fiscal impacts for the entire rule making effort. It is important to note that department staff did not evaluate the specific individual impacts or source reduction/treatment needs for each wastewater treatment facility noted in the FIS. Basic assumptions and evaluations were made on the general impacts on all facilities predicted to be affected. The specific individual impacts and needs will be best evaluated by the facility's staff or retained consultant. Innovative or unique treatment methods or source reduction techniques may be available to some facilities thereby reducing specific costs.

The number of NPDES regulated facilities expected to be impacted is an approximation based on study by the Iowa Water Pollution Control Association (IWPCA) conducted in conjunction with the Iowa DNR.

TDS, Chloride, and Sulfate Criteria Changes: The Notice of Intended Action is proposing to replace the current interim site-specific TDS general standard in IAC 567 – 61.3(2)g, with specific ion numeric criteria for chloride and sulfate. The proposed change comes as the result of the DNR conducting and compiling more research related to the toxicity of TDS, chloride, and sulfate in order to better protect river, stream, and lake aquatic life uses and reevaluate the current interim approach for TDS. Research has shown that integrative parameters such as TDS are not robust predictors of toxicity. IDNR research into existing ion concentrations in Iowa waters found that of the common substances comprising the major portion of total dissolved solids, toxicity is associated with either sulfate or chloride. Sodium, calcium, magnesium and carbonates make up the other ions in the majority, but these are not sufficiently toxic to create the need for individual water quality standards. Current science at this time demonstrates that if sulfate and chloride, alone or in combination, meet the proposed standards, toxicity from the other major ions comprising "total dissolved solids" is insignificant. Therefore, the TDS concentration provides no additional useful information. The existing standard is cumbersome and results in restrictions where none should exist and is proposed to be replaced by chloride and sulfate standards. The recommended specific ion criteria for chloride and sulfate are based on the most up-to-date toxicity data and are consistent with federal guidelines.

A. Projected Costs: First, it should be noted that the department does not anticipate any new costs to the state that do not already exist or any of its agencies as a result of these revisions. Wastewater discharges from IDOT maintenance garages and DNR state parks are addressed in this assessment. While no new costs are anticipated for the state, new costs are anticipated for cities and industry that discharge elevated levels of chloride and/or sulfate to Iowa's waters.

In determining the projected costs of the TDS, chloride, and sulfate criteria revisions a multitude of factors will need to be considered. The first factor is to determine who may be impacted by the proposed rule. The TDS, chloride, and sulfate criteria revisions may affect regulated NPDES point source dischargers

Relatively speaking, a majority of municipal and industrial NPDES regulated entities have begun to monitor TDS and chloride based on rules passed in 2004. These facilities include municipal wastewater treatment plants of all shapes and sizes, certain municipal drinking water treatment plants, and industries such as ethanol production, certain food processors, canneries, and industries that discharge cooling water. In 2006 the IWPCA and IDNR conducted a detailed monitoring study of TDS, chloride and sulfate of 103 municipal wastewater treatment plants statewide for the purpose of establishing a more accurate assessment of impacts. The study focused on facilities that would most likely struggle to comply with any future TDS, chloride, or sulfate permit limitations. As a result, a large proportion of these facilities were located in northwest Iowa where it is commonly known that this area of the state's groundwater possesses elevated chloride and hardness levels when compared to the rest of Iowa's groundwater resources. Groundwater is the common source for municipal drinking water and process water used for industrial purposes.   Other sources were utilized to help determine who may be impacted by the proposed rule. Partial data is available for 50 drinking water treatment facilities including individual chloride data for each plant. The Water Resources Section also maintains a toxicity testing database with 25 facilities with the potential to be impacted by the proposed chloride criteria and 28 different facilities with the potential to be impacted by the proposed sulfate criteria. Twenty independently discharging IDOT garages were also included. This results in approximately 199 facilities evaluated in all.

To best utilize the multitude of data acquired by IWPCA and the IDNR to help determine the fiscal impact of the proposed rule, individual wasteload allocations using statewide background default values for hardness, chloride, and sulfate were calculated to determine water quality based effluent limits for each individual facility included in the study. These likely permit limits were then compared with the effluent data provided by the studies. Facilities that appeared to comply with the calculated permit limits were not considered to be affected while facilities that appeared not to comply with calculated permit limits were flagged as likely to be affected by the proposed criteria revisions. These were categorized as either "chloride impacted", "sulfate impacted", or "chloride and sulfate impacted" and then further broken down by whether the facility was a municipal wastewater treatment plant, a municipal drinking water treatment plant, or an industry.

Table 1.
Affected Facilities Counts

Facility Type	Chloride Impacted	Sulfate Impacted	Chloride & Sulfate Impacted
Sewage Treatment Plants	39	0	0
Industrial	21	3	1
Water Treatment Plants	2	2	0
Total*	62	5	1

*see table 3 for the list of potentially affected facilities

The approximately 200 facilities examined for chloride and sulfate impacts were broken down in two distinct regions across the state. As previously mentioned, it is expected that NW Iowa may have more potentially affected facilities due to the regional differences in groundwater quality. As a result, 57 of the ~200 facilities examined fall into a 23 county area in NW Iowa as delineated on the map in Appendix B. The remaining 142 facilities are spread across the rest of the state.

Twenty-nine (29) of the 57 facilities studied in NW Iowa are considered affected by this rule making proposal (~51%). In addition, thirty-nine (39) of the 142 facilities studied for the rest of the state are considered affected by this rule making proposal (~27%). It is important to note that the majority of the facilities considered in the IWPCA study were selected because it was suspected that these facilities would struggle to comply with sulfate and/or chloride limitations.

The studies conducted and these analyses provide a small cross-section of all NPDES facilities statewide. It would be ideal to have detailed data for all facilities in Iowa and individualized wasteload allocations that calculate water quality based effluent limits for chloride and sulfate. However, this was not possible due to facility data deficiencies and limited resources to conduct the individualized permit limit calculations for 1,612 NPDES dischargers statewide.
That being said, it is possible to extrapolate impacts statewide for all dischargers by conducting a conservative proportion.

