Water Quality Credit Trading and Charles City

Travis Kleinschmidt

Andrew Kass

Tabatha Miller

Michael Palermo

Alex Rude

Jacob Tjaden

May 10, 2011

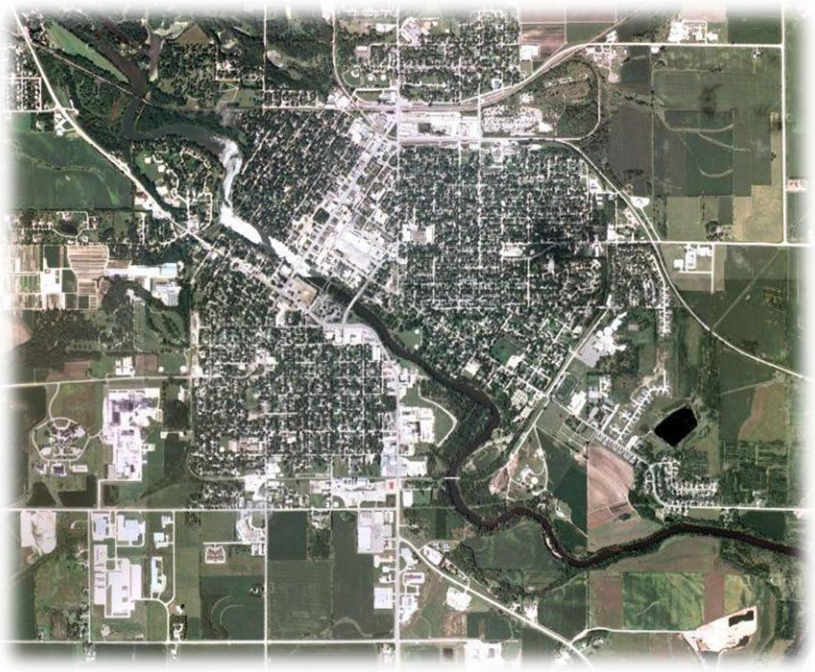


Table of Contents

Executive Summary

Water Quality Credit Trading may be a viable and cost-effective option for Charles City to address current water quality issues. We recommend that Charles City explore the possibility of point to non-point source water quality trading with area farmers north of Charles City or, alternatively, a point to non-point source trade through sole-source offsets. This option may lead to substantial cost saving and addresses the water quality flowing through the city and the Riverfront Development. In addition, the people paying the cost of this type of trade will also experience the benefits of this type of trade. However, there are a number of processes and considerations that are required before a water credit trading system can be instituted. We recommend Charles City spearhead an initiative to institute point to non-point water credit trading by following these steps:

1. **Obtain a NPDES Permit**. The municipal wastewater treatment plant should acquire a NPDES permit to determine if they can currently comply with the capped nitrate waste load allocation (WLA) without further modification to the treatment plant or utilizing a Water Quality Trading (WQT) program.

2. **Determine the cost to upgrade the water treatment facility**. If the current treatment plant cannot comply with a new nitrate WLA, the city has approximately three to five years to initiate compliance. Within that time period, the City should determine the cost to upgrade the water treatment facility. This analysis should consider any potential revenue sources, such as state or federal grants to ease the city's financial responsibilities. The cost to upgrade the water treatment facility may then be compared to the cost of similar WQT programs in the United States.

3. **Initiate a Petition for Rulemaking**. If similar WQT programs appear to be cost-effective compared upgrading current facilities, the City should form a coalition of partners to petition the IDNR for WQT rulemaking. This collaboration should include municipalities, agencies, and organizations with a vested interest in WQT to strengthen the petition and ensure the IDNR accesses this petition as a valid and powerful proposal.

4. **Reassess the cost-effectiveness and feasibility of WQT**. The City should reassess the cost-effectiveness and feasibility of water credit trading after the rulemaking is in place because the rules adopted may have a significant impact on cost-feasibility. Before a water credit trading system is instituted, the City will also need to assess local support for trading, and whether there are sufficient opportunities for upstream non-point source pollution reductions.

Introduction

The City of Charles City has expressed interest in WQT because the municipal wastewater treatment plant may be polluting more nitrates than allotted by the Iowa Department of Natural Resources (IDNR). WQT has been used as a mechanism by other municipalities to offset the excess pollution at a cost less expensive than alternative means. To determine if WQT is a valid method for Charles City, we researched and reviewed several documents provided by the United States Environmental Protection Agency (EPA) to better understand WQT in the United States., We established whether or not Charles City met the criteria for a successful trade, and ascertained how WQT may apply to Charles City. We also investigated other WQT programs throughout the United States and applied them to Charles City. Research was also conducted on the current state of WQT in Iowa, what elements lead to a successful trade, market structures for trading, and Best Management Practices that may be implemented near the Charles City area. In addition, knowledgeable people and organizations were contacted in the area for supplementary insight and information. A geology and water workshop entitled "A Upper Cedar Watershed: Geology and Water" was also attended in December 2010.

The Water Quality Trading Document is composed of the following sections:

- Charles City's Water Treatment Plant Status
- Water Quality Trading: An Overview
- Evaluating Selected Water Quality Trading programs
- Alternatives to Water Quality Trading
- Regulations and the Petition for Rulemaking
- Determining the Feasibility of WQT in Charles City
- Market Structures
- Elements Essential to Water Quality Trading Success
- Best Management Practices
- Recommendations for Charles City: The Action Plan

Charles City's Water Treatment Plant Status

In 2002, water extracted for drinking purposes by the City of Cedar Rapids exceeded the EPA maximum contaminate level (MCL) for nitrates. Appendix A indicates the nitrate levels at the Cedar Rapids monitoring station. The allowable maximum contaminate level is 10 mg/L NO_3-N for water designated for drinking purposes. This level has been established because nitrates in drinking water have been associated with harmful effects to susceptible populations. One of the most susceptible populations is infants, where excess nitrate concentrations have been associated with methemoglobinemia, or blue baby syndrome, a potentially fatal blood disorder that limits the intake of oxygen and can lead to suffocation. (1)

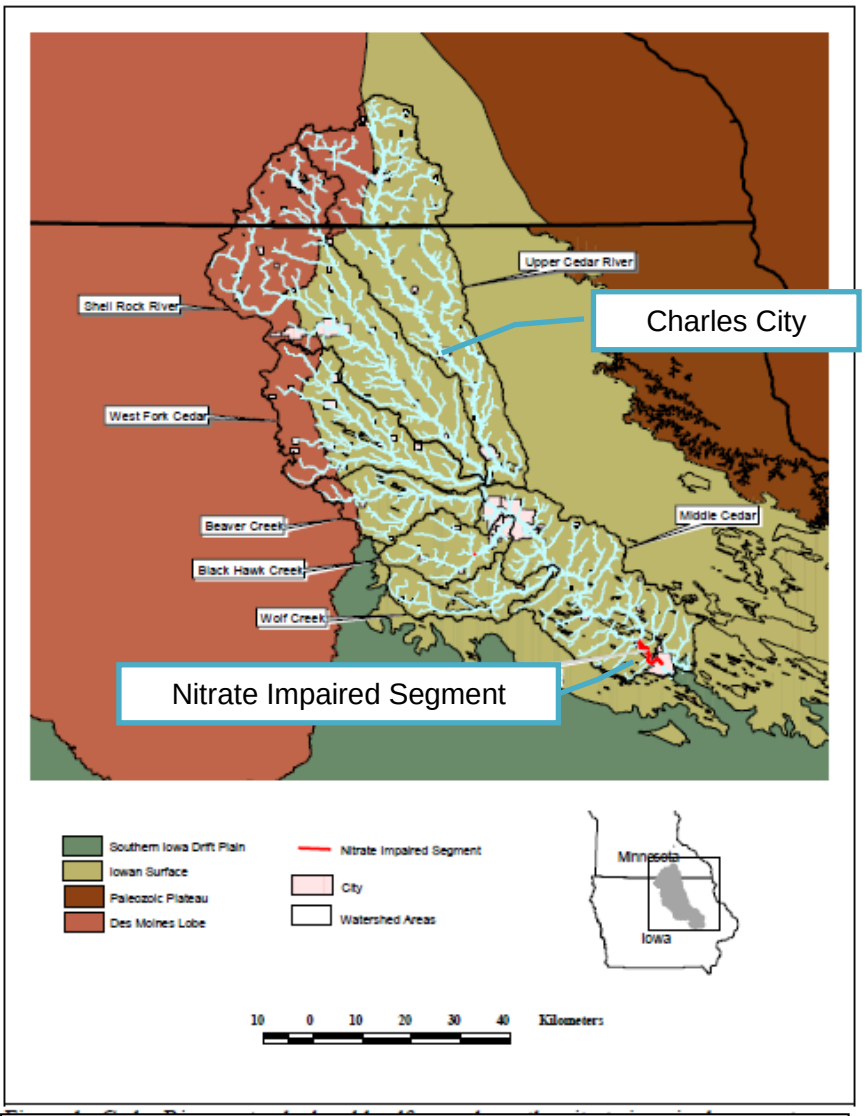


Figure 1. Area of TMDL for Cedar River
Source: TMDL for Nitrate, IDNR pg.2 (3)

Because the Cedar River tested over the EPA MCL for nitrate this segment of the river was designated as impaired by section 303(d) of the Clean Water Act. (2) This means that that water segment is unable to meet all of the state's water quality standards. After the segment is designated as impaired, the Federal Clean Water Act requires the IDNR to develop a total maximum daily load (TMDL)[1] for nitrates in that water segment. Figure 1 illustrates the 11.6 mile segment of the Cedar River designated as impaired by nitrates.