In NW Iowa, there are approximately 343 NPDES permitted discharges. The analyses of likely impacted facilities in this area revealed ~51% of the facilities may be affected. As a result, there can be a conservative expectation that approximately **175** facilities may be impacted (51% of 343 facilities in NW Iowa). For the rest of Iowa, there are approximately 1,279 NPDES permitted discharges. The analyses of likely impacted facilities in this area revealed ~27% of the facilities may be affected. As a result, there can be a conservative expectation that approximately **345** facilities may be impacted (27% of 1,279 facilities for the rest of the state). Combined, this would result in **520** facilities potentially impacted statewide.

Again, this approximation is weighted heavily towards the conservative end of the spectrum for several reasons.

1) The specific study analyses are focused on facilities suspected of being truly impacted.
2) The remaining NPDES facilities include facilities that likely will not be impacted by these rules, but could not accurately be sorted out such as facilities discharging to large rivers with a large amount of assimilative capacity

3) The specific study includes the small, but specific number of IDOT truck washing facilities that will inadvertently skew these percentages.

To address the conservatism of this analysis a lower end range is necessary to help approximate the likely number of impacted facilities. Based on best professional judgment, levels of adjustment of 25% were selected for NW Iowa and 13% for the rest of the state to provide an acceptable range of likely impacted facilities. As a result, the lower end range is calculated to be approximately **86** facilities that may be impacted (25% of 343 facilities in NW Iowa). For the rest of Iowa, there are approximately 1,279 NPDES permitted discharges. Therefore the lower end range is calculated to be approximately **166** facilities that may be impacted (13% of 1,279 facilities for the rest of the state). Combined, this would result in **252** facilities potentially impacted statewide.

Consequently, the range of overall affected facilities is expected to range between 252 and 520 facilities statewide (NW Iowa between 86 and 175, the rest of the state between 166 and 345).

The proposed criteria for chloride and sulfate will likely result in new permit limits for a relatively large portion of all NPDES permitted discharges and several cannot comply or will likely struggle to comply with the expected permit limitations. The question is how facilities that violate the new chloride and sulfate permit limits will eventually achieve compliance. The following outline represents the generalized implementation path expected for these situations with compliance evaluated after each step:

I. Calculate site-specific permit limitations and examine other implementation options (e.g. alternative discharge locations, zero discharge, mixing zone studies, or flow variable limitations)
II. Identify and implement voluntary source reduction efforts
III. Identify and implement mandatory source reduction efforts
IV. Evaluate options for treatment for chloride and/or sulfate
V. Evaluate options for a variance

Mechanical Treatment Options

Based on the research of this issue in other states, it is clear there is no easy treatment solution for the removal of chloride. The treatment options are few and the ones that are available are typically cost prohibitive when considered for publicly owned treatment works. For example, the Santa Clarita Valley Joint Sewerage System, CA (service population 125,000) estimated that the cost of constructing advanced chloride removal and brine disposal facilities would cost at minimum $350 million, which would be paid for by ratepayers in the service area, resulting in a 400% increase in sewer rates.

The option identified in the case of Santa Clarita is the effective, yet generally cost prohibitive, treatment option of microfiltration combined with reverse osmosis. Reverse osmosis is a technique whereby a solution is forced through a semipermeable membrane under pressure; used to generate drinkable water from sea water, or to separate chemical compounds. Some of Iowa's drinking water treatment facilities employ such technology for drinking water treatment and laboratories use it to produce pure water. While this technology can remove chloride and sulfate (and a whole host of other pollutants) from the "product" water, it also produces a "reject" stream (also called the "concentrate" stream). This reject stream contains all of the filtered pollutants, now concentrated into a brine, with very limited options for disposal or reuse due to the large volumes of it that would be created through wastewater treatment. While this treatment method can effectively remove chloride and sulfate, it is not currently viewed as a viable treatment option for most dischargers to surface waters, particularly for areas such as Iowa where disposal of the reject stream by evaporation or discharge to the ocean or a brackish water body are not currently feasible.

Source Reduction

The lack of cost effective treatment techniques available to remove chloride or sulfate and the presence of between 252 and 520 facilities in the state suspected not to comply with their future chloride and sulfate permit limits creates a dilemma for compliance statewide. This was a common theme found in the research of other states; however, other solutions are available to help facilities combat chloride and sulfate pollution issues. The most common process used by states across the country to reduce chloride and sulfate levels in wastewater effluent is to utilize an array of source reduction options, primarily associated with water softening.

Source reduction is accomplished in several ways, including but not limited to:

- Modified operation of home water softeners by maximizing salt usage
- Removal of home water softeners
- Exchange tank home water softeners
- Soften water where needed aka "feed softened water"
- Removal or replacement of centralized ion exchange
- Best management practices where solid salt is used to prevent it from being washed down the drain (e.g. kosher slaughter house and IDOT truck washing operations)
- Removal of chlorine contributions to the waste stream or effluent (e.g. chlorine bleach, disinfection processes via chlorination)

Options such as minimizing home water softener use, removal of water softeners, and using softened water at points where necessary can actually save money immediately or in the long run depending on how these options are implemented. Exchange tank softening is more expensive than traditional home water softening. Generally speaking, there is not an expected direct or high cost for BMPs to keep solid salt out of sewer drains. Removal or replacement of centralized ion exchange water softening for municipalities can be costly and is considered a last resort if it is identified as the main source of the chloride or sulfate in the effluent entering Iowa's surface waters. The sources of chloride may vary dramatically from town to town or industry to industry depending on several factors including, but not limited to:

Municipalities:
-The use of home water softening
-Drinking water treatment plant backwash
-Industrial contributors
-Centralized ion-exchange softening
-Source water

Industries:
-Industry type (e.g. ethanol, power plants, car washes, food processors, etc.)
-Processes that utilize salt
-Source water
-Use of softened water
-Closed loop or open loop cooling water
-Brine recovery

Since there are several different factors that are site-specific and can be different from facility to facility and with the multitude of source reduction options that may either save money or may require expenditures, it is difficult, if not impossible, to estimate overall costs or savings statewide with any degree of accuracy.

Site-Specific Monitoring
A unique aspect to the proposed chloride criteria is that its toxicity is dependent on hardness and sulfate (and conversely, sulfate toxicity is dependent on hardness and chloride). In general, the harder the water, the less toxic chloride and sulfate is to aquatic life. Conservative statewide default values will be used in the initial calculation of chloride and sulfate permit limits.

If a facility cannot comply or struggles to comply with chloride numeric permit limits, then it may explore the option of establishing revised chloride limitations based on site-specific hardness and sulfate concentrations of the effluent and receiving stream. Site-specific permit limits will ensure the appropriate benchmarks are in place for determining compliance. This is anticipated to be a course of action widely used as a first step towards compliance.

Currently, the department's site-specific data collection guidance requires two years of data at a frequency of once per week for each parameter. In the case of chloride, both hardness and sulfate wastewater effluent and ambient upstream samples can be collected for a total of four samples per week.

According to the University of Iowa Hygienic Laboratory both hardness and sulfate samples analyzed in a certified laboratory typically cost $18 per sample. This potential cost per facility is calculated as follows:

(4 samples * $18) * 104 weeks = **$7,488** for site-specific sampling costs per facility

The range of overall affected facilities is expected to be between 252 and 520 facilities statewide: therefore, it is possible that these facilities may pursue site-specific sampling as a part of their path to compliance. This potential range of overall costs is calculated as follows:

Lower-end scenario:
$7,488 for site-specific sampling costs per facility * 252 facilities = **$1,886,976 overall cost**

Higher-end scenario:
$7,488 for site-specific sampling costs per facility * 520 facilities = **$3,893,760 overall cost**

Consolidating Outfalls
Consolidating effluent streams may be a feasible option for industries with multiple outfalls that contain different process wastewater streams. It is possible that combining these treated wastewater streams together may make practical sense in order to achieve compliance with the proposed criteria. This is not expected to be a widely available option and where available, the costs are expected to be widely variable due to the amount of piping that may need to be reconfigured or added to combine the outfalls. Therefore these costs are not estimated.

General Monitoring
The proposed criteria for chloride and sulfate will result in more facilities having to monitor to determine compliance with permit limitations. The monitoring cost estimates will focus on chloride since sulfate compliance for regulated entities is anticipated to impact a very small number of facilities relative to the overall population of all NPDES permitted facilities.

It is difficult to determine with much accuracy exactly how many and what types of facilities will have monitoring and limits for chloride in their NPDES permits as a result of the rule. Based on conservative best professional judgment, it is expected that 50% of all NPDES facilities will have to monitor for chloride on a conservative basis of 2 samples per month. According to the University of Iowa Hygienic Laboratory both chloride and sulfate samples analyzed in a certified laboratory typically cost $18 per sample. This potential cost is calculated as follows:

806 NPDES permitted facilities * 12 months/year * ($18 * 2 samples) = **$348,192** for a chloride sampling costs per year.

There is not expected to be a dramatic increase in sulfate monitoring as there are only a very small amount of facilities expected to discharge sulfate at levels that are considered problematic; therefore, this has not been estimated.

It is important to note that this cost will be replacing the current TDS implementation procedures that have been in use since 2004. Based on information from the NPDES program, it can be assumed that the majority of the facilities identified as potentially impacted by the proposed chloride and sulfate criteria, are or would have also been impacted by the current implementation of the TDS standard over time. In most cases the TDS implementation procedures result in conducting acute and chronic whole effluent toxicity testing and analysis for the major ions comprising TDS. According to Mangold Environmental Testing, the cost of the WET testing and ion analysis is roughly $1300. Using the range of affected facilities this would result in a cost of $327,600 to $676,000. As the revisions do not propose to require this testing, this would be the potential cost savings to the facilities.

As a result, the following general monitoring costs are estimated as follows:

High-cost estimate
($348,192 general monitoring costs for proposed criteria - $327,600 low-end estimate of expected implementation costs for current TDS standard) = **+$20,592 (savings)**

Low-cost estimate
($348,192 general monitoring costs for proposed criteria - $676,000 high-end estimate of expected implementation costs for current TDS standard) = **-$327,808 (expense)**

Table 2. Summary of Costs Table for Each Category

Cost Category	Lower End Scenario Cost	Higher End Scenario Cost	Comments
Mechanical Treatment	NA	NA	Not considered a viable option at this time
Source Reduction	**-$**	**+$**	Not possible to determine savings or costs due to multitude of factors involved
Site-Specific Monitoring	**+$1,886,976**	**+$3,893,760**	Optional cost, but likely to be pursued
Blending	NA	NA	Not estimated as the option is likely only available to a small portion of potentially impacted facilities
General Monitoring	**-$327,808**	**+$20,592**	Required cost, conservatively estimated
Total	**$1,559,168**	**$3,914,352**	

B. Anticipated Benefits. In addition to some of the possible cost saving scenarios described above, the anticipated benefits from revising the chloride and sulfate criteria are associated with the potential improvements to: instream conditions for aquatic and semiaquatic life, wildlife and livestock watering needs, and aesthetic conditions. Common anticipated benefits will apply to the streams designated as Class B aquatic life use waters currently receiving wastewater discharges, but also waters receiving any future discharge of wastewater containing these pollutants. The benefits in the nature of projected improvements to instream water quality below wastewater treatment discharges would be derived from the removal of excess levels of chloride and/or sulfate via source reduction techniques and possibly, however unlikely, construction of treatment improvements or process modifications to comply with the numerical criteria in the Water Quality Standards. None of these potential benefits has a readily identifiable monetary value and thus will not be estimated in this impact statement.

C. Other Potential Impacts. There may be impacts associated with uncontrolled sources of pollution not associated with NPDES regulated wastewater contributions. Streams, primarily in urban areas, have been listed as impaired for chloride in other states. Chloride impairments for streams will be a possibility in Iowa as a result of this proposal. Generally road salt, used to de-ice driveways, sidewalks, parking lots, streets and highways, has been identified as the significant source of chloride in these situations. This can result in municipalities and the state utilizing best management practices to minimize the amount of salt that enters Iowa's rivers and streams. This can include, but is not limited to, more frequent street sweeping, only using the amount of salt necessary to achieve the desired deicing effect, mixing the salt with sand, etc.