[1] *A TMDL is the greatest amount of a pollutant that a waterbody can receive and still meet water quality standards. A total maximum daily load is the sum of individual waste load and load allocations for nonpoint, point, and background sources. Included in the calculation is a margin of safety that accounts for the uncertainty about future conditions and about the relationship between the pollutant loads and the water quality of the receiving waterbody. The Cedar River nitrate TMDL load reductions are designed to reliably meet the drinking water standard for nitrate, with an explicit margin of safety of 5%. This gives an end concentration value of 9.5 mg/L nitrate-N within the 11.6-mile segment listed as impaired.* (3)

Because the Cedar River is a main tributary to the Mississippi River, the impairment was deemed severe. Furthermore, because Cedar Rapids serves a substantial population the IDNR placed this TMDL study on a high priority list. In 2006, a TMDL study was conducted and a Water Quality Improvement Plan was proposed to the U.S. EPA. Appendix B is a summary of the study. (3) In addition, Figure 1 indicates the predicted area that nitrate additions may drain into the Cedar River segment near Cedar Rapids and affect the nitrate loads. It encompasses an area of 7,815 $mi.^2$ and defines the market area in which Charles City may trade nitrates.

In the Water Quality Improvement Plan for this area, it is proposed that nitrate loads into this segment of the Cedar River needs to decrease by 35% or 9,999 tons of nitrates a year. To ensure that this goal is met, the IDNR set all point source NPDES permitted Waste Load Allocations as static to the 2006 levels for all facilities in the defined area. NPDES permitted polluters may only increase their WLAs of nitrates if the population they serve increases by a substantial amount. Appendix C lists all of the NPDES permits and their WLAs in this study area. In the future, these may become possible point-to-point source trades. Waterloo and Hudson are currently having issues meeting their associated limits. (4) Charles City's WLA was set at 370.5 lbs/day average and 606.5 lbs/day maximum. (5) They may be exceeding their nitrate WLA by as much as 100 lbs/day or 36,500 lbs/year. Charles City may surpass their WLA for a few reasons. First, Charles City may have a new chicken processing facility incorporated into town, substantially increasing the amount of nitrates flowing into the treatment plant. Charles City's NPDES permit also expired February 22, 2005 (6). The City has submitted an application for a new permit which may alter their WLA because a TMDL has now been set in the watershed. As mentioned previously, the capped nitrates WLA, in correlation with proposed higher nitrate loads coming from the city have motivated the city to seek out options to offset their nitrate loads including WQT.

Water Quality Trading: An Overview

In 1996, the EPA released draft guidelines for water pollution trading that implicitly sanctioned the development of WQT programs and laid the ground rules for programs that the agency is likely to accept. (7) In January 2003, the EPA released the National Water Quality Trading Policy which created a framework in which pollutants can be traded.

WQT is a market based instrument that works alongside water quality regulation to improve water quality and provide flexibility in how those regulations are met. By definition, WQT allows facilities like Charles City who are facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent or superior pollution reductions (credits) from another source(s) at a lower cost. (7) Therefore, they are achieving the same water quality improvement set by regulations, over a defined area at a lower abatement cost. Ideally, WQT lowers regulatory compliance and abatement costs while downstream water quality is improved. Besides the obvious cost benefits, WQT also offers greater flexibility to plan capital intensive upgrades and better plan those upgrades within existing financial options (such as retirement of previous debt obligations prior to incurring new debt obligations). In addition, trading that involves non-point sources can have ancillary benefits such as controlling multiple pollutants

and improving the health of aquatic habitats, and trading has the potential to spur innovation that can further reduce the cost of pollutant controls. As of October 2008, there were 100 facilities in the United States that had participated in WQT, and 80 percent of the trades occurred within a single trading program. (8) The most common pollutants traded were nitrogen and phosphorus, but pollutants such as elevated temperatures, selenium, and sediment have also been swapped.

Trading programs started primarily because a TMDL was set in a certain area or watershed. There are many formulations of WQT programs. Trading can occur directly between two or more point sources (point-to-point source) or from a point source to a non-point source. There may also be third party organizations, people, or agencies which act as an intermediary between the polluters buying the credits and the polluters selling the credits. More information on WQT scenarios is presented in the Market Structure section (page 24).

Additional details on water quality credit trading are provided in subsequent sections of this document.

Evaluating Selected Water Quality Trading Programs

There are a number of trading programs across the United States that were investigated, but two programs were explored specifically based on their geographic locations and different trading structures. These two programs include the Red Cedar River Trading Program in Wisconsin and the Great Miami River Watershed Water Quality Credit Trading Program in Ohio. A list of additional WQT programs can be located at the EPA's website of State and Individual Trading Programs. (9) The World Resources Institute has also created a comprehensive report on Water Quality Trading Programs in the United States as well as trading programs in Australia. (10)

The Red Cedar River Trading Program: Wisconsin

The City of Cumberland, WI implemented a program to meet its discharge permit limit of phosphorous. The City did this because it was facing an expensive upgrade to its sewage treatment facility. With the help of the Wisconsin Department of Natural Resources and the local land conservation district, the City was able to establish a pilot program. The City targeted local farmers to offset this by compensating the farmers for no-till or conservation tillage practices. The City utilized the local land conservation district to identify willing farmers to participate. Contracts between the farmers and the City are valid for three years. The farmers are not compensated until it has been verified that the best management practice (BMP) is in use. (11)

According to a presentation by Peter Prusak of the Wisconsin Department of Natural Resources and other local experts, "between 2001 and 2008 the average amount of phosphorous removed per year was 8,800 pounds; the goal is to remove 4,400 pounds annually." Additionally, "575-acres of no-till and 240-acres of minimum-till are enrolled annually." "Farmers are compensated $18.00 per acre for no-till and $15.00 per acre for minimum-tillage practices." "The average cost to pay the farmers per year is $14,500 and the average cost per pound of phosphorous is $1.70." (12)

The structure of this program is appropriate for Charles City because the trading only takes place between the city and the farmers even though Charles City would be trading nitrates and not phosphorous. The Red River contract structure is advantageous because farmers have to honor the contract for at least three years. If a farmer does not wish to renew the contract following its expiration, the City of Cumberland has ample time to identify other farmers willing to participate. Another advantage to this program is that there is little bureaucracy encountered before the trades can occur.

The limitation of this program, in relation to Charles City, is that farmers may be unwilling to practice no-till/conservation till farming because of a reduction in crop yields and farmers may need to make expensive upgrades to their equipment.

The Great Miami River Watershed Water Quality Credit Trading Program: Ohio

Total Maximum Daily Loads (TMDLs) were developed in one watershed after substantial impairment was detected by the Ohio EPA. TMDLs are currently under development in the other two watersheds. Trading was implemented to improve water quality through the Miami River Watershed which eventually flows into the Ohio River in response to the TMDL's.

Initially, the Water Conservation Subdistrict (WCS) hired a consulting firm familiar with water quality credit trading to determine the economic viability of a trading program. Over 30 meetings were held between the WCS and a number of organizations such as county soil and water conservation districts, treatment plant operators, and community watershed groups. The input from these groups was used to develop the program. Meetings with the other relevant agencies such as the Ohio DNR, Ohio EPA, US EPA, and NRCS provided additional information. An advisory group consisting experts from multiple disciplines developed project criteria, review proposals, and recommend projects for funding. Some of the criteria include the existence of an approved watershed action plan and/or an approved TMDL for the area that project is proposed to be located.

This platform is a volunteer program, and the pollutants traded are phosphorus and nitrogen. Eligible buyers are required to have an NPDES permit, which must be modified to reflect their participation in the trading program. In addition, they must participate in the (WCS) administrative and analytic costs for the program. "One credit is equal to one pound of nutrients prevented from discharging." Typically the cost of a credit is the total cost of the project divided by the number of credits the project is expected to generate. The expected amount of credits that a BMP is expected to produce is determined by using a spreadsheet calculation method; actual reductions are verified through inspections and monitoring. Credits can be generated through the use of "BMP's for urban stormwater runoff, home sewage system upgrades that exceed requirements, and through agricultural BMP's." Local soil and water experts propose agricultural BMP's.