Another impact is the process wastewater discharges from Iowa Department of Transportation (IDOT) truck washing facilities. The wash water is heavily laden with chloride from salt that these trucks haul for winter deicing of Iowa's roadways. There are approximately 20 independently discharging truck washing facilities currently permitted, which dramatically fail to comply with current TDS interim limitations. The small amount of water used in the washing process results in high concentrations of chloride in the wash water. These facilities discharge to Iowa's waters intermittently during wash cycles. The amount of discharge is small compared to typical NPDES regulated facilities; however, the small amount of water discharged is highly concentrated with chloride and does not meet current limits and will not comply with these newly proposed criteria. Several of these facilities have already connected to nearby municipal sewage treatment systems where this small amount of wash water is diluted and mixed with the raw influent sewage of that municipality. The concept is that the chloride levels are dramatically diluted prior to the municipality discharging treated effluent from the municipal wastewater treatment plant. It appears many of the state's truck washing facilities are moving in this direction as the installation of a chloride removal system is widely considered cost prohibitive. Another option being utilized by IDOT at the Ames facility is reusing/recycling the washwater or salt brine to apply to roadways for deicing purposes. This can save the state money on salt costs as the salt purchased is more fully utilized. This option is being explored at other IDOT facilities across the state.

D. Anticipated Implementation Approach: The Department recognizes that the implementation of these proposed rules and rule changes may have extensive economic impacts. Historically, compliance with the provisions of the federal Clean Water Act has carried a significant price tag and will continue to be costly as requirements and guidelines are reaffirmed. It is the goal of the Department to implement these proposed rules in a reasonable, practicable, and responsible manner. Thus, the implementation will be linked to the reissuance of each facility's NPDES permit. All available NPDES provisions and consideration will be made to allow adequate time for each facility to comply with the adopted rules according to their time constraints, economic abilities, and source of financial aid.

Table 3.
Facilities that Could Potentially be impacted by the Chloride and/or Sulfate Rule

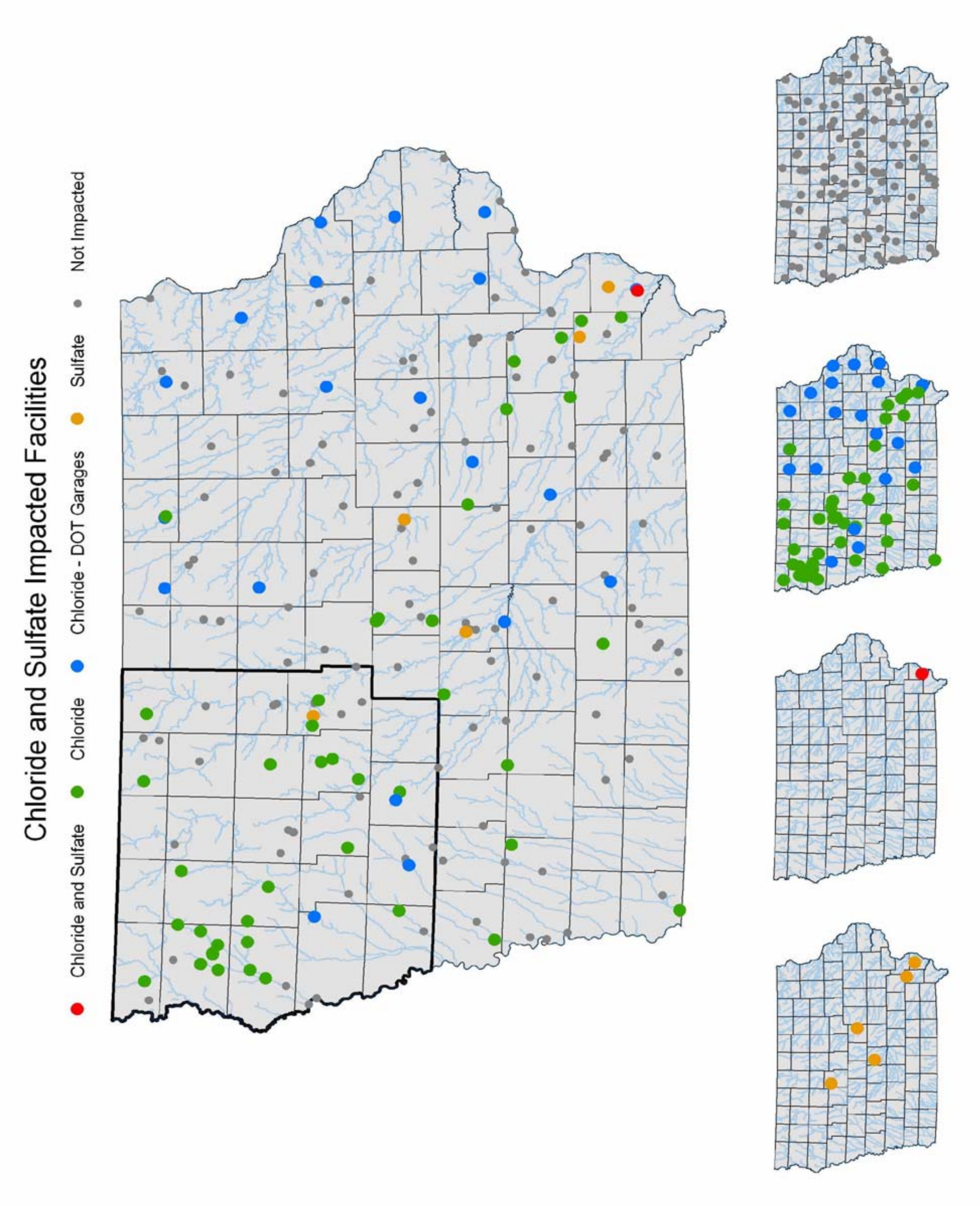
No.	NPDES Permit #	Facility Name	Impacted By:
1	0105001	Adair, City of STP	Chloride
2	8403001	Alton, City of	Chloride
3	6003001	Alvord, City of	Chloride
4	9408001	Barnum, City of	Chloride
5	2900112	Big River Resources West Burlington	Chloride & Sulfate
6	1415001	Carroll , City of STP	Chloride
7	1811002	Cherokee Ind.	Chloride
8	9214001	Crawfordsville , City of STP	Chloride
9	3218002	Estherville, City of STP	Chloride
10	9433003	Fort Dodge, City of STP	Chloride
11	7930001	Grinnell, City of	Chloride
12	3621001	Hamburg, City of STP	Chloride
13	7128001	Hartley, City of STP	Chloride
14	7700808	Hickory Hollow Water Services	Sulfate
15	8439001	Hospers, City of STP	Chloride
16	8538001	Huxley, City of STP	Chloride
17	0600904	Iowa DOT Maintenance Garage – Newhall	Chloride
18	7727902	Iowa DOT Maintenance Garage – Carlisle	Chloride
19	1400903	Iowa DOT Maintenance Garage – Carroll	Chloride
20	5900903	Iowa DOT Maintenance Garage – Chariton	Chloride
21	9700905	Iowa DOT Maintenance Garage – Correctionville	Chloride
22	8222902	Iowa DOT Maintenance Garage – Davenport	Chloride
23	9600903	Iowa DOT Maintenance Garage – Decorah	Chloride
24	2400902	Iowa DOT Maintenance Garage – Denison	Chloride
25	3100903	Iowa DOT Maintenance Garage – Dubuque	Chloride
26	3100904	Iowa DOT Maintenance Garage – Dyersville	Chloride
27	2200904	Iowa DOT Maintenance Garage – Elkader	Chloride
28	9800902	Iowa DOT Maintenance Garage – Hanlontown	Chloride
29	1000903	Iowa DOT Maintenance Garage – Independence	Chloride
30	3500903	Iowa DOT Maintenance Garage – Latimer	Chloride
31	7900706	Iowa DOT Maintenance Garage – Malcom	Chloride
32	4900902	Iowa DOT Maintenance Garage – Maquoketa	Chloride
33	6600903	Iowa DOT Maintenance Garage – Osage	Chloride
34	6200905	Iowa DOT Maintenance Garage – Oskaloosa	Chloride
35	1600906	Iowa DOT Maintenance Garage – Tipton	Chloride
36	2900904	Iowa DOT Maintenance Garage – West Burlington	Chloride
37	6469103	IP&L - Sutherland	Sulfate
38	9233001	Kalona, City of	Chloride
39	1345003	Lake City, City of	Chloride
40	7540001	Lemars, City of STP	Chloride
41	1838001	Marcus, City of STP	Chloride
42	8458001	Maurice, City of	Chloride