This program uses trading ratios to ensure that the program provides more environmental benefits than just upgrading a treatment facility would. Trading ratios are determined by the attainment status of the waterbody at the buyer's point of discharge. In this program trades can occur anywhere in the watershed as long as the BMP is upstream of the buyers point of

discharge. Incentives are given to buyers who participate in pollutant reduction efforts before their permit would require them to do so. The incentive is that those participating earlier can trade at lower ratios. “Buyers who participate before NPDES requirements are called investors. Investors trade at ratios of 1:1 for those who discharge to fully attaining waters and 2:1 for those who discharge to impaired waters.” “Those who do not participate after NPDES requirements are in place are called contributors. Contributors trade at ratios of 2:1 for those who discharge into fully attaining waters and 3:1 for those that discharge into impaired waters.” Contingency plans and a credit insurance pool were created to protect buyers from a failed BMP project. The WCS acts as the credit broker/bank throughout the process and issues the requests for proposals for projects. (13)

This program is similar to what was recommended to Charles City by the Iowa Department of Natural Resources (IDNR). This program is quite complex and involves many organizations. Additionally, the stakeholders took a considerable amount of time and effort to create a program that would be economically viable across the whole watershed. This watershed covers nearly 4,000 square miles and the stakeholders were fully invested in formulating a successful and viable trading program. According to some sources, participation from farmers has not been what was expected. This may be due to the process they must go through to submit a project and get it approved and the cost to qualify for a trade. Another item local soil and water authorities had was that there were limited resources to monitor projects like this on top of what they already do. Iowa may have the same issues.

Alternatives to Traditional Water Quality Trading

Currently, there are few alternatives to water quality trading implemented within this region or within the United States. The most obvious alternative is to construct an improvement to the wastewater treatment plant that can mitigate and clean the nitrates from the water before it is discharged into the Cedar River. Another alternative proposed is called reverse auctioning which is a variation of WQT. It has been investigated extensively by Catherine Kling at the Center for Agricultural and Rural Development (CARD) at Iowa State University. (14) Charles City may also consider another variation of WQT which involves the market structure of sole-source offsets.

New Activated Sludge Treatment Process

The technology required to remove nitrates would consist of a biological nutrient removal tool. For Charles City, it would include the addition of an activated sludge process to their plant. This process utilizes air, bacteria, and protozoans to convert ammonia to nitrates and nitrites and ultimately to nitrogen gas which dissipates into the air. The total capital cost to build this process and comply with the NPDES permit is estimated to cost between $10 and $12 million. (5) However, there are many details which are subject to change and may substantially alter the amount of funds needed to upgrade the plant.

Reverse Auctioning

Reverse auctioning is similar to water quality credit trading but instead of the landowner/farmer bearing the initial investment to implement BMPs on their land, the City would incur the initial financial burden. In water quality credit trading, the cost of BMPs as well as the loss of production on the land and financial gain are bought by the City in exchange for credits after the BMP has been implemented on a plot of land. In a reverse auction, the city would solicit bids from landowners/farmers in the area requiring them to state the BMP they plan to implement, how much it will cost, and how much nitrates it will decrease. The landowners/farmers would obtain these estimates through consulting with a third party agency such as the the Farm Bureau, Cedar Valley RC & D, or the U.S. Department of Agriculture. The bids are then evaluated by the City. The evaluation can simply select the lowest bids or use a formula which takes into account the BMPs that are most likely to succeed in decreasing nitrates and the least cost per pound of nitrate reduced. The City would then contract with the winning bidders. (15)

A major advantage to implementing reverse auctioning is that potential risk to a trade is minimized. A regulated point source cannot transfer legal liability to the non-point source when trading, therefore the City would be in violation of their permit if a non-point source defaulted on their contract. Since this type of system enables the City to bear the initial financial burden of a trade, the non-point source polluter has many fewer reasons to default on a trading contract. This type of trade may also see higher participation rates from non-point source polluters. As stated in the Great Miami River Watershed trades, the farmers do not like incurring a substantial initial cost to implement BMPs if they do not have to. This type of trading alleviates those costs.

Sole-Source Offsets

Sole-Source offset WQT does not actually involve trading at all. In this approach, sources are allowed to reduce pollution off-site or through non-standard means in lieu of reductions in their normal effluent stream. Charles City could possibly address their nitrate problem by restoring riparian zones along the rivers and streams that flow through the city. They may also implement stormwater practices that reduce nitrate runoff within the city owned golf course. This may be a quantifiable reduction because the TMDL stipulated that all MS4 NPDES permit holders in the area must address urban storm water nonpoint sources. (3) Some BMP for urban runoff in the TMDL include:

- Addition of landscape diversity to reduce runoff volume and/or velocity through the strategic location of filter strips, rain gardens, grass waterways, etc.
- Installation of terraces, ponds, and other control structures at appropriate locations to aid in attenuating nitrogen delivery through biological uptake or de-nitrification processes.
- Appropriate use of fertilizers on residential and commercial lawns. (3)

Charles City is currently using one approach to decrease nitrate loads by its permeable paving project. Through discussions with area residents and stakeholders there is substantial potential for more sole-source offset nitrate reducing practices in the city. Some of the other approaches to reducing nitrates in the city, such as filter strips, have shown improvements in land prices near the infrastructure as well as nonmonetary benefits in aesthetic value. (10) Another

advantage of this type of trade is that transaction costs are substantially diminished since Charles City would not be trading with anyone. In addition, the Charles City residents will benefit from cleaner water from offsetting their wastewater nitrate loads.

A disadvantage to this type of trade is that it may be more expensive to implement urban storm water BMPs than the BMPs used on agricultural fields without considering transaction costs. In addition, the city may not have enough potential urban storm water BMPs to offset all their nitrate loads though this mechanism alone. The credits generated from offset programs are usually only sufficient credits for one permit cycle.

Regulations and the Petition for Rulemaking

While the EPA has explicitly sanctioned WQT, it is still the responsibility of state governments to provide the framework and rules to implement WQT projects in their associated areas. This framework can include: rules on how trades may be conducted, the responsibilities of the credit buyers and sellers, third parties to be included and their responsibilities, what types of trades are allowed, baselines in which non-point source polluters qualify to trade, how much pollution is offset based upon different BMPs, the creation of credit reserves, reconciliation periods, and trading ratios.

Currently, there are no regulations pertaining to how a WQT may be conducted in Iowa. To implement a WQT program, it is imperative that the IDNR and the State of Iowa draft rules in which WQT may be conducted.

Petition for Rulemaking

To initiate a WQT program in Iowa, a petition for rulemaking must be submitted to the IDNR. This petition will start the discussion on how a WQT program may be administered in Iowa and create rules which are enforceable by law.

At times, certain federal and state agencies fail to develop regulations. A petition for rulemaking is a mechanism by which individuals, public interest groups, and private enterprise can argue in favor of changes or new rules for ensuring the general welfare of the state or nation. The primary law governing the federal regulatory process is the Administrative Procedure Act (APA). The APA provides for rulemaking in order for the public to express its desire for new regulations, deregulations, or modifications. Figure 2 provides six items to include in any petition for rulemaking.

Figure 2. Petition for Rulemaking, What to Include
Source: http://www.ombwatch.org/node/4061 (16)

1. Your name and mailing address and, if you wish, other contact information such as a fax number, telephone number, or e-mail address.
2. An explanation of your proposed action [commencement of a rulemaking, amendment to an existing rule, or deregulation] and its purpose.
3. The language you propose for a new or amended rule, or the language you would remove from a current rule.
4. An explanation of why your proposed action would be in the public interest.

5. Information and arguments that support your proposed action, including relevant technical and scientific data available to you.
6. Any specific facts or circumstances that support or demonstrate the need for the action you propose.

In the process of considering a petition, the IDNR may request that the petitioners provide information or data available to them. That can include the costs and benefits of the proposed action to society in general and specific groups within society, the regulatory burden of the proposed action on small businesses, small organizations, small governmental jurisdictions, and Indian tribes, the recordkeeping and reporting burdens of the proposed action and whom the burdens would affect, the effect of the proposed action on the quality of the natural and social environments.

Working together with other agencies and municipalities will be imperative for the petition's success. The more agencies and municipalities that have aligned interests make the petition more powerful. Demonstrating broad support from a large and diverse group of people or agencies will also strengthen the argument. In addition, acquiring support from public interest groups or businesses can strengthen the argument by having legal, scientific, or technical expertise. (16)

Currently, the cities of Waterloo and Hudson have issues meeting their associated limits. (4) Waterloo is a large municipality which could bring considerable assets and power to the petition. In addition, Catherine Kling with CARD at Iowa State and agencies such as the Farm Bureau, IDALS, USGS, IDNR, and USDA can provide data on the nitrate loads reduced on agricultural land from BMPs as well as expertise in other areas such as financial schemes and market structures.

Today, the political environment in Iowa can be suitable for WQT rulemaking. Section 319 of the CWA may be under the control of IDALS instead of the IDNR in the future. Compliance functions, water monitoring, and other water quality protection programs would be transferred. This shift can provide for easier trades with non-point source polluters. It may however decrease the amount of TMDL studies conducted in the state. Consequently, this may decrease the amount of NPDES permittees who want to engage in WQT. In addition, many rulemakers are in favor of easing the cost burden to permitters because environmental regulations initiated the pollutant caps. Many would prefer that the regulations were less strict at the outset. However, today's political climate may change who approves rulemaking criteria. A recent bill in the senate had proposed that the Environmental Protection Commission (EPC) be dissolved and the Governor of the State would provide a council to oversee any type of water rulemaking. The bill was however rejected but could be brought up again.

Petition for Rulemaking Flow

When a change to the wastewater rules is proposed, it is first presented to the EPC for approval as a Notice of Intended Action. Appendix D provides a summary of current EPC members including their political affiliation and e-mail address. If approved by the EPC, it is published in the Iowa Administrative Bulletin (IAB) as a Notice of Intended Action. Once the rule is published, it is discussed at the next legislative Administrative Rules Review Committee (ARRC) meeting. After a public comment period in which public hearings are held and comments on the proposed rules are accepted from the public, the proposed rule is again presented to the EPC for approval as a Final Rule. If a final rule is approved by the EPC, after taking into account comments from the public, it is published in the IAB as a Final Rule. The final rule is presented again at an ARRC meeting once the rule is published. (17) (18)

For information on the petition for rulemaking flow and the chances that a WQT petition may be approved, four contacts are provided in Figure 3.

Figure 3. Petition for Rulemaking, IDNR EPC Contacts

1. Bill Ehm
   - Position -- IDNR Water Policy Director
   - E-mail – William.ehm@dnr.iowa.gov
   - Phone – (515) 281-4701
2. Sharon Tahtinen
   - Position – Lobbyist Environmental Services
   - E-mail – Sharon-tahtinen@dnr.iowa.gov
   - Phone – (515) 238-4187
3. Wayne Gieselman
   - Position -- Environmental Services Division Administrator
   - E-mail – wayne-gieselman@dnr.iowa.gov
   - Phone – (515) 281-5817
4. Jerah Sheets
   - Position – EPC Information Contact
   - E-mail – jerah-sheets@dnr.iowa.gov
   - Phone – (515) 313-8909

Determining the Feasibility of WQT in Charles City

This section provides a summary of steps to determine if water quality trading is viable in Charles City and the Upper Cedar River Watershed. The steps provided originate from the *Water Quality Trading Assessment Handbook: Can Water Quality Trading Advance Your Watershed's Goals* published by the United States EPA in November 2004. (19) For more information and detailed examples consult this handbook.

I: Conduct the Six Step Pollutant Suitability Analysis

This analysis is necessary to determine if four criteria are aligned within the watershed. The four criteria are: Type/Form of the Pollutant, Impact, Timing, and Quantity. The following sub-steps provide information on how to conduct this analysis.

Step One: Create a Watershed Profile

Creating a watershed profile will help outline the pollutant(s) that are a problem in the watershed. Understanding the type or form, location, and quantity of pollutant(s) from point and non-point sources is important in this step. This information is typically included in the TMDL, watershed plans, and other local sources. Generally, information on non-point sources such as agriculture can be found in the TMDL. The Iowa Department of Natural Resources (IDNR) or the Iowa Department of Agriculture and Land Stewardship (IDALS) may have additional information available

Step Two: Identify Type/Form of Pollutant Discharged by Sources

Identifying if sources are polluting the same type or form of a pollutant is crucial in setting up a WQT program. "Current practice requires that WQT systems use an identified controllable pollutant common to all market participants. This establishes a "common currency" that market participants can evaluate potential trades." In the case of Charles City, the pollutant that needs to be reduced is nitrates.

A.: Determine if sources are discharging the same type/form of pollutant as identified by the TMDL

In this step, utilize the information that was gathered in Step One to identify the type of pollutant addressed by the TMDL. Many times the pollutant type will be in different forms. In the case of Charles City the pollutant is nitrates, but nitrates come in organic and inorganic forms. TMDLs usually address pollutants as total nitrogen or total phosphorous, it is important to know what forms each source is discharging to ensure that trades will represent an equivalent impact on water quality. In most cases, the pollutant most permitted facilities in the watershed will have problems meeting the capped load is nitrates.

B.: Determine if there are opportunities to trade between different forms of the same pollutant, or between different types of pollutants

"If the TMDL provides allocations for different forms of the same pollutant a translation may need to be established in order for trades to occur between the two forms." For example, the different forms of the pollutant may be trading between organic and inorganic nitrogen. If trading between different forms of a pollutant occurs, ratios should be created to account for this. Creating a translation between the different forms of the pollutant requires data and analysis and would be agreed upon in the petition for rulemaking.

Step Three: Assess Water Quality Equivalence of Pollutant Reductions at Different Discharge Points

The purpose of this step is to evaluate the location of possible reductions and receiving water conditions to see if the impact on water quality from trading are the same as reductions that would have been made without trading (e.g. upgrading a treatment facility). Two factors need to be considered, "the fate and transport characteristics of a pollutant and the characteristics of the watershed. These need to be considered because a pollutants effect on water quality can vary as it moves from upstream to downstream."

Equivalency ratios, commonly referred as trading ratios, are used to account for the fate and transport of pollutants, and watershed characteristics. For example, Charles City may pay

Farmer John to reduce nitrate credits 20 miles upstream. Because he lives 20 miles away a trading ratio of 2:1 may be required account for the distance. This means that Charles City would have to purchase 2-pounds of reductions from Farmer John to get one credit (1-pound) to ensure that at least 1-pound of nitrogen is actually 1-pound when it reaches Charles City's point of discharge.

Step Four: Determine the Potential for Aligning the Timing of Load Reductions and Regulatory Timeframes Among Dischargers

The purpose of this step is to determine how different sources discharge loads vary across time and the associated aspects of the variability. The following three aspects should be addressed, and if all three can be aligned, trading may be possible.

A: Load Variability

Since loads vary over time, "identify only major load variations that occur over the course of the year." One aspect to note is that load variability can be seasonal, particularly with agricultural runoff. Another aspect to note is if the TMDL allocations are seasonal or annual. This is important so that trading partners can align themselves with others who have similar discharge timing.

B: Compliance Determination Variability

"Because dischargers may have different timing specifications for monitoring and compliance, trades must be consistent with the time periods assigned with permit limitations." For example, if Charles City is required to comply with monthly standards they can only trade with a source that demonstrates monthly reductions.

C: Compliance Deadline Variability

Compliance deadlines should be closely aligned for a trade to occur between dischargers. Consult the TMDL and NPDES permits for more information on source deadlines.

Step Five: Determine if the Supply of and Demand for Pollutant Reduction Credits is Reasonably Aligned Within the Watershed

In this step, information gathered from Step I will be analyzed to determine if supply and demand are closely aligned. "For trading to be possible the quantity of pollutant reductions (supply) must meet or exceed the quantity of reductions needed for compliance (demand)." "Demand is dictated by current and future loads while supply is dictated by a sources ability to "overcontrol" its pollutant loads below the target load." Overcontrol refers to a sources ability to control a pollutant over what it is required to do. This will depend if it is a permitted polluter or a non-point source with a specific baseline for a pollutant. The surplus reductions represent those that can be traded. Many aspects of the petition for rulemaking will affect the supply of nitrate credits.

Step Six: Review the Results of Steps One through Five to Complete the Pollutant Suitability Determination

The purpose of this step is to review the results of the preceding steps to determine if the suitability factors align. "All four suitability factors need to align for at least two market

participants for trading to be highly possible. If any of the four factors show a low possibility for alignment, the pollutant is likely not suitable for trading."

II: Financial Attractiveness

This section will outline a process to determine whether water quality trading (WQT) will be financially attractive to Charles City and other participants in Upper Cedar River Watershed. To conduct this portion of the analysis, estimating the costs of all trades in the watershed is not required. Instead, focus should be placed on identifying "Alpha Trades," which are trades with significant economic return after trading ratios are applied. If there are several "Alpha Trades" in the watershed, trading may be possible.

This analysis requires basic mathematical and microeconomic knowledge as well as the information gathered in the previous steps. It is recommended to consult Chapter 3 of the *Water Quality Trading Assessment Handbook: Can Water Quality Trading Advance Your Watershed's Goals?* for detailed examples of the following information is this section. There are three stages to this analysis and are included in the following sections.

Stage 1: Calculating Incremental Cost of Control for One or More Key Point Sources

The purpose of this step is to calculate the incremental cost of control for key point sources. "Incremental cost of control is calculated as the average cost of control for the increment of reduction for a source to achieve its target load." The first sources analyzed should be ones that are polluting over their limits.

There are five tasks to complete in this stage, and they are included in the following paragraphs. The following information is needed to calculate incremental cost of control:

- The source's current load
- The source's TMDL target load
- The source's projected load on its required compliance date if no controls are implemented
- The source's projected future load
- Annualized cost of control option(s) including capital investment and annual operating and maintenance costs
- Expected reductions achieved by the control option (19)

Task 1: Calculate Required Reductions

In this task, required reductions need to be calculated. Changes in demand such as population increase or decrease and industrial level changes influence future discharge. These changes "affect needed reductions, incremental cost of control, and the financial attractiveness of trading." "The reductions needed to comply equal the discharger's target pollutant wasteload minus its current loads and any expected future load increases." The projected load at compliance date and long-term future load should be calculated to do this analysis. Past WQT projects have used high, moderate, and low growth scenarios to forecast loads.

Task 2: Examine Control Technology Options

In this task, an analysis of control technologies available to control the pollutant and its costs needs to be undertaken. Typically, more control results in higher costs. In the case of Charles City a control option available is the Activated Sludge Treatment Process discussed in Section II of this document. For information on funding and financing water infrastructure improvements consult the document titled *Tools for Financing Water Infrastructure* published by the EPA in March, 2007. This document can be accessed at the web address listed in the bibliography. (20)

Task 3: Calculate Incremental Reductions Needed for Compliance

Sometimes technology will not generate enough pollutant reductions. If this occurs the polluter will need to invest in further control technology, even if the new technology will control more of the problem pollutant than is needed.