43	7548001	Merrill, City of	Chloride
44	4344001	Missouri Valley , City of	Chloride
45	4458001	New, London City of STP	Chloride
46	4858001	North English, City of STP	Chloride
47	8144001	Odebolt, City of STP	Chloride
48	4465000	Olds Water Department	Sulfate
49	8474001	Orange City, City of STP	Chloride
50	8474000	Orange City, City of WTP	Chloride
51	6663001	Osage, City of STP	Chloride
52	2038002	Osceola, City of STP	Chloride
53	7633001	Pocahontas, City of STP	Chloride
54	7568001	Remsen, City of STP	Chloride
55	5470001	Richland, City of STP	Chloride
56	1376001	Rockwell City, City of STP	Chloride
57	7170001	Sheldon, City of STP	Chloride
58	8486002	Sioux Center, City of STP	Chloride
59	8584001	Story City, City of STP	Chloride
60	NA	Story City Water Plant	Chloride
61	5584001	Swea City, City of STP	Chloride
62	1300903	Twin Lakes Sanitary District	Chloride
63	2500100	Tyson Fresh Meats - Perry	Chloride
64	2900103	US Gypsum	Sulfate
65	6762001	Ute, City of	Chloride
66	9433115	Verasun Energy	Sulfate
67	7872001	Walnut, City of STP	Chloride
68	4493001	Winfield, City of STP	Chloride

Appendix A - References

1. Affected Facilities Spreadsheets

Appendix B – Affected Facilities Map



NPDES #	Site	Facility Type	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
0105001	Adair	Trickling Filter	0.124	0.511	0.08	0.33	0	0	34	0.25	0.025	389	629	Composite	540	Yes
														Grab	536	
1108001	Alta	Trickling Filter	0.271	0.851	0.175	0.55	0	0	34	0.25	0.025	389	629	Composite	85.8	No
														Grab	114	
8503001	Ames	Trickling Filter	13.304	18.719	8.6	12.1	0	0	34	0.25	0.025	389	629	Composite	117	No
														Composite	114	
														Grab	111	
														Grab	107	
3203001	Armstrong	Aerated Lagoon	0.193	0.503	0.125	0.325	0.165	0.127	34	0.25	0.025	465	639	Composite	336	No
														Grab	348	
8104001	Auburn	Waste Stabilization L	0.627	0.627	0.405	0.405	7.46	6.38	34	0.25	0.025	1446	780	Grab	99.5	No
0607001	Blairstown	Aerated Lagoon	0.125	0.427	0.081	0.276	0.24	0.16	34	0.25	0.025	559	648	Composite	403	No
														Composite	409	
														Composite	427	
														Grab	439	
														Grab	423	
														Grab	416	
2613001	Bloomfield	Aerated Lagoon	0.541	1.083	0.35	0.7	0	0	34	0.25	0.025	389	629	Composite	63.3	No
														Grab	64.1	
9209001	Brighton	Aerated Lagoon	0.143	0.357	0.0925	0.231	0	0	34	0.25	0.025	389	629	Composite	278	No
														Grab	283	
9417001	Callender	Waste Stabilization L	2.274	2.274	1.47	1.47	0	0	34	0.25	0.025	389	629	Grab	263	No
9615001	Calmar	Aerated Lagoon	0.156	0.774	0.101	0.5	0.021	0.02	34	0.25	0.025	401	631	Composite	324	No
														Grab	322	
1415001	Carroll	Activated Sludge	2.475	6.497	1.6	4.2	0.04	0.038	34	0.65	0.0325	393	629	Composite	459	Yes
														Grab	425	
0709001	Cedar Falls	Trickling Filter	11.881	13.614	7.68	8.8	270	246	34	0.25	0.025	2406	937	Composite	175	No
														Grab	152	
1811002	Cherokee City	Activated Sludge	1.253	3.372	0.81	2.18	12.44	11.47	34	0.25	0.025	1270	765	Composite	405	No
														Composite	406	
														Composite	479	
														Composite	435	
														Composite	402	
														Grab	388	
														Grab	359	
														Grab	412	
														Grab	368	
														Grab	387	