Task 4: Calculate Annualized Control Cost

To complete this step, total the annualized capital cost and annual operation and maintenance costs. The following points demonstrate how to do this:

- Annualized capital cost is the total cost (including finance charges) incurred for installing a control option divided by the control option's useful lifespan.
- Annual operation and maintenance cost includes monitoring, inspection, permitting, fees, waste disposal charges, repair, replacement parts, and administration (19)

Task 5: Calculate Incremental Cost of Control

In this step, "evaluate the unit cost of pollutant control for each key source." Incremental cost of control is used as opposed to average or marginal cost because it better represents an estimate of a source's willingness to pay for reduction credits.

To calculate the incremental cost of control for each growth scenario, "divide annualized costs by incremental reductions needed for each control step." One important aspect to remember is that once a control step is implemented, the money used to implement that control option represents a sunk cost and should not influence other control option decisions.

Stage 2: Examine Other Data

In this step, gather information from other non-point sources, private point sources, and non-point sources. It is important to garner support for a trading program and this step is a good point to start by getting municipalities and other stakeholders interested in WQT. When compiling the information ensure that there is a common numerator and denominator for compliance between the sources (e.g. pounds per month, pounds per day)..

Stage 3: Analyze the Results

Stage 3 involves completing two tasks: identifying viable trades and detailed analysis.

Task 1: Identify Potentially Viable Trades

In this step, identify potentially viable trading partners. It is important to look at it from the point of view of a credit seller. Calculating average and marginal cost to control the pollutant will indicate prices that a seller may accept for reductions. Looking at this from the point of view of a

seller is important because some sellers may be willing to sell credits at a price that is lower than or nearly the cost of control.

Task 2: Detailed Analysis

Up to this point, the analysis has been basic and has not taken some factors into consideration. The following paragraphs will address some of these factors that should be considered in the detailed analysis.

Incremental Control Cost Adjusted by Uncertainty Discount

Because Best Management Practices (BMPs) reductions are usually estimated, the uncertainty discount ensures that errors in BMP performance estimates will not hinder water quality equivalence of trades involving these control activities. The uncertainty discount is another way to reference a trading ratio.

"The size of the discount rate is driven by input from stakeholders and local conditions." To determine the effect that the uncertainty discount has on financial attractiveness, "recalculate the sources incremental cost of control using the discount reductions."

Incremental Control Cost Adjusted by Water Quality Equivalency Ratios

The impact of pollutant discharge depends on the location of the pollutant in the watershed and other factors such as fate, transport, and watershed conditions. Over large areas of trading, equivalency ratios (trading ratios) should be used to ensure that pollutant reductions will have and equivalent impact on water quality.

"Past projects have used fixed ratios (example: 2:1) or an index system based on a model that accounts for features such as groundwater infiltration, withdrawals, and inputs." In the model formula a compliance point downstream is used to quantify the transport characteristics of a pollutant from an upstream source. "The ratio is determined by dividing the compliance point index by the upstream point index. This determines the number of reductions that the compliance point would need to buy for a credit."

The overall goal in this analysis is to identify "Alpha Trades," which are trades that offer financial gains after trading ratios are applied. Trading ratios can have a significant effect on the financial attractiveness of trading. As the ratio between buyer and seller increases, the cost per unit increases. As the ratio decreases, the cost per unit decreases. One other aspect to note is that there are a number of different types of trading ratios that can be applied to a WQT program (e.g. uncertainty discounts and equivalency ratios). It is up to the market participants and regulatory agencies to decide which ratio to use or to use a combination of ratios. An example of this would be if Charles City has a 4:1 ratio that represents 2-pounds for uncertainty and 2-pounds for equivalency.

Transaction Costs

Transaction costs should be considered in the financial attractiveness analysis because they increase incremental control cost. The costs included in transactions costs represent salary, time, travel, legal fees, and monitoring.

Market and Trade Risk

Risk needs to be considered because the market may not generate approved trades and sellers may not hold up their end of the agreement. The risks involved in WQT should be discussed with participants in the program.

III: Market Structure

The infrastructure to WQT is how the trading market is set-up. When setting up a market, it is important to manage friction (market development cost, transaction cost, and risk) because these factors, if not managed, can hinder trading potential. In order for a market to be viable, the market must provide benefits to its participants. "Success of the market is more likely if rules and procedures allow participants to operate at a cost acceptable to all participants." The overall goal of setting up the market infrastructure is to minimize cost and uncertainty. Some facets to consider when setting up a market will be included in this section.

Market Sizing

"The geographic size and the number of point sources in the watershed will help with market infrastructure development." Since the Upper Cedar River Watershed is rather large the size of this will help determine the market size.

What is Driving the Market?

The driving force in WQT are the Total Maximum Daily Loads (TMDLs) imposed in a watershed. TMDLs are the driver because they create the need to reduce pollutants. There are eight functions of a WQT market. The market should address the following eight functions:

1: Complying with Clean Water Act and other state/local requirements

The EPA and other relevant agencies such as the IDNR need to be involved because they are the regulatory agencies that municipalities answer to regarding environmental issues. These agencies need to have a process by which they can "authorize, evaluate, permit, verify, and evaluate trading programs or individual trades."

2: Defining and executing trades

The EPA's Water Quality Trading Policy does not specify the process that a market must go through for a trade to happen. Consequently, each market must develop its own process. Some things to consider when developing the trading process include:

- Negotiating a transaction
- Accounting for water quality equivalence and avoiding hotspots
- Completing and relaying documents
- Trade review and approval
- Installation of facility upgrades or adopting Best Management Practice (BMP) methods
- Reduction monitoring and verification
- Reporting to agencies and participants
- Auditing reported information
- Enforcement actions (19)

3: Defining marketable reductions

The marketable product in WQT is the credits of pollutant overcontrol. For a marketable product in the watershed two things must be done. “The first is to identify the relevant pollutant reduction expectations. This information should be located in the TMDL. The second thing is to change overcontrol into a marketable product by allowing it to acquire value.”

4: Ensuring the equivalence of trades and avoiding hotspots

This can be done by developing an accurate model or through the use of trading ratios. Modeling can be more accurate, but is more expensive which can hinder trading. It is up to the participants as to how they want to ensure equivalency, “but a good mechanism will minimize costs.”

Strategies to avoid hotspots include “limiting trades beyond a certain size and limiting the portion of a facility’s discharge limit that may be met through the purchase of credits.”

5: Communication between buyers and sellers

Sharing of information regarding the product is important between buyers and sellers. The information that should be shared should include type/form, amount, and other related information about the pollutant. A market that is more likely to succeed will be one that shares information.

6: Tracking Trades

This is important to ensure that “reductions credited to a source are actually made, discounts are applied to credits, double counting does not occur, and for auditing purposes. Two pieces of information to be included are the amount of excess reduction and the chain of custody (right to use the reductions for compliance).”

7: Managing transaction risk between parties to a trade

There are three facets of transaction risk. These include: “the risk that reductions negotiated do not conform to the market rules, the risk that the reductions will not be produced, and the risk that the reductions will not have an impact on water quality.” A way to address risk is to identify and assigning risks to specific parties, and setting up ways to fulfill agreements.

8: Providing information to the public

The Clean Water Act requires public participation; therefore WQT markets must do the same. This is important because it allows the public and stakeholders to understand what WQT is, comment on the topic, and to garner support of the program.

IV: Stakeholder Readiness

When considering who should be involved in the set-up of a WQT program look at point sources (public and private) and non-point sources (agriculture, for example). Focus on those that need to reduce pollutants and those with the ability reduce pollutants. When engaging these stakeholders it is important to gain their trust because if they do not have trust the program will not succeed. Another important mechanism is to identify the benefits of WQT that might attract each stakeholder to learn more. One example of this is the potential cost savings of WQT.

Another group of stakeholders that need to be engaged are regulatory agencies such as the EPA and IDNR. The reason why these agencies need to be involved is so that the relevant agency can write rules for the program and provide technical assistance.

Current Market Structures

Market structures define how trading may occur and the infrastructure used to support the WQT program. There are four main market structures in which WQT has been conducted in the United States. They include bilateral trades, sole-source offsets, clearinghouses, and exchange markets. A detailed review of these market structures and legal considerations in market structures is available through the World Resources Institute and an article entitled "Market Structures for U.S. Water Quality Trading." (10) (21)

Bilateral Trades are one-on-one negotiations where a price for a credit is bargained upon rather than arriving at a price through the observed market price. As of 2009, of the 26 active trading programs, 10 operated through this mechanism. (10) Sole-source offset trades occur when the source is allowed to increase their pollutant discharge if they reduce their discharge somewhere else. This does not require any trading. This type of trade is mentioned more extensively in the "Alternatives to WQT" section (pages X-Y). Clearinghouses are a third party intermediary that links the buyers and sellers of credits. The clearinghouse converts a commodity that may have a variable price such as a nutrient credit into a uniform commodity. Some states may set up clearinghouse funds. Of the active programs today, nine use this type of market structure. Exchange markets are where buyers and sellers meet in a public forum with the commodities equivalent and all the prices transparent. There are two active programs that use exchange markets. (10) Each of these market structures is not mutually exclusive from the others. Many WQT programs use a combination of these market structures.