NPDES #	Site	Facility Type	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
1811002	Cherokee Ind.	Activated Sludge	1.547	1.934	1	1.25	12.44	11.47	34	0.25	0.025	1103	739	Composite	692	Yes
														Composite	799	
														Composite	662	
														Composite	714	
														Composite	629	
														Grab	666	
														Grab	568	
														Grab	663	
														Grab	702	
														Grab	618	
2326001	Clinton	Activated Sludge	454.968	774.761	294.0971	500.8151	1,200	9,460	34	0.1	0.01	483	753	Composite	151	No
														Grab	207	
5815001	Columbus Junctic	Activated Sludge	2.785	4.177	1.8	2.7	Flow is split to two separate receiving streams					#VALUE!	629	Composite	298	No
														Grab	299	
1427002	Coon Rapids	Waste Stabilization L	2.862	2.862	1.85	1.85	7.14	5.95	34	0.125	0.0125	500	644	Grab	59.9	No
7820001	Council Bluffs	Trickling Filter	10.056	18.564	6.5	12	10,100	6,830	34	0.1	0.01	36046	4670	Composite	118	No
														Grab	130	
9214001	Crawfordsville	Waste Stabilization L	0.495	0.495	0.32	0.32	0	0	34	0.25	0.025	389	629	Grab	478	Yes
7822001	Crescent City	Waste Stabilization L	0.897	0.897	0.58	0.58	1.524	1.397	34	0.125	0.0125	464	641	Grab	109	No
2715001	Davis City	Aerated Lagoon	0.040	0.139	0.026	0.09	0	0	34	0.25	0.025	389	629	Composite	61.5	No
														Grab	62.5	
9630001	Decorah	Activated Sludge	2.058	6.683	1.33	4.32	38	36	34	0.25	0.025	2028	889	Composite	284	No
														Grab	283	
2424000	Denison	Activated Sludge	4.151	4.946	2.683	3.197	4.598	3.949	34	0.25	0.025	487	643	Composite	384	No
														Composite	403	
														Composite	406	
														Composite	411	
														Grab	392	
														Grab	402	
														Grab	390	
														Grab	420	
9921001	Dows	Aerated Lagoon	0.169	0.413	0.109	0.267	7.66	7.04	34	0.25	0.025	4421	1250	Composite	64.5	No
														Grab	63.3	
3130001	Dyersville	Activated Sludge	0.804	1.284	0.52	0.83	0	0	34	0.25	0.025	389	629	Composite	315	No
														Grab	325	
9926001	Eagle Grove	Rotating Biological C	1.301	3.730	0.841	2.411	0	0	34	0.25	0.025	389	629	Composite	46.2	No
														Grab	38.3	
2825001	Earlville	Trickling Filter	0.116	0.131	0.075	0.085	0.16	0.122	34	0.25	0.025	511	645	Composite	330	No
														Grab	398	
?	Edwardsville		#VALUE!	#VALUE!	?	?	?	?	34	0.25	0.025	#VALUE!	#VALUE!	Grab	97.5	No
9053001	Eldon	Waste Stabilization L	1.843	1.843	1.1916	1.1916	382.5	204.5	34	0.25	0.025	18804	2279	Grab	27.6	No

NPDES #	Site	Facility Type	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
3218002	Estherville	Trickling Filter	3.094	5.415	2	3.5	1.277	0.904	34	0.25	0.025	426	633	Composite	1360	Yes
														Composite	1400	
														Composite	1340	
														Grab	1380	
														Grab	1350	
														Grab	1320	
9433003	Fort Dodge	Activated Sludge	10.056	14.697	6.5	9.5	35.63	25.45	34	0.25	0.025	703	667	Composite	662	Yes
														Grab	687	
2725001	Garden Grove	Waste Stabilization L	0.487	0.487	0.315	0.315	0	0	34	0.25	0.025	389	629	Grab	63.4	No
4130002	Garner	Aerated Lagoon	0.531	1.351	0.343	0.873	0.101	0.086	34	0.25	0.025	406	631	Composite	277	No
														Composite	261	
														Grab	188	
														Grab	281	
8637001	Garwin	Lagoon	0.091	0.630	0.059	0.407	0.102	0.048	34	0.25	0.025	488	637	Grab	81.7	No
3833001	Grundy Center	Sequence Batch Rea	0.619	1.856	0.4	1.2	0	0	34	0.25	0.025	389	629	Composite	120	No
														Grab	128	
3621001	Hamburg	Waste Stabilization L	5.028	5.028	3.25	3.25	0	0	34	0.25	0.025	389	629	Grab	448	Yes
9442001	Harcourt	Waste Stabilization L	0.557	0.557	0.36	0.36	0	0	34	0.25	0.025	389	629	Grab	265	No
7128001	Hartley	Activated Sludge	0.371	1.207	0.24	0.78	0	0	34	0.25	0.025	389	629	Composite	616	Yes
														Grab	604	
5432001	Hedrick	Aerated Lagoon	0.169	0.545	0.109	0.352	0	0	34	0.25	0.025	389	629	Grab	219	No
2835001	Hopkinton	Activated Sludge	0.110	0.258	0.071	0.167	0	0	34	0.25	0.025	389	629	Composite	192	No
														Grab	210	
8439001	Hospers	Aerated Lagoon	2.692	2.692	1.74	1.74	0	0	34	0.25	0.025	389	629	Composite	365	Yes
														Grab	469	
8444001	Hull	Aerated Lagoon	0.681	0.928	0.44	0.6	0	0	34	0.25	0.025	389	629	Composite	278	No
														Grab	283	
4641001	Humboldt	Activated Sludge	2.011	2.785	1.3	1.8	25.5	23.5	34	0.25	0.025	1514	803	Composite	96.5	No
														Grab	92.1	
9348001	Humeston	Aerated Lagoon	0.170	0.418	0.11	0.27	0	0	34	0.25	0.025	389	629	Composite	73.1	No
														Grab	95.6	
8538001	Huxley	Trickling Filter	0.534	0.981	0.345	0.634	0	0	34	0.25	0.025	389	629	Composite	717	Yes
														Grab	232	
1037001	Independence	Trickling Filter	2.785	6.188	1.8	4	18.3	10.17	34	0.25	0.025	972	683	Composite	385	No
														Grab	423	
6040001	Inwood	Aerated Lagoon	0.085	0.122	0.055	0.079	0	0	34	0.25	0.025	389	629	Composite	355	No
														Grab	326	

NPDES #	Site	**Facility Type**	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
4260001	Iowa Falls	Trickling Filter	1.284	3.403	0.83	2.2	9.96	9.15	34	1	1	3143	4869	Composite	606	No
														Composite	710	
														Composite	760	
														Grab	551	
														Grab	709	
														Grab	691	
0640001	Keystone	Aerated Lagoon	0.104	0.217	0.067	0.14	0.185	0.166	34	0.25	0.025	547	653	Composite	214	No
														Grab	223	
0543001	Kimballton	Aerated Lagoon	0.077	0.077	0.05	0.05	0	0	34	0.25	0.025	389	629	Grab	117	No
4155001	Klemme	Aerated Lagoon	0.119	0.659	0.077	0.426	0	0	34	0.25	0.025	389	629	Composite	121	No
														Grab	118	
9545001	Lake Mills	Aerated Lagoon	0.775	1.160	0.501	0.75	0	0	34	0.25	0.025	389	629	Composite	204	No
														Grab	253	
0345001	Lansing	Activated Sludge	0.347	0.630	0.224	0.407	9030	8190	34	0.1	0.01	925466	141254	Composite	97.4	No
														Grab	130	
7540001	Lemars	Activated Sludge	3.960	5.161	2.56	3.336	1.1	0.95	34	0.25	0.025	414	633	Composite	817	Yes
														Composite	704	
														Composite	761	
														Grab	715	
														Grab	680	
														Grab	748	
8748001	Lenox	Aerated Lagoon	0.183	0.571	0.118	0.369	0	0	34	0.25	0.025	389	629	Composite	74.9	No
														Grab	80.4	
2742001	Leon	Aerated Lagoon	0.588	1.671	0.38	1.08	0	0	34	0.25	0.025	389	629	Composite	73.4	No
														Grab	71.4	
6858001	Lovilla	Aerated Lagoon	0.099	0.282	0.064	0.182	0	0	34	0.25	0.025	389	629	Composite	75.2	No
														Grab	76.6	
5047001	Lynnville	Waste Stabilization L	0.634	0.634	0.41	0.41	1.59	1.4	34	0.25	0.025	611	662	Grab	123	No
2436001	Manilla	Waste Stabilization L	1.436	1.436	0.928	0.928	5.163	3.285	34	0.25	0.025	708	663	Grab	383	No
4950001	Maquoketa	Activated Sludge	1.593	2.011	1.03	1.3	102	90	34	0.25	0.025	6070	1469	Composite	222	No
														Grab	216	
1838001	Marcus	Waste Stabilization L	3.635	3.635	2.35	2.35	0	0	34	0.25	0.025	389	629	Grab	473	Yes
														Grab	425	
1750001	Mason City	Activated Sludge	10.520	23.050	6.8	14.9	8.39	6.5	34	0.25	0.025	460	638	Composite	181	No
														Grab	199	
9155001	Milo	Aerated Lagoon	0.170	0.681	0.11	0.44	0	0	34	0.25	0.025	389	629	Composite	68.7	No
														Grab	70.2	
4453002	Mt. Pleasant	Aerated Lagoon	2.088	4.254	1.35	2.75	31.65	26.07	34	0.25	0.025	1734	815	Composite	210	No
														Grab	202	
7048001	Muscatine	Activated Sludge	7.967	15.934	5.15	10.3	5919	5489	34	0.1	0.01	26763	4728	Composite	140	No
														Grab	119	

NPDES #	Site	Facility Type	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
1970001	New Hampton	Trickling Filter	2.042	3.403	1.32	2.2	0.027	0.025	34	0.25	0.025	390	629	Composite	142	No
														Grab	133	
4458001	New London	Aerated Lagoon	0.294	1.454	0.19	0.94	0	0	34	0.25	0.025	389	629	Composite	455	Yes
														Grab	453	
4858001	North English	Trickling Filter	0.084	0.374	0.054	0.242	0	0	34	0.25	0.025	389	629	Composite	747	Yes
														Grab	728	
8144001	Odebolt	Aerated Lagoon	0.227	0.732	0.147	0.473	0.045	0.04	34	0.25	0.025	407	632	Composite	697	Yes
														Grab	689	
3353001	Oelwein	Activated Sludge	1.485	3.945	0.96	2.55	0.528	0.293	34	0.15	0.015	408	631	Composite	174	No
														Grab	167	
8474001	Orange City	Aerated Lagoon	1.663	2.939	1.075	1.9	0	0	34	0.25	0.025	389	629	Composite	619	Yes
														Composite	648	
														Composite	656	
														Grab	604	
														Grab	644	
														Grab	696	
6663001	Osage	Activated Sludge	0.804	1.160	0.52	0.75	0.078	0.068	34	0.25	0.025	398	630	Composite	402	Yes
														Grab	428	
2038002	Osceola	Trickling Filter	1.648	4.096	1.065	2.648	0	0	34	0.25	0.025	389	629	Composite	409	Yes
														Grab	403	
9083001	Ottumwa	Activated Sludge	9.963	22.671	6.44	14.655	300	300	34	0.8	0.8	8941	14962	Composite	93.6	No
														Grab	81.7	
3971001	Panora	Aerated Lagoon	0.219	0.789	0.1414	0.51	12	12	34	1	1	19864	33270	Composite	215	No
														Grab	216	
2561001	Perry	Activated Sludge	2.321	4.486	1.5	2.9	12.2	10.9	34	0.025	0.0025	436	636	Composite	64	No
														Grab	57.4	
7633001	Pocahontas	Activated Sludge	0.401	1.408	0.259	0.91	0	0	34	0.25	0.025	389	629	Composite	973	Yes
														Composite	1840	
														Composite	1340	
														Composite	1540	
														Grab	841	
														Grab	2480	
														Grab	1380	
														Grab	1260	
7568001	Remsen	Aerated Lagoon	0.330	0.687	0.213	0.444	0	0	34	0.25	0.025	389	629	Composite	573	Yes
														Composite	521	
														Composite	560	
														Grab	587	
														Grab	520	
														Grab	546	