Elements Essential to Water Quality Trading Success

Two papers were reviewed that investigated existing and expired WQT programs. Key elements, from those papers, emerged as being important for the development of effective WQT program. (10) (8) These elements are important to consider when implementing a program in Charles City and developing rules through the IDNR.

The first essential element is that adequate drivers exist to reduce pollutants and implement a WQT program. Several potential programs in the past have developed a WQT program only to discover that the nutrient caps were set at a level that did not create sufficient demand for trading. Before spending the time and money to develop a WQT program, the point source polluter should ascertain whether regulatory requirements were likely to generate the demand for credits.

The second essential element needs to be adequately addressed in the rulemaking process through the IDNR. Many point source polluters do not pursue WQT because of the risk involved. When trading with a non-point source polluter, the contract only protects the buyer financially. However, the point source polluter does not transfer the legal liability of meeting the permit requirements. Therefore, if a seller defaults on their contract, the seller may be in

violation of their NPDES permit. The WRI and EPA have identified three methods to address this problem while Catherine Kling provided another. They include:

1. *Allowing and encouraging aggregators to operate within a market*. Aggregators are third-party entities that buy and sell credits like a mitigation bank. Because the aggregators usually have large portfolios of credits, they are able to put some in a reserve should a credit seller default on their contract. Therefore, they can absorb the credit hit and the credit buyer. In this case, Charles City can still buy the credits they need.
2. *Creating credit reserves*. This is a method that the IDNR may implement. They may provide a credit reserve in the case that a credit seller defaults and the buyer has acted in good faith to secure the proper credits. The buyer can then purchase the credits that were defaulted upon from the state to remain in compliance with the NPDES permit.
3. *Creating reconciliation periods*. Because the amount of pollution a NPDES permittee may vary substantially, some programs can implement a reconciliation period at the end of the compliance period to make up for any short-falls in their pollution compliance. This will allow facilities to have sufficient time to purchase the credits needed from another source to make up their compliance amount.
4. *Reverse Auctioning.* As mentioned in the "WQT Alternatives" section, reverse auctioning can provide a method to decrease risk from trading with non-point source polluters. Because the city would have the initial financial burden to implement BMPs the credit seller will have little reason to default on their contract.

The third element must be addressed in the rulemaking process. There must be standardized estimations of nonpoint-source emissions and reductions. This can be a challenge because each area is different and every BMP does not have the same nitrate reduction effect. In addition, scientific evidence of the effect of these BMPs may not be analyzed at this point. It is important to have these estimations because they can be used to calculate reduction from nonpoint sources and is defensible from a scientific and regulatory perspective. The USDA has created a Nitrogen Trading Tool (22) to assess how various BMPs may affect nutrient loads. The EPA also has a Load Estimation Spreadsheet Model (23) and the World Resources Institute has a NutrientNet model. (24) However, these tools need to be calibrated to Iowa specifications.

The fourth element is that transaction costs within the trading program need to be minimized. As mentioned in the "WQT Alternatives" section (page 10), sole-source offset trades minimize transaction costs. However, if Charles City trades with non-point source polluters, they may find that identifying possible sellers of credits may be difficult. The IDNR may address this issue by creating a baseline for nonpoint polluters that is not too difficult to attain therefore many nonpoint source polluters may be willing to qualify for trading. The addition of Aggregators may also decrease transaction costs for Charles City because that third-party agency would identify credit sellers. Other trading programs have also identified online marketplaces and registry databases as tools to decrease transaction costs.

The fifth element is that the program has buy-in from local government, the regulated community, and other stakeholders within the watershed. Again, as mentioned in the rulemaking process, a more diverse and powerful group of people, agencies, and programs will lead to successful implementation of a trading program. Early education and ongoing dialogue of WQT will dissipate misconceptions and tensions pertaining to WQT. Other programs have identified a "trading champion" which is a high-level elected official that can motivate other high-level officials during the early stages of developing a trading program. It is important to note that significant support at the local level has led to support at the state level.

Best Management Practices

The geology of the Charles City area is very unique. The ground is composed of layers of soluble bedrock or karsts. Karsts are typically referred to as sinkholes. This karst landscape causes some BMPs to operate inefficiently. This is because the karst landscape provides a direct and quick route for nitrates to enter the groundwater where it may recharge into rivers and streams. Many BMPs are in place to slow the path of nitrates to the rivers from surface water runoff. The nitrates may then be degraded or are removed from the ground via biota before they reach the rivers and streams. Because the karst landscape offers the nitrates an alternative and quick path to the rivers through groundwater, many BMPs on this type of landscape offer far smaller reductions to nitrate levels than other areas.

The BMPs that would function best in the Charles City area are BMPs that decrease the use of nitrates on nonpoint source areas and stress the correct times in which nitrates should be used. These types of BMPs can be implemented with non-point source polluters on agricultural fields or through BMPs initiated by the city through sole-source offsets. The use of BMPs and their associated benefits may be quantified and stipulated in the IDNR rulemaking process.

Recommendations for Charles City: The Action Plan

We recommend that Charles City explore the possibility of point to non-point source water quality trading with area farmers north of the city of Charles City or a point to non-point source trade through sole-source offsets. This option may not only lead to significant cost saving but addresses the water quality flowing through the city and the Riverfront Development. In addition, the people paying the cost of this type of trade will also incur the benefits from it as well.

The first step to this recommendation is for the Charles City Wastewater Treatment Plant to obtain a new NPDES permit. This will enable the city to determine if they can comply with the new waste load allocation (WLA) for nitrates without further modification to the treatment plant or implementing a Water Quality Trading (WQT) program. If the current treatment plant cannot comply with the new WLA set by the new NPDES permit, the city has approximately three to five years to initiate compliance. If the treatment plant upgrade is determined to be prohibitively expensive and funding cannot be obtained outside of current city mechanisms, we propose that the city initiate a process to petition the Iowa Department of Natural Resources (IDNR) for WQT rulemaking. Within this petition for rulemaking process, we propose that the city collaborate and

incorporate other municipalities, agencies, and organizations with a vested interest to strengthen the petition and ensure the IDNR accesses this petition as a valid and powerful proposal.

If the IDNR starts the rulemaking process for WQT, it may take 12 to18 months or longer to agree on rules to initiate a WQT program. Once these rules are agreed upon by all vested and interested parties, Charles City may conduct an economic feasibility study to determine if WQT is a valid alternative to upgrading the treatment plant. Because, the segment of the Cedar River flowing through the city and the Riverfront Development is an impaired waterway, we propose that Charles City consider trading with non-point source polluters upstream of the city initially. This point-to-non-point source trade may be more difficult to implement and may not be as economically promising as a point-to-point source trade. However, the results of the trade would be beneficial to the city paying for the trade through better quality water flowing through the city. Additionally, because the topography of the Charles City area is composed of layers of soluble bedrock or karsts, we propose that non-point source polluters utilize the best management practices (BMPs) that decrease the amount of nitrates used initially on the farm fields or urban areas and stress the most appropriate times in which the nitrates should be applied. Currently, these BMPs are the most quantifiable in how much they decrease nitrate loads into rivers and streams. Furthermore, they are not as affected by the karst topography of the region as other BMPs.

It is important to note, that the action plan for point-to-non-point source trading can be terminated at any step. Factors such as cost feasibility, the political environment, little financial or labor support, liability, and a lack of credit suppliers may disrupt the plan at any step. The petition for rulemaking process is significant and the rules constructed from this process can lead to strong WQT programs if all areas for successful WQT are addressed. Charles City should be prepared to upgrade their wastewater treatment plant in the event that a WQT program fails to come to fruition.

Bibliography

1. **Agency, U.S. Environmental Protection.** *Risk policy could reawaken concern about illness linked to Nitrates in well water.* s.l. : Nonpoint Source News Notes, 1996.

2. **Office, U.S. Government Printing.** Electronic Code of Federal Regulations Title 40: Protection of Environment. *GPO Access.* [Online] 4 7, 2011. [Cited: 4 11, 2011.] http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div5&view=text&node=40:21.0.1.1.18&idno=40#40:21.0.1.1.18.1.16.1.

3. **Iowa Department of Natural Resources Watershed Improvement Section.** Total Maximum Daily Load for Nitrate Cedar River Linn County, Iowa. [Online] 2006. [Cited: April 25, 2011.] http://www.iowadnr.gov/water/watershed/tmdl/files/final/cedarriver.pdf.

4. **Atkinson, Tom.** *Iowa DNR.* April 14, 2011.

5. **President, Dale Watson.** *Fox Engineering.* Ames, January 25, 2011.

6. **IDNR.** Final Permit #3405001. *IowaDNR NPDES Permits.* [Online] [Cited: April 26, 2011.] https://programs.iowadnr.gov/wwpie/default.aspx?cmd=PermitDetails&Permitid=527.

7. **U.S. Environmental Protection Agency, Office of Water.** Draft Framework for Watershed-Based Trading. [Online] 1996. [Cited: April 26, 2011.] www.epa.gov/owow/watershed/framework.html.

8. **EPA.** EPA Water Quality Trading Evaluation. *Final Report.* [Online] October 2008. [Cited: April 28, 2011.] http://www.epa.gov/evaluate/pdf/wqt.pdf.

9. **U.S. Environmental Protection Agency.** State and Individual Trading Programs. *Water Quality Trading.* [Online] November 12, 2010. [Cited: April 26, 2011.] http://water.epa.gov/type/watersheds/trading/tradingmap.cfm.

10. **Selman, M., S. Greenhalgh, E. Branosky, C. Jones, J. Guiling.** Water Quality Trading Programs: An International Overview. *WRI Issue Brief.* [Online] March 2009. [Cited: April 28, 2011.] http://www.wri.org/publication/water-quality-trading-programs-international-overview.

11. **Bhattacharjee, Subrah and Kling, Catherine L.** *Water Quality Trading and Wetland Banking: Lessons for Iowa.* Iowa City : The Iowa Policy Project, 2010.

12. **Chartraw, Jerry, Gruetzmacher, Tyler and Prusak, Peter.** Cumberland, Wisconsin: Point to Non-point Trading Presentation. 2010.

13. **Water Conservation Subdistrict of The Miami Conservancy District.** Great Miami River Watershed Water Quality Credit Trading Program: Operations Manual. Dayton : Water Conservation Subdistrict of The Miami Conservancy District, 2005.

14. **Kling, Catherine.** *Professor, Iowa State University.* January 10, 2011.

15. **Center for Agriculture and Rural Development.** Watershed Advisory Council. [Online] Iowa State University, September 21, 2010. [Cited: April 26, 2011.] www.card.iastate.edu/presentations/watershed_trading_advisory_council.ppt.

16. **OMB Watch.** How to File a Petition for Rulemaking. *Regulatory Resource Center.* [Online] 2011. [Cited: April 25, 2011.] http://www.ombwatch.org/node/4061.

17. **Resources, Iowa Department of Natural.** IowaDNR NPDES Permits. *NPDES Permits.* [Online] [Cited: April 26, 2011.] http://www.iowadnr.gov/water/npdes/rulemaking.html.

18. **The Iowa Legislature.** Wasterwater Construction and Operation Permits. *Environmental Protection Commission.* [Online] December 3, 1986. [Cited: April 26, 2011.] http://search.legis.state.ia.us/NXT/gateway.dll/ar/iac/5670___environmental%20protection%20commission%20__5b567__5d/0640___chapter%2064%20wastewater%20construction%20and%20operation__2e/_c_5670_0640.xml?f=templates$fn=default.htm.

19. **United States Environmental Protection Agency .** Water Quality Trading Assessment Handbook: Can Water Quality Trading Advance Your Watershed's Goals? Washington, D.C. : National Service Center for Environmental Publications, 2004.

20. **United States Environmental Protection Agency.** Tools for Financing Water Infrastructure . [Online] United States Environmental Protection Agency, March 2007. http://www.epa.gov/efinpage/waterinfra2007.pdf.

21. *Market Structures for U.S. Water Quality Trading.* **Woodward, R. and R. Kaiser.** 2, s.l. : Review of Agricultural Economics, 2002, Vol. 24, pp. 366-383.

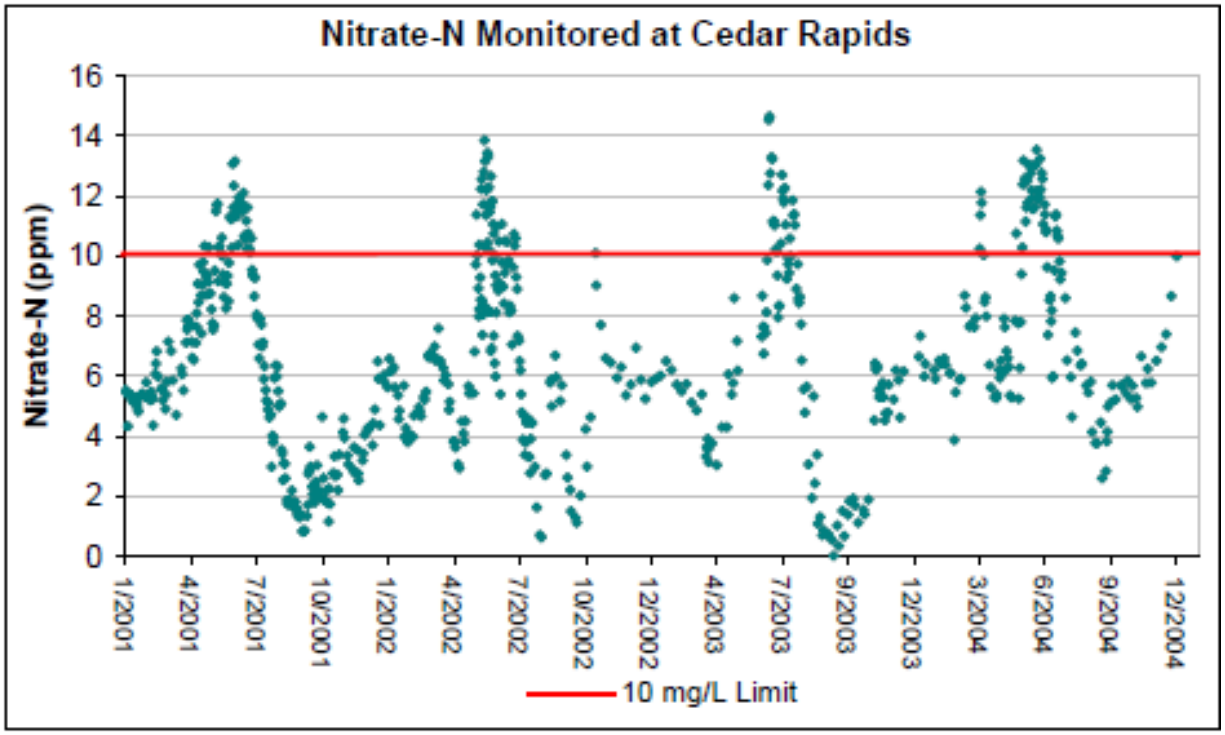
22. **USDA.** Nitrogen Trading Tool. [Online] http://199.133.175.80/nttwebax/.

23. **U.S. EPA.** Region 5 Spreadsheet Model. [Online] http://it.tetratech-ffx.com/stepl/.

24. **World Resources Institute.** NutrientNet. [Online] www.nutrientnet.org.

Appendices

Appendix A – Nitrate Monitored at Cedar Rapids Monitoring Station



Source: Total Maximum Daily Load for Nitrate, IDNR pg.12 (3)

Appendix B – Regulations and Consequent TMDL Development

1. Name and geographic location of the impaired or threatened waterbody for which the TMDL is being established: Cedar River, McCloud Run (S16, T83N, R07W) to Bear Creek (S21, T84N, R08W).

2. Identification of the pollutant and applicable water quality standards: The pollutant causing the water quality impairment is nitrate. Designated uses for the impaired segment are significant resource warm water (Class B(WW)), primary contact recreational use (Class A1) and drinking water supply (Class C). Excess nitrate loading has impaired the drinking water supply water quality criteria (567 IAC 61.3(3)) and hindered the designated use.

3. Quantification of the pollutant load that may be present in the waterbody and still allow attainment and maintenance of water quality standards: The target of this TMDL is the drinking water nitrate concentration standard of less than 10.0 mg/L NO3-N.

4. Quantification of the amount or degree by which the current pollutant load in the waterbody, including the pollutant from upstream sources that is being accounted for as background loading, deviates from the pollutant load needed to attain and maintain water quality standards: The existing nitrate load is 14.7 mg/L . The estimated nitrate loading capacity is 9.5 mg/L. The targeted reduction is 35%. This would equal a yearly reduction of 9,999 tons nitrate-N/year from the current loading of 28,561 tons nitrate-N/year.

5. Identification of pollution source categories: The load duration curve specifies nonpoint sources of nitrate as the cause of impairments to the Cedar River. Major constituents of nonpoint sources are fertilizer, legume crops, and manure.

6. Wasteload allocations for pollutants from point sources: The wasteload allocation for point sources is 9%, (2,521 tonsN/yr) of the total load as listed in Appendix C.

7. Load allocations for pollutants from nonpoint sources: The load allocation for nonpoint sources is 91%, (26,040 tonsN/yr) listed in Table 17.

8. A margin of safety: An explicit margin of safety of 5% has been included to ensure that the required load reduction will result in attainment of the water quality target. An implicit margin of safety was also included in the TMDL, comprised of no denitrification in NPDES permitted sites, and conservation of nitrate-N in the water column.

9. Consideration of seasonal variation: This TMDL was developed based on the daily nitrate loading that will result in attainment of the nitrate target throughout the year. [iii]

10. Allowance for reasonably foreseeable increases in pollutant loads: No allowance for increase in nitrate-N load, as the primary source of nitrate is from nonpoint sources. Similarly, increases in point source pollution are not allowed. Pollutant loads will increase and decrease based on the precipitation and hydrology of the Cedar River.