NPDES #	Site	Facility Type	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
5470001	Richland	Lagoon	1.117	1.117	0.722	0.722	0	0	34	0.25	0.025	389	629	Grab	473	Yes
3275001	Ringsted	Waste Stabilization L	0.596	0.596	0.385	0.385	0	0	34	0.25	0.025	389	629	Grab	264	No
1376001	Rockwell City	Trickling Filter	0.497	1.570	0.321	1.015	0	0	34	0.25	0.025	389	629	Composite	1050	Yes
														Grab	993	
7170001	Sheldon	Rotating Biological C	1.779	2.150	1.15	1.39	0.006	0	34	0.25	0.025	389	629	Composite	558	Yes
														Grab	526	
8486002	Sioux Center	Rotating Biological C	1.702	2.785	1.1	1.8	0	0	34	0.25	0.025	389	629	Composite	723	Yes
														Grab	672	
9778001	Sioux City	Activated Sludge	24.752	27.227	16	17.6	10100	7028	34	0.25	0.025	36603	4853	Composite	1250	No
														Grab	1160	
6484001	State Center	Aerated Lagoon	0.286	0.719	0.185	0.465	0	0	34	0.25	0.025	389	629	Composite	189	No
														Grab	185	
1178001	Storm Lake	Activated Sludge	2.785	7.735	1.8	5	0	0	34	0.25	0.025	389	629	Composite	213	No
														Grab	234	
1178105	Storm Lake Tysoı	Activated Sludge	5.724	6.531	3.7	4.222	0.209	0.177	34	0.25	0.025	392	629	Composite	186	No
														Grab	190	
8584001	Story City	Sequence Batch Rea	0.640	1.467	0.414	0.948	0.028	0.017	34	0.25	0.025	393	629	Composite	415	Yes
														Composite	417	
														Composite	411	
														Grab	376	
														Grab	429	
														Grab	389	
?	Story City Water I	Sequence Batch Rea	#VALUE!	#VALUE!	?	?	?	?	34	0.25	0.025	#VALUE!	#VALUE!	Grab	8800	Yes
0180001	Stuart	Trickling Filter	0.260	0.928	0.168	0.6	0.016	0.015	34	0.25	0.025	394	630	Composite	160	No
														Grab	144	
5584001	Swea City	Waste Stabilization L	0.975	0.975	0.63	0.63	0	0	34	0.25	0.025	389	629	Grab	456	Yes
8676001	Toledo	Aerated Lagoon	0.611	1.275	0.395	0.824	0.251	0.118	34	0.25	0.025	425	632	Composite	233	No
														Grab	241	
4875001	Victor	Activated Sludge	0.139	0.309	0.09	0.2	0.592	0.53	34	0.25	0.025	766	686	Composite	643	No
														Grab	614	
7872001	Walnut	Aerated Lagoon	0.167	0.362	0.108	0.234	0.022	0.021	34	0.25	0.025	401	631	Composite	691	Yes
														Grab	686	
9271001	Washington	Trickling Filter	1.686	5.043	1.09	3.26	0	0	34	0.25	0.025	389	629	Composite	274	No
														Grab	283	
0790001	Waterloo	Activated Sludge	27.846	53.836	18	34.8	296	270	34	0.25	0.025	1332	773	Composite	330	No
														Grab	375	
2573001	Waukee	Activated Sludge	1.071	1.853	0.692	1.198	0	0	34	0.25	0.025	389	629	Composite	102	No
														Grab	96.6	
4063001	Webster City	Rotating Biological C	2.321	5.105	1.5	3.3	3.581	3.388	34	0.25	0.025	526	651	Composite	174	No
														Grab	154	

Appendix A - Chloride Impacts from IWPCA Study

NPDES #	Site	Facility Type	ADW (cfs)	AWW (cfs)	ADW (mgd)	AWW (mgd)	7Q10 (cfs)	1Q10 (cfs)	Background Cl (mg/L)	Mixing Zone	Zone of Initial Dilution	Avg. Limit (mg/L)	Max. Limit (mg/L)	Sample Type	Cl Sample Result (mg/L)	Limit Violation ?
9276001	Wellman	Activated Sludge	0.425	0.696	0.275	0.45	0	0	34	0.25	0.025	389	629	Composite	368	No
														Grab	334	
7073001	West Liberty	Activated Sludge	1.887	2.429	1.22	1.57	0	0	34	0.25	0.025	389	629	Composite	287	No
														Grab	293	
3383003	West Union	Trickling Filter	0.774	1.315	0.5	0.85	0.751	0.651	34	0.25	0.025	475	642	Composite	283	No
														Grab	242	
5493001	What Cheer	Aerated Lagoon	0.133	0.495	0.086	0.32	0	0	34	0.25	0.025	389	629	Grab	82.6	No
4493001	Winfield	Aerated Lagoon	0.209	0.511	0.135	0.33	0	0	34	0.125	0.0125	389	629	Composite	796	Yes
														Grab	811	