11. Implementation plan: An implementation plan is outlined in section 6 of this report. Implementation will be incentive-based, best management practices (BMPs) focused on reducing surface water nitrate-N concentration. These practices include fertilizer reduction, wetland construction, and conservation reserve program (CRP) enrollment. Practices will focus more heavily on subbasins that have higher nitrate loading per unit area.

Source: Total Maximum Daily Load for Nitrate, IDNR pg.ii (3)

Appendix C – Capped Municipal Wastewater Plants in the TMDL Watershed

Upper Cedar River				
NPDES #	Name	Current Allocation (tonsN/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
	Iowa			
6658001	Orchard	0.4	0.4	--
0960001	Plainfield	2.2	2.2	--
6677001	Stacyville	2.3	2.3	--
3414001	Floyd	1.8	--	9.7
0932001	Janesville	4.1	--	22.4
6673001	St. Ansgar	5.1	--	27.8
1967001	Nashua	8.2	--	45.1
0915001	Denver	8.0	--	43.9
6663001	Osage	23.0	--	125.9
3405001	Charles City	35.6	--	195.0
0990001	Waverly	45.5	--	249.1
3405100	Cambrex, Inc.	1.7	1.7	--
	Minnesota			
	Austin	635.7	*NA*	*NA*
	Elkton	0.7	*NA*	*NA*
	Hollandale	1.6	*NA*	*NA*
	Jim's Motor Mart	0.0	*NA*	*NA*
	Lyle	2.8	*NA*	*NA*
	Oakland S.D.	0.0	*NA*	*NA*
	Blooming Prairie	9.5	*NA*	*NA*
	Adams	3.9	*NA*	*NA*
	Waltham	1.0	*NA*	*NA*
	Osmundson Bros.	0.0	*NA*	*NA*

NPDES #	Name	Allocation (tons/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
	Iowa			
1228001	Clarksville	6.2	6.2	--
4100900	DNR Pilot Knob S.P.	0.0	0.0	--
9820001	Fertile	1.7	1.7	--
9525001	Forest City	21.5	--	117.8
9500102	Golden Oval Eggs	16.7	16.7	--
9825001	Grafton	1.4	1.4	--
1253001	Greene	5.4	--	29.7
9800801	IDOT Northwood	0.5	0.5	--
9545001	Lake Mills	14.8	--	80.9
1700100	Lehigh Cement	0.1	--	0.8
9549001	Leland	1.2	1.2	--
0700115	Magellan Pipe Co.	0.0	--	0.0
9845001	Manly	6.6	6.6	--
3420001	Marble Rock	1.6	1.6	--
1750001	Mason City	89.8	--	492.0
3423001	Nora Springs	7.5	--	41.4
9855001	Northwood	10.1	--	55.4
1759001	Plymouth	2.2	2.2	--
1769001	Rock Falls	0.8	0.8	--
3430001	Rockford	4.7	4.7	--
1286001	Shellrock	6.4	--	35.0
9585001	Thompson	2.9	2.9	--
1700901	Willow Pointe	0.3	--	1.6
4100112	Winnebago Industries	6.9	6.9	--
59312	Tyden #1 Family Farm Feed	0.0	0.0	--
	Minnesota			
	Albert Lea	246.8	*NA*	*NA*
	Glenville	3.5	*NA*	*NA*
	Emmons	2.1	*NA*	*NA*
	Magellan Pipe Co.	0.0	*NA*	*NA*
	MDNR S.P.	0.3	*NA*	*NA*
	Twin Lakes	0.8	*NA*	*NA*

West Fork Cedar				
NPDES #	Name	Allocation (tons/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
1203001	Allison	5.5	--	30.4
1716901	Clear Lake S.D.	1.5	--	8.0
3500901	DNR Beeds Lake S.P.	0.8	--	4.3
1240001	Dumont	3.3	--	18.3
3500201	Gold Key Dining & Lounge	0.2	--	0.9
3500202	Gold Key Motel	0.1	--	0.5
3544001	Hampton	16.2	--	89.0
3554001	Latimer-Coulter	4.1	4.0	--
1773001	Rockwell	5.2	5.2	--
3570001	Sheffield	4.6	--	25.1
1778001	Swaledale	0.8	0.8	--
3500900	Terrace Hill S.D.	0.4	0.4	--
1781001	Thornton	2.1	2.1	--

Beaver Creek				
NPDES #	Name	Allocation (tons/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
4201001	Ackley	8.9	--	48.8
1207001	Aplington	5.2	--	28.5
1271001	New Hartford	3.2	--	17.8
1281001	Parkersburg	9.9	9.9	--
3890001	Wellsburg	3.5	--	19.3

Black Hawk Creek				
NPDES #	Name	Allocation (tons/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
3800600	Dietrick MHP	0.6	0.6	--
3815001	Dike	4.7	--	25.5
3833001	Grundy Center	2.2	--	12.0
3839001	Holland	1.2	1.2	--
0737002	Hudson	10.4	--	57.2
3870001	Reinbeck	8.6	--	47.3
61302	Sunnybrook Farm Feedlot	0.0	--	0.0

Wolf Creek				
NPDES #	Name	Allocation (tons/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
3803001	Beaman	1.0	1.0	--
3809001	Conrad	5.2	--	28.5
8640001	Gladbrook	5.0	--	27.4
8600900	Hickory Hills Park	0.0	0.0	--
0743001	La Porte	11.2	--	61.4
8681001	Traer	7.9	--	43.0

Middle Cedar River				
NPDES #	Name	Allocation (tons/yr)	Controlled TMDL Allocation (tons/yr)	Continuous TMDL Allocation (lbs/day)
0603001	Atkins	4.8	--	26.4
0600901	Benton Care Facility	0.0	--	0.0
0600201	Benton Commerce Village	0.5	--	3.0
1011001	Brandon	1.5	--	8.4
709001	Cedar Falls	125.2	--	686.0
0709600	Cedar Falls MHV 1	0.3	0.3	--
0709600	Cedar Falls MHV 2	0.7	0.7	--
3405001	Center Point North	6.8	--	37.1
5718002	Center Point South	3.1	--	17.1
0600601	Country Aire	0.1	--	0.8
0712901	Dewar S.D.	0.9	0.9	--
0721001	Elk Run Heights	6.4	--	35.1
0723001	Evansdale	22.3	--	122.2
0625001	Garrison	1.8	1.8	--
0733001	Gilbertville	3.8	--	20.7
5700104	IP&L Duane Arnold	0.5	--	2.6
1044002	Jesup South	1.3	--	7.3
1044001	Jesup Southeast	9.6	--	52.5
0650001	Mt. Auburn	0.0	0.0	--
0653001	Newhall	4.4	--	23.9
5765001	Palo	3.0	--	16.6
0670001	Shellsburg	4.6	--	25.3
0600600	Timber Ridge MHP	0.7	--	3.8
0680001	Urbana	5.0	--	27.5
0688001	Vinton	20.3	--	111.0
5792001	Walker	3.6	3.6	--
0700904	Washburn Area STP	3.0	3.0	--
0790001	Waterloo	505.2	--	2768.0

Source: Total Maximum Daily Load for Nitrate, IDNR

Appendix D –EPC Members

Mary Boote **300 Walnut Street Unit 123** **Des Moines, Iowa 50309** Mary.Boote@dnr.iowa.gov	Position: Elector of State Term Begin: 5/1/11 Term End: 4/30/15 Party: Republican
Dee Bruemmer **600 West 4th Street** **Davenport, Iowa 52801** Dee.Bruemmer@dnr.iowa.gov	Position: Elector of State Term Begin: 6/9/10 Term End: 4/30/13 Party: No Party
Nancy Couser **20408 620th Ave** **Nevada, Iowa 50201** Nancy.Couser@dnr.iowa.gov	Position: Farmer Term Begin: 5/1/11 Term End: 4/30/15 Party: Democrat
John Glenn **16166 Hwy J29** **Centerville, Iowa 52544** John.Glenn@dnr.iowa.gov	Position: Elector of State Term Begin: 8/10/10 Term End: 4/30/13 Party: Republican
Dolores Mertz **607 110th Street** **Ottosen, Iowa 50570** Dolores.Mertz@dnr.iowa.gov	Position: Elector of State Term Begin: 5/1/11 Term End: 4/30/15 Party: Democrat
David Petty **32198 237th Street** **Eldora, Iowa 50627** David.Petty@dnr.iowa.gov	Position: Farmer Term Begin: 5/1/09 Term End: 4/30/13 Party: Republican
Lorna Puntillo **301 South Davidson St** **Sioux City, IA 51103** Lorna.Puntillo@dnr.iowa.gov	Position: Commerce/Finance Term Begin: 8/4/09 Term End: 4/30/13 Party: Republican
Brent Rastetter **2131 Quail Ridge Rd** **Ames, Iowa 50010** Brent.Rastetter@dnr.iowa.gov	Position: Farmer Term Begin: 5/1/11 Term End: 4/30/15 Party: Republican
Marty Stimson **4601 Bowling Street** **Cedar Rapids, IA 52404** Marty.Stimson@dnr.iowa.gov	Position: Manufacturing Term Begin: 5/1/09 Term End: 4/30/13 Party: No Party

Source: http://www.iowadnr.gov/epc/files/epcmembers.pdf